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Community Visions for the Paducah Gaseous Diffusion Plant Site

Prepared by
Kentucky Research Consortium for Energy and Environment
233 Mining and Minerals Building
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Prepared for
United States Department of Energy
Portsmouth/Paducah Project Office

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This report presents the results of a future vision process for the Paducah Gaseous Diffusion Plant. The report is meant to inform the local citizens of the Paducah area, as well as US DOE as part of its ongoing End State Vision Process. The process implemented in this study and the associated presentation of these results are not pre-decisional; rather, they are intended to provide insights into a range of perspectives and community preferences related to the future use of the Paducah Gaseous Diffusion Plant site and surrounding US DOE properties. The ultimate selection of specific actions will be made in accordance with applicable laws and agreements.

CONTENTS

FIGURES

TABLES

ACRONYMS

AAT	Area Advisory Team
ACO	Administrative Consent Order
ACT	Active Citizens for Truth
AEC	Atomic Energy Commission
AIP	Agreement in Principle
AOC	Areas of Concern
ARS	Audience Response System
ATSDR	Agency for Toxic Substances and Disease Registry
CAB	Citizens Advisory Board
CaVE	Casewise Visual Evaluation
CBPC	Community-Based Participatory Communication
CBPR	Community-Based Participatory Research
CERCLA	Comprehensive Environmental Response, Compensation, & Liability Act
CSOU	Comprehensive Sitewide Operable Unit
D&D	Decontamination and Decommissioning
DOD	Department of Defense
DUF_6	Depleted Uranium Hexafluoride
ECA	Energy Communities Alliance
EM	Environmental Management
ERDA	Energy Research and Development Administration
FACA	Federal Advisory Committee Act
FFA	Federal Facilities Act
FFC	Federal Facilities Compliance
FS	Feasibility Study
GIS	Geographic Information System
GLE	Global Laser Enrichment
GPEDC	Greater Paducah Economic Development Council
IRB	University of Kentucky Nonmedical Institutional Review Board
KDEP	Kentucky Department for Environmental Protection
KDFWR	Kentucky Department of Fish and Wildlife Resources
KDWM	Kentucky Division of Waste Management
KGS	Kentucky Geological Survey
KOW	Kentucky Ordnance Works
KRCEE	Kentucky Research Consortium for Energy and the Environment
KRS	Kentucky Revised Statutes
LCRS	Lower Continental Recharge System
LMES	Lockheed Martin Energy Systems
LMUS	Lockheed Martin Utility Services
MCL	Maximum Contaminant Level
MODFLOWT	An enhanced groundwater transport model developed by USGS
NEPA	National Environmental Protection Act
NIOSH	National Institute for Occupational Safety and Health
NMSZ	New Madrid Seismic Zone
NPL	National Priority List, US EPA name for high-priority Superfund sites

NRC	Nuclear Regulatory Commission
ORO	Oak Ridge Office
OU	Operable Unit
PACRO	Paducah Area Community Reuse Organization
PGDP	Paducah Gaseous Diffusion Plant
PCBs	Polychlorinated Biphenyls
PLA	Participatory Learning and Action
POC	Politics of Cleanup
PRA	Participatory Rural Appraisal
PRCA	Participatory Rural Communication Appraisal
PUPAU	Paducah Uranium Plant Asset Utilization Task Force
RBES	Risk-Based End State
RCRA	Resource Conservation and Recovery Act
RGA	Regional Gravel Aquifer
RRA	Rapid Rural Appraisal
RI	Remedial Investigation
SI	Site Investigation
SMP	Site Management Plan
SPI	Structured Public Involvement
STP	Site Treatment Plan
SSAB	Site-Specific Advisory Board
SWMU	Solid Waste Management Unit
SWU	Separable Work Unit
Tc-99	Technetium-99
TCE	Trichloroethylene
TNT	Trinitrotoluene
TSCA	Toxic Substances Control Act
TVA	Tennessee Valley Authority
UCRS	Upper Continental Recharge System
UDS	Uranium Disposition Services, LLC
UN FAO	United Nations Food and Agriculture Organization
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
US DOE	United States Department of Energy
US DOE EM	US Department of Energy Environmental Management
USEC	United States Enrichment Corporation
US EPA	United States Environmental Protection Agency
USGS	United States Geological Survey
WAC	Waste Acceptance Criteria
WDA	Waste Disposal Alternative
WKWMA	West Kentucky Wildlife Management Area
WVSZ	Wabash Valley Seismic Zone

EXECUTIVE SUMMARY

In 2003, the Kentucky Research Consortium for Energy and Environment (KRCEE) was created at the University of Kentucky. The Consortium's mission is to provide technical support to the US Department of Energy (US DOE), the US Environmental Protection Agency (US EPA), and the Kentucky Division of Waste Management (KDWM) regarding non-consensus issues associated with clean-up efforts at the Paducah Gaseous Diffusion Plant (PGDP) National Priority List (NPL) Superfund site. In 2009, US DOE asked KRCEE to develop a community-based end state vision encompassing the range of community perspectives for the site's future after the facility closes. In addition to qualitatively and quantitatively documenting stakeholder beliefs and preferences, this report also provides an overview of the methodology developed and implemented for this project, as well as lessons learned through engaging a diverse set of stakeholders.

In 2002, the US DOE Office of Environmental Management (US DOE EM) developed a detailed strategy in response to a national top-to-bottom review of the agency. This strategy included the development of Risk-Based End State (RBES) vision documents for each US DOE facility. A draft RBES for the PGDP was developed and released in 2004 under the title *Risk Based End State Vision and Variance Report for the Paducah Gaseous Diffusion Plant, Paducah, Kentucky,* DOE/OR/07-2119&D0/R2. This report was then revised and published in 2008 under the title *Update to the End State Vision for the Paducah Gaseous Diffusion Plant, Paducah, Kentucky,* DOE/LX/07-0013&D1. A guidance memo from Eugene Schmidt, Deputy Assistant Secretary for Cleanup and Acceleration, stated that "the fundamental purpose of the RBES vision for a site is to depict a set of site conditions and associated information that will sustainably protect human health and the environment for the planned land use of the site property and its environs." Public comments responding to the document indicated that some segments of the community had serious reservations about the adequacy of certain proposals.

At about the same time as the release of the RBES was the publication of *The Politics of Cleanup* (Energy Communities Alliance [ECA], 2007), a report highlighting lessons learned from complex federal environmental cleanups (i.e., Rocky Flats, CO; Mound, OH; and Oak Ridge, TN). This document provided several recommendations for improving community involvement in decision-making processes at such sites and building upon an earlier study about US DOE EM public participation programs by Battelle (2003). Consequently, the Kentucky Research Consortium for Energy and Environment (KRCEE) received a Financial Assistance Award from US DOE to develop and implement a stakeholder engagement process that could address ECA recommendations.

This report focuses on assessing community preferences for the future use of the PGDP site, given the site's pending closure by US DOE. In addition to providing the community with a record of the diversity of values and preferences, the research team hopes that the study's results also will inform and guide US DOE in the final formulation of its future vision for the facility.

The key for creating any community-driven future vision is the fullest possible involvement of local stakeholders at every stage of the visioning process. A guiding document throughout the PGDP Future Vision Project, ECA's *The Politics of Cleanup* explicitly advocates for such involvement, with members of Superfund communities joining federal and state regulators and contractors to meet site cleanup goals in a way and to a degree that allows sites to remain or once again become assets. The ECA affirms that two-way communication that engages communities through consultation, coordination, and ongoing dialogue is essential for developing appropriate cleanup goals and for identifying future uses for Superfund sites like the PGDP. *The Politics of*

Cleanup therefore calls for all parties, including community members and government agencies, to collaborate in the development of site cleanup goals and future use visions.

The ECA asserts that successful collaboration requires mutual understanding of community values, as well as cooperation toward incorporating these values into the planning process. According to ECA, successful environmental cleanups go beyond risk reduction and the minimization of federal government liability; success is predicated on substantively incorporating local community values into the cleanup and visioning processes. In certain cases, the incorporation of these values has led to cleanup efforts that extend beyond that which would be anticipated for a strictly risk-based cleanup. The sole way to ensure that sites can become assets for affected communities is to engage local stakeholders in determining how both the cleanup and the future use goals support or advance local needs. *The Politics of Cleanup* predicts that cleanup or future use decisions that are made unilaterally by government agencies without input from community members run the risk of being fundamentally inconsistent with local needs, as well as with the core values held by local governments and others in the affected community.

According to the ECA, two-way communication means that all parties must educate each other on technical and policy issues that underlie cleanup decisions, committing staff and other resources toward mutual engagement. Discussions need to take place throughout the process and must include issues related both to technical risk and to perceptions of risk, recognizing that the two do not always align (Slovic, 2000). Not only must community members be educated about technical risk by federal and state agencies and contractors, but federal and state agencies and contractors must be educated by the community about its history, goals, and needs.

Regarding risk communication at Superfund sites, the ECA strongly recommends that federal agencies enter into dialogue with local governments and community members to better understand community perceptions of risk – perceptions that often vary from community to community and even among different members of the same community. Such dialogues present the greatest opportunity for various parties to reconcile disparate perspectives about risk, thus facilitating agreement on difficult cleanup decisions. Such decisions, even technical ones, often are not solely technically based.

The KRCEE project was designed to maximize citizen engagement, as characterized by the Ladder of Citizen Participation (Arnstein, 1969). Not only did the ladder provide a philosophical guideline for the team, it provided a quantitative way to gauge public perceptions about past levels of community involvement, as well as preferences for future involvement. The Arnstein Ladder illustrates different levels of public participation that have been observed in policy and infrastructure decisions. A slightly modified version of the ladder is shown in Figure ES1. Although most of the terms used in the steps of the ladder are fairly self-explanatory, more explicit descriptions and explanations of the terminology can be found in Arnstein's original publication.

In general, the steps of the ladder can be grouped into three broad classifications: Non Participation, Tokenism, and Citizen Power, with specific rungs falling within each broad category. In previous studies, most citizens have scored past levels of involvement in public processes somewhere between informing and placation in the Tokenism section of the ladder; however, the majority of those polled in the past desire levels of participation somewhere between partnership and delegated power in the Citizen Power section of the ladder (Grossardt et al., 2010). In other words, and perhaps unexpectedly for some agencies and policymakers, most members of the public see a role for technical expertise in planning processes, while very few people feel that complete citizen control is necessary to achieve optimal outcomes.

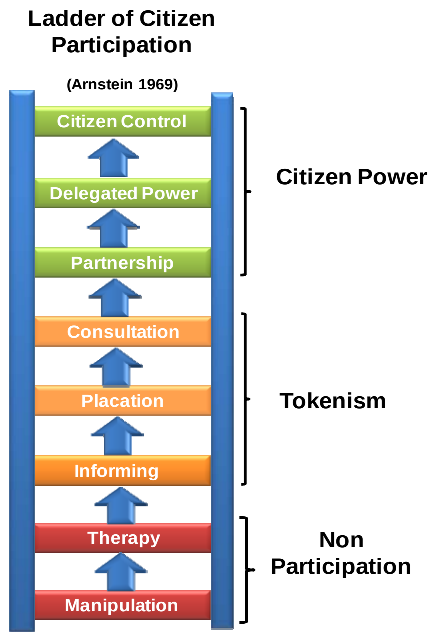

Figure ES1. Arnstein Ladder of Citizen Participation (Arnstein, 1969)

Considering the issues raised above, the KRCEE concluded that community engagement is critical at all stages for identifying and evaluating potential future uses for the PGDP. In 2009, KRCEE convened a project team that subsequently developed and implemented a multi-method approach, integrating both qualitative and quantitative data. Social scientists use such research designs for a number of reasons, including triangulation of findings, improved explanation of phenomena, increased credibility, and diversity of data related to research questions (Bryman, 2006). As Roth and Mehta assert, "The best way to avoid being misled by a single inaccurate or biased source of data is to include as many viewpoints and as many sources of data as time, money, and convenience permit" (p. 153).

The research team's composition reflects a broad range of experience with the technical aspects and regulatory history of the PGDP site, with international development projects, and with public infrastructure planning, and technical aspects related to the PGDP site. Research team members are:

- **Dr. Lindell Ormsbee (principal investigator/project manager).** Dr. Ormsbee is the director of the Kentucky Water Resources Research Institute, the associate director of the UK-NIEHS Superfund Research Center, the former director of the KRCEE, and a Raymond-Blythe Professor of Civil Engineering at the University of Kentucky. He researches, teaches, and consults on water resources and environmental engineering and has published more than 200 technical papers and reports on various topics in the field.
- **Dr. Chike Anyaegbunam (co-principal investigator for Community-Based Participatory Communication).** Dr. Anyaegbunam is an associate professor of integrated strategic communication in the University of Kentucky College of Communications and Information Studies. He has worked extensively both nationally and internationally on a variety of development projects funded by the Pfizer and Robert Wood Johnson Foundations, the National Cancer Institute, the World Bank, the United Nations Food and Agriculture Organization (UN FAO), the United Nations Children's Fund (UNICEF), and the United States Agency for International Development (USAID).

- **Dr. Ted Grossardt (co-principal investigator for Structured Public Involvement).** Dr. Grossardt is research program manager for the Kentucky Transportation Research Center in the University of Kentucky College of Engineering, as well as associate faculty in both the University of Kentucky Department of Geography and the Historic Preservation Program. As a co-creator of Structured Public Involvement (SPI), Dr. Grossardt has expertise in large group processes for complex infrastructure planning and design problems and has provided decision support services for such projects as the Milton-Madison Ohio River Bridge design project and Jeffersonville, IN's comprehensive land use planning.
- **Dr. Keiron Bailey (Casewise Visual Evaluation).** An associate professor of geography and regional development at the University of Arizona, Dr. Bailey is a co-creator of Structured Public Involvement and has pioneered the method of Casewise Visual Evaluation (CaVE). His work overlaps geography, planning, decision science and geoinformatics, and he has presented extensively both nationally and internationally about both SPI and CaVE.
- **Ben Blandford (Structured Public Involvement technical support).** Mr. Blandford is a doctoral student in geography at the University of Kentucky. He assisted with the development of the hypothetical future use visualizations used both in focus groups and in public meetings. Mr. Blandford also assisted with the analysis of scoring results.
- **John R. Ripy, Jr. (Structured Public Involvement technical support**). Mr. Ripy is information systems manager for the Kentucky Transportation Center. He played a key role in developing the hypothetical future use visualizations used both in focus groups and in public meetings. Mr. Ripy also assisted with the analysis of scoring results.
- **Chas Hartman (transcription and preliminary data analysis).** A doctoral candidate at the University of Kentucky College of Communications and Information Studies, Mr. Hartman assisted with the transcription and preliminary qualitative data analysis of field recordings.
- **Anna Goodman Hoover (research project coordination and facilitation).** As communication director for the Kentucky Water Resources Research Institute, Ms. Hoover oversees public information activities and assists with the design and implementation of research projects that link environmental concerns with risk and public communication processes. She provided focus group facilitation, logistical guidance, and assisted with data analysis.
- **Jason Martin (transcription).** A doctoral candidate at the University of Kentucky College of Communications and Information Studies, Mr. Martin assisted with transcription of early-project field recordings for research team analysis.
- **Mitchael Schwartz (focus group facilitation and logistics),** A master's student in the University of Kentucky College of Communications and Information Sciences, Mr. Schwartz provided facilitation and transcription services to the research team, as well as assisting in qualitative data analysis, prior to his graduation in August 2010.

For this project, the research team first implemented Community-Based Participatory Communication (CBPC) methods, which use interviews, focus groups, and projective techniques to identify and interact with various community groups. The goal of CBPC is to discover value systems, risk perceptions, preferences for various facets of the future vision question, as well as perspectives about cleanup issues (Anyaegbunam, Mefalopulos, & Moetsabi, 2004). The team then engaged in SPI activities, which constitute a democratic process that uses anonymous Audience Response Systems (ARS) or similar feedback methods in large-scale public meetings. In this way, SPI encourages democratic solutions to complex issues while resisting co-optation of the public meeting process by a single interest group.

In the research team's novel deployment of the CBPC-SPI integration, results from an extensive CBPC listening tour assist in generating SPI-based visualizations, which then become discussion triggers for additional CBPC based focus group interactions, which ultimately feed into a broad-based SPI community forum that quantitatively measures preferences for future outcomes as thoroughly and accurately as possible. Final SPI-generated data then can be integrated into the Casewise Visual Evaluation Model, or CaVE (Bailey et al., 2010), helping to identify clusters of stakeholder likes and dislikes and predicting preferences and aversions for possible scenarios not explicitly considered. The latter capability becomes increasingly important as the complexity of land use possibilities increases, making it unrealistic for the public to evaluate all possible scenarios. CBPC, SPI, and CaVE, as well as their applications within this project and subsequent results, are discussed in more depth in Anyaegbunam et al., (2010), Grossardt, et al. (2010), and Bailey, et al. (2010), while results are discussed in Chapters 7-9 of this report. A diagram of the final study methodology is shown in Figure ES2.

The public engagement model for this project involved five steps: 1) iterative stakeholder identification and listening tour, 2) stakeholder focus groups, 3) community-based informational open houses, 4) community-based future vision scenario evaluations, and 5) a future vision scenario scoring website. A pilot test group also was established, with members chosen to represent diverse stakeholder interests. This group pre-tested all project engagement protocols (with the exception of the website). As a result of this integrated process, the research team has engaged more than 900 individuals through interviews, focus groups, and public meetings, and an online survey during more than two years in the field. Each project step is summarized below, with more in-depth discussions in ensuing chapters.

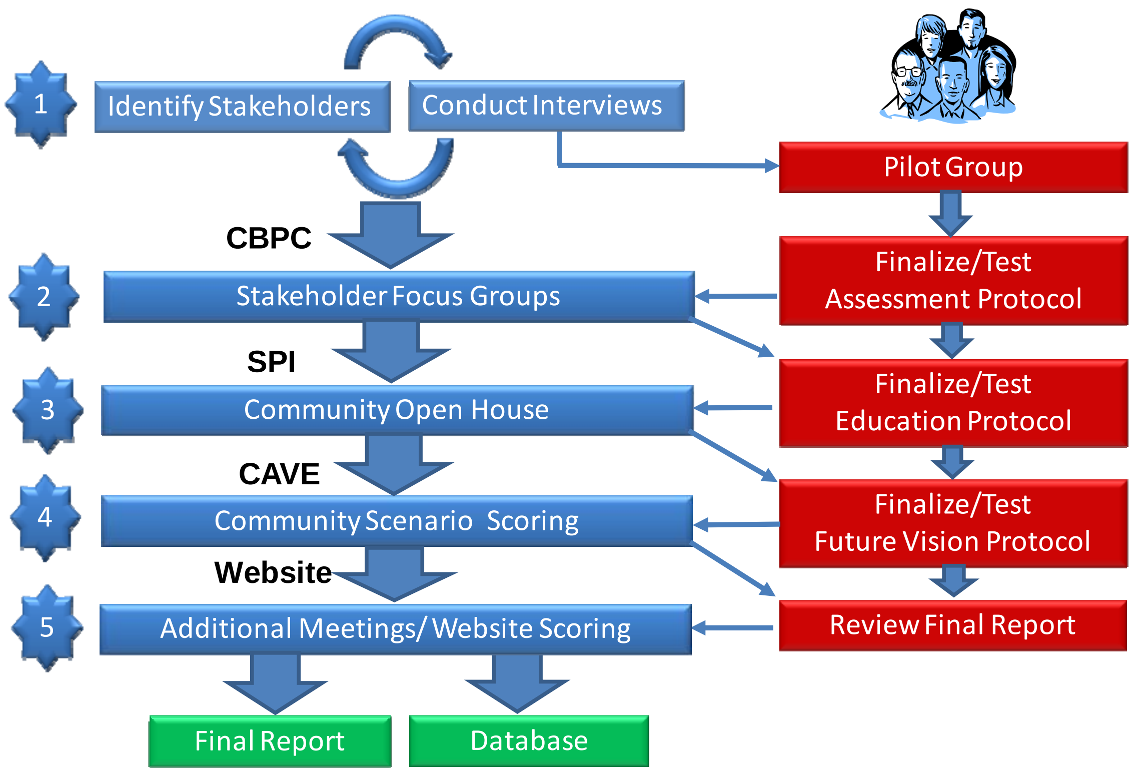

Figure ES2. PGDP Future Vision Process

Step One – Iterative Stakeholder Identification and Listening Tour

After creating an initial draft guide for the integrated CBPC-SPI process, the next step was the identification of key stakeholder groups affected by and affecting PGDP decisions. To fulfill this objective, the research team first conducted a brainstorming session to identify as many stakeholders as possible. Given that several members of the research team were familiar with some stakeholders due to involvement in prior projects in and around the region, the team was able to generate an initial list that included 44 specific organizations and individuals. This list was intended as a starting point for an iterative process in which additional stakeholder interactions would generate the identification and engagement of other stakeholders, who would identify more stakeholders, until saturation had been achieved, with no additional groups or individuals being identified (Lindlof and Taylor, 2002).

The listening tour allowed the research team to become better acquainted with the PGDP's place in the community, both in the present and the past. Stakeholder interactions also pointed the researchers to a number of reports related to the facility's future -- many of which are included in the appendices of this document. Finally, the listening tour pointed to the existence of competing commitments and tensions among diverse stakeholder groups. It became clear that this study would need to address all of these issues.

After interviewing more than 80 individuals, the research team initially identified ten stakeholder groups; however, additional research team discussions further segmented these groups into 16 distinct stakeholder clusters:

- Water Policy District Residents
- Economic Development
- United States Enrichment Corporation (USEC) Employees
- Environmental/Health Advocates
- Healthcare Providers
- Education
- Media
- Religious/Spiritual Community
- Wildlife/Recreation Enthusiasts
- Tourism
- Ballard County Stakeholders
- US DOE
- US DOE Subcontractors
- McCracken/Paducah Government
- PGDP Citizens Advisory Board
- Regulatory Agencies

The research team recruited a pilot test group comprised of representatives from each of the sixteen stakeholder groups. This pilot group pre-tested individual steps of the process along with some initial trigger scenarios prior to community-wide implementation and, where warranted, recommended protocol and/or scenario changes. As an example, an initial heavy industry scenario for a steel mill was replaced with a potential auto assembly plant similar to the Ford Plant in Louisville or the Toyota plant in Georgetown, Kentucky. The inclusion of a golf course in the active recreational scenario was also eliminated based on the lack of perceived economic viability of such a land use within the Paducah area. Potential members of the pilot test group also helped to recruit additional members of their constituencies into the process.

Step Two – Stakeholder Focus Group

Following creation of the pilot test group, a draft focus group protocol was developed, pre-tested, and slightly amended. The resulting protocol was submitted to and approved by the University of Kentucky non-biomedical Institutional Review Board (IRB). A total of sixty-four people attended eight stakeholder-specific focus groups. Because of logistical constraints and the large number of constituencies, a reduced number of focus groups were held in which distinct-but-related stakeholder groups met jointly. These meetings were conducted over a three-day period in McCracken and Ballard Counties. Per the revised protocol, focus group participants engaged in several exercises designed to identify 1) community values, 2) concerns and issues regarding a number of distinct hypothetical future uses, and 3) existing beliefs and information gaps.

The CBPC protocol included the evaluation of potential future vision scenarios developed by the Structured Public Involvement team. The SPI team created the focus group scenarios based upon the range of possible land uses and taking into consideration stakeholder feedback from the listening tour, data gathered during the pilot focus groups, and prior end-use reports and recommendations from various entities. To accommodate time constraints and to allow ample time for group evaluations, a limited number of scenarios were selected as discussion triggers. The specific sample scenarios were chosen to provide a robust and representative sample of potential future land uses. Additionally, both the listening tour and pilot tests of the focus group protocol indicated that the scenarios should treat two decisions separately: 1) the disposition of the existing US DOE property currently licensed to Kentucky as part of the West Kentucky Wildlife Management Area (WKWMA), and 2) the disposition of the existing US DOE property that is currently used in enrichment operations (i.e., the existing plant site). In addition, it became readily apparent that landuse preferences could be significantly impacted by the future disposition of legacy wastes (i.e. wastes currently in burial grounds) and future wastes associated with the demolition of the existing PGDP (i.e. whether such wastes should be shipped offsite or buried on site in a special landfill). As a result, these variables were included in the final matrix which was used for creating the set of potential scenarios. Focus group participants discussed the specific hypothetical scenarios in relation to community values, concerns, and beliefs. Following the discussion, participants evaluated individual sample scenarios anonymously using SPI keypad technology.

Broadly, the focus group discussions painted a picture of a community attempting to balance key values related to environmental responsibility and economic stability. In every session, the issues of both job and environmental preservation arose, often revealing internal conflicts for individual participants, as well as resulting in differing assessments of the hypothetical scenarios. A number of knowledge gaps also emerged within the discussions, with participants identifying specific informational needs that would assist in making suitability determinations about specific scenarios. However, many participants expressed concerns about the credibility of potential information sources due to existing ill will and lack of trust among various parties. Specifically, some participants felt that factual information should come from and be presented by entities other than US DOE.

Step Three – Community Informational Meetings

Through the focus groups, as well as during previous US DOE and PGDP Citizens Advisory Board (CAB) public meetings, stakeholders have identified more than 100 questions as important factors for evaluating potential future uses of the PGDP property. The KRCEE research team assembled these questions, grouping them into five primary categories: 1) The Past, 2) The

Present, 3) The Future, 4) Science, and 5) Cleanup. Background information on each of these topic areas, along with answers for each question, was collected and posted on the project's www.paducahvision.com website. Planning then began for public meetings to help address the information gaps.

In preparation for these informational meetings, the initial 100+ questions were prioritized, synthesized, and pared down to a final set of 30 questions, with six questions in each category. Multiple-choice question formats were created, with five potential answers provided for each question. The questions then became the basis for a slide presentation, with each multiple-choice question slide followed by a slide showing the correct answer, including appropriate documentation for that answer. The presentation was integrated into a formal sequence structured much like the popular television game show *Jeopardy*.

The research team recruited participants for both the Step Three Community Informational Meetings and the Step Four Scenario Evaluation Meetings through multiple channels. An extensive advertising campaign was conducted in local and regional newspapers with a combined circulation of more than 43,000. In addition, an advertisement was placed on the second page of the *BBQ on the River* regional festival tabloid, which has a circulation of 38,000. Meeting announcements and flyers were sent to the entire project stakeholder email list of approximately sixty individuals, with a request that recipients forward the information to their own contacts in the area. Announcements and flyers also were posted in local online bulletin boards, including iList Paducah and local radio and television websites. University of Kentucky Public Relations also sent press releases and media alerts to its entire west Kentucky mailing list.

During two public informational meetings (one each in McCracken and Ballard Counties), the project team first introduced the meeting format to audience members, who were asked to use anonymous ARS keypads to select a preferred initial category. After the audience's preferences were displayed onscreen, the series of questions for the selected category was shown, with the audience asked to select the correct answer from the multiple-choice list. Audience members individually selected answers for each question, which were recorded via individual keypads, aggregated, and shown to the audience in bar graph form as percentages of the audience selecting each potential choice. The correct answer, references, and supporting documentation were then displayed in subsequent slides. In this way, the audience completed the entire set of 30 questions. After each answer was revealed, along with supporting documentation, audience members had an opportunity to ask follow-up questions. Depending on the nature of the questions, either a moderator or a technical expert provided answers. At the end of the meeting, participants were asked to evaluate the process and format. Paper comment cards provided opportunities for participants to voice concerns about specific questions and/or answers and to point researchers to alternative information sources.

Step Four – Community Scenario Meetings

Following public informational meetings, three different community scenario meetings were held during October 2010, two at West Kentucky Community and Technical College campus in McCracken County and one at Ballard County High School. An additional public meeting was held on April 28, 2011 at the First Christian Church of Paducah as part of a West-End Neighborhood Association meeting. A total of 128 individual responses were recorded from all four public meetings.

During each meeting, the KRCEE team initially described twelve hypothetical scenarios that were developed through the listening tour and focus group processes. During the description, participants were encouraged to ask questions about specific scenarios. The twelve scenarios were constructed from six different basic land use categories for the main industrial footprint: nuclear industry; heavy industry; light industry; active recreational; passive recreational, which involved extending the wildlife management area to include the industrial footprint; and institutional controls, which involved fencing and closing the site to future use. Additional land-use variations were included within the broader land use categories, included: 1) keeping the existing wildlife management area or including additional recreational facilities; 2) shipping all future plant decommissioning waste offsite, keeping part of the decommissioning waste onsite, or keeping all decommissioning waste onsite, and 3) excavating all of the legacy waste burial grounds or only excavating part of the legacy waste burial grounds – see Table ES1.

After all scenarios had been presented and discussed, each scenario was presented again individually, allowing participants to rate a specific scenario's suitability on a scale of 1 to 9, with 1 being completely unsuitable and 9 being highly suitable. These results are summarized in Figure ES3. In short:

1) Of the range of six major possible land use options for the PGDP footprint, industrial land uses scored higher than non-industrial land uses. However, relying on only the average scenario scores as a basis of evaluation or comparison can be misleading.

    - While more participants supported a nuclear industry option than opposed it, the preference scores were strongly polarized at either end of the preference scale. A similar pattern of preference was also observed for both light and heavy industry.

    - Heavy industry land uses received the second highest mean score among the industrial land-uses, but they also received the least opposition.

    - Among the non-industrial land uses, the expanded wildlife management option received the most favorable response, although only marginally better than the other two: structured recreational and institutional controls.

2) Based on the data collected to date, it would appear that the community's preferences between different land use types were somewhat independent of the following secondary factors: 1) the land use of the property surrounding the PGDP industrial footprint, i.e. property that has been currently licensed to Kentucky as part of the WKWMA, 2) the disposition of the current burial grounds, and 3) the disposition of future wastes associated with the facility's decontamination and decommissioning (D&D). However, preferences within similar land use types were influenced by these secondary factors.

3) Based on the data collected to date, it appears that the majority of respondents oppose the construction of any structured recreational facilities within the existing WKWMA.

4) Based on the data collected to date, it appears that a large number of respondents favor removal of all of the burial grounds. However, this preference is somewhat influenced by the actual land use.

5) To a slightly lesser extent, a larger proportion of respondents also oppose the construction of a new waste disposal facility on site. Reasons for opposition included:

- Environmental and health concerns
- Future development concerns

Some reasons respondents provided for support of such a facility included:

- Job security (e.g. individuals from USEC and US DOE employee community)
- Discourage competing interests (e.g. individuals from the WKWMA users)
- Unethical to ship our waste to others (e.g. individuals from the environmental community)

Table ES1. Description of Future Land Use Scenarios (i.e. S# = scenario number)

S#	PGDP Land Use						WMA Land Use		Future Waste Disposal			Legacy Waste	
	Nuclear Industry	Heavy Industry	Light Industry	Recreation	Expanded WMA	Permanent Site Closure	Recreation	Keep Existing WMA	Removal	Part Onsite	All Onsite	Dig Up	Leave As
1	x							x			x	x	
2	x							x		x			x
3		x					x		x			x	
4		x						x			x		x
5			x				x			x		x	
6			x					x	x				x
7				x				x		x			x
8				x			x				x	x	
9					x		x		x				x
10					x			x		x		x	
11						x		x	x			x	
12						x	x				x		x

Following community scoring of the initial 12 scenarios, participants were invited to provide their preferences from a longer list of possible future uses for the current industrial area. (Unfortunately, this exercise was not conducted at the April 28th meeting because of time constraints). This list included suggestions from the audience, as well as those provided by the KRCEE study team. The composite scores for this longer scenario list are provided in Figure ES4. In general, the expanded results tended to align with trends identified in scoring the original 12 scenarios.

Scenarios independently suggested by stakeholders attending the public meetings included: 1) Alternative Energy Research Center, 2) Federal Lab to Test Cleanup Technologies, 3) Remediation Research Facility Combined with Power Plant, and 4) Remediation Research Facility. Each of these suggestions marks a potential future land use that simultaneously provides high-paying jobs while explicitly addressing legacy environmental issues. Interestingly, these four audience-suggested scenarios received higher average scores than other scenarios. It is important to note that the PGDP Citizens Advisory Board had made a similar future use recommendation in 2004, thus reflecting local stakeholders' thoughtful attempts to incorporate community values into infrastructure planning. After conducting this study, the team concludes that many of the original 2004 CAB recommendations are still sound and worthy of full consideration today.

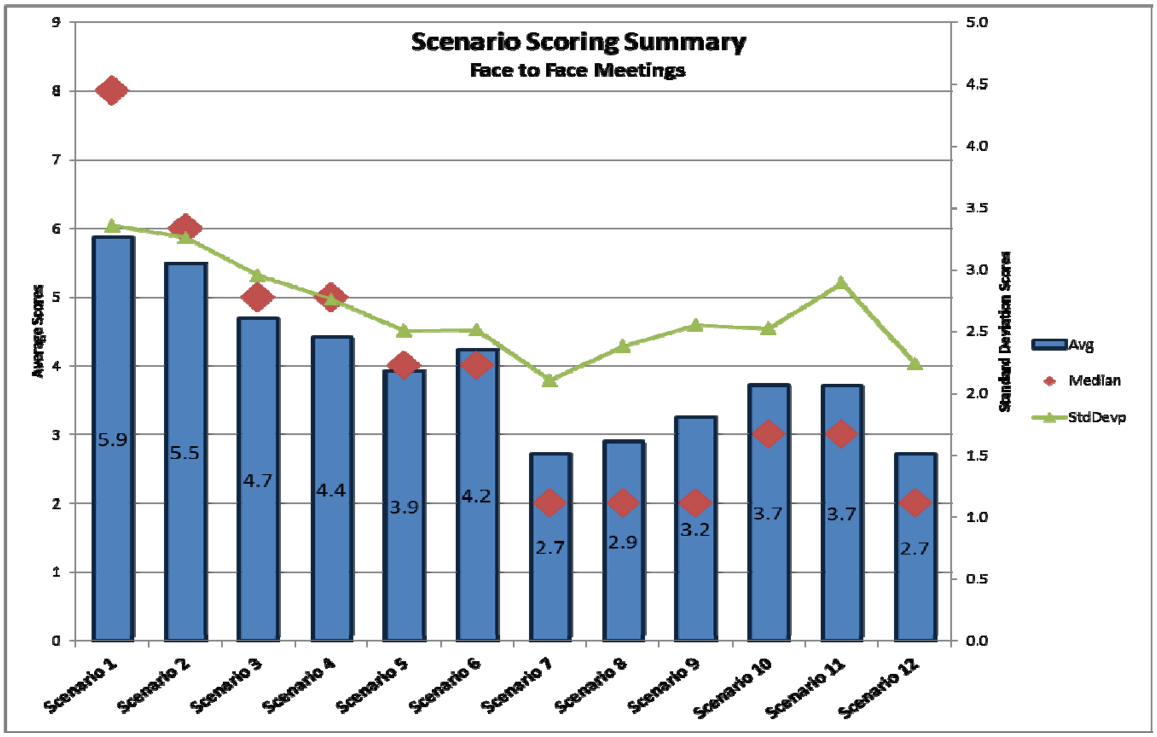

Figure ES3. Public Meeting Scenarios Evaluation Scores (scenario content defined in Table ES1)

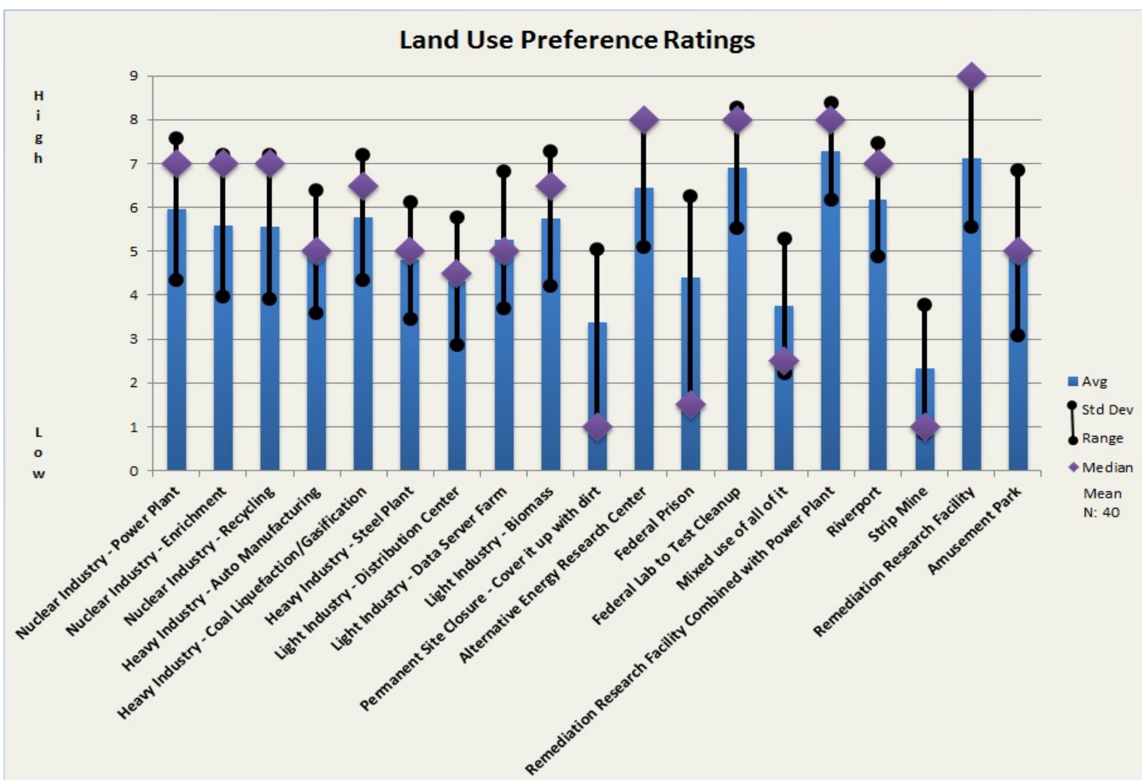

Figure ES4. More Detailed Scenario Scores

Step Five – Web-based Scoring

Following the public meeting project phase, the research team determined that it was necessary to increase the number of community participants by soliciting additional scenario scoring through an interactive website: www.paducahvision.com. The website included general information about the pertinent topics discussed during the public information sessions: 1) The Past, 2) The Present, 3) The Future, 4) Science, and 5) Cleanup. In addition, the website provided an opportunity for visitors to experience the same guided presentation given during public scenario evaluation meetings. The guided presentation ended with an opportunity for visitors to express preferences for each of the same 12 scenarios, following the same protocol implemented in community meetings. The resulting data were recorded for analysis and inclusion in the final project report.

The website was promoted through advertisements in the *Paducah Sun*, the *Ballard Weekly*, the *West Kentucky News*, and the *Advance Yeoman*, as well as during public meetings of the Paducah Chamber of Commerce (April 14, 2011) and the Paducah Rotary Club (May 4, 2011). The site also was promoted through: 1) a tailored education program presented to five sixth grade science classes at Heath Middle School on May 16, 2011; 2) direct mailings to all Water Policy District residents; and 3) a mass emailing to all former project participants. Website data collected from April 14th through July 8th indicated that the site was visited by 713 distinct IP addresses. While a total of 156 people viewed the entire survey, only 97 people actually entered preference scores for at least one scenario. The average number of responses per scenario was 90. A summary of the results from the online surveys is provided in Figure ES5. A summary of the total results (from public meetings and web-based sources) is provided in Figure ES6.

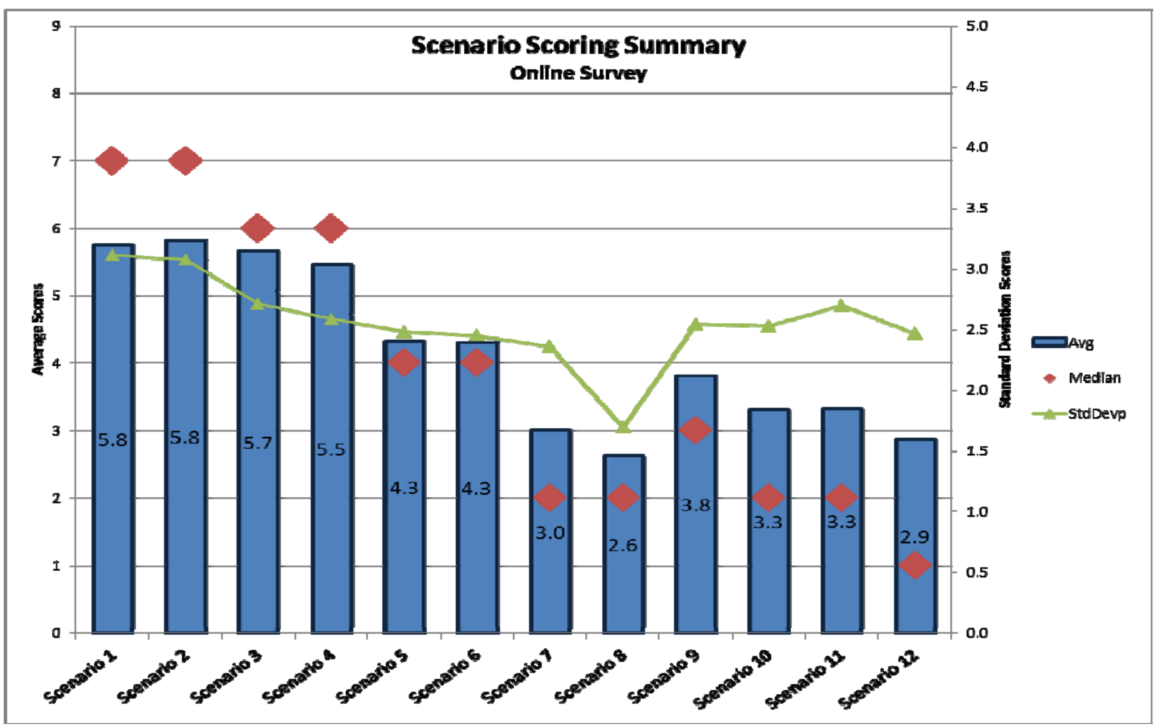

Figure ES5. Web-based Scenario Evaluation Scores (scenario content defined in Table ES1)

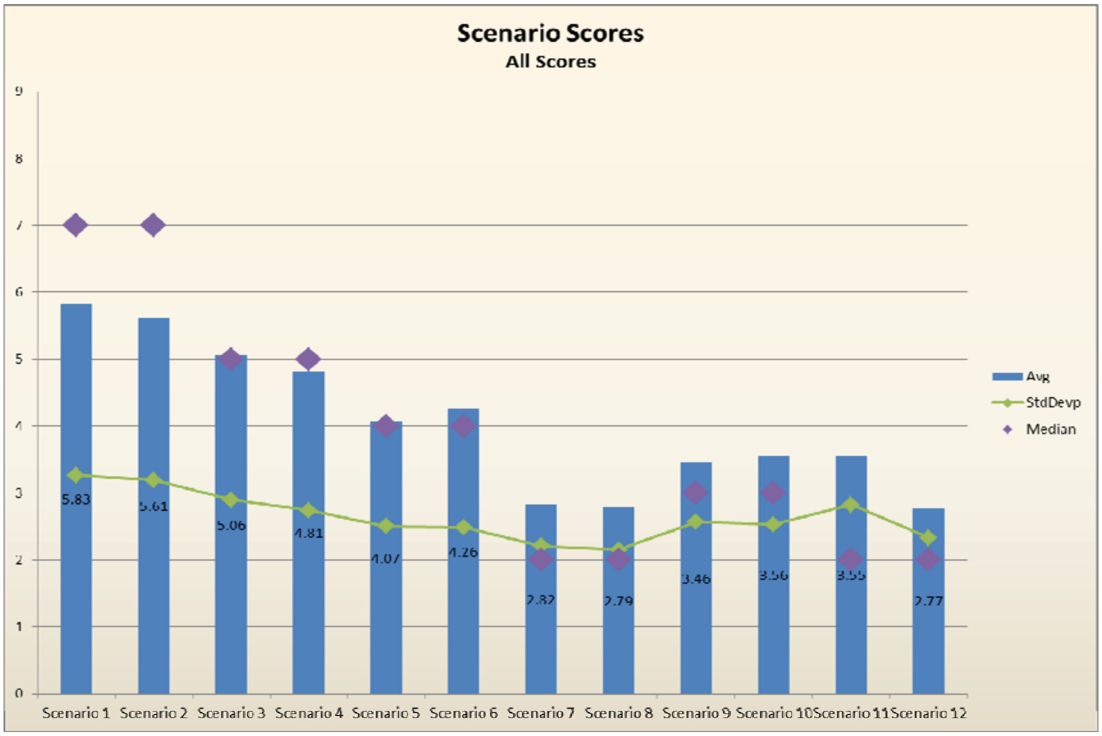

Figure ES6. Total Scenarios Evaluation Scores (scenario content defined in Table ES1)

Summary

Ultimately, community values identified through KRCEE's future use project support a balance between economic development and environmental stewardship. While local citizens clearly were very concerned about the potential economic impact of PGDP closure, they also were concerned that legacy and future decommissioning waste issues be addressed in scientifically sound and ethical ways. Some citizens stated that their values and opinions had not been adequately considered in past decisions, despite more recent attempts by US DOE to improve levels of community involvement. Thus, this study supports a shift from the historical one-directional, informative paradigm of community relations toward a multi-level engagement paradigm that includes the public as a collaborator in identifying and developing solutions for admittedly complex problems. When organizations and communities join together in dialogue to identify both broad values and specific preferences, the risk-bearing community becomes an important decision-making partner for developing solutions that seek to achieve the greatest good.

While the results of the study provide significant insights into current community preferences with regard to the suitability of potential future land uses at the PGDP site, the research team recognizes that such preferences may change in the future as circumstances change. Thus, the results of this study are not intended to be viewed exclusively as a means to an end (as significant as the insights derived from this study may be) nor as the basis for a final community consensus, but also as a first step in building a more effective process of public engagement that can continue to adapt to a changing future.

Despite recent attempts to increase public involvement in its decision making processes, US DOE continues to be perceived in a negative light by some project participants. Given this reality, the project team suggests that US DOE considers adopting a stakeholder engagement process that better integrates citizens into decision-making processes. The project team believes that the public engagement methodology developed in this study provides a framework for such a process.

The public engagement process employed in this study received very high satisfaction ratings from the participants. These positive experiences should promote further participation from other citizens as they learn that their preferences have been collected efficiently, respectfully, and reliably. Because they can verify for themselves that their scores, and all other scores, are being recorded transparently, stakeholders should have increased confidence in the results, and thus are more likely to expend the effort for future participation. A lack of willingness and/or ability to participate, to volunteer the time and effort to attend a public meeting, has been a challenge for this project and others related to PGDP issues. We hope that the methodologies developed through this study will provide an effective tool for counteracting skepticism borne from previous public engagement efforts by illustrating as accurate and robust a picture of community preferences as possible.

Based on the perceived success of the methodologies employed in this study, the following recommendations are suggested:

- Although clearly important, the results of this study should not be viewed as a means to an end, but rather as the first step toward building a more effective process of public engagement. It is highly recommended that US DOE consider use of the developed methodology in their future stakeholder engagement process. The research team sees a potential facilitation role for the CAB in such a process that should be investigated and considered.

- A comprehensive website, www.paducahvision.com, was developed as part of this project to provide significant historical and technical information about the PGDP. It is recommended that US DOE consider continued support for this website, either directly through US DOE itself or through the CAB.

- As the study progressed, it became apparent that stakeholder preferences for future land uses at the PGDP are influenced somewhat by the extent and degree of anticipated environmental remediation at the site, as well as other environmental factors. It also became apparent that community preferences for different cleanup options could be influenced by future land use choices. Although hypotheses about some of these relationships were developed in the course of this research, their explicit evaluation was not part of the scope of work for this project. As a consequence, we would recommend that US DOE consider using the developed methodologies to further investigate this issue. Of most immediate concern is the selection of a waste management alternative for future D&D wastes (e.g. a CERCLA cell).

- Given the increasing likelihood of plant closure, US DOE and the local community should initiate a formal process to help facilitate any transition. This recommendation echoes the 2004 CAB recommendations. The research team finds that many of the CAB's recommendations remain valid and encourages the community and US DOE to revisit them in light of the plant's probable closure. In particular, relevant decision makers should investigate the practicality of establishing some type of formal research facility at the site that would focus on the development and testing of innovative remediation methods or technologies for alternative energy. Such a land use was suggested at each of the public meetings and was strongly supported by a majority of the participants.

1.0 INTRODUCTION

In 2003, the Kentucky Research Consortium for Energy and Environment (KRCEE) was created at the University of Kentucky. The Consortium's mission is to provide technical support to the US Department of Energy (US DOE), the US Environmental Protection Agency (US EPA), and the Kentucky Division of Waste Management (KDWM) regarding non-consensus issues associated with clean-up efforts at the Paducah Gaseous Diffusion Plant (PGDP) National Priority List (NPL) Superfund site. In 2009, KRCEE was asked to work with the local community to help develop a community-based end state vision encompassing the range of community perspectives and preferences for the site's future after US DOE closes the facility.

This report's opening chapters provide an overview of critical factors that could affect future land use decisions at the site. Among these factors are general site information, including the plant's operational and regulatory history (Chapter 1), the site's physical geography and geology (Chapter 2), past environmental impacts and remediation efforts (Chapter 3), various relevant state and federal regulations (Chapter 4), and past community preferences (Chapter 5). Chapters 6-9 of the report describe methodology development and implementation for this project, as well as detailed results of specific methodological components, conclusions that can be drawn from these results, and lessons learned through engaging a diverse set of stakeholders.

1.1 GENERAL SITE INFORMATION

Currently, the PGDP is the nation's only active uranium enrichment facility. Located approximately 15 miles west of Paducah, Kentucky, the PGDP is some 3.5 miles south of the Ohio River in the western part of McCracken County, near neighboring Ballard County. Several small towns are situated within a 5-mile (8.l-km) radius of the US DOE property boundaries, including Heath and Grahamville to the east and Kevil to the southwest (Figure 1.1.1). The plant is located on a US DOE reservation; with the total acreage divided as follows (see Figure 1.1.2)

- 748 acres are located within a restricted area that encompasses plant industrial operations;

- Approximately 822 acres that are not surrounded by the main security fence, but are controlled for security purposes. These properties include the K, S, T and U landfills as well as the Depleted Uranium Hexafluoride (DUF_6) conversion facility which began operation in 2010 and is expected to continue operation for the next 25 years;

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- 1986 acres are currently licensed to the Commonwealth of Kentucky as part of West Kentucky Wildlife Management Area (WKWMA). The entire WKWMA covers approximately 6,823 acres.

For the purposes of this report, it is assumed that the majority of the 822 controlled acres, including landfills and the DUF_6 facility, will continue to be maintained by US DOE or its contractors for the foreseeable future. However, a smaller fraction of this property, including the US DOE administrative building, could be used for future industrial development or could be incorporated into the existing WKWMA. Land use decisions for the 748 acres currently located within the security area were treated separately from land use decisions associated with the 1986 acres currently licensed to the Commonwealth of Kentucky. This decision followed a precedent set by previous studies (e.g. DOE, 1995) as well as feedback from various stakeholder groups that participated in the Paducah Future Vision Process. In addition, the study examined the potential for an onsite waste disposal cell on these properties.

Bordering the PGDP reservation to the northeast, between the plant and the Ohio River, is a Tennessee Valley Authority (TVA) reservation occupied by the Shawnee Steam Plant. Several private properties (both agricultural and rural residential) border the US DOE reservation to the east and west (Figure 1.1.2).

Following the initial discovery of contamination in nearby drinking water wells in 1988, US DOE initiated a Water Policy, which provides potable water to properties overlying or potentially overlying a contaminated groundwater plume. The boundary of the area encompassed by the Water Policy is highlighted with red in Figure 1.1.3 (KRCEE 2007a).

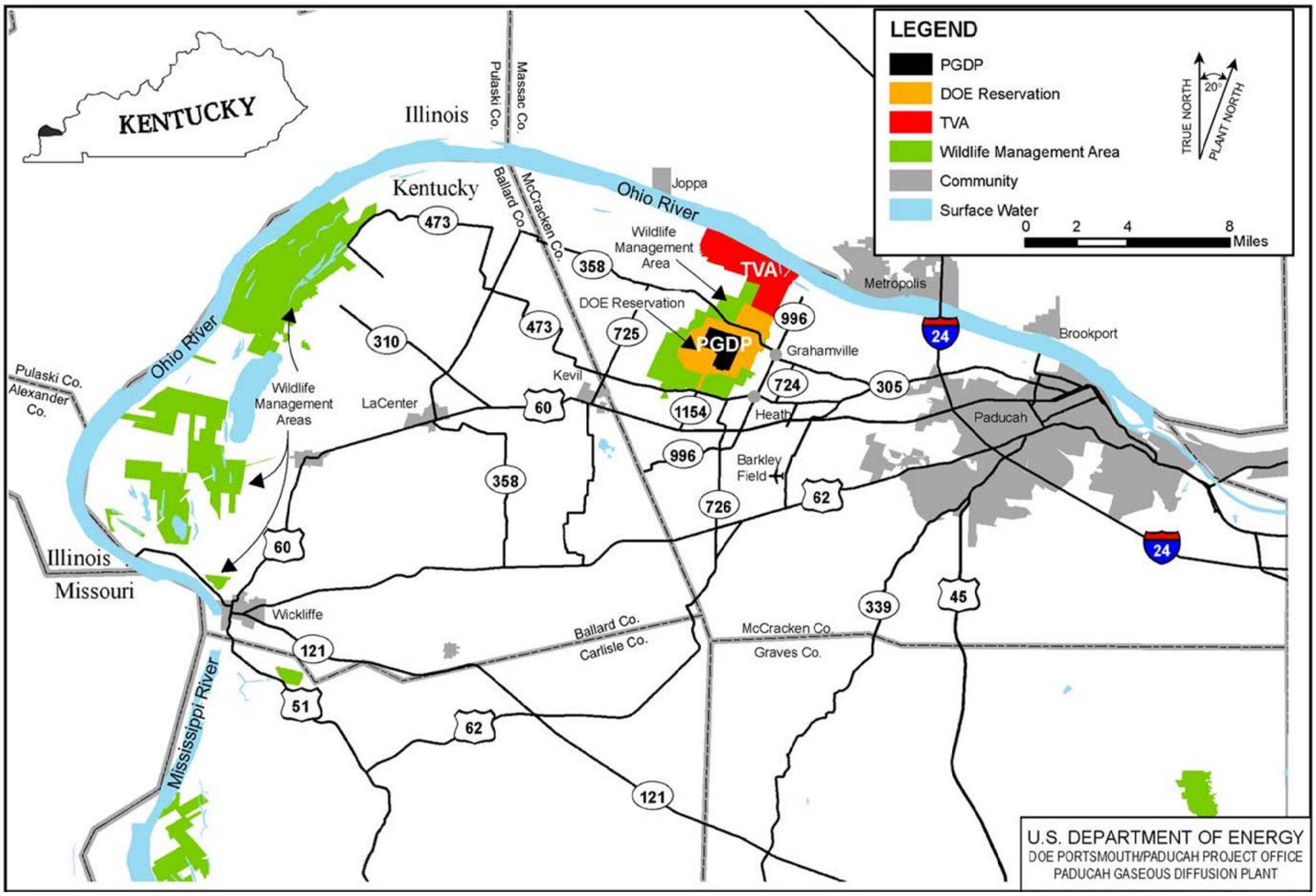

Figure 1.1.1 PGDP Vicinity Map (US DOE, 2010a)

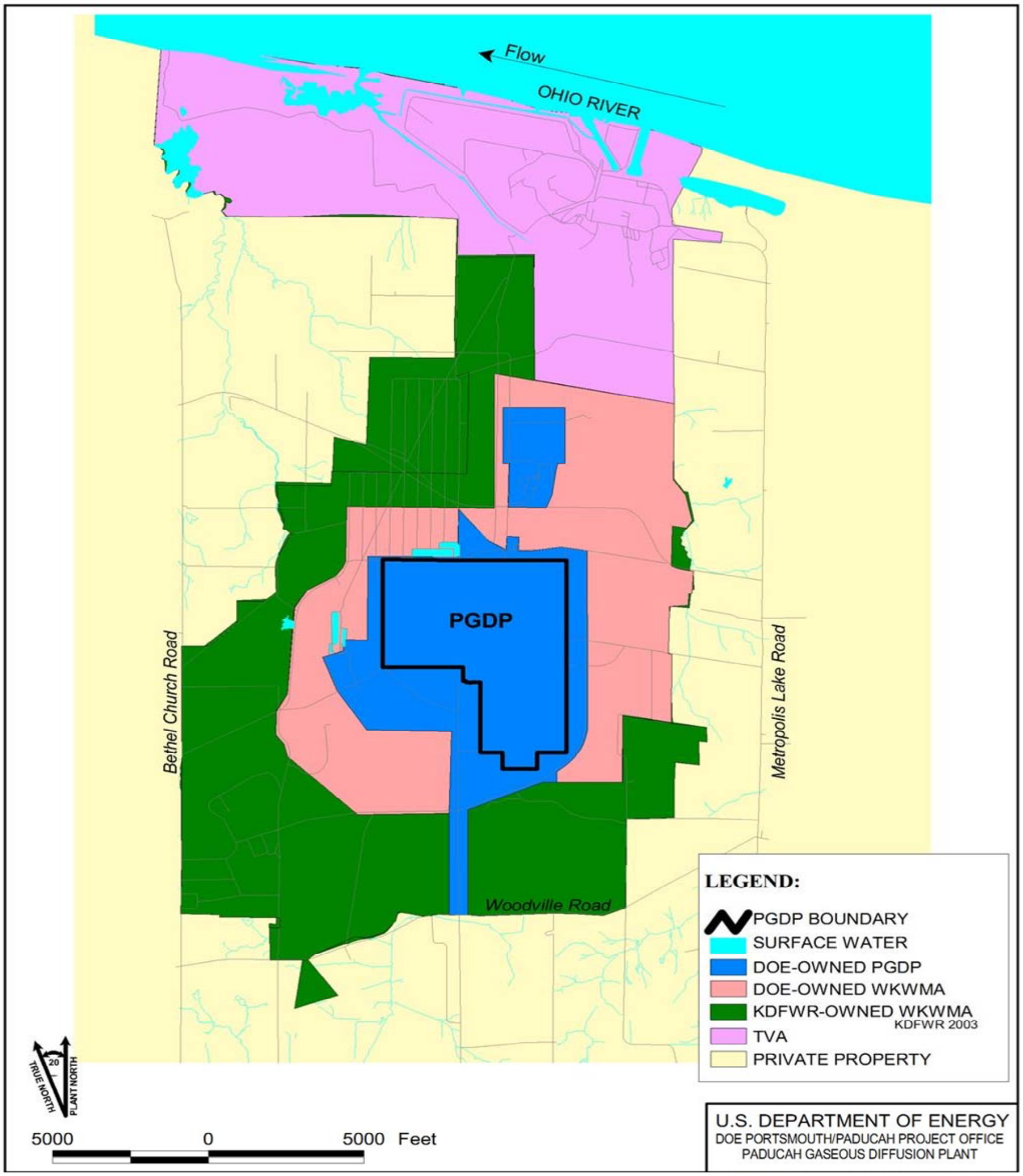

Figure 1.1.2 PGDP Site Location and Adjacent Properties (US DOE, 2010a)

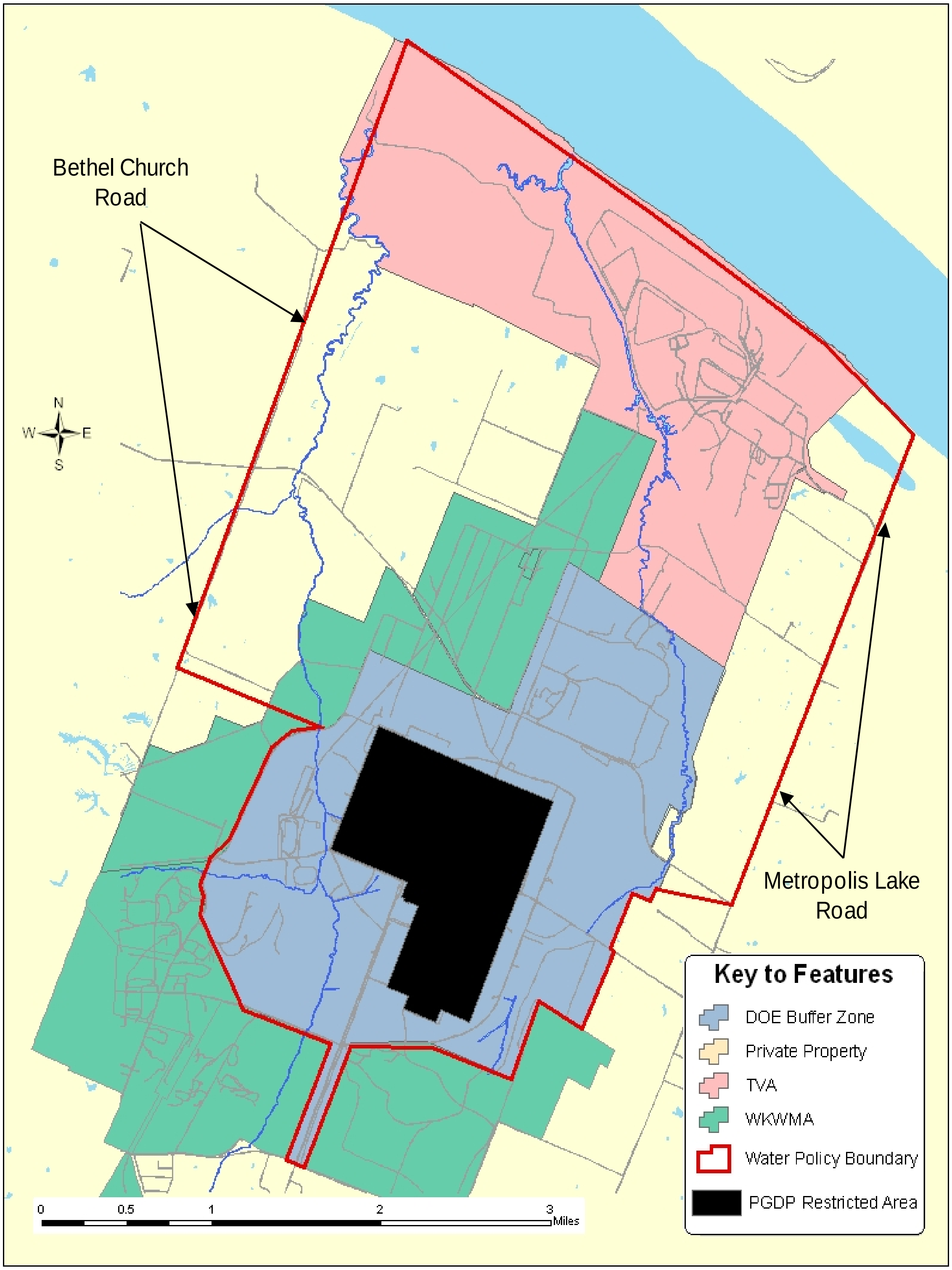

Figure 1.1.3 PGDP Site Location Showing the Water Policy Boundary (KRCEE, 2007)

1.2 GENERAL HISTORY

1.2.1 The Kentucky Ordnance Works (US DOE, 2010b)

Before World War II, the current Paducah site was agricultural. Numerous small farms produced various grain crops and provided pasture for livestock. Early in the war, a 16,126-acre tract was acquired by the US Department of Defense (DOD) for a munitions facility, the Kentucky Ordnance Works (KOW), which was operated by Atlas Powder Company until it was closed in 1946. The KOW included a trinitrotoluene (TNT) manufacturing area; an acid production area; coal, sulfur, toluene, and ordnance storage areas; a sewage treatment plant; a water treatment plant, which is still used by the PGDP (ATSDR, 2002); and burning grounds. After the war, the property was turned over to the Federal Farm Mortgage Corporation and then to the General Services Administration.

In August 1950, the U.S. government identified a need to double the capacity for existing domestic fissionable materials production at Oak Ridge, TN. The US DOD and US DOE's predecessor, the Atomic Energy Commission (AEC), thus began efforts to expand production capacity. As part of this effort, the National Security Resources Board was instructed to designate power areas within a strategically safe area of the United States. Eight government-owned sites were selected as candidates. In October 1950, joint recommendations from DOD, the Department of State, and the AEC led President Truman to direct the production of atomic weapons, an expansion that included the provision for a new gaseous diffusion plant. On October 18, 1950, the AEC approved the Paducah site for uranium enrichment operations, formally requesting that the Department of the Army transfer the site from the General Services Administration to the AEC. The PGDP began producing enriched uranium in 1952; however, final construction of the facility was not completed until 1956 (US DOE, 2010b).

The AEC selected a plant option consisting of two primary facilities. Paducah's C331 facility contained 400 stages modeled after Oak Ridge's K31, while Paducah's C333 facility contained 480 stages twice the size of Oak Ridge's K31 (Global Security, 2011). A picture of one of the PGDP stages (or converters) is provided in Figure 1.2.1.

Of the 7,566 acres acquired by the AEC, 1,361 acres were transferred to the TV) for use in constructing the Shawnee Steam Plant, and 2,781 acres were conveyed via a license to the Commonwealth of Kentucky for wildlife conservation and recreational purposes at the WKWMA. US DOE's current holdings at the Paducah Site total 3,424 acres. The three major land uses are illustrated in Figure 1.1.2.

1.2.2 PGDP Construction

PGDP construction spanned 1951 through 1956 and was conducted in two phases. Construction of the first phase began January 2, 1951, and included erection of the following process and production facilities: C331 and C333, the Gaseous Diffusion Process Buildings; C410/420, the Uranium Hexafluoride (UF_6) Feed Plant; C310, the Purge and Product Withdrawal Building; C315, the Surge and Waste Building; and C300, the Central Control Building. Authorization for the second construction phase was received on July 15, 1952. Two additional enrichment buildings, C335 and C337, were added, with construction being completed in 1956 (Global Security, 2011).

Although major construction activities continued through 1956, Union Carbide began hiring approximately 1,700 permanent plant employees in 1951. The first process buildings, C331 and C333, started operation in September 1952. The first enriched uranium product was withdrawn in November. PGDP was designed to enrich uranium hexafluoride feed material containing approximately 0.7 percent U-235 to UF_6 containing one to three percent U-235. Initially the enriched product from PGDP was then sent to Oak Ridge; however, after 1956, the enriched product was sent to Portsmouth, OH for further enrichment (Nuke Worker, 2011).

On January 6, 1951, TVA began construction of the four-unit Shawnee Steam Plant on the Ohio River and near the PGDP to provide a portion of the needed electricity. On February 15, 1951, Electric Energy, Inc. began construction of the Joppa Steam Plant, in Joppa, IL, also to provide electricity to PGDP. Today energy to run the plant continues to come from the power-grid associated with these plants (Nuke Worker, 2011). Globalsecurity.org (2010) estimates that the PGDP uses as much electricity as the city of Nashville, TN.

In addition to large amounts of electric power, the facility also uses large amounts of lubrication, water, and air cooling. The compressed gases used in the diffusion process are cooled by heat exchange fluids, which in turn are cooled by re-circulating water processed through four sets of cooling towers (ATSDR, 2002). The PGDP currently uses approximately 17 million gallons of water a day, which is provided to the plant via two 36-inch pipelines from the Ohio River (KRCEE, 2006).

The current PGDP facilities include the four main process buildings, four major electrical switchyards, four sets of cooling towers, a three-boiler steam plant, a water treatment facility, a chemical cleaning and decontamination building, the northwest groundwater treatment facility, the northeast groundwater treatment system, maintenance and laboratory facilities, two active landfills, and several inactive facilities inside a fenced security area (Lockheed Martin, 1997a; CH2M Hill, 1992a). The steam plant provides process and comfort heating for other buildings on site. In 1974 and 1975, two boilers were converted to burn low-sulfur coal and oil instead of natural gas. The third boiler burns natural gas or oil but cannot be converted to burn coal (Union Carbide, 1975; Union Carbide, 1976).

Figure 1.2.1 PGDP Converter (US DOE, 2010c)

1.2.3 PGDP Operations

The gaseous diffusion enrichment process employed at the PGDP requires UF_6, a chemical compound consisting of one atom of uranium combined with six atoms of fluorine. It is the chemical form of uranium that is used during the uranium enrichment process. Within a reasonable range of temperature and pressure, it can be a solid, liquid, or gas. Solid UF_6 is a white, dense, crystalline material that resembles rock salt. Uranium hexafluoride is used in uranium processing because its unique properties conveniently allow it to be used as a gas for processing, as a liquid for filling or emptying containers or equipment, and as a solid for storage, all at temperatures and pressures commonly used in industrial processes (US DOE, 2011b).

PGDP was initially designed to enrich UF_6 feed material containing approximately 0.7 percent U-235 to UF_6 containing one to three percent U-235. Initially the enriched product from PGDP was sent to Oak Ridge; however, after 1956, the enriched product was sent to Portsmouth, OH for further enrichment (Nuke Worker, 2011).

In the first step of UF_6 production, uranium ore is mined and sent to a mill where uranium oxide - U_3O_8 (often called "yellowcake") - is produced. The uranium oxide is then sent to a UF_6 production facility. At the production facility, the uranium oxide is combined with anhydrous hydrogen fluoride (HF) and fluorine gas in a series of chemical reactions to form the chemical compound UF_6. The product UF_6 is placed into steel cylinders and shipped as a solid to a gaseous diffusion plant for enrichment (US DOE, 2011b). The overall uranium fuel cycle is visualized in Figure 1.2.2.

Once uranium hexafluoride is received at the enrichment plant, it is heated and converted from a solid to a gas. The gas then is forced through a series of compressors and converters that contain porous barriers. PGDP has 1,760 diffusion stages housed in four buildings, which cover about 74 acres (30 hectares) (USEC, 2011). Because U-235 has a slightly lighter isotopic mass than U-238, UF_6 molecules made with U-235 diffuse through the barriers at a slightly higher rate than the molecules containing U-238 (see Figure 1.2.3). At the end of the process, there are two UF_6 streams, with disproportionate concentrations of U-235. The stream with the greater U-235 concentration, or “the product”, is referred to as enriched UF_6, while the stream with the reduced U-235 concentration, or “the tails”, is referred to as depleted UF_6, or DUF_6 (US DOE, 2011b). Since their initial operation, the tails associated with the enrichment processes at both Paducah and Portsmouth have been removed from the enrichment stream, transferred to cylinders, and placed in storage yards at both sites (ATSDR, 2002). The PGDP currently has an inventory of approximately 39,000 cylinders, while the Portsmouth facility has an inventory of approximately 25,000 cylinders.

In the early years, the PGDP facilities included the gaseous diffusion plant, the uranium hexafluoride manufacturing plant, the uranium metal plant, and more than a hundred support buildings (SAIC and Oak Ridge, 1996, 1997). The uranium hexafluoride manufacturing plant converted natural uranium trioxide to UF_6. Later, the plant also converted reprocessed uranium from plutonium production reactor tails, as discussed below (ATSDR, 2002).

Recycled uranium from nuclear reactors was introduced into the PGDP enrichment cascade from 1953 through 1964, when cascade feed material was switched to solely virgin-mined uranium. Use of recycled uranium resumed in 1969 and continued through 1976, when the practice of recycling uranium feed material from nuclear reactors was permanently halted. During the recycling periods, Paducah received approximately 100,000 tons of recycled uranium containing an estimated 328 grams of plutonium-239 (^{239}Pu), 18,400 grams of neptunium-237 (^{237}Np), and 661,000 grams of technetium-99 (Tc-99). The majority of the ^{239}Pu and ^{237}Np was separated out during the initial chemical conversion to UF_6. Concentrations of transuranics -- elements heavier than uranium, such as ^{239}Pu and ^{237}Np -- and (Tc-99) are believed to have been deposited on internal surfaces of process equipment and in waste products. This is believed to be the source of the current Tc-99 groundwater plume at the site, which will be discussed further in Chapter 3 (US DOE, 2010b).

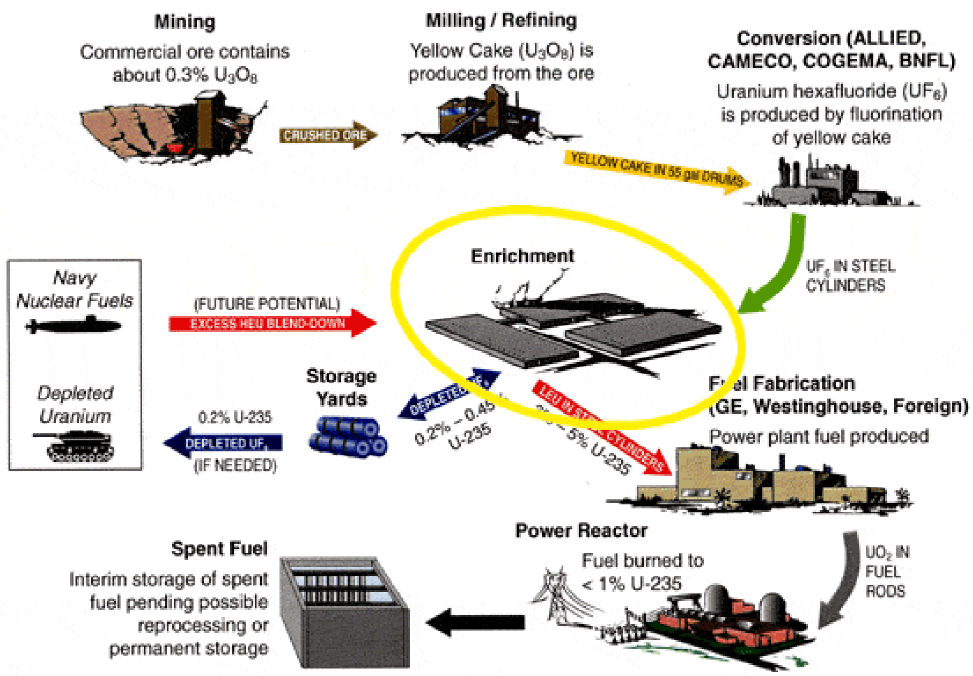

Figure 1.2.2 The Uranium Fuel Cycle (US DOE, 2011b)

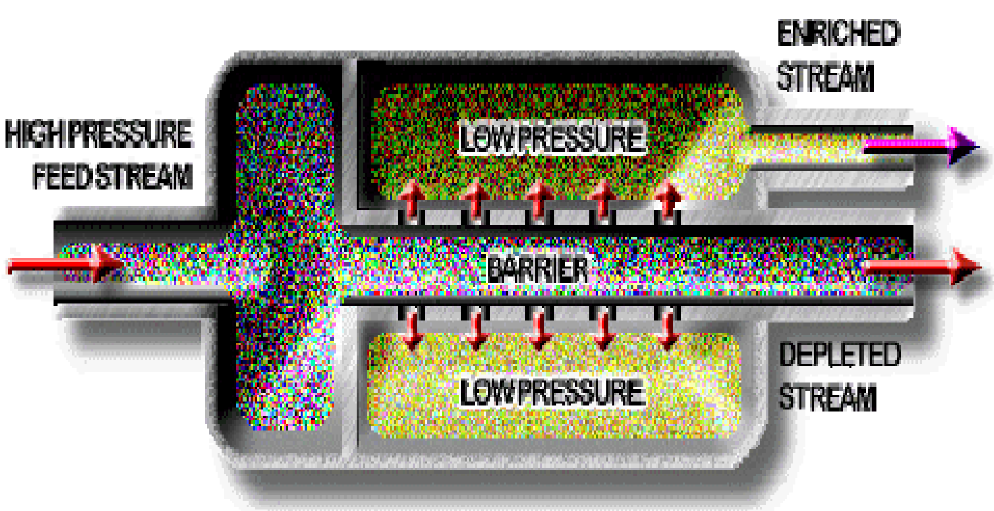

Figure 1.2.3 Diagram of Converter Used in the Uranium Gaseous Diffusion Enrichment Process (USEC, 2011)

At the PGDP uranium metal plant, depleted UF_6 was reacted with hydrogen to recover hydrogenfluoride and to convert the volatile UF_6 into more easily stored uranium tetrafluoride (UF_4). Some of the UF_4 was reduced with magnesium to uranium metal. The uranium metal plant stopped operating in 1975 (Union Carbide, 1978). Also, between 1952 and 1986, PGDP operated several secondary smelters to recycle scrap metals (ATSDR, 2002).

From 1952 through 1977, UF_6 feed material also was produced from uranium trioxide or UO_3 (called "yellowcake") at PGDP buildings C410 and C420. This feed material, which was supplied by such sources as El Dorado Mining and Refining, Mallinkrodt Chemical Works, and General Chemicals (now Allied Chemical), comprised less than ten percent of the UF_6 fed to the cascade. Since 1977, PGDP has received UF_6 feedstock both from commercial vendors, such as Honeywell in Metropolis, IL, and from foreign sources (US DOE, 2011b)

1.2.4 More Recent Operational History

In 1974, the responsibility for PGDP transitioned to the newly formed US Energy Research and Development Administration, which became US DOE in 1977. Carbide and Chemicals Company, which later became Union Carbide Corporation Nuclear Division, was named as the original site contractor based on the company's experience with gaseous diffusion operations at Oak Ridge. Carbide operated PGDP for the AEC, and for its successor agencies the Energy Research and Development Administration (ERDA) and US DOE, until 1984, when they were replaced through a competitive procurement by Martin Marietta Energy Systems, Inc. In June 1995, Lockheed Martin Corporation was formed through the merger of Lockheed and Martin Marietta corporations. Lockheed Martin Corporation later became Lockheed Martin Energy Systems (LMES) and Lockheed Martin Utility Services (LMUS).

In November 1992, the U.S. Energy Policy Act created the United States Enrichment Corporation (USEC) to take over the U.S. government’s uranium enrichment enterprise. In July 1993, USEC officially assumed responsibility for the Paducah and Portsmouth uranium enrichment plants, contracting with newly-created subsidiary Martin Marietta Utility Services for operation and maintenance of the two plants. Beginning July 1, 1993, LMUS operated and maintained PGDP under contract to USEC. Environmental compliance and waste generated from the operating plant since July 1, 1993, are the responsibility of the USEC (ATSDR, 2002). US DOE remains site owner of the original property.

On March 3, 1997, regulatory oversight of enrichment plants officially transferred from the Department of Energy to the Nuclear Regulatory Commission (NRC). US DOE and LMES retained environmental remediation and waste handling responsibilities for activities performed prior to July 1, 1993 (Lockheed Martin, 1997b). On April 1, 1998, the new US DOE contractor for these responsibilities became Bechtel-Jacobs Company (ATSDR, 1998).

On July 28, 1998 USEC was privatized and officially became USEC Inc., an investor-owned company licensed by the NRC. In 1999, USEC took over direct operation of the Paducah Gaseous Diffusion Plant, and then announced a plan to consolidate all enrichment activity at Paducah by 2001. In March 2001, the NRC amended the operating certificate for the Paducah plant, permitting uranium enrichment levels up to 5.5%. A month later, USEC completed a Paducah assay upgrade program, enabling the plant to enrich uranium up to 5%. In May 2001, USEC ceased enrichment activities at Portsmouth, OH, leaving Paducah as the only operational uranium enrichment facility in the United States (US DOE, 2010b).

1.2.5 DUF_6 Facility

In August 2002, US DOE awarded a contract to Uranium Disposition Services, LLC (UDS) to design, construct, and operate facilities at Paducah and Portsmouth for disposing approximately 700,000 metric tons of DUF_6 stored at the two facilities. Both the Paducah and Portsmouth DUF_6 facilities began operation in 2010, with a goal of converting the US DOE inventory of DUF_6, into two different products: 1) uranium oxide, a more stable chemical form of uranium that should facilitate its future disposal and 2) Hydrogen Fluoride (HF), which has a commercial value (UDS, 2011).

The DUF_6 conversion process is based on a technology currently operating under NRC license in Richland, WA. That plant has operated safely and has been environmentally compliant for more than ten years. The conversion process begins with DUF_6 in its solid form contained in feed cylinders. These cylinders are placed into autoclaves and heated to vaporize and transfer the UF_6 from the cylinder into the process. In the conversion process, DUF_6 is reacted with steam and hydrogen, which results in the formation of a uranium oxide and aqueous hydrogen fluoride. The process also includes scrubbers, filters, and monitoring equipment to assure proper conversion and to eliminate releases into the atmosphere (UDS, 2011).

The Portsmouth DUF_6 inventory is expected to be completely processed in approximately 18 years and Paducah’s larger inventory within 25 years. Consequently, all future land use scenarios examined in this study included the assumption that the DUF_6 facility will remain in operation during and following the remaining site's transition to a future use.

1.2.6 Current Economic Pressures

The Paducah plant it currently set to be replaced by the American Centrifuge Technology and Manufacturing Center in Portsmouth, OH. In March 2004, the U.S. Nuclear Regulatory Commission (NRC) licensed USEC to operate its American Centrifuge Demonstration Facility, called the Lead Cascade, in Piketon, OH. In August 2004, USEC applied for a NRC license for constructing and operating the proposed full-scale commercial uranium enrichment plant. The proposed plant will include gas centrifuge uranium enrichment technology, which will replace the gaseous diffusion process. USEC began construction on the American Centrifuge Plant in May 2007. Commercial operations were expected to begin in late 2009, with a production level of 3.5 million separable work units (SWU, i.e. a unit of enrichment) by 2010 (Global Security, 2011); however, delays have pushed back these plans, and the plant is not yet operable as of this report. The plant's cost was anticipated to be $3.5 billion.

On June 17, 2002, a US DOE-USEC Memorandum of Agreement committed USEC to operating and maintaining the Paducah site until the American Centrifuge Plant can be deployed. The US DOE Office of Nuclear Fuel Supply Security ensures implementation of the Agreement. Under US DOE NE-60 programmatic missions, the Oak Ridge Office (ORO) administers leases between US DOE and USEC at the Paducah site. In March 1997, NRC assumed nuclear safety oversight responsibilities; however, ORO also provides regulatory oversight for the portions of Paducah leased to USEC but not under NRC regulation (Global Security, 2011).

While USEC continues experiencing delays with the Ohio centrifuge facility, at least three other enrichment facilities currently are being planned at U.S. sites by other companies. These include a facility planned for Idaho Falls, Idaho by the French Company Areva (Environment News Services, 2008), a facility planned near Wilmington, North Carolina by Global Laser Enrichment, or GLE (Reuters, 2009), and a project planned for New Mexico by a subsidiary of Urenco, a company partially owned by the British and Dutch governments (Columbus Dispatch, 2010).

At the federal level, the Department of Energy continues moving ahead with plans to double the amount of federal loan guarantees available for enrichment projects to $4 billion. Such a move could double the competition the Piketon project faces for a loan guarantee that it requires to survive. According to the Columbus Dispatch (2010), “The Obama administration's intent apparently is to be able to grant separate $2 billion loan guarantees to the USEC project in Piketon and a competing enrichment plant being built in Idaho by French-based Areva.”

While neither GLE nor Urenco applied for the initial $2 billion loan guarantee, both Areva and USEC did. Areva's application is pending. USEC's application was rejected in 2009 by US DOE, which said USEC had not yet shown that its centrifuge technology would be commercially viable. US DOE agreed to let USEC reapply and gave the company $45 million to carry out more research and development. USEC officials insist the company is on track to operate a successful centrifuge plant.

Should USEC be successful with its current plans, or should any of the other three facilities be constructed, additional economic pressure could be placed on USEC to close the PGDP, which is based on 60 year-old technology. Regardless of the eventual outcome, the future use study described herein operated under an assumption that the PGDP will be closed, most likely in the next decade.

1.3 REGULATORY HISTORY

The regulatory history associated with the PGDP is somewhat complex, given the myriad federal regulations that are applicable at a National Priority List (NPL) Superfund site. These are summarized in Appendix A.1. The following regulatory history has primarily been obtained from one of the most recent reports about the site, the 2008 Paducah Annual Site Evaluation Report (US DOE, 2010b) and provides some background for understanding some of the potential implications of such regulations as they may impact the future use the site.

In July 1988, the Kentucky Radiation Control Branch, in conjunction with the Purchase District Health Department, sampled several residential groundwater wells north of the plant in response to concerns from a local citizen regarding the quality of water in a private well. Subsequent analyses of these samples revealed elevated gross beta levels, indicating possible radionuclide (i.e. radioactive material) contamination. On August 9, 1988, these results were reported to US DOE, which responded by sampling several private groundwater wells adjacent to the site the following day. Upon analysis, some private drinking well samples demonstrated elevated levels of Technetium-99 (Tc-99), a man-made radioisotope that is a by-product of the fission process that occurs inside a nuclear reactor. Technetium-99 had been introduced to the PGDP enrichment process from the recycling of spent nuclear fuel rods from the US DOE Hanford and Savannah River nuclear facilities (US DOE 2010b). The discovery of Tc-99 and Trichloroethylene (TCE) in drinking-water wells led US EPA and US DOE to enter into a formal legal agreement called an Administrative Consent Order (ACO) as mandated under Section 104 and 106 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), i.e. the U.S. Superfund Law. The ACO required that US DOE investigate and address the nature and extent of PGDP-related contamination, as well as potential impacts on human health and the environment (US DOE, 2010b).

Following the initial discovery of contamination, US DOE instituted the following actions:

• Provided a temporary alternate water supply to affected residences;

• Sampled surrounding residential wells to assess the extent of contamination;

• Extended a municipal water line to affected residences as a long-term source of water; and

• Began routine sampling of residential wells around the PGDP.

As required by the ACO, US DOE continued routine sampling of residential wells and initiated a two-phase site investigation (SI) to identify the nature and extent of off-site contamination at the PGDP. Phase I of the SI, which was conducted from summer 1989 to March 1991, evaluated the extent of off-site contamination through extensive groundwater monitoring and surface water sampling. Results of these activities are reported in *Results of the Site Investigation, Phase I, at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky* (CH2M HILL, 1991). Phase II of the SI, which was conducted from November 1990 to October 1991, focused on identification and characterization of on-site sources contributing to off-site contamination. Phase II determined the level of risk to human health and the environment from exposure to contaminated media and biota and developed an initial list of remedial alternatives. Results are reported in *Results of the Site Investigation, Phase II, at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky* (CH2M HILL, 1992a). Risks to human health and the environment from exposure to contamination originating at the PGDP were reported in *Results of the Public Health and Ecological Assessment, Phase II, at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky* (CH2M HILL, 1992b). This report used data collected during the SI to quantitatively assess risks to human health and to qualitatively assess risks to the environment (US DOE, 2010b). Additional health investigations were later conducted by two other federal agencies, the Agency for Toxic Substances and Disease Registry (ATSDR), and the National Institute for Occupational Safety and Health (NIOSH). Synopses of these investigations are provided in Appendices A.2 and A.3.

ACO activities identified two off-site groundwater contamination plumes, referred to as the Northwest and Northeast Plumes, as well as several potential onsite source areas requiring additional investigation. ACO activities also included the evaluation of alternatives and the implementation of several interim activities (US DOE, 2010b).

On May 13, 1991, the Commonwealth of Kentucky and US DOE signed an Agreement in Principle (AIP). This non-regulatory program provides funding for independent, impartial, and qualified assessments of past, present, and future environmental and health issues related to but not addressed by CERCLA and other regulatory programs at contaminated US DOE sites. US DOE initiated AIP to fund additional data collection and assessments in response to potential public distrust of the agency regarding site cleanup (US DOE, 2010b).

The Kentucky/US DOE AIP reflects the understanding and commitments between US DOE and the Commonwealth of Kentucky regarding US DOE's provision of technical and financial support to Kentucky for environmental oversight, surveillance, remediation, and emergency response activities. The goal of the AIP is to maintain an independent, impartial, and qualified assessment of the potential environmental impacts from present and future US DOE activities at the PGDP. The AIP is intended to support non-regulated activities, while the Federal Facilities Agreement (FFA) covers regulated activities. The AIP includes a grant to support the Commonwealth of Kentucky in conducting independent monitoring and sampling, both on-site and off-site, and support a number of emergency response planning initiatives. Included are cooperative planning, conducting joint training exercises, and developing public information about preparedness activities (US DOE, 2010b).

On August 19, 1991, Kentucky issued US DOE a Resource Conservation Recovery Act (RCRA) permit for the treatment and storage of hazardous PGDP wastes. The RCRA permit requires US DOE to comply with environmental laws and regulations in the cradle-to-grave management of hazardous wastes, worker safety, record keeping, emergency planning and prevention, and protection of public health and the environment (US DOE, 2010b).

The Federal Facilities Compliance (FFC) Act, enacted in October 1992, eliminated a then existing federal facilities immunity from fines and penalties for violations of hazardous waste management as defined by RCRA. It also provided for the development of site treatment plans (STPs) for treating US DOE mixed waste and for approving such plans by the states. As a result of the complex issues and problems associated with the treatment of mixed hazardous and radioactive waste (mixed waste), US DOE and KDEP solicited and considered input prior to signing an STP on September 10, 1997. The STP facilitates compliance with the FFC Act. A series of mixed waste treatment milestones are detailed in the STP, which also requires that US DOE consider waste minimization in all projects and processes (US DOE, 2010b). This requirement has potential implications when considering the future disposition of wastes associated with the decommissioning and demolition (D&D) activities that are expected to occur once the facility is eventually shut down.

As part of the residential well sampling program that began when off-site contamination was discovered, US DOE established a water policy in 1994. This policy provides that in the event contamination originating from the Paducah site is detected above plant action levels, a response would be initiated by the US DOE. These levels were established at the analytical laboratory detection limits of 25 picocuries per liter (pCi/L) for Tc-99 and 1 part per billion (ppb) for TCE. Accordingly, residents, as well as state and US EPA officials, are notified immediately of sampling results above these levels, and alternative water supplies must be provided to those residences through the municipal water system. In the event of a time lapse between discovery and the ability to complete connections, bottled water must be provided. In accordance with the water policy of 1994, US DOE pays installation cost of water systems, as well as monthly charges for water service to residences within the established water policy area. US DOE modified this water policy in 1994 to extend a municipal water line to the entire area of the groundwater contamination originating from the PGDP. All residents within the defined area, regardless of whether their wells were contaminated, were given the option to receive municipal water at US DOE’s expense. US DOE also provided municipal water to new residences and to some new businesses in the area (US DOE, 2010b). The extent of the water policy area is shown in Figure 1.3.1.

On May 31, 1994, the Paducah site was placed on the US EPA National Priorities List (NPL) of the highest priority US sites for remediation. Section 120 of CERCLA requires federal agencies with facilities on the NPL to enter into a Federal Facilities Agreement (FFA) with the US EPA. The FFA, which was signed February 13, 1998, by US DOE, EPA, and KDEP, established a decision-making process for remediation of the Paducah Site and coordinates CERCLA remedial action requirements with RCRA corrective action requirements (US DOE, 2010b).

Upon signing the FFA in February 1998, the parties declared that the ACO requirements were satisfied, terminating the ACO because the remaining cleanup would be continued under the authority of the FFA. A series of remedial investigations (RIs) and feasibility studies (FSs) were initiated under the FFA, including the ongoing evaluation of all major contaminant sources impacting groundwater and surface water. In accordance with the ACO and FFA, US DOE's subsequent actions have focused primarily on reducing potential risks associated with off-site contamination (US DOE, 2010b).

According to the FFA, US DOE must submit an annual Site Management Plan (SMP) to US EPA and KDEP. The SMP summarizes completed remediation work, outlines remedial priorities, and contains schedules for completing future work. The SMP is submitted to regulators each November to update enforceable milestones and to include any new strategic approaches. Specific timelines for site remediation projects are established and tracked via the FFA and the SMP. Assurance of project performance is provided by a CERCLA five-year review process (US DOE, 2010b).

1.4 IMPACT ON FUTURE LAND USE DECISIONS

Future land use decisions for the PGDP are obviously linked with the level of contamination and proposed remediation at the site. As summarized in the preceding sections, the site has experienced significant contamination over the last 60 years of operation. Such contamination has raised serious concerns among the local citizens (especially those who live closer to the plant) about how safe the site will be for different land uses as well as the possible impact of legacy environmental issues to the properties which surround the DOE facility today. While the Paducah community as a whole has been found to be supportive of future land uses that will foster economic development they also remain concerned about legacy waste issues. Thus any successful proposal for future land uses must be one that adequately addresses existing, legacy, and future environmental impacts. It is thus imperative that US DOE include the local community in the overall decision making process associated with these issues. While the PGDP Risk Based End State Vision process and resulting report are theoretically meant to accomplish this goal by advancing potential solutions that are explicitly tied to risk reduction and management, this study had found that a transition from a strategy that seeks to inform the public to one that seeks to engage the public is warranted. Potential strategies for such engagement are provided in Chapters 6-9.

2.0 PHYSICAL DESCRIPTION OF THE PGDP PROPERTY

2.1 SITE DEMOGRAPHICS

The PGDP is surrounded by the West Kentucky Wildlife Management Area (WKWMA) and some sparsely populated agricultural lands. The closest communities to the plant are Heath, Grahamville, and Kevil, which are within 3 miles (4.8km) of US DOE property boundaries. The economy of Western Kentucky historically has been agriculturally based, although industrial development has increased in recent years. PGDP employs approximately l,200 workers, and the TVA Shawnee Steam Plant employs an additional 265 individuals (US DOE, 2010b).

The total population within a 10-mile radius of PGDP was an estimated 32,292 in 2003 (US DOE, 2003). The closest residences to the site are approximately 3,280 ft north and 3,609 ft east of PGDP (US DOE, 2010a). The closest communities are unincorporated Grahamville, and Heath, located 1 to 2 miles east of the plant. According to the 2000 census, the total populations of McCracken and Ballard Counties were 64,790 and 8,158, respectively.

In addition to the residential population surrounding the plant, the WKWMA draws thousands of visitors yearly for recreational activities. The WKWMA is used primarily for hunting and fishing; other activities include horseback riding, field trials, hiking, and bird watching. Last year, an estimated 20,000 visits were made to the area (Kreher, 2010) .

2.2 CLIMATE

Located in the humid continental zone, the Paducah site experiences warm summers (July averages 79 °F) and moderately cold winters (January averages 35 °F). Yearly precipitation averages about 49 inches. The prevailing wind is from the south-southwest at approximately 5-5.5 meters per sec (m/s) (US DOE, 2010a). The annual average direct solar radiation at the site is approximately 4 kilowatt hours per meter squared per day (kW-hr/(m^2day)).

According to the Commonwealth of Kentucky Alternative Energy Facilities Site Bank (2010) and the National Renewable Energy Lab (2011), the PGDP site is not suitable for either a wind energy facility or a solar energy facility. Generally such sites require wind speeds greater than 6.5 m/s and solar radiation greater than 6 kWh/m^2/day.

2.3 SOILS

The soils found near the PGDP are formed from Pleistocene loess and Holocene alluvium (10,000 to 12,000 years ago to present). The general soil map for Ballard and McCracken Counties delineates three soil associations within the vicinity of PGDP: the Rosebloom-Wheeling-Dubbs association, the Grenada-Calloway association, and the Calloway-Henry association (USDA, 1976). Inside the fenced area of the plant, the best description of the soil would be urban, since many soil type characteristics have changed through construction and maintenance activities (USDA, 2005). Soils around the site have been contaminated with various chemicals including PCBs, TCE, and radioactive metals.

2.4 GEOLOGY

The PGDP is located in the Jackson Purchase region of Western Kentucky, which represents the northernmost extent of the ancient Mississippi Embayment geologic formation. The geologic sequence (or layers) in the region typically are classified based on their geologic age. Starting from the top and working downward, the layers are Quaternary sediments (1.8 million years ago [mya] to today), Tertiary formations (65 to 1.8 mya), Cretaceous formations (144 to 65 million mya), and Paleozoic bedrock (543 to 248 mya). Paleozoic strata younger than Mississippian are not present at the site. The geology around the PGDP is illustrated in Figure 2.4.1.

The Paleocene formation (65 to 54.8 mya) includes Porters Creek Clay, which occurs in the southern portions of the site. This formation consists of dark gray to black silt with varying amounts of clay and fine-grained sand, which can be as thick as 200-feet. The Porters Creek Clay subcrops along a buried terrace slope that extends east–to-west across the site. This subcrop is the northern limit of the Porters Creek Clay and the southern limit of the Pleistocene (1.8 mya to 11,000 years) formation. This formation effectively acts as a dam, preventing contaminated groundwater from moving south of the PGDP.

2.5 SEISMICITY

Three seismic sources have the potential to affect PGDP (Figure 2.5.1): the New Madrid Seismic Zone (NMSZ), which is entered near the juncture of Kentucky, Missouri, and Tennessee; the Wabash Valley Seismic Zone (WVSZ), located in southeast Illinois and southwest Indiana; and background seismicity (KRCEE, 2007b). Of these, the NMSZ presents the most prominent seismic hazard to PGDP (US DOE, 2010a). Four or five major earthquakes are believed to have occurred in the NMSZ in late 1811 and early 1812 (Nuttli, 1982). The most significant earthquakes during this period (December 16, 1811, January 23 and February 7, 1812) are estimated to have had a magnitude between M7.0-7.5 (Hough *et al.*, 2000; Hough and Martin, 2002).

While many people assume that the PGDP is located within the active part of the NMSZ, it technically is located adjacent to the zone. Recent results from the Kentucky Geological Survey (KGS) seismic network show that the seismicity in the area is different from the NMSZ (KGS, 2008). The most recent geologic field research at the PGDP site has failed to uncover any evidence of active faults within the last 10,000 years (KRCEE, 2006b) While the region is still susceptible to earthquake activity, there currently are no regulations that would prohibit the construction of engineered landfills or other such structures at the site. For more information on the regulatory seismic requirements for a landfill at the site, the reader should consult the document: *Workplan for CERCLA Waste Disposal Alternatives Evaluation Remedial Investigation/Feasibility Study at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, DOE/LX/07-0099&D2*.

Before any final decision is made regarding the placement and design of any future landfill, the CERCLA design criteria require that the public be involved in the decision making process. To date, the DOE has held five public informational meetings about current proposals to construct a hazardous waste landfill at the PGDP. The first set of meetings was held on November 18 and 20, 2008 and the second meeting was held on March 24, 2009. DOE conducted two additional meetings on January 14 and 15, 2011. For the purpose of this study, it was assumed that a CERCLA Waste Disposal Cell would be one of the possible options for disposing of future D&D wastes.

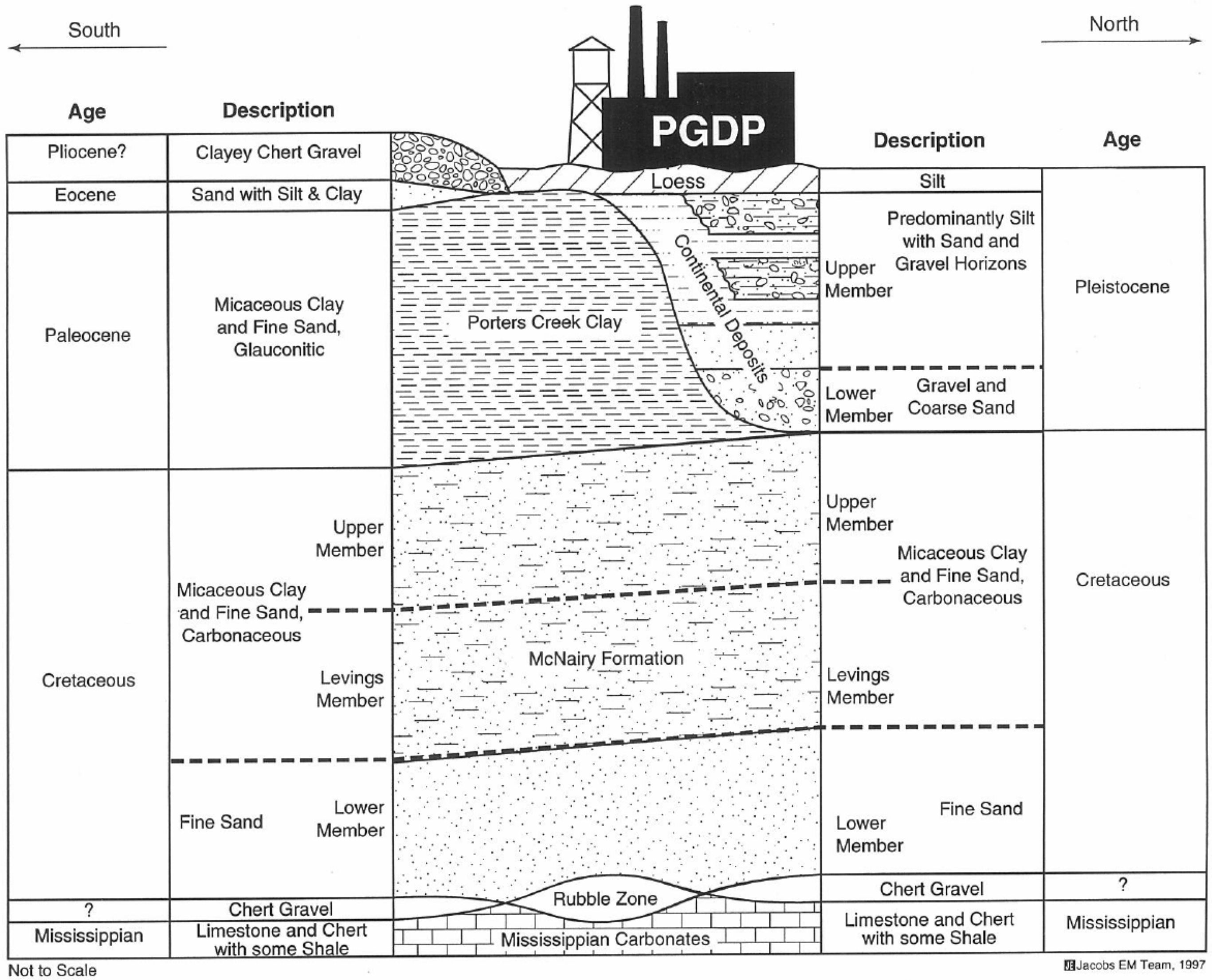

Figure 2.4.1 Geologic Formations in the Vicinity of the PGDP (US DOE, 2010a)

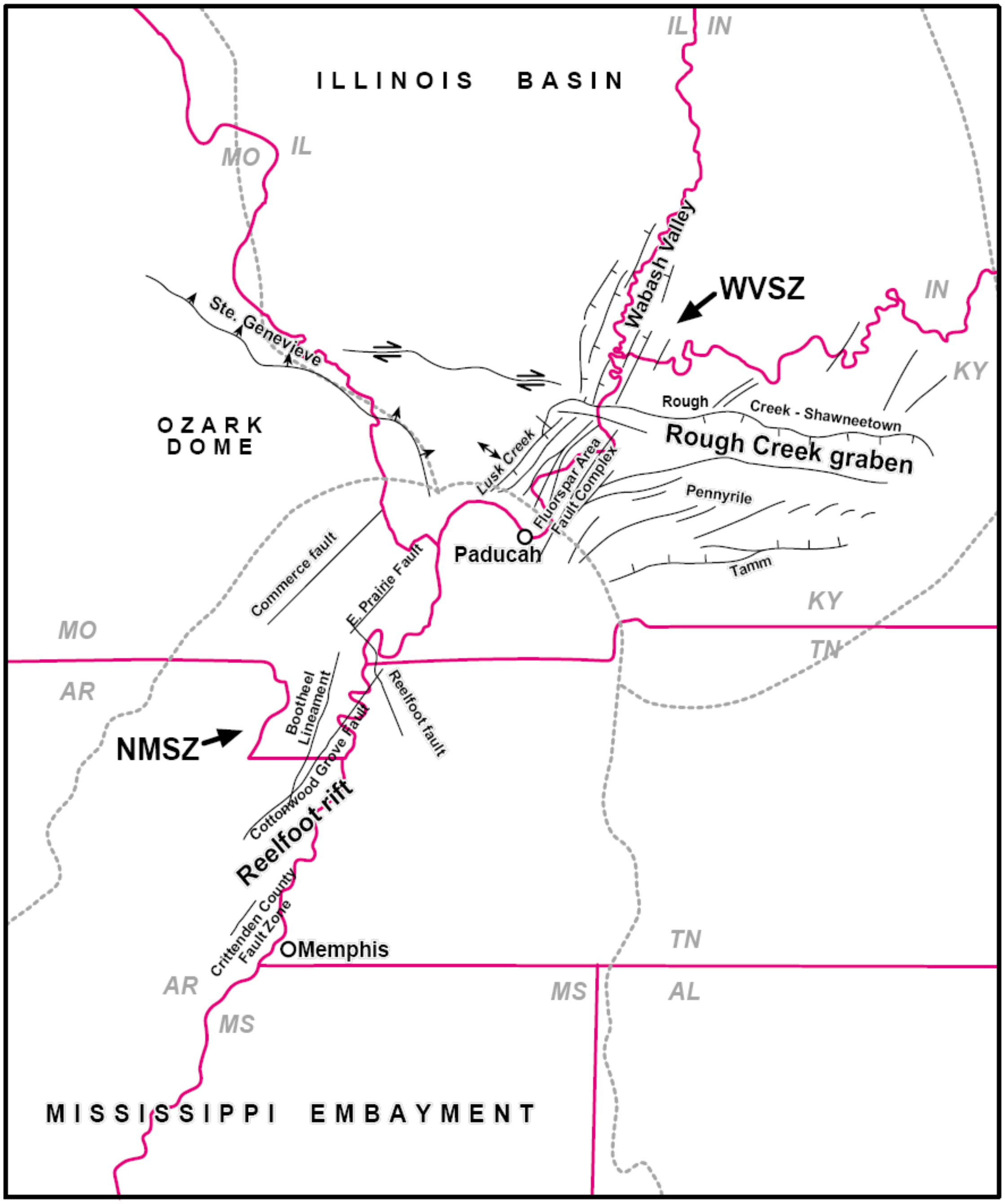

Figure 2.5.1 Regional Tectonic Map (US DOE, 2010a)

2.6 GROUNDWATER HYDROLOGY

Groundwater flow at the site is controlled by four major geologic formations: 1) The Terrace Gravel, 2) the Porters Creek Clay formation, 3) the Pleistocene Continental Deposits, which includes Upper Continental Deposits or Upper Continental Recharge System (UCRS) and Lower Continental Deposits or Lower Continental Recharge System (LCRS), and 4) the McNairy Formation (see Figure 2.6.1).

Infiltrating rainfall south of the PGDP flows downward through the Terrace Gravel until it encounters the Porters Creek Clay formation, where it then flows north until it encounters the Terrace Slope of the Porters Creek Clay formation. At this point, the water cascades down the slope as it migrates down through the UCRS and LCRS. These features have the net result of blocking the migration of any contaminated groundwater south of the plant.

Infiltrating rainfall north of the PGDP migrates vertically through the UCRS and LCRS until it encounters the McNairy Formation. Groundwater flow in the UCRS and LRCS layers occurs vertically and is a primary pathway for transport of dissolved contamination from PGDP. Because the McNairy Formation is much less permeable than both the UCRS and the LCRS, any such flows are then diverted northward toward the Ohio River (US DOE, 1999).

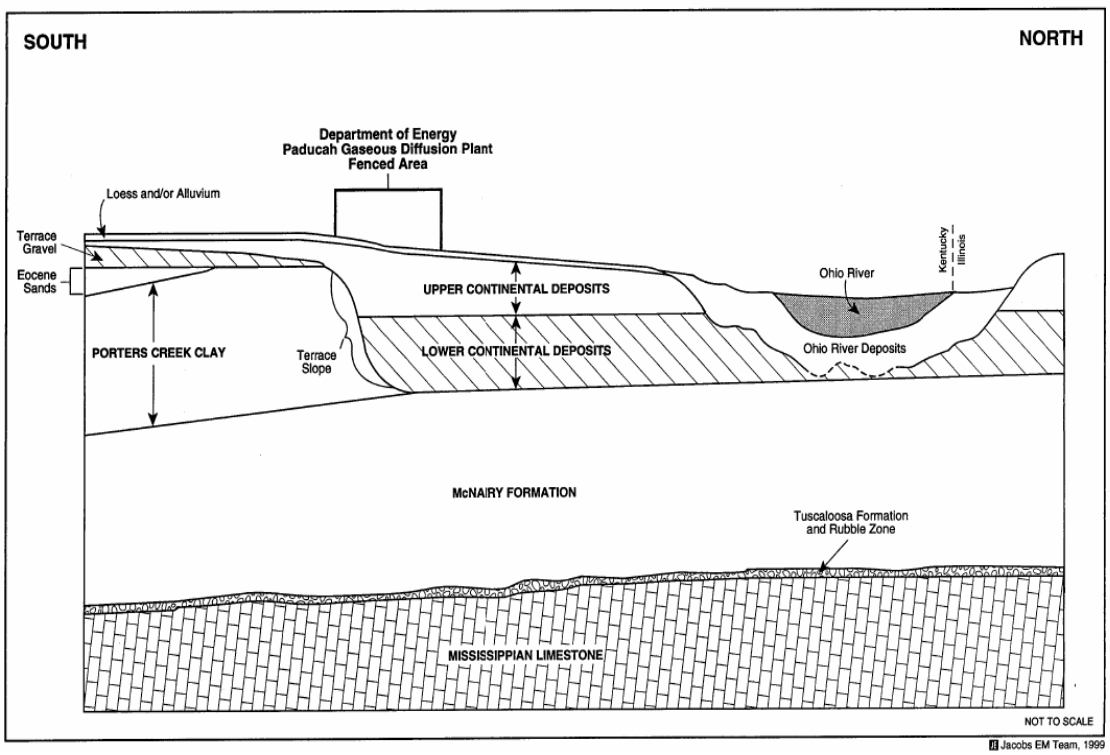

Figure 2.6.1 Geologic Formations Affecting Groundwater Flow at the PGDP (US DOE, 2005)

2.7 SURFACE WATER HYDROLOGY

The PGDP is in the western portion of the Ohio River basin, approximately 15 miles downstream of the confluence of the Ohio River with the Tennessee River, and approximately 35 miles upstream of the confluence of the Ohio River with the Mississippi River. Locally, PGDP is within the drainage areas of the Ohio River, Bayou Creek (also known as Big Bayou Creek), and Little Bayou Creek.

Approximately 3.5 miles north of PGDP, the Ohio River is the most significant surface water feature in the region, carrying an average of over 25 billion gal/day of water. Several dams regulate flow in the Ohio River. The Ohio River stage near PGDP is measured at Metropolis, IL, by a US Geological Survey (USGS) gauging station. River stage typically varies between 293 and 335 ft above mean sea level (amsl) over the course of a year. Water levels on the lower Ohio River generally are highest in late winter and early spring, with lowest levels in late spring and early summer. The entire PGDP is above the historical high water floodplain of the Ohio River (CH2M HILL, 1991) and above the local 100-year flood elevation of the Ohio River (333 ft).

The plant is situated on the divide between Little Bayou and Bayou Creeks (Figure 2.7.1). Surface flow is east-northeast toward Little Bayou Creek and west-northwest toward Bayou Creek. Bayou Creek is a perennial stream on the western boundary of the plant which flows generally northward, from approximately 2.5 miles south of the plant site to the Ohio River along a 9 mile course. An 11,910 acre drainage basin supplies Bayou Creek. Little Bayou Creek becomes a perennial stream at the east outfalls of PGDP. The Little Bayou Creek drainage originates within WKWMA , drains a 6,000 acre area and extends northward along a 6.5 mile course, before joining Bayou Creek near the Ohio River. Drainage areas for both creeks are generally rural; however, they receive surface drainage from numerous swales that drain residential and commercial properties, including PGDP and the TVA Shawnee Steam Plant. The confluence of the two creeks is approximately 3 miles north of the plant site, just upstream of the location at which the combined flow of the creeks discharges into the Ohio River.

The USGS maintains gauging stations on Bayou Creek at 4.1 and 7.3 miles upstream of the Ohio River, as well as a gauging station on Little Bayou Creek that is 2.2 miles upstream from its confluence with Bayou Creek. The mean monthly discharges vary from 7.1 to 22 million gal/day on Bayou Creek and from 1.3 to 7.1 million gal/day on Little Bayou Creek.

Most of the flow within Bayou and Little Bayou Creeks is from process effluents or surface water runoff from PGDP. The upper reach of Little Bayou Creek flows as a perennial stream as a result of plant discharges. A network of ditches discharges effluent and surface water runoff from PGDP to the creeks. Plant discharges are monitored at the Kentucky Pollutant Discharge Elimination System outfalls prior to discharge into the creeks. Changes in the existing land use at the site could have a significant impact on the quantity and quality of flows that occur in both creeks.

Other surface water bodies near PGDP include the following: Metropolis Lake, located east of the Shawnee Steam Plant; several small ponds, clay and gravel pits, and settling basins scattered throughout the area; and a marshy area just south of the confluence of Bayou Creek and Little Bayou Creek. The smaller surface water bodies are expected to have only localized effects on the regional groundwater flow pattern.

Recently, researchers from the University of Kentucky have documented the occurrence of a “head reversal” in the Little Bayou Creek, resulting in the flow of water from the Regional

Gravel Aquifer (RGA) into Little Bayou through a series of seeps or springs (LaSage et. al., 2008). The exact cause of the springs has not been determined, but the result has been the discharge of contaminated water into the creek, thereby producing a potential exposure pathway.

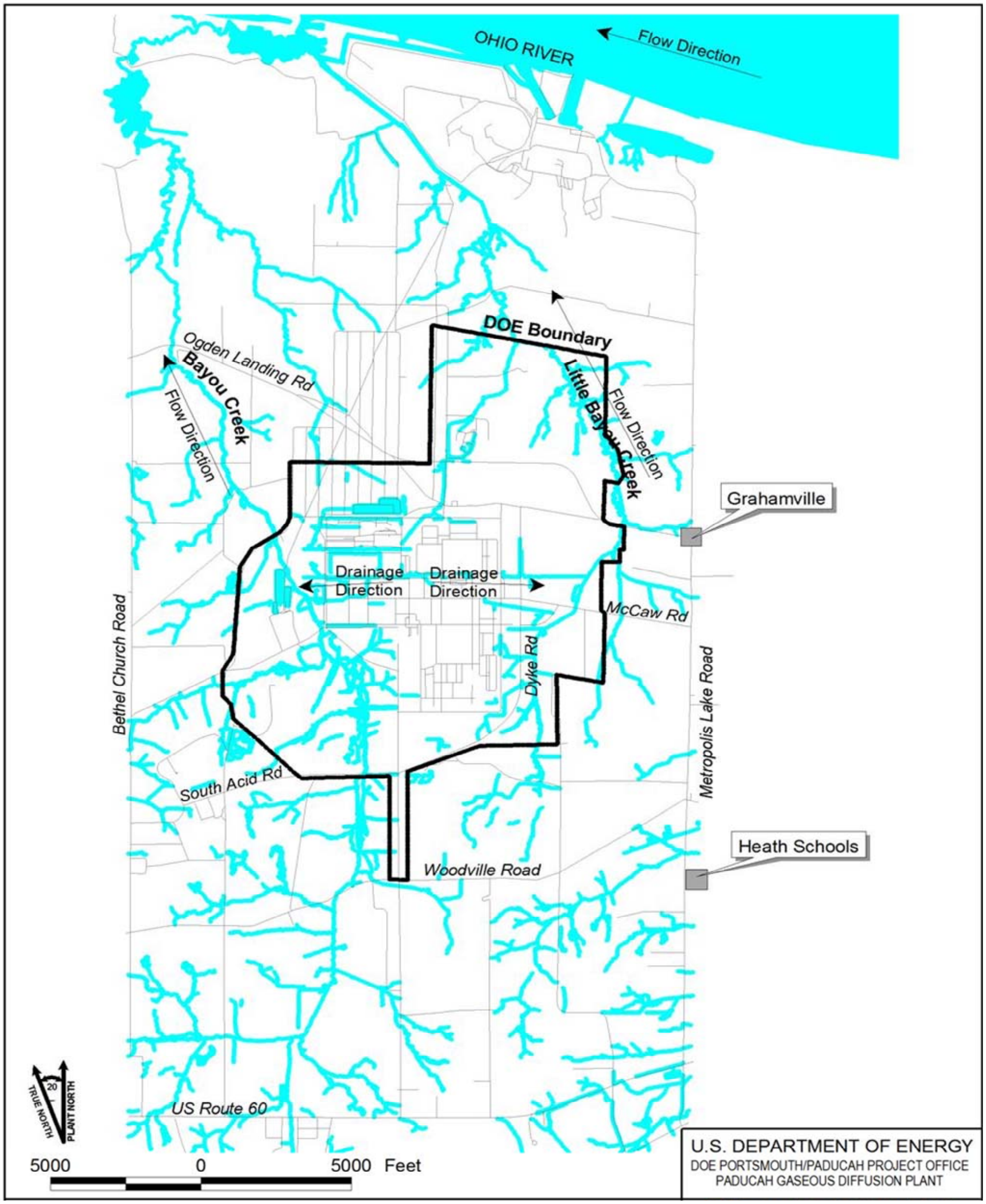

Figure 2.7.1 Surface Water Features in Vicinity of US DOE Site (US DOE, 2010a)

3.0 ENVIRONMENTAL IMPACTS

3.1 WASTE CHARACTERIZATION

During the PGDP's construction and for a number of years following, significant state and federal environmental regulations did not exist to their current extent. As a result, commonly accepted standard operating procedures for managing and/or disposing of potentially toxic chemicals were more relaxed, leading to significant environmental contamination at the PGDP site. A detailed list of toxic chemicals present at the site can be found on the US EPA Superfund website at: http://cfpub.epa.gov/supercpad/cursites/csintinfo.cfm?id=0404794.

Much of the PGDP's environmental contamination resulted from improper handling and disposal of toxic chemicals. Significant groundwater contamination arose from improper disposal of fluids used in cleaning the PGDP equipment. For example, trichloroethylene (TCE), a chief site contaminant, was a widely-used cleaning solvent from the PGDP's construction until June 30, 1993. Resulting environmental releases of TCE occurred through spills, leaks, vapor emission, and discharges to soils, surface water, and groundwater, creating several massive TCE groundwater plumes (US DOE, 1995).

Similarly, the release of cleaning fluids carried other toxic chemicals into the ground, including Technetium-99 (Tc-99), a radioactive metal, resulting in a significant Tc-99 groundwater contamination plume. In fact, detection of Tc-99 in nearby residential drinking water wells first alerted officials to groundwater contamination at the PGDP site. Maps showing the extent of TCE and Tc-99 groundwater contamination are provided in Figures 3.1.1 and 3.1.2.

In addition to these contaminants, such chemicals as polychlorinated biphenyls (PCBs) and heavy metals, including uranium, also have been found at the site, both in soils within the site's security area and in streams and stream sediments outside of the plant boundary. A summary of the types of wastes found at the PGDP is provided in Appendix A.4.

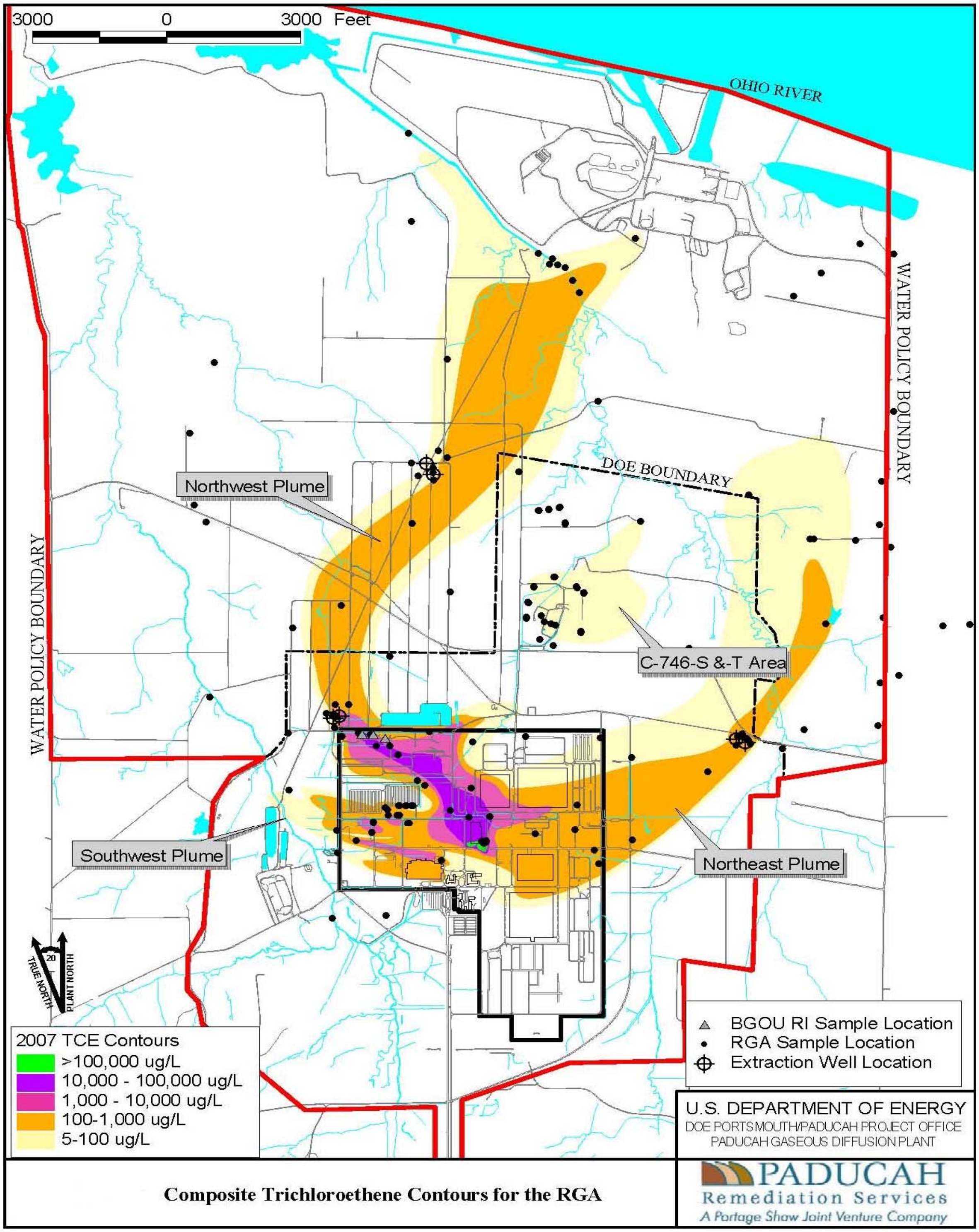

Figure 3.1.1 Spatial Extent of TCE Plume (PRS DOE, 2008)

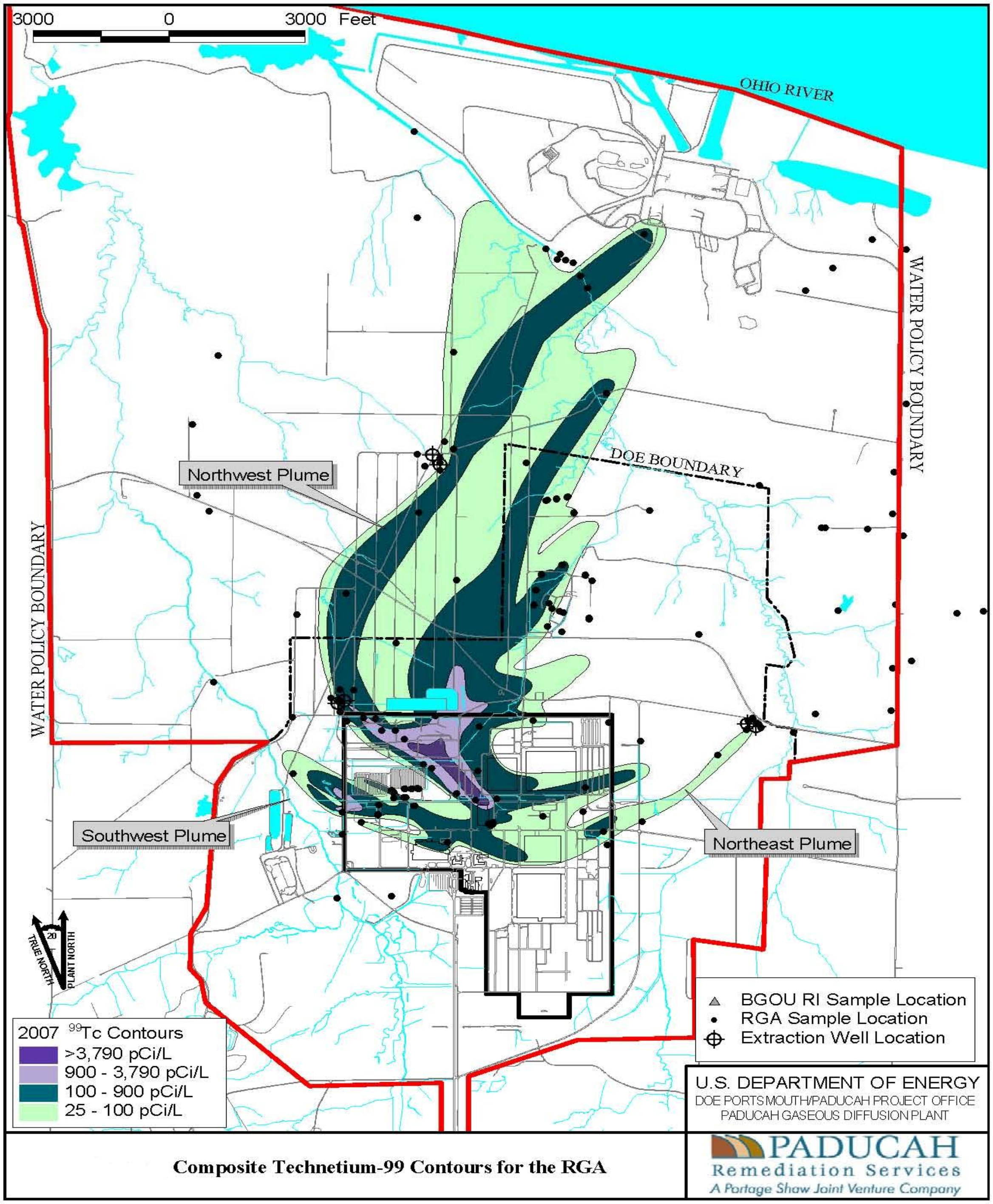

Figure 3.1.2 Spatial Extent of TC99 Plume (PRS, 2008)

3.2 BURIAL GROUNDS

In addition to contamination from leaks and spills, some groundwater contamination has occurred from wastes buried in eight different PGDP on-site burial grounds. Seven of these are located in the upper northwest corner of the site, as shown in the map below (see Figure 3.2.1), while the remaining burial ground is located just north of the plant under the S & T landfills (see Figure 3.3.1). For more information on the contents of the burial grounds, see Appendix A.5.

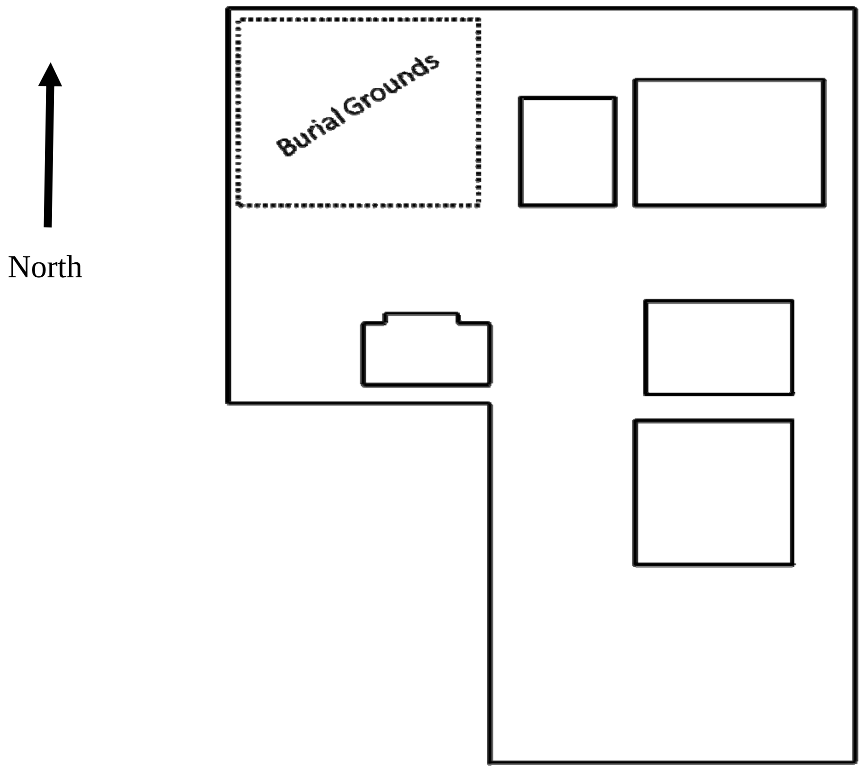

Figure 3.2.1 Location of Burial Grounds at the PGDP

Future disposition of these burial grounds could affect the potential future land use of the site. Three options currently are under consideration: 1) removing all of the materials in the burial grounds and re-burying them in an onsite EPA-approved landfill; 2) removing and transporting all materials from the burial grounds to a federally sanctioned facility; or 3) removing some of the materials while placing an onsite EPA-approved cap on others.

3.3 LANDFILLS

In addition to the PGDP burial grounds, the site also has several landfills that potentially could be sources of groundwater contamination. Regulatory standards for the characterization, treatment, storage, and disposal of solid and hazardous wastes are established by the Research Conservation and Recovery Act (RCRA). Thus, waste generators must follow the specific requirements outlined in RCRA regulations for handling such wastes. Owners and operators of hazardous waste treatment, storage, and disposal facilities are required to obtain operating and closure permits for waste treatment, storage, and disposal activities. The PGDP generates solid waste, hazardous waste, and mixed waste (i.e., hazardous waste mixed with radionuclides). The plant operates four permitted hazardous waste storage and treatment facilities (the K, S, T, and U landfills), as well as one closed hazardous waste landfill (C404), all of which are managed under RCRA regulations and permitting. The location of each landfill is shown in Figure 3.3.1. The total land area of the five landfills is approximately 80 acres. A detailed explanation of the contents of each landfill is provided in Appendix A.6. For the purposes of this study, the K, S, T, and U landfills are assumed to remain in place and the burial grounds currently underneath the S and T landfills left undisturbed. The future disposition of the C404 landfill was assumed to be similar to the disposition of the burial grounds (i.e., if all the burial grounds are left in place, then the C404 landfill will be left in place; if all the burial grounds are removed, then the C404 landfill also would be excavated).

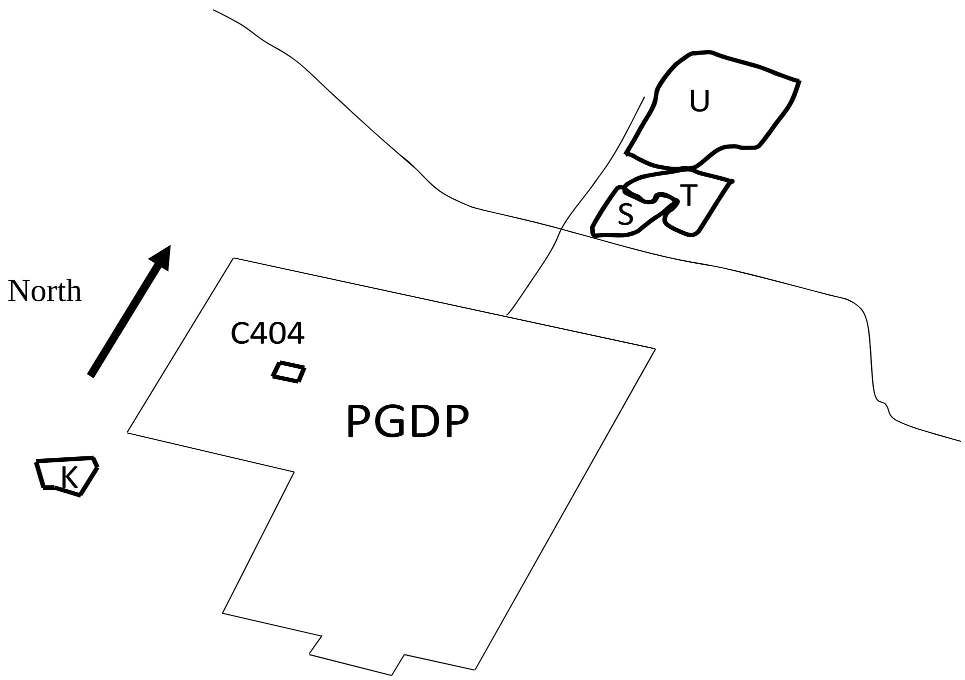

Figure 3.3.1 Relative Location of Landfills at the PGDP

4.0 ENVIRONMENTAL CLEANUP ACTIVITIES AT THE PGDP

4.1 REGULATORY FRAMEWORK

The US EPA National Contingency Plan states that owners of large, complex Superfund sites with multiple source areas, such as federal facilities, may choose to divide their sites into smaller areas to characterize them and to implement response actions, rather than conducting a single sitewide comprehensive action. These discrete actions, referred to as operable units (OUs), may address a geographic portion of the site or specific site problems, or may include a series of interim actions followed by final actions. The PGDP site cleanup strategy adopts this approach and includes a series of high-priority actions, ongoing site characterization activities to support future response action decisions, and eventual D&D of the currently operating PGDP after it ceases operation, followed by a Comprehensive Sitewide Operable Unit (CSOU) evaluation. The timing and sequencing of these actions is based on a combination of factors, including risk, compliance, and technical considerations associated with PGDP operations and other criteria, as outlined in the Paducah site management plan (US DOE, 2008a).

Because several federal regulations -- including CERCLA, RCRA, and the Toxic Substances Control Act, or TSCA -- are applicable to the type of contamination found at the PGDP, the federal government (both US EPA and US DOE) and the state of Kentucky jointly developed a set of guidelines and agreements that spell out how the site will be cleaned up to meet requirements. This document is known as a Federal Facilities Agreement (FFA).

As part of the FFA for the PGDP, management of clean-up efforts first involved characterization (or grouping) of all potential sources of contamination into solid waste management units (SWMUs) or Areas of Concern (AOC). This process included a qualitative evaluation of contaminant types and concentration, release mechanisms, likely exposure pathways, estimated points of exposure, and potential receptors based on current and reasonably foreseeable future land and groundwater uses. These sources then were grouped into one of six media-specific Operable Units (OUs):

- Groundwater OU
- Surface Water OU
- Soils OU
- Burial Grounds OU
- Decontamination and Decommissioning OU
- Comprehensive Site OU

Current cleanup efforts are planned and managed by the particular operable unit involved. Management activities associated with each OU typically involve the core steps of the CERCLA process: 1) remedial investigation, 2) baseline risk assessment, 3) feasibility studies, 4) record of decision/selection of a particular remedial action, 5) remedial design, and 6) remedial action.

In most cases, OU management involves several different projects that address the contamination/risk issues associated with one or more SWMUs or AOCs. For example, the Groundwater OU includes several different projects: 1) onsite TCE source remediation, 2) the Northwest and Northeast Plumes, 3) the Southwest Plume, and 4) potential sources associated with two off-site landfills. Specific timelines for each of these projects are established and tracked via the FFA and an annual site management plan developed by US DOE. A summary of the various cleanup projects that have been completed through 2010 is provided in Appendix B.

4.2 PLANS FOR A FUTURE WASTE DISPOSAL FACILITY (CERCLA CELL)

CERCLA response actions at the PGDP are expected to generate approximately 3.7 million cubic yards (mcy) of waste from 2014 until completion of final site cleanup in 2039 (US DOE, 2010a). To date, CERCLA cleanup and waste management projects at PGDP have generated and disposed of tens of thousands of cubic yards of waste. Visible progress is evident in the clearing of scrap yards, demolition of excess facilities, and removal or mitigation of contaminant sources presenting unacceptable risk to human health and the environment or exceeding concentrations established in applicable or relevant and appropriate requirements. Disposal alternatives for large volumes of waste that will be generated through D&D are being evaluated using the CERCLA process and in collaboration with US EPA, the Commonwealth of Kentucky, and site stakeholders. The disposal alternatives evaluation will be consistent with the PGDP FFA negotiated among US DOE, US EPA, and the Kentucky Department for Environmental Protection. PGDP cleanup will generate low-level radioactive waste, hazardous waste, nonhazardous solid waste, and mixtures of these waste types. No Action, Off-Site, and On-Site disposal alternatives will be evaluated during the remedy selection process.

As part of this process, a Remedial Investigation/Feasibility Study (RI/FS) Scoping Document (US DOE, 2008a) was prepared in April 2008. Information in this document was used in a series of project scoping meetings with US EPA and Kentucky, which laid the groundwork for the RI/FS process. Specifically, the meetings facilitated the development of this RI/FS Work Plan, thereby accelerating the review, comment, and approval process. Issues discussed in the scoping meetings were addressed in the scoping document. A major agreement that emerged from the meetings was that two alternatives would be evaluated in the RI/FS; however, following the scoping meeting, US DOE determined that a revised No Action Alternative should be included in the evaluation. The following are the disposal alternatives that will be evaluated.

- The *No Action Alternative* involves the continuation of coordinated project-by-project disposal for CERCLA waste. For waste that does not meet the waste acceptance criteria (WAC) of the currently operating on-site C-746-U Landfill, it is assumed this waste will be disposed of off-site. This alternative assumes that nonhazardous solid waste will continue to be disposed of in the C-746-U landfill. This alternative assumes no site-wide efforts to effect waste volume reduction.

- The *Off-Site Alternative* includes two scenarios for comparison purposes: 1) a high-end waste volume scenario for which CERCLA waste is assumed to be shipped off-site; and 2) a low-end waste volume scenario, which assumes various waste-reduction actions, continued use of the C-746-U Landfill for nonhazardous solid waste disposal, and off-site disposal of CERCLA waste that does not meet the WAC of the C-746-U Landfill.

- The *On-Site Alternative* involves disposal of CERCLA waste into a newly constructed on-site waste disposal facility that would be located on property currently owned by US DOE. The On-Site Alternative includes the same two scenarios: 1) a high-end waste volume scenario for which CERCLA waste would be disposed in a newly constructed on-site facility; 2) a low-end waste volume scenario, which assumes various waste reduction actions, continued use of the C-746-U Landfill for nonhazardous solid waste disposal, and disposal of CERCLA waste that does not meet the WAC of the C-746-U Landfill in a newly constructed on-site disposal facility.

Based on initial feedback from site stakeholders, US DOE has identified five possible sites that satisfy initial screening criteria. The five possible sites currently under consideration are shown in Figure 4.2.1. In developing the hypothetical land use scenarios as part of this study, site 3A was assumed to be the preferred site, although in theory the site cell could be constructed at any of these sites pending final approval from Kentucky Division of Waste Management and US EPA.

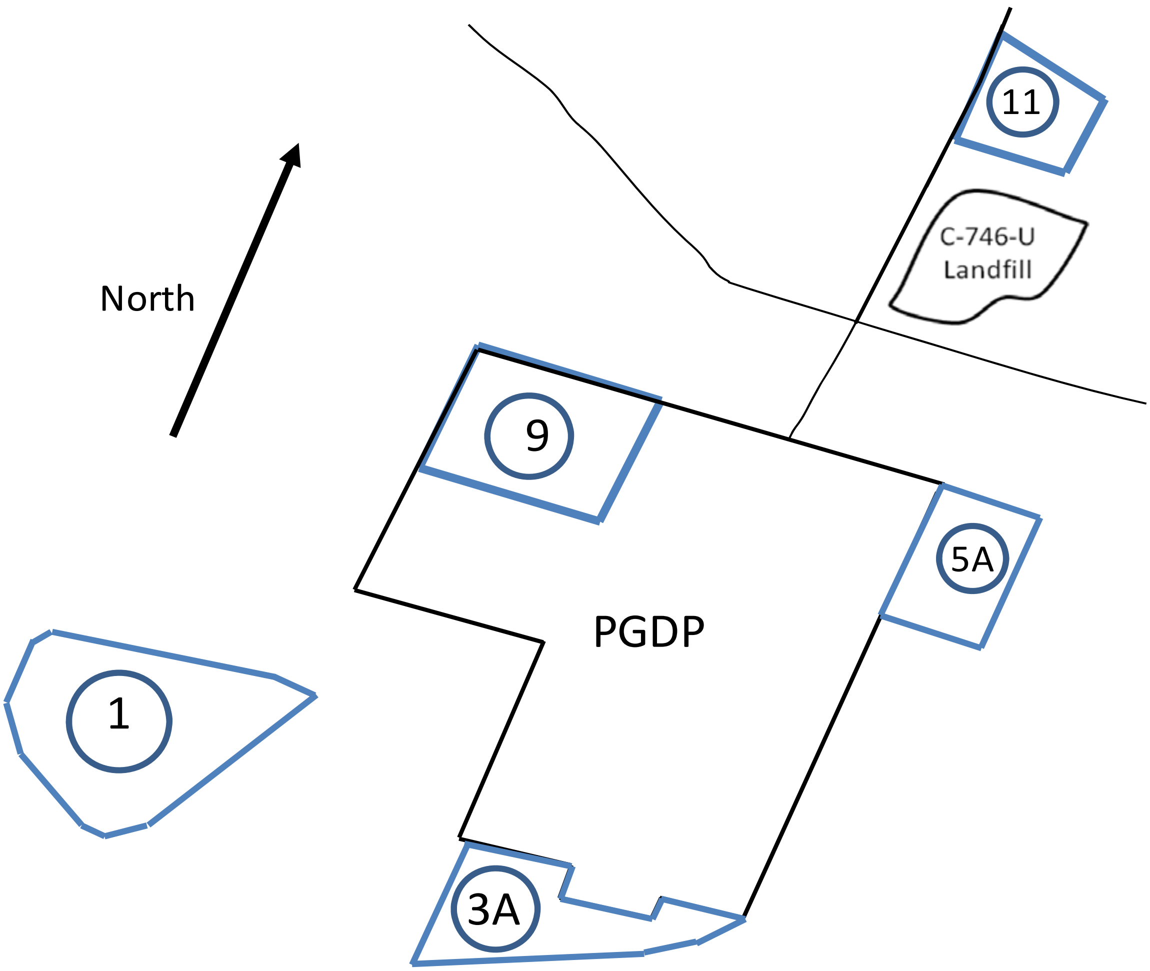

Figure 4.2.1 Possible Sites for On-Site Waste Disposal Cell

5.0 PREVIOUS VISIONING EFFORTS FOR THE PGDP

Several previous studies addressing future PGDP land use have been published, including the US DOE-sponsored Common Ground Process Team Report (US DOE, 1995), the US DOE sponsored Risk-Based End State Report (US DOE, 2004) and its revision (US DOE, 2008), the resulting PGDP Citizens Advisory Board Recommendations (CAB, 2004), and subsequent CAB subcommittee recommendations by Jim Smart (2007) and Bobby Ann Lee (2009). Two different local economic development organizations also were formed to promote the future use of the PGDP site and resources: the Paducah Area Community Reuse Organization (PACRO) was formed in 1997, and the Paducah Uranium Plant Asset Utilization Task Force (PUPAU) was formed in 2005. More recently, Kentucky's 2008 Seven Point Energy Strategy established an Alternative Energy Facilities Site Bank that considered the suitability of the PGDP site for different energy production facilities. Each of these efforts is summarized in the following sections.

5.1 US DOE COMMON GROUND PROCESS TEAM REPORT

In 1994, US DOE formally initiated its Common Ground Process to help identify future use options for various facilities. A Common Ground Process Team looked specifically at future uses for the US DOE Oak Ridge facility. In 1995, this team published a report entitled *Future Land Use Process for Oak Ridge Operations,* which provided detailed recommendations for future use options at the Oak Ridge facility, as well as general recommendations for the Paducah and Portsmouth plants. Based on input from a limited number of stakeholders, the team found that the majority favored maintaining the PGDP property for its current industrial/recreational use. No stakeholders recommended converting the property to residential use or to a use that was either exclusively industrial or recreational (US DOE, 1995). According to the report,

> DOE began preliminary discussions with stakeholders on Future Land Use at Paducah on June 30, 1994. A public workshop was conducted, and one of the break-out tables featured Future Land Use as a topic. Subsequently, Future Land Use was presented and discussed at public workshop on, December 1, 1994, January 26, 1995, and September 26, 1995. In addition, the subject has been discussed at various meetings with the PGDP Neighborhood Council, the PGDP Environmental Advisory Committee, with city and county officials, and economic development interests.
>
> The Neighborhood Council, administered by Lockheed Martin Utility Services, Inc. (LMUS), is an eight-member body comprised of individuals who live near the plant. The environmental Advisory Committee, which has five active members comprised of scientists, businessmen and plant neighbors, is administered by LMUS and has been an active committee since 1986. In general, these organizations, including city and county officials, support a continued industrial/commercial presence at the site that would preserve existing jobs and continue to contribute to the regional economy.
>
> The Environmental Advisory Committee suggested some specific uses of the property that involved turning the facility into a national research center to test new technologies for groundwater remediation. The committee has suggested that resources from regional and state universities and colleges be used to accomplish this goal. The committee has suggested pulling together academic, economic, environmental, and scientific interests to discuss such a proposal. Because of the nature of the contamination at PGDP and its extent off-site, the committee considers the plant an ideal site for such research.

Another major stakeholder in the region besides DOE and USEC is the Kentucky Department of Fish and Wildlife. Most DOE property outside the 748-acre fenced security area is licensed to KDFW as part of a wildlife management area adjacent to property owned by KDFW. KDFW has indicated that it supports the current land use arrangement at the site; however, if DOE ever decides to sell the property that KDFW currently leases, they would like the first opportunity to acquire the property before it is offered to another entity. Of the residents living within a three-mile radius of the plant that choose to express views on this subject, the majority had a preference to retain the jobs and economic benefits associated with the current land use practices. However, they have expressed a desire to ensure that site contamination is adequately contained within the DOE property, thus preventing any off-site migration that may result in devaluation of their properties.

Certain environmental activist groups have suggested that the area inside the plant fence be remediated enough to prevent further migration of contaminants off-site, but stopped short of recommending cleanup to green field standards, because of the exorbitant costs involved and the lack of technologies to accomplish such a standard. However, these groups suggest an “iron fence” approach to the 748-acre fenced area, restricting access and continuing surveillance and maintenance. These groups have suggested that DOE offer to buy out any property owners in the vicinity of the plant whose property is contaminated or could potentially be contaminated (pp. 47-68).

5.2 1997 PADUCAH AREA COMMUNITY REUSE ORGANIZATION

According to the Paducah-Area Community Reuse Organization (PACRO) website, the organization was “formed in August of 1997 by regional community representatives from western Kentucky and southern Illinois in an effort to mitigate potential downsizing and restructuring of the Paducah Gaseous Diffusion Plant (PGDP) workforce as a result of the end of the Cold War and changing Department of Energy (US DOE) priorities" (PACRO, 2010). PACRO membership is designed to represent the counties in which the majority of the PGDP workforce lives. The PACRO impact area includes McCracken, Ballard, Graves and Marshall Counties in western Kentucky and Massac County in southern Illinois. The various initiatives of PACRO can be found at its website:

http://www.purchaseadd.org/Paducah_Area_Community_Reuse_Organization_(PACRO)/

5.3 2004 US DOE RISK-BASED END STATE REPORT

In 2002, the US DOE Office of Environmental Management (US DOE EM) developed a detailed strategy in response to a top-to-bottom review of the agency. Included in this strategy was the development of Risk-Based End State (RBES) vision documents for each US DOE facility. A draft RBES for the PGDP was developed in 2004 (US DOE, 2004). The RBES originally was prepared to meet requirements set forth in a memorandum from Jessie Roberson dated September 22, 2003, as amended per a memorandum entitled “Risk-Based End State Guidance Clarification” dated December 23, 2003 (US DOE, 2003), and in the notes from the U.S. Department of Energy (US DOE) Risk-Based End State (RBES) Next Steps Workshop, October 6 and 7, 2004.

The RBES document subdivided the risks associated with the facility into nine different hazard areas, including groundwater operable unit, surface water operable unit, cylinder yards and DUF_6 conversion facility. The document provided risk assessments for each of the hazard areas, as well as risk management strategies and risk levels associated both with currently planned remedial actions and with a modified plan. The basic objective of the RBES was to propose modified remediation plans that could lead to a more cost-effective, timely solution without increasing the overall risk to remediation work and the local community. The RBES process requires that stakeholder input be sought from Paducah's citizens. A copy of the executive summary of the Risk-Based End State report is provided in Appendix C. A copy of the complete report can be found at www.paducahvision.com.

5.4 PADUCAH CITIZENS ADVISORY BOARD RECOMMENDATIONS

According to the Paducah Citizens Advisory Board (CAB) website (2010), the organization:

> is a stakeholders' board that provides advice and recommendations to the U.S. Department of Energy (US DOE) on environmental remediation, waste management and related issues at the Paducah Gaseous Diffusion Plant (PGDP) site. The Board was established in 1990 and is composed of up to 18 members, chosen to reflect the diversity of gender, race, occupation, views, and interests of persons living near the PGDP. The board was created for the purpose of reflecting the concerns of the communities impacted by environmental management of the plant site. Members are appointed by US DOE and serve on a voluntary basis. Non-voting liaisons include representatives from the U.S. Environmental Protection Agency, the Kentucky Department for Environmental Protection, the Kentucky Department of Fish and Wildlife Resources and the Kentucky Radiation Health Branch. These members advise the CAB on their agencies' policies and views. (CAB, 2010)

After its formation, the CAB (2010):

> requested that the U.S. Department of Energy (DOE) provide a list of topics for the CAB to work from in developing recommendations. In DOE's response, the CAB was asked to focus on long term stewardship, specifically the CAB's End State Vision for the PGDP site. In June 2003, the Long-Range Strategy/Stewardship task force began the process of obtaining input from the community for an End State Vision. The first meeting was attended by representatives of the CAB, DOE, the Kentucky Department of Waste Management, the West Kentucky Wildlife Management Area (WKWMA), the Greater Paducah Economic Development Council (GPEDC), the Paducah Area Community Reuse Organization (PACRO), Active Citizens for Truth (ACT), and the Coalition for Health Concerns. Also present were the McCracken Judge Executive, the Mayor of Paducah, the Paducah City Manager, and members of the public. In subsequent meetings, the Board also discussed their recommendation with the McCracken County Administrator. Following development of the End State recommendation in draft form, presentations were made to various groups and organizations to obtain comments and suggestions on specific points contained within the recommendation. This information was presented to the PACRO Finance and Executive Committee, the Ballard County Chamber of Commerce, the Paducah Chamber of Commerce, ACT, and to the Paper, Allied-Industrial, Chemical, and Energy Workers Local 5-550. Comments received from these meetings were then incorporated into the CAB's final recommendation. Throughout the eight-month process, the CAB's objective has been to include and represent the community in this matter.

A copy of the CAB's final recommendations are provided in Appendix D. On March 9, 2004, Bill Tanner, Chairman of the Paducah CAB, presented their recommendations to the Paducah Area Chamber of Commerce Community and Business Development Committee.

5.5 2007 CAB PRESENTATION

On December 12, 2007, Dr. Jim Smart (CAB member and faculty member of the University of Kentucky Engineering Program in Paducah) gave a presentation to the CAB related to previous and ongoing efforts to develop an End State Vision for the PGDP. A copy of his presentation is provided in Appendix E.

5.6 2008 US DOE END STATE VISION REPORT

In 2008, US DOE released the *End State Vision for the Paducah Gaseous Diffusion Plant,* (US DOE/LX/07-0013&D1), an update to the 2004 *Risk-Based End State Vision and Variance Report for the Paducah Gaseous Diffusion Plant, Paducah, Kentucky* (US DOE/LX/07-0013&D1). This document catalogued stakeholder involvement in the RBES process through 2007. A copy of the report's executive summary is provided in Appendix F. A copy of the complete report can be found at www.paducahvision.com.

The document communicates US DOE's end state vision for the Paducah Gaseous Diffusion Plant to various stakeholders, including US DOE, the U.S. Environmental Protection Agency, the Commonwealth of Kentucky, and the general public. The document was designed to be updated to reflect actual decisions from the ongoing site CERCLA process.

According to US DOE (2008b):

> [a]lthough this report presents potential hazard-related actions that could be used to achieve a PGDP end state, this report is not a decisional document. Rather, discussions of potential specific mechanisms provide an analytical framework that DOE will use to further evaluate cleanup activities and strategic approaches at PGDP to determine whether it is appropriate to pursue changes in the PGDP baseline. Any decision to pursue changes to the baseline will include factors beyond those presented in this document, including input from stakeholders. If DOE ultimately decides to seek changes to the current compliance agreements, decisions, or statutory/regulatory requirements, then those changes will be made in accordance with applicable requirements and procedures.

5.7 2009 CAB PRESENTATION

On October 16, 2009, Bobby Ann Lee (PGDP CAB Reuse Subcommittee Chair and faculty member at West Kentucky Community and Technical College) gave a presentation to the CAB, discussing previous and ongoing efforts toward the development of an End State Vision for the PGDP. A copy of her presentation is provided in Appendix G.

5.8 PADUCAH URANIUM PLANT ASSET UTILIZATION TASK FORCE

As indicated previously, PACRO has initiated various studies to examine how to promote economic development associated with the PGDP. One initiative involved the creation of the PUPAU Task Force in 2005.

According to the PUPAU (2010) website: “The mission of PUPAU is to **“**provide community consensus to our local elected officials on strategic optimization of the national assets of the Paducah Gaseous Diffusion Plant and promote the development and use of those assets for the benefit of our country, state, and community."

The Task Force is concentrating on three areas of asset utilization for the facility:

1. Optimizing existing operational, cleanup, and recreational activities at the site.

2. Exploring and promoting new missions for the site, both short- and long-term, that will fully utilize site assets.

3. Mobilizing at the national, state, and community level support for the task force's strategic and tactical recommendations.

The PUPAU (2010) states that it

> is seeking to return value back to the community. The marketable assets on site are the buildings, infrastructure, equipment, land, metals, service, technology, and the most important asset, the employees. With the precedent set at sites such as Oak Ridge, Mounds, and Savannah River, the Task Force is working with DOE to establish a path forward to return value back to the community through the reuse of the site assets.

The various initiatives of PUPAU can be found at their website:

http://www.co.mccracken.ky.us/paducah/pupau-task-force.

5.9 KENTUCKY ENERGY STRATEGY

In November 2008, the Kentucky Governor’s Office released *Intelligent Energy Choices for Kentucky’s Future: Kentucky’s Seven-Point Strategy for Energy Independence*. Both "Strategy 3: Sustainably Grow Kentucky's Production of Biofuels" and “Strategy 7: Examine the Use of Nuclear Power for Electricity Generation in Kentucky” have potential relevance for the PGDP site

5.10 COMMONWEALTH OF KENTUCKY ALTERNATIVE ENERGY FACILITIES SITE BANK

As a result of the 2008 Kentucky Energy Strategy, a comprehensive analysis of potential energy sites across the state was conducted. The results were summarized in the Commonwealth of Kentucky Alternative Energy Facilities Site Bank: www.kysitebank.com. According to the site bank, the PGDP received a suitability score of 70% for nuclear (7th out of 42 sites), 83% for biomass (4th out of 42 sites), and 79% for clean coal technology (25th out of 42 sites).

5.11 US DOE WASTE DISPOSAL ALTERNATIVE VISIONING MEETINGS

On November 18 and 20, 2008, US DOE conducted a public open house at Paducah's Robert Cherry Civic Center. During the open house, participants expressed preferences for future land uses in both the PGDP site area and in the area that currently is licensed to Kentucky as part of the West Kentucky Wildlife Management Area. A third meeting on March 24, 2009, was held at a downtown Paducah movie theatre. Two additional public meetings were held on January 18 and 19, 2011. The results of the participant feedback at each of these meetings are provided in Appendices H and I.

6.0. KCREE PGDP FUTURE VISION PROJECT

6.1 INTRODUCTION

The US DOE Risk-Based End State Vision Report, which was released in 2008, was by necessity technical, given that its purpose was to demonstrate the maintenance of accepted risk levels while simultaneously proposing more cost-effective remediation strategies. Public comments made in response to the document indicated that some segments of the community continue to have serious reservations about the adequacy of certain proposals. Nearly coincident with the RBES release was the release of a report entitled *The Politics of Cleanup* (ECA, 2007), which seeks to "analyze and present the varied opportunities and challenges in environmental cleanups" (p. 1). The report accomplishes this through a discussion of past US DOE efforts to engage local communities and associated stakeholders in decisions related to environmental management and remediation efforts at three major US DOE facilities: Rocky Flats, Colorado; Mound, OH; and Oak Ridge, TN. *The Politics of Cleanup* provides several recommendations regarding the need to better involve local communities in decision-making processes at such sites. Consequently, US DOE contracted the Kentucky Research Consortium for Energy and Environment (KRCEE) to develop and implement a stakeholder engagement process that could address ECA recommendations. The process described herein focuses on assessing community preferences for the future use of the PGDP site, given the site's pending closure by US DOE. In addition to providing the community with a definitive record of the diversity of community values and preferences, it is hoped that the study's results also will inform and guide US DOE in the final formulation of its End State Vision for the facility.

6.2 GUIDING ELEMENTS

The key for creating any community-driven future vision is the involvement of the community to the fullest possible extent at every stage of the visioning process. A guiding document throughout the PGDP Future Vision Project, ECA's *The Politics of Cleanup* explicitly advocates for such involvement, with members of Superfund communities joining federal and state regulators and contractors to meet site cleanup goals in a way and to a degree that allows sites to remain or once again become assets. The ECA affirms that two-way communication that engages the community through consultation, coordination, and ongoing dialogue is essential for developing appropriate cleanup goals and for identifying future uses for Superfund sites. *The Politics of Cleanup* therefore calls for all parties, including community members and government agencies, to collaborate in the development of site cleanup goals and future use visions.

The ECA asserts that successful collaboration requires all parties to understand community values and to work toward incorporating these values into the planning process. According to the report, successful environmental cleanups go beyond risk reduction and the minimization of federal government liability. Success also is predicated on substantively incorporating local community values into the cleanup and visioning processes. In certain cases, according to the report, the incorporation of these values has led to cleanup efforts that extend beyond that which would be anticipated for a strictly risk-based cleanup (pp. 5-6). “The sole way to ensure” that sites can become assets for affected communities is to engage local stakeholders in determining how both the cleanup and the future use goals support or advance local needs (p. 6). *The Politics of Cleanup* predicts that cleanup or future use decisions that are made unilaterally by government agencies without input from community members run the risk of being fundamentally inconsistent with local needs, as well as with the core values held by local governments and others in the affected community.

According to the report, two-way communication means that all parties must educate each other on technical and policy issues that underlie cleanup decisions, committing staff and other resources toward mutual engagement. Discussions need to take place throughout the process and must include issues related both to technical risk and to perceptions of risk, recognizing that the two do not always align (Sandman, 1993; Slovic, 2000). Not only must the community be educated about technical risk by federal and state agencies and contractors, but federal and state agencies and contractors must be educated by the community about its history, goals, and needs.

Regarding risk communication at Superfund sites, the ECA recommends that federal agencies enter into dialogue with local governments and community members to better understand community perceptions of risk – perceptions that often vary from community to community and even among members of the same community. Such dialogues present the greatest opportunity for various parties to reconcile differing perspectives about risk, thus facilitating agreement on difficult cleanup decisions. Such decisions, even technical ones, often are not solely technically based.

The KRCEE project was designed to maximize citizen engagement, as characterized by the Ladder of Citizen Participation (Arnstein, 1969). Not only did the ladder provide a guideline for use by the team, it served as a way to gauge public perceptions about past levels of community involvement, as well as preferences for future involvement. The Arnstein ladder illustrates different levels of public participation that have been observed in policy and infrastructure decisions. A slightly modified version of the ladder is shown in Figure 6.2.1. Although most of the terms used in the steps of the ladder are fairly self-explanatory, more explicit descriptions and explanations of the terminology can be found in Arnstein's original publication. In general, the steps of the ladder can be grouped into three broad classifications: Non Participation, Tokenism, and Citizen Power. Historically, most citizens have scored past levels of involvement with public processes somewhere between informing and placation in the Tokenism portion of the ladder; however, the majority of those polled in the past desire levels of participation somewhere between partnership and delegated power in the Citizen Power portion of the ladder. In other words, and perhaps unexpectedly for some agencies and policymakers, most members of the public see a role for technical expertise in planning processes, while very few people feel that complete citizen control is necessary to achieve optimal outcomes.

After due consideration of the issues raised above, KRCEE concluded that community engagement is critical at all stages for identifying acceptable future uses for the PGDP. In 2009, KRCEE convened a project team that subsequently identified two related methods as the most promising strategies for achieving project goals. The first method, Community-Based Participatory Communication (CBPC), uses interviews, focus groups, and projective techniques to identify and interact with various community groups. The goal of CBPC is to discover value systems, risk perceptions, preferences for various facets of the future vision question, and perspectives about cleanup issues. The second method, Structured Public Involvement (SPI), is a democratic process that uses anonymous Audience Response Systems (ARS) or similar feedback methods in large-scale public meetings.

Ultimately, the project team determined to integrate both CBPC and SPI in the development of the PGDP Future Vision Project. In this novel model, results from CBPC interview interactions assist in generating SPI-based visualizations, which then become discussion triggers for additional CBPC focus group interactions, which ultimately feed into a broad-based SPI community forum that quantitatively measures preferences for future outcomes as thoroughly and accurately as possible. Final SPI-generated data then can be integrated into the Casewise Visual Evaluation Model, or CaVE (Bailey et. al., 2010), helping to identify clusters of stakeholder likes and dislikes and predicting preferences and aversions for possible scenarios not explicitly considered. The latter capability becomes increasingly important as the complexity of land use possibilities increases, making it unrealistic for the public to evaluate all possible scenarios. CBPC, SPI, and CaVE, as well as their applications within this project and subsequent results, will be discussed in more depth in ensuing chapters.

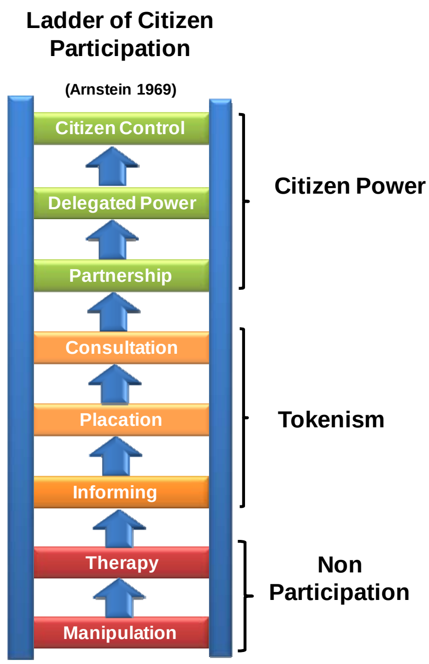

Figure 6.2.1 Modified Ladder of Citizen Participation (Arnstein, 1969)

6.3 STUDY CHALLENGES

Interactions with stakeholders throughout the course of this study indicated that the PGDP has enjoyed strong support from many who reside in the Paducah area, primarily because of the number of jobs the facility provides and its subsequent regional economic impact. However, some residents who live near the facility, as well as other community members who expressed plant-related environmental and health concerns, have developed a strong distrust of the federal government in general and of the US DOE in particular. Such distrust reflects a complicated public perception of the nuclear industry in general, which Slovic (2000) characterizes as "a crisis of confidence" rooted in "the continuing story of decades of mishandling of wastes" at nuclear facilities (p. 281).

The PGDP site itself has been the focus of several federal investigations (including those by EPA, the Agency for Toxic Substances and Disease Registry, NIOSH, and the US Government Accountability Office), as well as the subject of numerous published articles in such newspapers and magazines as *The Washington Post* (Warrick, 1999), *The Louisville Courier Journal* (Carroll and Malone, 2000) and *The New Yorker* (Mason, 2000). Additional academic and environmental activists' studies also have been conducted about the facility (Moser, 2005; Paschenko, 2005; ISAR, 2005). The site is even believed to be the inspiration for a recent novel (Mason, 2005). Finally, past activities have been the focus of highly critical research efforts, including *State-Corporate Crime and the Paducah Gaseous Diffusion Plant* (Bruce and Becker, 2007).

Adding to this challenging backdrop has been the administration of a federal health compensation program by the Department of Labor, which has led to some controversy regarding who should be covered by the policy; a class action lawsuit by local residents which was filed against Martin Marietta for damages to property values as a result of groundwater contamination (which was recently settled out of court); controversy related to the methods and implications of a recent epidemiological study of past workers at the plant (Chan, et. al. 2010; Aldrich, 2010); rumors of the offsite disposal of contaminated materials; and questioning of the initial mission of the CAB, which led to the resignation of its initial chairman along with eight other board members (PGDP CAB, 1995).

Based on numerous interviews with local stakeholders conducted during this study, it appears that US DOE's past attempts to inform and involve the Paducah community, including the creation of a public information center and the formation of a Citizens Advisory Board comprised of local residents, have faced challenges in building trust among some segments of the population, including some residents who live near the facility and/or are active in environmental and health advocacy. Additional attempts to involve the general public in substantive ways toward developing a future vision for the facility engenders initial reactions ranging from apathy to extreme skepticism to anger. While some may interpret citizen apathy as a sign that citizens are satisfied with the status quo, civic apathy also has been linked with such individual differences as low involvement levels, low perceptions of the efficacy of engagement, and high levels of cynicism (Pinkleton and Austin, 2004). The latter two factors are evident in the comments of one local activist, who said, "[DOE's] process seems to be…how can we get around the interest of the people, how can we get them to swallow this one more time" (KRCEE, personal communication, July 2009).

Despite these challenges, the KRCEE has attempted to develop a comprehensive process that can provide the initial framework for building communicative bridges between the community and US DOE. In the long-term, the resulting dialogues could improve trust among numerous stakeholders. A key starting point for such dialogue is the realization that organizations like US DOE and its contractors are comprised of people, many of whom also are members of the local community. Thus, it is hoped that the process described herein can lead to better and more informed decisions by and for the community, providing a vehicle for dialogue and shared understanding, even if the results do not ultimately reflect uniform consensus on future land use decisions.

6.4 PROJECT METHODOLOGY

To fulfill the project goals, KRCEE recruited a multidisciplinary research team that reflected a broad range of experience with the technical and regulatory history of the site, with national and international development projects, and with public infrastructure planning, and technical aspects related to the PGDP site. Research team members are:

- **Dr. Lindell Ormsbee (principal investigator/project manager).** Dr. Ormsbee is the director of the Kentucky Water Resources Research Institute, the associate director of the UK-NIEHS Superfund Research Center, the former director of the KRCEE, and a Raymond-Blythe Professor of Civil Engineering at the University of Kentucky. He researches, teaches, and consults on water resources and environmental engineering and has published more than 200 technical papers and reports on various topics in the field.

- **Dr. Chike Anyaegbunam (co-principal investigator for Community-Based Participatory Communication).** Dr. Anyaegbunam is an associate professor of integrated strategic communication in the University of Kentucky College of Communications and Information Studies. He has worked extensively both nationally and internationally on a variety of development projects funded by the Pfizer and Robert Wood Johnson Foundations, the National Cancer Institute, the World Bank, the Food and Agriculture Organization of the United Nations (FAO), UNICEF, and USAID.

- **Dr. Ted Grossardt (co-principal investigator for Structured Public Involvement).** Dr. Grossardt is research program manager for the Kentucky Transportation Research Center in the University of Kentucky College of Engineering, as well as associate faculty in both the University of Kentucky Department of Geography and the Historic Preservation Program. As a co-creator of Structured Public Involvement, Dr. Grossardt has expertise in large group processes for complex infrastructure planning and design problems and has provided decision support services for such projects as the Milton-Madison Ohio River Bridge design project and Jeffersonville, IN's comprehensive land use planning.

- **Dr. Keiron Bailey (Casewise Visual Evaluation).** An associate professor of geography and regional development at the University of Arizona, Dr. Bailey is a co-creator of Structured Public Involvement and has pioneered the method of Casewise Visual Evaluation (CaVE). His work overlaps geography, planning, decision science and geoinformatics, and he has presented extensively both nationally and internationally about both SPI and CaVE.

- **Ben Blandford (Structured Public Involvement technical support).** Mr. Blandford is a doctoral student in geography at the University of Kentucky. He assisted with the development of the hypothetical future use visualizations used both in focus groups and in public meetings. Mr. Blandford also assisted with the analysis of scoring results.

- **John R. Ripy, Jr. (Structured Public Involvement technical support**). Mr. Ripy is information systems manager for the Kentucky Transportation Center. He played a key role in developing the hypothetical future use visualizations used both in focus groups and in public meetings. Mr. Ripy also assisted with the analysis of scoring results.

- **Chas Hartman (transcription and preliminary data analysis).** A doctoral candidate at the University of Kentucky College of Communications and Information Studies, Mr. Hartman assisted with the transcription and preliminary qualitative data analysis of field recordings.

- **Anna Goodman Hoover (research project coordination and facilitation).** As communication director for the Kentucky Water Resources Research Institute, Ms. Hoover oversees public information activities and assists with the design and implementation of research projects that link environmental concerns with risk and public communication processes. She provided focus group facilitation, logistical guidance, and assisted with data analysis.

- **Jason Martin (transcription).** A doctoral candidate at the University of Kentucky College of Communications and Information Studies, Mr. Martin assisted with transcription of early-project field recordings for research team analysis.

- **Mitchael Schwartz (focus group facilitation and logistics),** A master's student in the University of Kentucky College of Communications and Information Sciences, Mr. Schwartz provided facilitation and transcription services to the research team, as well as assisting in qualitative data analysis.

The research team collaboratively developed a public engagement model for this project that involves five basic steps (see Figure 6.4.1): 1) stakeholder identification and strategic interviews, 2) stakeholder focus groups, 3) community-based informational open houses, 4) community-based future vision scenario evaluations, and 5) web-based future vision scenario evaluations. As part of this process, a pilot test group also was established, with members chosen to represent the diversity of stakeholder interests. This group pre-tested all project engagement protocols. The end results of this process are: 1) a database documenting stakeholder preferences, and 2) this project report.

6.4.1 Step One – Iterative Stakeholder Identification and Listening Tour

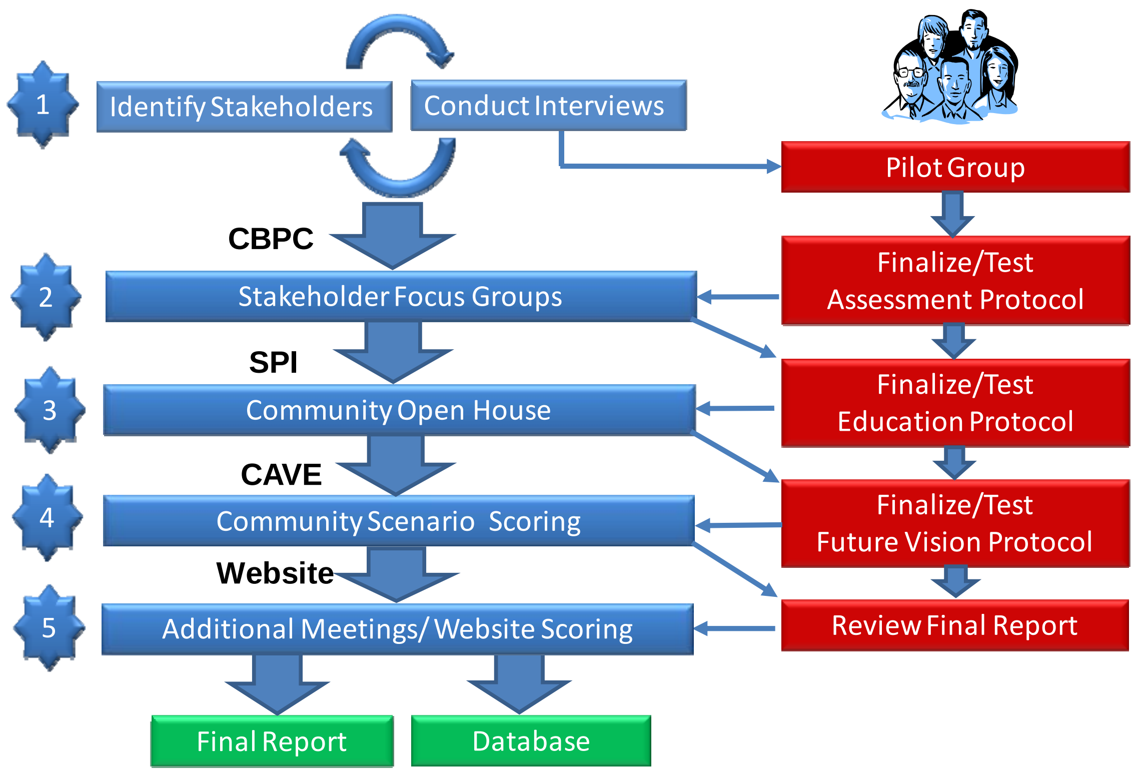

Figure 6.4.1 PGDP Future Vision Process

After creating an initial draft guide for the integrated CBPC-Structured Public Involvement process, the next step was the identification of key stakeholder groups affected by and affecting PGDP decisions. The research team conducted a brainstorming session to identify as many stakeholders as possible. This preliminary stakeholder list included 44 specific organizations or individuals of whom the research team was aware prior to entering the field (see Appendix J). This list became a starting point from which additional snowball sampling could generate the engagement of as many community members as possible.

The research team then began a listening tour, meeting with stakeholders from the initial list and conducting interviews, which will be discussed in more depth in Chapter 7. During each interview, interviewees examined the list of previously-identified stakeholders and advised of additional individual stakeholders and groups who should be included in the project. The research team then interviewed newly-identified stakeholders and groups until theoretical saturation was achieved, which is marked by no additional categories emerging from interview data (Lindlof & Taylor, 2002).

After interviewing some 80 individuals, ten initial stakeholder groups were identified. Additional researcher analysis further divided these groups into 16 distinct clusters:

- Water Policy District Residents
- Economic Development
- USEC Employees
- Environmental/Health Advocates
- Healthcare Providers
- Education
- Media
- Religious/Spiritual Community
- Wildlife/Recreation Enthusiasts
- Tourism
- Ballard County Stakeholders
- US DOE
- US DOE Subcontractors
- Paducah Government
- PGDP Citizens Advisory Board
- Regulatory Agencies

A pilot test group comprised of representatives from each of the sixteen groups was recruited. This pilot group pre-tested individual steps of the process along with some initial trigger scenarios prior to community-wide implementation and, where warranted, recommended protocol and/or scenario changes. As an example, an initial heavy industry scenario for a steel mill was replaced with a potential auto assembly plant similar to the Ford Plant in Louisville or the Toyota plant in Georgetown, Kentucky. The inclusion of a golf course in the active recreational scenario was also eliminated based on the lack of perceived economic viability of such a land use within the Paducah area. Members of the pilot test group were selected based in part on statuses within their respective stakeholder groups, which allowed them to bring additional members of their constituencies into the process.

The interview protocol, subsequent data analysis, and the creation and function of the pilot test group will be covered in more depth in Chapter 7.

6.4.2 Step Two – Stakeholder Focus Groups

Following creation of the pilot test group, a focus group protocol was developed, pre-tested, and revised. The resulting protocol was submitted to and approved by the University of Kentucky non-biomedical Institutional Review Board (see Appendix K). Focus groups then were implemented with distinct stakeholder groups. Because of logistical constraints and the large number of stakeholder interests, focus groups were held in which distinct-but-related stakeholder groups met jointly. These meetings were conducted over a three day period in Paducah. Per the revised protocol, focus group participants engaged in several exercises designed to identify: 1) community values, 2) concerns and issues, and 3) existing beliefs and information gaps. A detailed discussion of the CBPC focus group process as implemented in Paducah is provided in Chapter 7.

The CBPC protocol included the presentation of potential future vision scenarios developed by the Structured Public Involvement team. The SPI team created the focus group scenarios based upon the range of possible land uses and taking into consideration stakeholder feedback from the listening tour, as well as data gathered during the pilot focus groups and from prior end use reports and recommendations. From these interactions, it became clear that each scenario would involve a combination of two land-use decisions: 1) the disposition of the existing US DOE property that is currently licensed to Kentucky as part of the West Kentucky Wildlife Management Area, and 2) the disposition of the existing US DOE property that is currently used in enrichment operations (i.e., the existing plant site). In addition, it became readily apparent that land use preferences could be significantly impacted by the future disposition of legacy wastes (i.e. wastes currently in burial grounds) and future wastes associated with the demolition of the existing PGDP (i.e. whether such wastes should be shipped offsite or buried on site in a CERLCA landfill). As a result, these variables were included in the final matrix which was used for creating the set of potential scenarios. To accommodate time constraints and to allow ample time for group evaluation, a limited number of scenarios were selected for use as discussion triggers. The specific sample scenarios were chosen to provide a robust and representative sample of potential future land uses. All twelve focus group scenarios are included in Appendix L.

Focus group participants discussed specific scenario examples as they related to the previously identified community values, concerns, and beliefs. Following the discussion, participants evaluated individual sample scenarios anonymously using the ARS keypads used in SPI. A detailed discussion of the application of the SPI process at Paducah is provided by Grossardt et al. (2010) and Bailey et al. (2010) and in Chapters 8 and 9 of the report.

6.4.3 Step Three: Community Informational Meetings

The stakeholder focus group process identified a shared desire for a simple, educational, unbiased approach to presenting PGDP issues, balanced against a simultaneous need to maintain the KRCEE project's focus on future site uses rather than on airing existing grievances. In response, the KRCEE team developed a public information meeting protocol to address this need.

After analyzing focus group transcripts, the KRCEE team divided the identified information gaps into five broad categories -- The Past, The Present, The Future, Science, and Cleanup. These categories and their associated questions then became central to the public information meetings as well as to a project website, www.paducahvision.com, that was developed to provide greater citizen access to answers associated with relevant PGDP questions. The public information meetings are discussed in more detail in Chapter 8.

6.4.4 Step Four: Community Scenario Meetings

Following the public informational meetings, three separate community meetings were held during the week of October 21, 2010. The venues for these meetings included the West Kentucky Community and Technical College campus in McCracken County and Ballard County High School. An additional public meeting was held on April 28th, 2011 at the First Christian Church of Paducah as part of a West-End Neighborhood Association meeting. A total of 128 individual responses were recorded from all four public meetings.

During each meeting, the KRCEE team provided initial explanations of the 12 hypothetical scenarios developed through the interview and focus group processes, along with opportunities for participants to ask follow-up questions. After all scenarios had been presented and discussed, the individual scenarios were presented a second time to allow participants to score each scenario on a suitability rating that varied from 1 to 9. At the end of the process, additional scenarios were solicited directly from the audience, which were then presented, and scored. As with the community informational meetings, the participants evaluated the process at the end of the meeting. Detailed descriptions and scoring results for each scenario are provided in Chapter 8. Data analysis follows in Chapter 9.

6.4.5 Step Five: Web-based Scoring

Following the public meeting phase, the research team determined to solicit additional scenario scoring through its interactive website: www.paducahvision.com. The website included general information about pertinent topics addressed during public information meetings: 1) The Past, 2) The Present, 3) The Future, 4) Science, and 5) Cleanup. In addition, visitors could experience the same guided presentation given at the public scenario scoring meetings. At the end of the guided presentation, visitor was could indicate their preferences for each of the 12 scenarios presented in public meetings. Resulting data were recorded for analysis and inclusion in the final project report.

The website was promoted through advertisements in the *Paducah Sun*, the *Ballard Weekly*, the *West Kentucky News*, and the *Advance Yeoman*, as well as during public meetings of the Paducah Chamber of Commerce (April 14, 2011) and the Paducah Rotary Club (May 4, 2011). The website also was promoted through: 1) a tailored education program presented to five sixth grade science classes at Heath Middle School on May16th, 2011; 2) direct mailings to all Water Policy District residents; and 3) a mass emailing to all former project participants. Website data collected from April 14, 2011 through July 8, 2011 indicated that the site was visited by 713 distinct IP addresses. While a total of 156 people viewed the entire survey, only 97 people actually entered preference scores for at least one scenario. The average number of responses per scenario was 90. Detailed descriptions and scoring results for each scenario are provided in Chapter 8. Data analysis follows in Chapter 9.

7.0 LISTENING TOUR AND FOCUS GROUP MEETINGS

7.1 BACKGROUND

Community-Based Participatory Communication (CBPC) has developed within the broader context of Participatory Communication, Community-Based Participatory Research (CBPR), Participatory Rural Communication Appraisal (PRCA), and other participatory approaches (Beltrán, 1993.). Participatory processes view communication NOT as an instrument of transmission or persuasion but instead as a dialogic process for exchanging views and involving community members in discussing issues that affect their lives. CBPC uses both traditional and modern forms of communication and organization to protect tradition and cultural values, while facilitating the integration of new elements. It creates an environment that empowers individuals and groups, giving them the freedom to voice their perceptions of reality and to act on these realities (Dagron, 2001; Carey, 1989).

CBPC is not simply a community outreach strategy, and it is less focused on widespread generalizability and diffusion (Dagron, 2001). Rather, it emphasizes the building of trust and rapport among all parties, along with the empowerment of individuals and communities, toward truly collaborative decision-making processes to achieve outcomes that resonate with community values, culture and perspectives about the future. CBPC thus favors decentralization and democracy, people involvement and dialogue, interpretive, horizontal, and bottom-up perspectives. It posits an alternative and, to some, a complementary conceptualization of communication that does not model the process as a linear, one-way, top-down transmission of information and persuasive messages (Anyaegbunam, Mefalopulos, & Moetsabi, 1999; Wallerstein & Duran, 2006).

In CBPC, as in CBPR and PRCA, research is a collaborative partnership that strives to equitably involve in every aspect of the process all potentially affected parties, including community members, organizational representatives, and researchers (Israel et al., 2001). Done properly, such research builds bridges between community participants and government agencies, allowing all parties to gain knowledge and experience. All partners contribute their expertise and share ownership of research findings and decisions for action. This collaboration assists in developing culturally appropriate decisions and policies, thus making projects more effective and efficient. Finally, participatory methods can establish a level of trust that enhances both the quantity and the quality of information generated (Anyaegbunam & Kamlongera, 2002; Viswanathan et al., 2004; Cornwall & Jewkes, 1995; Wallerstein, 2000; Fisher & Ball, 2005).

Using visualizations, interviews, and group-work, CBPC facilitates dialogue among community members and between them and researchers. This dialogue enables all parties to reach mutual understandings and to create action plans that are acceptable to the community (Anyaegbunam, Mefalopulos, & Moetsabi, 2004). In CBPC, communication is a two-way process in which all people are seen as important sources of information with ideas worthy of being heard. Passiveness, therefore, is non-existent in this process because it requires active mental cooperation of all the people involved until a common awareness and understanding is reached (Rogers & Kincaid, 1981). It is a process in which all participants decide on a course of action together. This view of communication presupposes the equality of all actors. The convergence model of communication developed by Rogers and Kincaid (1981) best captures this framework.

7.2 THE ROOTS OF CBPC

The roots of CBPC can be traced to the work of Lewin (1946), who used the term "action research" to describe an approach that stressed cycles of action and reflection involving both researchers and research participants. After several mutations, Lewin's work found expression in various participatory methods that started to emerge in the 1970s (Beltrain, 1993(. During this period, many researchers became increasingly disillusioned with the lack of progress and achievement of development activities, especially in rural areas. The limitations of many traditional communication research methods were becoming apparent. By this time, the assumption that lack of education was a primary impediment to development began giving way to the realization that the wealth of collective indigenous knowledge among rural people could effectively help raise living standards. It also was realized that when rural people are involved in the identification of their own problems and needs, they are more likely to support the necessary actions to address their situations (Anyaegbunam, Mefalopulos, & Moetsabi, 2004).

As such recognition emerged, researchers in the development field began abandoning questionnaire methods, which tended to be too long to administer, very rigid in their formats, lacking in recognition of local realities (as the instruments were usually designed by researchers sitting in urban offices), and complex to process and analyze. Seeking more effective methods of data gathering, development researchers realized that most illiterate or semi-literate people can communicate effectively about any issues that impact them with the help of visual representations.

All of these factors gave birth to Rapid Rural Appraisal (RRA), a great improvement from questionnaire methods. Data were gathered more quickly, and the resulting reports were prepared faster. RRA also better addressed the needs of indigenous people. However, after collecting data in villages, researchers continued to take the information away from the people to analyze it in their own offices with their own sets of assumptions. Thus, RRA is primarily an extractive approach in which outsiders control the research process, going into rural areas, obtaining information from rural people, and taking that information away to process and analyze it (Brown et al., 2002).

As RRA was applied in more situations, it became clear that communities needed to be involved not only in data collection but also in the prioritization and analysis of their problems and needs. Out of this process emerged Participatory Rural Appraisal (PRA) and later Participatory Learning and Action (PLA). PRA and PLA recognized that researchers and subject matter specialists did not know many things about the communities in which they worked and that the only way to learn those things was by listening to the rural people. Similarly, rural people lacked some of the technical knowledge necessary to solve some of their problems. Thus, knowledge *sharing* became an essential component of PRA. PRA has been used extensively in agriculture, forestry, and a number of other areas; however, it has never been used specifically in the communication field, although most of its techniques and tools derive from communication. This disjuncture led to the creation of Participatory Rural Communication Appraisal (PRCA) in 1995 and later to the development of CBPC. CBPC, therefore, belongs to the same family as RRA, PRA, PLA, CBPR, PRCA, and other participatory methods.

7.3 CBPC PROCESS, METHODS AND MATERIALS IN THE PGDP PROJECT

As discussed in section 6.4.1 of this report, the research team jointly drafted a guide for the integrated CBPC-Structured Public Involvement process before identifying as many initial stakeholders as possible. The preliminary, team-generated stakeholder list included 44 specific organizations or individuals of whom the research team was aware prior to entering the field (see Appendix J). Recognizing themselves as outsiders to the Paducah community, however, the team intended this list only as a starting point from which participation from as many community members as possible would be encouraged through additional snowball sampling (Berg, 1988). As finally developed and implemented in Paducah, the CBPC process involved two basic steps: 1) a listening tour, and 2) focus groups. Each of these steps is discussed in the following sections.

7.3.1. Step One: Listening Tour

In adherence to participatory research tenets, the PGDP project began with a listening tour that took the KRCEE team to various local, state and federal government offices in Paducah, Frankfort, and to other locations in Kentucky. This first process stage involved individual and small group background interviews with constituencies identified during the brainstorming session, as well as sessions with additional stakeholders of whom the project team became aware through the initial interviews. Stakeholders approached during the listening tour included elected and appointed officials; local opinion leaders; economic development, environmental, and health advocates; and representatives of the PGDP Citizens Advisory Board (CAB), a stakeholders' board that advises US DOE regarding environmental remediation, waste management, and other plant-related issues.

During each session, the team discussed the proposed methodology, describing preliminary plans for the community engagement project and soliciting stakeholder suggestions about the proposed CBPC-SPI approach. Additional questions attempted to identify: 1) specific stakeholder concerns about the PGDP's future; 2) perceived opportunities for the site's future; 3) perceived challenges for the site's long-term development; 4) specific long-term site usage suggestions of which stakeholders were aware or which they had developed themselves; and 5) any additional background information that the stakeholders felt the project team should know. In accordance with its iterative stakeholder identification approach, the project team ended sessions by asking interviewees to examine the list of previously identified stakeholders and to recommend any additional individual stakeholders or groups who should be engaged by the process.

In all, 80 stakeholders took part in 23 separate sessions during this first stage. Most interview participants authorized the team to audio record the sessions. These recordings were transcribed for accuracy. Transcription data were later triangulated with the team's field notes. One session was not audio recorded at the request of the participants; in this instance, the project team relied solely upon field notes for information gathering.

The listening tour assisted the project team with identifying various population segments affected by PGDP operations and related issues. Initially, ten stakeholder clusters were identified: residents near the facility; plant employees; environmental/health advocacy groups; economic development community; healthcare community; education community; media; religious/spiritual community; recreation/tourism/wildlife; and Ballard County stakeholders. Additional project team discussions further segmented this list into 16 distinct stakeholder clusters:

- Water Policy District Residents
- Economic Development
- USEC Employees
- Environmental/Health Advocates
- Healthcare Providers
- Education
- Media

- Religious/Spiritual Community
- Wildlife/Recreation Enthusiasts
- Tourism
- Ballard County Stakeholders
- US DOE Employees
- US DOE Subcontractors
- Paducah Government
- PGDP Citizens Advisory Board
- Regulatory Agencies

Using this list as its guide, the project team formed a community consultation panel/pilot test group comprised of representatives from each of the 16 groups. This pilot test group pre-tested individual research protocols prior to community-wide implementation and, where warranted, recommended modifications to the process and/or its associated components. Consultation panelists also assisted in recruiting participants from their respective stakeholder groups, bringing members of their constituencies into the community engagement process.

In addition to assisting with the creation of the community consultation panel/pilot test group, data collected from interviews also provided important background information for the remainder of the project. For example, discussions with government and elected officials strongly indicated that any decisions about the PGDP's future must prioritize safety and health. It also became apparent that the phrase "end state" created a challenge for discussing the plant's pending transition from uranium enrichment to an as-yet-undetermined use; thus, the study team shifted to using "future use" terminology. Further, the interview data and background materials gathered during the listening tour informed the development of a focus group discussion guide and hypothetical future use visualizations that would serve as discussion triggers during the second phase of the project.

7.3.2 Step Two: Focus Groups

Following the end of the listening tour, the KRCEE project team developed a preliminary focus group protocol for soliciting community values, perceptions about the plant's future, and information gaps. The draft protocol was provided in written form to community consultation panelists for review and comment. As a result of these written comments, changes were made to the draft protocol.

Community consultation panelists pilot-tested the draft protocol during three sessions in the fall of 2009. As a result of these pilot tests, the research team made additional changes to the amount and form of information provided, as well as expanding upon the number and content of projective scenarios included as discussion triggers. An amended version of the protocol was submitted to the University of Kentucky Nonbiomedical Institutional Review Board. Following minor changes to the informed consent language, the focus group portion of the study was approved as IRB Protocol #10-0086-P4S (see Appendix K).

As developed by the KRCEE project team, pilot tested by the community consultation panel, and approved by the university's Institutional Review Board, the focus group protocol was designed to identify the following:

- Both preferred and unacceptable future use scenarios/combinations of scenarios for the PGDP and its environs among various community groups.

- How the various groups in the community name and frame the following issues related to future use scenarios/combinations of scenarios for the PGDP and its environs:

    - opportunities
    - strengths
    - challenges
    - weaknesses
    - threats
    - fears
    - risks
    - concerns
    - solutions

- The overall quality of life goals and values of the community and, more specifically, the priority quality of life goals and values that influence the decisions of various groups regarding future use scenarios for the PGDP and its environs.

- Any additional information that various community groups need to make the best decisions about future use of the PGDP and its environs.

- The most accessible and trusted channels for receiving PGDP-related information.

Given logistical and fiscal constraints related to the KRCEE team's travel between Lexington and the Paducah area, it was not practical to schedule sixteen separate focus groups targeting each distinct set of stakeholders. However, the team felt it was essential that the groups be populated in a manner that would encourage maximum dialogue. Thus, the team then used constant comparative analysis (Strauss, 1987; Lindlof & Taylor, 2002) of existing data to group stakeholders who appeared to have similar backgrounds, relationships to the plant, and practical and philosophical commitments. Ultimately, eight stakeholder-specific focus groups were scheduled during May 2010:

1. PGDP/USEC Employees
2. US DOE Employees/Subcontractors
3. Water Policy District Residents
4. Ballard County Citizens
5. Environmental and Health Advocates
6. Economic Development/Local Government
7. Wildlife/Recreation Enthusiasts/Tourism
8. Healthcare Professionals/Educators

Focus group participants were recruited primarily through email invitations and snowball sampling. Specifically, email invitations were sent to all individuals who had been interviewed during stage one and to other stakeholders who had been identified by both the project team and interviewees. These invitations included a request that recipients share the invitation with other interested individuals in their cohorts. All written invitations requested an RSVP and included the caveat that attendance at any individual session would be limited to the first fifteen respondents. In addition, US DOE subcontractors mailed hard copies of the invitations to residents of the Water Policy District. USEC's public relations office in Paducah also disseminated the invitation to plant personnel. Similarly, a local hospital voluntarily sent a KRCEE-prepared mass surface mailing of some 200 invitations to its allied health professionals list. Finally, a research team member invited one interested individual onsite to join a focus group that had particularly low attendance. Individuals who had pilot-tested the protocol were not eligible to participate in the stakeholder-specific focus groups, as their pre-existing familiarity with the processes and materials could have wielded undue influence on group discussions.

During each focus group, facilitators briefly explained the project and why the meeting was convened. Facilitators also reiterated the voluntary nature of participation and advised any participants who did not want to continue the study that they could leave. Assurances of confidentiality were verbally provided in accordance with human research guidelines, and copies of the consent form were given to all participants. The project team then used specific exercises, questions, and prompts to elicit the information identified above.

Focus group data were coded using NVIVO 9 qualitative data analysis software. Members of the research team conducted two kinds of qualitative data analysis: 1) emic analysis focused on participant-identified community values, opportunities, barriers, and information gaps; and 2) etic analysis allowed researchers to assess deductively additional opportunities, barriers, and information gaps implied by the assembled data but not expressly stated by participants. A researcher who had not attended the focus groups independently conducted the initial transcript analyses, which were then verified by investigators who had attended the sessions.

7.3.2.1 Focus Group Results

Focus group attendance generally was in the optimal range of eight to twelve participants (Kitzinger & Barber, 1999). A total of 64 individuals attended at least some portion of eight sessions. The majority of attendees were male, with only twenty females participating in focus groups. Not all focus group attendees participated in the keypad scoring portion of the protocol. Ten individuals registered opinions via keypad in each of three focus groups: Economic Development/Local Government; PGDP/USEC Employees; and US DOE Employees/Subcontractors. Nine attendees used keypads in each of two sessions: Water Policy District Residents and Ballard County Citizens. Eight participants provided keypad scores in the Wildlife/Recreation Enthusiasts/Tourism focus group. Unfortunately, only three individuals were present for two focus groups: Environmental/Health Advocates and Healthcare Professionals/Educators. Because the former group began with only two attendees, the decision was made to forego keypad scoring given that participant anonymity could not be maintained under such circumstances.

Focus group sessions began with an overview of the project, followed by participant evaluations of past and ideal levels of community involvement in public processes using the Arnstein Ladder (Arnstein, 1969). According to focus group participants, the community sees itself as located between informing and placation, or rungs 3 and 4 of the Arnstein Ladder, but would prefer to be consulted and treated as partners, or rungs 5 and 6, in community development projects.

The Arnstein evaluation was followed by exercises designed to identify community values and ideals that should bear upon future use decisions. This task was accomplished by asking each participant to name three qualities that make the area near the PGDP a good place to live. A follow-up question asked each participant to imagine the ideal place to live and to name three qualities of this hypothetical model community. The ensuing conversations indicated that citizens of and visitors to the region place high importance on:

- Safety and security
- Clean and healthy environment

- Employment
- Strong sense of community, e.g. collaboration and friendliness
- Good educational system
- Religious/moral community
- Good infrastructure
- Cultural vibrancy

Some focus group participants, however, explained that all the values above depend on the availability of good jobs for people in the community. According to one participant, “[U]nless we have the kinds of jobs that industry affords where people can make enough money to buy a home and educate their children, you’re not going to be able to have the other items that make for a good community.”

Another participant agreed and opined, “Of all the things that we have listed—friendliness, safety—we have all of that; what we need is employment. We have an excellent school system… What we need is employment… So we need some type of employment that people can get a job…”

Participants, however, stressed that in addition to jobs, the community also values a clean and healthy environment. According to one focus group participant, “What we tried to stress was sustainable jobs and an environmentally safe and sound future to preserve the environment not only now but in the future. It wouldn’t just be any jobs; it would be jobs that would keep those values in mind as well.”

Thus, ideal future uses for the PGDP should incorporate -- or, at the very least, should not oppose -- these core community values, especially the request that decisions about the plant and its environs consider the provision of employment and good environmental stewardship as key issues.

7.3.2.2 Small Group Scenario Presentations

In the next set of focus group exercises, participants evaluated twelve computer-generated visualizations of sample scenarios. These hypothetical scenarios were created based on previous studies and public recommendations, as well as on information gathered from interviews, to represent the range of possible future uses for the site. Hypothetical land uses included: 1) nuclear industry; 2) heavy industry; 3) light industry; 4) recreational uses; 5) expanded wildlife management; and 6) complete closure of the site with no future development. Each set of visualizations included an aerial footprint and two computer renderings illustrating the scenario from different vantage points. Two options were created for each specific future land use, based on different waste disposal options. Because the DUF_6 plant is anticipated to operate for at least twenty-five years, the facility was included in each hypothetical scenario. The methodology for selecting and designing specific land use and waste disposal options is discussed in more detail in Chapter 8.

During this set of exercises, seeing and discussing trigger visualizations allowed community members to think about various possible future uses for the PGDP, to share their knowledge and experiences about additional possible scenarios, and to evaluate and appreciate myriad issues related to various future uses. Participants separated into small groups, each of which was tasked with independently examining and discussing a specific visualization selected at random. Following the small group discussions, group members described their specific scenario to the entire reconvened focus group, highlighting their perceptions about what the visualization represented, whether it depicted a good or bad future use for the site, and what the consequences of the specific scenario would be for the community. When necessary, facilitators further engaged the plenary group in discussion using the following probes:

- What do these scenarios mean for the community?
- How do these scenarios relate to your lives? Your families? Your communities?
- What are the most important issues related to these scenarios?
- What are the barriers to implementing these scenarios?
- In what ways can these barriers be overcome?
- What other scenarios/combinations of scenarios can we consider for the plant site and why?

The hypothetical scenarios thus engaged participants in dialogues about the potential effects on their community of several diverse future use scenarios. Following this discussion, focus group participants used the Audience Response Systems (ARS) discussed in Chapter 8 to register their assessments of each hypothetical scenario's suitability as a future use for the site. The specific quantitative results of this exercise will be discussed in Chapter 9; however, transcript data indicate that community members are working to balance complex economic, environmental, health, and seismic risks in determining their preferences for the PGDP site's future. Scenario descriptions and discussion analyses, including exemplar participant statements, follow.

7.3.2.2.1 Scenarios 1 and 2: Nuclear Power Plant

In these sets of images, a nuclear power plant was placed inside the existing fence. The differences between the two scenarios rested on the disposition of plant waste. In the first scenario, burial grounds were excavated and legacy waste moved offsite, while a large onsite waste disposal cell held all plant waste from decommissioning. In contrast, the second scenario showed the existing burial grounds remaining onsite, with some decommissioning waste placed in a smaller onsite waste disposal cell and some decommissioning waste shipped elsewhere.

In response to the research team's initial question about what the specific scenarios represented, answers varied among different stakeholder groups. Potential employment opportunities were discussed by several groups, but concerns about environmental and health implications, as well as seismicity, also were highlighted in the conversations. These scenarios generated a diversity of opinions regarding the optimal balance of economic opportunities and community health and safety. In short, the images represented very different things to different stakeholders. Specific comments included:

- "[This scenario represents] jobs in the area, and not only just jobs, but high technology jobs. And also another representation here is future use for the land, as opposed to walking away from the site."

- "I guess it would create jobs, but I don’t think it’s going to happen because of the New Madrid fault. It would probably be dangerous, and the West Kentucky Wildlife [Management] Area would probably have to be expanded... That might be a plus for the Wildlife Management Area, as far as being able to expand farther out.”

- "[T]he idea of nuclear power is appealing to me. I think that’s really a big opening for us in the future for our power supply, and I’m not really opposed to having that around us as long as it’s safe, as long as it can be made safe. I don’t want another Chernobyl. Or another -- was it Two Mile, Three Mile, or Ten Mile Island? Whatever it was. I don’t want another one of those. I certainly would be in favor of that."

- "On the positive side, [this scenario represents] economic stimulus. It would bring a lot of jobs into the community for years to come as this thing’s being built. But in the end, due to the fact that it’s a nuclear power plant, you’ve got potential environmental disaster [and] further contamination. So I guess that would be the good and the bad. In our personal opinion, the bad outweighs the good."

- "[W]ell, obviously, this is the future or the end of USEC, as we now know it... It’s gonna represent maybe some economic base for the Paducah area. ...I like the idea of a nuclear power plant, using some alternative energy sources instead of coal, hydro... I don’t see any windmills out there, but that might be a possibility too, since...there’s a lot of land out there. My question was...nuclear power plants have to have enriched uranium; I mean, by taking away one of these plants, do we still have enough for nuclear power plants in the future, and for defense or, you know, whatever? ...There’s still gonna have to be enriched uranium developed for uses in this country. You know, can Portsmouth and Oak Ridge suffice that? Or is takin’ this out gonna restrict...our availability of that energy source?"

- "[O]ur community, we’re already in the nuclear—we feel safe with it, you know? We feel like it’s okay."

- “*The Politics of Cleanup*...listed three separate scenarios; one was Rocky Flats in Colorado, one was Miamisburg in Ohio, and the third was Oak Ridge, TN. If you look at why we support this mixed scenario... Rocky Flats was similar to what Paducah is, although they did a lot of weapons parts—triggers—very contaminated site. That community voted in *toto* to have a bird sanctuary, so what you drive out there and see now is land with tape around it, and I think that does nothing for the hundred and forty-two million dollars annually that the plant brings in to this area. So, I think the mixed scenario is a good scenario. Miamisburg of Ohio, on the other hand, had a downtown location; theirs is a lab... That doesn’t fit for us because I think we’ve got something like 3,800-plus acres out there. I think that if you look at Oak Ridge...they have a linear location; the land, they have industrial use; you have ORNL in Oak Ridge, national lab; you have K-25 down over—or K-12; down on the other end, they’ve shut that end down, and they’re trying to clean it up and completely reindustrialize it. I think, again, that makes sense for this area, and that’s why we support a mixed usage... We’re for the Wildlife Management Area remaining... [W]e have bird dog trials, we have hunting out there... [This scenario] gives us continued economic opportunities onsite; it does not devastate this community."

- "I don’t see the justification for building new power plants around the country—nuclear power plants. I don’t buy the argument...that it doesn’t produce any greenhouse gases because in order to—from the beginning of the mining, from there to the Cowder facility to Metropolis to Paducah to fuel rods...all that transportation, most of that is run by coal-fired plants. This site...would have to be generating more waste, more radioactivity… We’re right on the border between the seismic zones nine and ten. I just think it’s totally unrealistic that when it comes down to it to think about putting a nuclear power plant out there on that contaminated site... It’s not gonna happen."

A second question focused on whether participants thought the scenarios were a good or bad future use for the site. Valuations varied based upon the ways in which speakers prioritized competing employment, environmental, health, and seismic risks, with most participants recognizing multiple areas as important considerations. However, some participants expressed concerns about the increased risk related to building a nuclear power plant at the PGDP location.

- "From the contemplation of future jobs, it looks good. I do want to point out from my perspective as a geologist, in some respects; it's an unrealistic scenario since we're in a really high seismic concern area. Currently, there is a state law that prohibits nuclear facilities in Kentucky, although I understand there's a lot of impetus to change that. At least in the current standing, it couldn't happen."

- "If it's safe, then I say yes it is a good future use... The use of that for a nuclear plant would fit with what I would want."

- "We've got [a] potentially bad future due to contamination of the water and wildlife on the [WK]WMA, as well as surrounding areas, and even surrounding counties and states if...some kind of nuclear disaster did take place."

- "[T]he alternative energy process would get our dependency off foreign oil. The job creation, okay, is a very positive thing, 'cause with the jobs comes economic impact; with the economic impact, helps your businesses. It also helps your...population growth, your schools, and you know, it just kind of—it's trickle-down theory..."

- "[W]e talked about the infrastructure. That's the power transmission lines and everything set for as much power as we use that it would be easy to feed it back on to the grid. We have the water and the other types of utilities to be able to support a power plant here, and it would retain a lot of jobs too, especially like all the maintenance people. I mean working on our cascade or working on turbines or other stuff like that. I mean, the mechanical's mechanical. A lot of things will transition over that way, so I think that will retain a lot of jobs and the expertise that we have in this area."

- "[W]e think that [this scenario is] a good use of the site, because it utilizes the NRC-trained workforce; the site assets of water, rail, interstate transportation infrastructure, and the electrical grid. It allows for a mixed use..."

In considering the potential consequences of nuclear power plant scenarios, individuals expressed both fear and hope related to potential environmental, health, and economic outcomes, with waste disposal decisions being a chief consideration. While many cited the maintenance of a strong economic base and jobs, a number of participants expressed concern about increased environmental and health risks.

- "I think it would be like Three Mile Island. Anything could happen."

- "Of course, continued employment is a plus, and another positive aspect of this is it probably means cleanup of the site in a very timely manner. So there may be some impetus to clean up the site quicker than other scenarios."

- "[T]o be able to market nuclear power to the rest of the area, the community, the country, or the whole Midwest, I could see that would be an improvement of our economy here and that would certainly be of great benefit to us, the citizens and my family."

- "I was joking...a while ago -- I said, 'well, honestly, if I didn't live here, I would probably look at a situation like this and say -- hey, they've already screwed up that area so bad, go ahead and stick a nuclear power plant on it.' But, obviously that is not the case. I do live here, and we did not think it would be a good outcome for the existing site, to put a nuclear power plant on it."

- "[W]e didn't come up with [any consequence] that was really negative or against that. It's more positive for future jobs for the people that work here and retain the expertise that people have out in this area. A lot of people that actually work out here have worked at power plants and stuff like that. So I mean we even have the expertise in this area to maintain facilities like that."

- "[I]t just boils down to economic impact and all the trickles-down that goes with that. ...[W]e need something there to replace what is there now; you know, that's a big part of our economy. ...Ballard County doesn't—besides our paper mill and our school district, who're the two biggest employers—other than that, people go to USEC or they go into Paducah. ...[W]e have some relatively small businesses within the county, but they're not large enough, you know? They can't provide the job opportunities that we need. 'Cause I think Ballard County kind of ends up being...a nice, rural buddy for Paducah. You know, it really does. Because you can still buy property here relatively cheap; you can still buy eight, ten, twelve, fifteen acres if you want to, and kind of have a rural lifestyle; or you can be a farmer or whatever, you know. And people like that lifestyle. ...I know when kids are young, you know, they're interested in buildin' a house, buildin' a family, and payin' off their debts, and you know, gettin' their kids raised; but, you know, as that age matures and as they grow older and their kids get older, they start lookin' at quality of life issues; and, you know, that's, I think, what makes our community so attractive, is the quality of life here. So it all kind of plays a part."

- "I'm all for nuclear power as long as you do two things. One, get nuclear power that doesn't leave waste. And second is repeal Murphy's Law. The reason they don't shoot that nuclear waste into the sun is what happens if you get another Challenger accident and there's all that nuclear fuel up there in the atmosphere, then we're all screwed. You can't do that. There's just nothing to do with it. When God built a nuclear reactor, he put it 63 million miles away. That's where they ought to be."

- "[T]he consequences of this scenario, if it was played out, would be more cancer and more health problems in our community...because it would have cumulative impacts with everything that's been released so far, which is many, many, many hundreds of curies that they've admitted to releasing into the environment since '52."

7.3.2.2.2 Scenarios 3 and 4: Heavy Industry

These scenarios featured heavy industry inside the existing plant footprint. For discussion and scale purposes, the renderings illustrated an automobile manufacturing plant. In scenario three, the burial grounds were removed, all decommissioning waste was sent off-site, and recreational facilities were added in the Wildlife Management Area. In scenario four, the burial grounds remained in place, all plant decommissioning waste remained in a large onsite landfill, and no recreation was added to the Wildlife Management Area.

Discussions around these scenarios tended to be slightly less polarized than those around nuclear plant options, with participants generally enthusiastic about the potential for job creation but still concerned about environmental impacts.

- "We thought this sounded like the best case scenario. Future companies can come in and start up immediately, with all environmental issues resolved. This appears to be maximum jobs created. There's complete waste removal, which is jobs involved in that, and remediation for future industry, which obviously involves jobs. Maximum economic development; so that's what we think this scenario represents."

- "We said, 'Great!' It seems to maximize economic development and minimize environmental degradation; enhances both economic development jobs through industry and tourism by enhancing the recreational potential of the area around the site. But the property must not be removed from state tax laws—or, we should say, any more property should not be removed from state tax laws; it ought to protect the local counties and other tax communities."

- "We thought it was probably the most feasible thing you could do with the land."

- "There were goods and bads. The good is it would give continued employment maintaining the burial grounds, and the bad may not result in new industry."

- "[W]e figure it's about as good as you can get... If you do that, it can bring in jobs, help keep the community alive, and it keeps the wildlife management the same as it is. We think it's probably a good idea, as long as the industry that it brings in doesn't damage the wildlife area anymore."

- "[Y]ou'd have a lot of jobs there, but you'd still have the same old problems we've always had. There's very little recreational facilities added on. I mean, we already have field trials and dog hunting; I mean, it hasn't changed that much. So that was the bad side."

Several individuals expressed concern about the potential impact of onsite waste disposal on the community's ability to recruit industry for the site.

- "[W]ho's going to want to build some sort of new plant or, you know, new entity next to a nuclear waste dump -- which is what it's gonna be viewed as, I feel like, by the public? I think that it has some serious implications as far as limiting the site for re-industrialization; it limits the number of permanent jobs. Right now, with Shawnee Steam Plant, the current workers, onsite, at the Gaseous Diffusion Plant—not clean-up workers—we're looking somewhere around sixteen hundred people, and those are sixteen hundred head-of-household jobs that, when the Gaseous Diffusion Plant shuts down, thanks to stimulus work, there aren't gonna be as much jobs left at the end as were initially thought. And when you take sixteen hundred head-of-household jobs, you're not talking about jobs that you can easily replace in Western Kentucky; you're talking about jobs that also contribute to our other industries—our service industries, our restaurants, our shopping, the things that contribute to the community—the Carson Center. People having the ability to go to those things is based on the income that they're able to earn, and, you know, we really have to look at trying to create something to come into this site that's gonna create that same level of income, or people aren't going to be able to afford to live here and enjoy the great things that the community has to offer."

- "There's a lot of good people that probably want to build plants in this area, but the problem is they don't want, I mean, you put workers on a site that's heavily contaminated, you've got insurance policies. I mean, I think you're going to have to get insurance on these people. If they're scared to come in here and work because of past contamination, they're not going to come."

- "I, personally, believe this is a bad use for this site, because it has a bad public image as far as a waste storage facility; that's not really something anyone wants in their backyard. Although we have an operating gaseous diffusion plant, it doesn't seem to bother the public image with the community; we fit in well—the plant—it's not something that we have protesters everyday lining up out in front of. And, you know, we have some issues with groundwater contamination now; I'm not convinced that we're not gonna have some contamination issues from this storage facility. I also think that although it will produce a large amount of jobs to construct this facility and to do the D-and-D work, I don't think it's gonna produce long-term jobs. I think building a fence around this [waste disposal] cell and saying, 'You can't go here,' it's gonna take up, roughly, from my estimates, about a tenth of the site. It's one of the better sites as far as if you're going to re-site some other sort of industry on the plant site... I really feel like this is a bad option... It just seems like, although [onsite decommissioning waste disposal is] cost-effective for the Department of Energy and for the federal government, I think it will be a great cost to the community as far as long-term use."

- "[I]f these things are so contaminated that we can't use them in some other way, such as the nickel and things like that -- if we can't use them and they're not safe for public use, then burying it all in the ground isn't really gonna be, you know, an option where...somebody's gonna wanna come and locate a large amount of workforce that they're gonna be responsible for their health. You know, I don't see how you're gonna overcome that concept...in people's minds. I just don't see how you're gonna convince them that this is perfectly safe and, you know, we can build right next to this cell. I think...it's gonna, basically, condemn the site for any future development."

- "Depending on the type of industry, I don't think it would be a deterrent; it just depends on the type of industry that you wanna attract. A lot of it's psychological; I mean, 'cause it's—it would be safe, but you've got this psychological part of it."

- "...[P]ersonally, we think [the heavy industry scenario is] bad because we're more interested in the recreational use of the area. And yeah, it would maintain jobs, I'll admit. But still, you've got the same old problems that it's had forever. And, you know, removing the waste from site, I think would be absolutely impossible. I mean how many years and years, and money and money—I don't see how it could ever be done, 'cause it wasn't done in a day, and I—it would take a long time to do it...Well, it's just the same old, same old; it's—we'd have a lot of jobs here, but have a lot of—lot of problems, just with all heavy industry. And that's what we think."

In terms of consequences, the discussions often focused on long-term employment opportunities and the economic health of the community.

- "We said, ‘Positive’ -- exclamation point! Creates jobs, enables our youth to remain close to home or to return home instead of working somewhere else, while at the same time a benefit is protecting and preserving our greatest natural resource: our rural environment."

- "[R]eindustrialization will provide jobs."

- "[I]t would keep the community here for future generations. It would keep good jobs in this area for our children, and, as we said, the damage to the land has already been done. It’s been made abundantly clear there’s no real reversing that. So you make the best you can of what you’ve got... [F]or instance, if you put a nuclear power plant there, I don’t think that’d be a problem at all, but you know, it just depends; you couldn’t—you know, or a steel mill or something like that, it probably wouldn’t be a problem."

7.3.2.2.3 Scenarios 5 and 6: Light Industry

These scenarios featured light industry footprints, with light industry potentially denoting a distributional facility or warehouse. In scenario five, burial grounds were removed, some plant decommissioning waste remained in an onsite cell, and recreational facilities were added. In scenario six, burial grounds remained intact onsite, all decommissioning waste was sent off-site, and no recreational facilities were added to the WKWMA.

Discussion of these scenarios focused on the perceived public appeal and economic potential of the options.

- "This seems to be one of the easier ones for the public to swallow. It takes the plant and changes it to light industry and adds recreational facilities. And it does have the waste disposal alternative there at the same location that the previous scenario had, but if you look at the...southern view of it, it doesn’t look like it’s taller than the trees; it’s not a mountain, it’s more like a molehill, I guess."

- "[This scenario represents] the continuation of jobs and employment here with light industry. We’re not exactly sure what that would mean, but obviously these are generalities. That’s encouraging ‘cause we’re all interested in continuing to have a job. ...[W]e saw [what] looked like an oval track, so we kind of envisioned a dirt track maybe -- the atomic dirt track -- for uh sprint cars or stock cars or whatever. ...[T]here already is a little bit of dirt racing that goes on in this area. There’s a lot of problems with noise, I think, in the neighborhood. It wouldn’t be a big issue out here. You’ve got a lot more area to fill up. It would be something that might create some jobs there in and of itself. It would be a destination for families to go for entertainment."

Participant analyses of whether the scenario would be a good or bad future use indicated the complexity of interactions between recreation, waste disposal choices, and economic considerations

- "[W]e did like the recreational facility as a buffer between where a lot of the residents are, and it looks like it’s a walking track and, I’m not sure, soccer fields. I do agree that soccer fields may not be the best thing out there, but it does look like a walking track...

[M]aybe the waste disposal cell could create some sort of jobs in that whole process. The rec facility could be a positive attraction for the facility, by attracting people to it and getting rid of the secretiveness of what was the Paducah Gaseous Diffusion Plant. [N]ow changing it to light industry -- [a] positive future for it. The waste cell: some people may look at it as a buffer to the light industry; as you're coming in to the site, you could go off to the right to go to the recreational area, or if you went straight, you would go to the light industry; well the waste disposal cell would be a buffer. However, it is the first thing that you see when you come in to that area; so, it could be a detraction too. No use of the trained workforce—the nuclear workforce—we thought that was a negative; it's light industry; we don't know exactly what that industry would be, but you could have a whole section of the workforce not using their credentials... We thought it was one of the easier [scenarios] for maybe the public to accept."

- "We can see pros and cons... Light industrial would mean jobs, and also if we had the recreation area, there could be some additional jobs created through that... [P]art of our scenario says existing burial grounds would be excavated, probably to make room for some of the expanded light industrial area on this map. That's one of the things we're not too crazy about is disturbing some of the landfills. That's stuff that's been in place for so long. There would seem to be a better solution than digging it up and putting it somewhere else and contaminating some other area to leave it where it is. It's already there. And again, the light industry part sounds good if it does create jobs that last. Not just five years and done. That was a positive thing."

Focus group attendees expressed cautious views of the consequences for this scenario, largely based on economic unknowns.

- "[I]t comes back to the nature of light industry and how long that would last, because a reduced number of jobs in this area or a reduced number of well-paying jobs in the area would dramatically affect the local economy. That's something we all understand. So that's something that would directly relate to how it would affect our family and community...the number of jobs that are either created or lost..."

7.3.2.2.4 Scenarios 7 and 8: Recreation

These scenarios depicted the current plant's replacement by low-intensive recreational facilities, perhaps driving and/or hiking paths, with the potential for a nature center or something similar. In scenario seven, burial grounds remained onsite, some decommissioning waste was put in an onsite disposal cell, and no recreation was added to the Wildlife Management Area. In scenario eight, the burial grounds were removed, all decommissioning waste was placed in a larger onsite landfill, and structured recreation activities were added to the WKWMA, including a driving path through the trees.

In terms of what these scenarios represented, focus group participants tended to be concerned about the lack of economic opportunity inherent in strictly recreational uses.

- "You're replacing pretty much everything on this site, with the exception of the DOE offices and the DUF_6 facility, with recreational facilities despite the fact that the infrastructure is here for much more. The water treatment plant, the sewer system, power, natural gas. All of that is here. So that's really what we're looking at in this particular case is just basically resigning to the fact of just putting a recreational facility out here and not pursuing other industry is what it appears to do."

- "[This represents] all recreational use -- no additional industry, no existing economic development opportunities. So [we] felt...like makin' recreation inside the fence would cost more, because it would take better cleanup in order to have recreation opportunities there. And could it ever be safe enough for people to want a form of recreation out there? Having recreation out there, then maybe you wouldn't want the waste onsite; so you gotta address that."

In general, recreational alternatives were viewed as poor solutions, which provided little economic benefit. In addition, many participants were skeptical about community members' willingness to participate in recreational activities at the site.

- "[W]e think it's actually a bad use for it, the reason being there are already so many recreational facilities in this area such as the lakes. Those are in the Land Between the Lakes, and [the PGDP is] currently in the middle of a wildlife management area. So, there's already a recreational facility that surrounds it, and I guess the biggest use for this area right now is dog crawls and some of the hunting, and there's a little bit of fishing in the area, but that's the main use of it, and just to put some trails out there, there's already lots of trails out in this area. So it really is, we believe, a bad use because of the transportation and the utilities that are here that could support major heavy industry or light industry. There's a lot of capabilities here."

- "I don't believe we'd want a recreational facility right there. There are hazards associated with the...facility that I don't believe I'd want my family out in that area."

- "We think it's a bad scenario; we need mixture of economic development and, as I said, recreation... The waste disposal site we feel like should be in a more concealed location as opposed to right in front. And that it was a good thing to move the burial grounds; I think that was sort of already decided. I think they're gonna do that."

- "I believe it's an okay scenario, but not the best possible outcome. This area really needs industry, and I think there's a legitimate concern that even though the community is, and has been for fifty years, very comfortable with a nuclear enterprise in the community, I think people will always—at least a large volume of people—will always have some concern in the back of their mind that 'Whoa, wait a minute; I know what they used to do there. How could they have ever cleaned it up to a degree that I want my kids kickin' a ball and playin' in the grass?'"

The consequences of the recreational scenarios were viewed largely in economic terms.

- "The consequences would be the long-term economic impact of this. You would be replacing over a thousand jobs with probably less than 20 to maintain that recreational facility."

- "[T]his takes away a tool because we're not allowing any economic development to go out there. It would be...difficult to convince the community that this area is ever gonna be clean enough to go out there with their children and do soccer, baseball, whatever it might be. And then it would have extreme consequences, again, for the community in terms of lost revenue because we have not created any jobs for the good of the community."

- "Essentially, once we get to that point in this particular scenario, the plant's shut down, cleanup operations are complete. That is a lot of jobs and a lot of economic impact negatively to this community that we don't have a plausible answer for in a compensatory measure at this time."

- "Take a thousand jobs making $65,000 a year. That's a huge impact on a city the size of Paducah. You talk about a plan of taking an area this size and making it just a recreation area, who's going to come to a recreation area? Who's going to have the money to bring their kids to a recreation area, or have the time to do that? They're not. It's just going to sit out here and waste itself. Who's going to pay for it? The upkeep of it. It's not going to be our tax dollars that's going to be able to pay for it. We're not going to be making any money."

7.3.2.2.5 Scenarios 9 and 10: Expanded Wildlife Management

These scenarios depicted options for creating a nature preserve at the site. In scenario nine, the Wildlife Management Area was extended into the existing PGDP footprint, burial grounds remained in place, all decommissioning waste was shipped off-site, and some recreational facilities were added to the existing WKWMA. Scenario ten expanded the Wildlife Management Area, removed existing burial grounds, kept some decommissioning waste in an onsite waste disposal cell, and did not add recreational facilities. In these scenarios, trees covered the entire PGDP footprint.

Most focus group participants simply described the visualizations without making specific value judgments; however, wildlife and recreational enthusiasts felt that these scenarios represented positive outcomes.

- "I think [this] represents a wildlife, nature route."

- "It's a wildlife management area and nothing else."

- "[W]e thought this was probably the best use for the area, in the long run."

- "[This represents] a lot of continued and enhanced recreational uses of the area; enhanced economic potential, secondary to widespread recreational uses. We have, this weekend...a field trial...dogs from eighteen different states coming into the area, and that's an enhanced economic benefit for the area. And…and then, in a way, it would maintain and improve the overall quality of the life in the surrounding community."

Whether the scenarios were viewed positively or negatively largely depended upon whether participants felt that the expanded nature preserve would be used, the extent to which an emphasis was placed on potential jobs loss, and if high priority was given to the environmental impacts of the site.

- "I think it would be a bad scenario. We have great game reserves in our county; we do not have a tourism population to support another reserve. We also have Kentucky Lake, rivers—Ohio River, Mississippi River—a lot of people use for boating and so forth."

- "I mean if you just look at it narrowly and say it's a nature preserve, then, yeah, it's good. It blends well with the surrounding area because the surrounding area is a wildlife management area. But if you look at it in a broader respect, you've gotten rid of industry and the whole jobs and employment kind of thing has went away. So, I mean, good preserve, bad that you lose jobs."

- "[This option is] good for the future. It decreases the problems from contamination of the site because the contamination is gonna be there, and there's less likely to be problems with the contamination in this particular use. It enhances the public use of the Western Kentucky Wildlife Management Area and Nature Preserve. Cleanup would facilitate adjoining development. In other words, there's a potential, if the quality of the area is enhanced here, that people would be more likely to use the surrounding area. Also, the economic impact of the area would be enhanced through the additional use for—potentially from the area...and around the country. The only thing...we suggested that it may be better to leave the waste material on the site 'cause it helps to stabilize the area; other areas are probably not gonna be dying to get the waste—no pun intended. And it would also limit what you could do with the site; in other words, heavy industrial or other utilizing of the areas of the site. So leaving the material onsite might work in our benefit, in the long run."

In terms of consequences, perspectives about the scenarios' ultimate value also relied upon the extent to which economic outcomes were emphasized. However, many participants also recognized the potential contribution of an expanded wildlife area to outdoor recreational opportunities.

- "I think it would affect [the community] very negatively. [T]he tax-base cannot stand if you do away with [industrial or commercial use]... I think, you know, a business world or something else would be effective over there."

- "As far as the good side of it, increased wildlife, more opportunities to connect with nature, I guess, and get out and hunt, fish, hike, do those kinds of things that you do in the outdoors. The bad was, again, we get back to the industry people don't have jobs, they don't have opportunities to do what helps you be able to get to go to the outdoors and have money and stuff."

- "I probably wouldn't go out there. There would probably be people that would enjoy it."

- "[I]t would not really be beneficial to the area like to make it all—close it off and make it a wildlife area. I mean, that would be okay, but, you know, we have plenty of opportunities for wildlife areas and outdoor recreation around here; we really do. We have lots of opportunities. What this area needs is economic development of some sort."

7.3.2.2.6 Scenarios 11 and 12: Institutional Controls

Under institutional controls scenarios, a fence was built around the perimeter after plant disassembly. In scenario eleven, burial grounds were removed, all decommissioning waste was shipped offsite, and no recreation was added to the Wildlife Management Area. In scenario twelve, burial grounds remained intact onsite, all decommissioning waste was placed in an onsite waste disposal cell, and recreational facilities were added to the Wildlife Management Area.

What these scenarios represented varied widely depending on the specific commitments of the focus group stakeholders, with some viewing institutional controls as economically impractical and others seeing it as an environmentally-conscious solution to legacy contamination issues.

- "[W]e thought it represented just a return to the wild. There's no development. It's fenced, and that's just kind of a, I don't know that we really talked about this, but when I see it fenced like that, to me it says that there's a problem like it's not cleaned up. Everything is still there."

- "We felt that this would be a low-cost means of terminating the facility. It would have very little—or at least low impact on our [recreational] focus, in terms of the activities that we're concerned with and want to participate in."

- "I'll just say we weren't very positive on that idea... I thought we might have had the worst scenario, but I think their's might have actually been even worse -- to try to make a recreation area out of it. The reason being, like I said, all our thoughts were basically negative because first of all obviously you're limiting any potential job creation, economic development. Not by just sort of letting nature take over, but by putting controls you're giving the whole area such a stigma that, I mean we already see it... We've got institutional controls...that to me greatly exaggerate the risks involved with them anyway, when you go up Little Bayou and Big Bayou. And now you're making the whole area kind of that. You're holding the stigma. Then try to put, uh, like a ballfield or a track right beside it; once again, it's going to be near an industrial uranium conversion plant. That would not make it attractive for those who want to go out right next to the polluted institutional control area."

- "[T]o me, it looked like an attempt to undo damage. It's damage that I don't think can ever be undone, but it's an attempt to do something about it."

In terms of whether these scenarios represented good or bad future uses, opinions again hinged on economic and environmental interests.

- "[T]hat's not good for the environment and that's not good for the economy. It's in my humble opinion a pretty poor decision to make, and the consequences are there are no jobs, and it's not being a good steward to the earth, and I didn't much care for it."

- "We think, from our perspective, it would be a good way of going forward, again, with very little or neutral impact on outdoor usage."

- "[Y]ou're wasting the existing infrastructure that's already at the plant. The roads, the electrical, the sewage, the water treatment plant. That would be way over capacity for what you're leaving out here in terms of industrial activity. So you're just completely wasting and giving that away. Of course, I work in environmental, and to me this place isn't nearly that bad that you would throw that type of infrastructure away."

- "[I]t is a step in the right direction. There just can't be any good solution. There just aren't any answers. It's good because it's closing the area off, which is what they did at Rocky Flats. There's just a huge fence around it now. Nobody goes there. It just keeps everybody out. It doesn't matter what you do to it. It's going to be contaminated. It can't be cleaned up."

- "[T]his scenario doesn't offer anything other than recreational for anyone. [W]ith the loss of jobs, you lose tax-base and your—I mean your payroll tax. That's something we've learned that we need for the counties to exist is the payroll tax. We need that, and with the loss of jobs you're gonna...it's gonna be significant... [Y]ou look at this scenario -- really it's a scenario of just let's leave it there and [smacks table] fence it off, is just pretty much what...what it's saying."

- "[T]his doesn't really give us an opportunity to address what we really want; and that is job opportunities and other things that we all look for in our counties and region that we live in..."

The primary consequences cited for these scenarios were in terms of lost jobs and the subsequent impact on the local community.

- "[W]e didn't really go into the good, and the bad, and the ugly, so to speak, but...I've heard, in discussion with some of the locals, about the job—you know, bringin' in jobs. We talked about that a little bit... [W]e can't fathom anything other than...something similar in usage bein' out there. I mean, you can't even sell a little old gas station that's still got a tank buried, due to the economic aspect of cleanin' it up and gettin' it accordin' to US EPA specs; and I cannot for the life of me figure any industrial company would touch that with a ten-foot pole. It would have to be something in a nuclear facility of some sort... But, as far as this particular scenario and the consequences, it would not be high, you know, impact in terms of jobs comin' in for that specific site, but it would certainly be very little impact on what we do, or at least that's the way it appears. We think it would probably be a good deal."

- "Obviously, the consequences for this scenario are families. You can see it would limit future opportunity. With using the land, which would be almost no value to anybody. I'm sorry I can't give you any positives."

- "Closing it off [is good because it] tries to maintain, contain, protect people, anybody from [being] exposed to anything."

7.3.2.3 Group Discussions

In addition to discussing specific scenarios, focus group participants tied the scenarios back into the previous conversation about community values. As the preceding pages show, employment opportunities were a primary factor in deciding the suitability of specific scenarios. One participant summed it up this way:

> "[U]nless we have the kinds of jobs that industry affords where people can make enough money to buy a home and educate their children, you're not going to be able to have the other items that make for a good community. You're not going to have nice homes. You're not going to have stores to shop in. You're not going to be able to take your children to hear the orchestra or see the ballet. You're not going to have good schools. Unless there's an economic base to provide for those things, then you're regressing as opposed to progressing."

Another community member noted the need for the site to remain an economic engine for the region by stating, "Bring something in here that will feed other smaller businesses." As one focus group participant put it:

> "I think the main issue most people are thinking about is the jobs. It's the impact on our economy... We're talking a thousand jobs or more right now. We all want to see something transition with this facility that will -- I don't know that we'll necessarily expect it to be on par with that number of jobs -- but we want to try and retain as many employees as we can. We want to try to provide this quality of life for everybody."

In terms of economic feasibility, several focus group participants noted the site's proximity to the Ohio River as a potential attractor for industry. As one community member stated, "There's a lot of different things you can do to make the river industry part of it; it could definitely become a factor."

Ultimately, though, participants in most of the focus groups emphasized the need for the site's future to contribute jobs to the region. According to one participant, "[W]e're thinkin' back to these quality of life issues we've discussed, and which of the scenarios gets us closer to that... [Y]ou've got a lot of those cultural and community aspects, but you need jobs. So is one of the jobs options better than the other? Is nuclear better than heavy industry, or vice versa? Does it matter in that respect?"

In addition to employment, two other sets of community values also dominated the discussions: 1) safety and security, and 2) a clean and healthy environment. These issues were closely tied, specifically in relation to environmental cleanup and waste issues. Overriding concerns about the content and disposition of PGDP waste emerged at multiple stages of every focus group discussion, pointing to numerous information gaps and potential misconceptions, as well as to important differences of opinion within the community.

- "When I look down these other things here about moving [the waste] -- like moving the existing burial grounds...I don't like to dump on other people's property. This idea of sending it out to Yucca Flats or Yucca Mountain out in Nevada. If I were in Nevada, I would jump up and down and scream, 'No, don't send it to us.' If we have that, then we're going to have to do something with it here. I don't know if we're that far advanced to do that. I don't want to move it around very far. You may want to move it off to one side there, that burial ground. It makes you nervous. The decommissioned waste kept on site. I think that we're going to have to keep it here. I think that we'd have to keep it here. How safe is it? 'Cause if it's not safe, we just need to fence it off. Just like they did at Rocky Flats. I can live with that. [But] it's certainly not going to help our economy just to fence it off."

- "[T]alking about decommissioning the present plant and keeping the waste here. I don't agree with that at all. I think it ought to be shipped."

- "[A]lthough we have all seen the studies that a group from UK has done about seismic issues and that they're not as much of a concern as they were once thought, you know, that, supposedly, has been the reason that we've not been able to get industry to come—our seismic issue... [T]he public still believes we have seismic issues, and you're talking about building a waste facility... [W]e couldn't get the Atlas plant to come to Paducah because of seismic issues, but we can build a nuclear waste site out there, and it's safe? I think that’s the public perception that is gonna be very, very difficult to overcome with [onsite decommissioning waste disposal]."

- "[W]hat is the... life expectancy [of burial ground wastes]? I’m not a nuclear physicist or an engineer; you know, what’s the life expectancy of that stuff? How is it affecting the environment? ...[I]s there severe contamination out there? ...[T]he local joke is around here is all the deer and the animals on that wildlife area glow in the dark. ...And, there’s always been questions about, you know, the water...table, and...the things that are happening around that... Is it environmentally safe? That’s always a question; and that question’s gonna remain... I would think that...some of those problems need to be resolved and put to rest, because...it would be urban legend or rural legend, around here...about what is buried under there and how does it affect us and our environment? I think that’s a good question."

- "[T]here’s that proverbial question, you know: what do you do with nuclear waste? If you move it, you just move it to somebody else’s—somebody else’s problem. You know? Even if you put it in the middle of the Nevada desert...potentially it’s gonna come up again some time."

- "I think we all understand that there are waste cells out there already; there’s a landfill, there’s burial grounds, and then there’s a landfill to the north; and...we’ve all bought into the fact that probably you should take some of the waste that will be created as the plant comes down, and it should be on-site. There are two things that are—were concerns for our group, and that is, first of all, what goes in the cell. We visited the Oak Ridge CERCLA cell in the first part of April. They don’t have any...high-radioactivity material going in to that cell. We thought that’s the plan here [but] it was explained...by the site manager that his plan is to put everything in the CERCLA cell. We don’t support that; and so...I don’t mean to bring other things to the table that are not in the scenario, but our group does not support some of the high-radioactivity that exists at the site...bein’ put into the ground out there, that has a water table of, like, fifteen or twenty feet; and for us to believe that it’s gonna stay there for another thousand years... I think everybody just sort of says, ‘Well, what’s there is there.’ I don’t think there’s a desire to move that off-site; maybe it would be if we knew what was in the burial grounds. [Secondly], out of the eight [decommissioning waste] sites that were proposed by DOE...we see only depicted. [T]his is my little scenario: I pick a client up at the airport to try to demonstrate...that he needs to be at the site, whether it’s a nuclear plant development that’s gonna locate a nuclear plant site, whether it’s a guy that’s locatin’ an industry out there that builds parts for a nuclear plant, whether it’s [putting] a river-port there to serve that nuclear plant or other heavy industry... I get him down Hobbs Road, and he says, ‘What!? What is that!?’ And you go, ‘That is our forty-foot high, one-hundred-acre radioactive waste dump.’ And he looks at his watch and says, ‘My plane leaves in just a few minutes. I think I need to go.’ I don’t think we ever get the client into the site, to show him the site, with [the onsite waste disposal alternative (WDA) cell in the location depicted]. [Our proposal would be to] move the [decommissioning] waste to one of the existing areas."

- "We thought [leaving wastes onsite] would be a low cost solution to clean up, but it would be detrimental to recruiting non-nuclear industry."

- "My main concern is about the safety of the area. You hear all kinds of war stories around here. I hear them in the emergency room about the contaminated water out there and the amount of cancer that we see, and we do see a lot of cancer in the Paducah area. I think it's kind of a high risk area for cancer. To say [the PGDP is] causing it, I'm not sure we can say that, but it certainly makes you nervous about it. So the safety of it is my concern. Is the area safe for any future use at all? If it isn't, then I think you ought to fence it off and leave it alone. Let God take care of it. Whatever He'll do for us, if we don't know what we're doing."

- "You're basically building a small mountain [with onsite storage of decommissioning waste], and it's not like anybody's gonna drive anywhere near this plant site that they're not gonna see this and know exactly what's in there. I mean, you can't sit a few deer on top of it and a few trees around it and say, 'Oh it's beautiful. It's a...,' you know... No one's gonna drive by there and go, 'Oh look, a beautiful hill that God created.' [T]hey're gonna drive by it and say, 'That's a waste dump.'"

- "[T]he general public of Western Kentucky have been told for the last fifty years, since this plant was built, that, well, the reason we can't get anything else is because of seismic issues and that the only reason we got this plant in the first place was because Alvin Barkley wanted it to come here. And, when you start looking at it from that, and you've told generations of people that there are seismic issues, I don't know how you're gonna overcome that and say, 'Well, suddenly, there are no seismic issues, and it's safe to build a waste facility there.'"

- "The location of the waste disposal cell: we're thinking that's a new area of contamination, possibly. Maybe put it back [with] the other couple of landfill areas."

- "The existing burial grounds sealed and left in place? If I thought we could absolutely seal what was put there 50 or 60 years ago, yes. But the idea or the likelihood that we could truly seal it, I think is unlikely, but an attempt to seal it is probably better than disturbing what's in there by rummaging around to try and get it out to take it somewhere. That scares me more, I think, than leaving it in there. But I do want the cylinders and the separation process gone, gone, gone. And then what would be the consequences. We just now, the past few years, understand the damage that's been done to the people and the area from what's been going on there the whole time. How could we not learn anything from that? I mean it seems really stupid to be considering that."

- "Another question...that I would have is the cylinder yard: what is the longevity of those cylinders? How long do they hold that? I mean, I'm from Utah where they've had plenty of discussions out there about temporary being not really temporary... [I]f it's a solid that's inside of there, then, even if you get to the point where it's oxidized and corroded to the point that you're just looking straight at it, how—you know, water coming down across that, just environmental effects on that—how much is actually coming off of any, you know, exposed material and getting into the environment? Is it—does it quickly leach?"

- "I am worried about the wildlife management area because I keep hearing stories about the wells. You keep finding contamination in people's gardens. They keep finding really nasty stuff in the vegetables out in their gardens. I think the wildlife management area ought to be monitored closely and the use be controlled. I worry about people hunting in there and eating that food. Animals have been grazing in there and things. The bad part is removing the materials only contaminates a second site. You're not going to be able to remove those materials in any way that will leave that clean. If you move them someplace else, you just contaminate another place. Then when those people's wells or food starts getting contaminated, they start getting tempers. They're gonna want it moved. Then you contaminate another place. I think we ought to just admit we're never going to be able to clean this up. I don't know what you to do to it. Glass, concrete, iron, lead. Whatever you have to do to try to just hold it there. I don't know what else you can do to it."

- "The only good outcome I can see is minimize the harm as much as possible and you do it in a way that you don't cause additional harm someplace else by moving it off-site and putting it in someone else's backyard. My God, I hate that that thing's there, but what do you do? It's there."

Discussions about site cleanup emphasized both the environmental and the economic consequences. In one exchange, a focus group participant stated, "Well, I think everybody would agree we want a clean environment." A second participant responded, "Well, of course, cleanup...provides jobs, as well. And if you're looking more short term as opposed to a hundred years from now, and where we live, our jobs are directly impacted by cleanup."

Numerous participants in multiple focus groups called for environmental impact studies to evaluate each of the potential future use scenarios, stating that truly informed decisions could not be made until such studies had been completed. Other community members called for expanded economic impact studies to determine the potential implications of specific scenarios. Some attempted a delicate balancing act between economic and environmental concerns. As one community member put it, "From an environmental perspective, you have a site that's already somewhat contaminated, and of course it definitely needs to be cleaned up; but I would rather see a site that's already been developed and contaminated reused for industry, instead of going to a site that's, you know, undeveloped, in wetlands or streams, and environmental resources that we desperately need be taken for that."

In addition to the scenarios presented by the research team, community members made their own suggestions for future uses. Some felt that an environmental laboratory for testing contaminants and remediation strategies could be a viable alternative. Others suggested developing different kinds of alternative energy sources onsite, including wind and/or solar power. The possibility of developing a coal liquid gasification plant was also mentioned in several focus group meetings.

Although the focus group protocol centered on future use issues, community outrage occasionally boiled over into the discussions. In one instance, such outrage led a participant to propose a unique potential future use for the site:

> "We need to find out who it was that made the decision to mislead the workers about what they were handling. They were taking this stuff home and contaminating their children. Those people ought to go to prison, and I think the prison ought to be located on that site... I think the site ought to be made into a memorial, something like Auschwitz. It ought to be a reminder to hopefully prevent anything like that from ever happening again. School children will have to go out there and see what it was. There will be photo displays out there. People ought to have to go and hear those stories and see the photos, see what went on... It's sort of like Stockholm Syndrome. You become dependent on the people that are doing it to you. That's where education can come in. I think somehow or

another that facility ought to be used. I think Rocky Flats ought to be used to warn people against ever doing anything like that again."

Recreational users of the West Kentucky Wildlife Management Area had a very unique perspective about the site's future use, expressing that either too much development or too much cleanup could negatively affect their usage of the area. As one focus group participant said, "Actually, the contamination—and this sounds kind of weird—but it may work in our benefit, in the long run, because it's gonna help to stabilize this area, and it probably will limit enhanced facilities… So we're—it sounds weird, but I think we—most of us—feel like we can use the area as it is now, with little or no risk, and a lot of benefit."

Whether community members rated economic concerns or environmental issues more highly, participants across the board shared a desire to extend site planning beyond the short term. This might best have been expressed by the individual who remarked, "[I]n any event, we need to look beyond the twenty-five years, and we need to plan for our grandkids. [In evaluating potential scenarios, we should ask] 'How 'bout your family and your community—what would it do?'"

7.3.2.4 Focus Group Scenario Evaluations

After focus group participants were satisfied that they understood all of the scenarios and their implications, participants in seven of the eight groups were asked to score the scenarios anonymously using an Audience Response System (ARS). Unfortunately, too few participants were present at the opening of the eighth focus group to ensure participant anonymity; therefore, the research team elected to forego tracking ARS rankings in that session. A single criterion termed "suitability" was the metric used for evaluation. The scale used is a variation of a Likert system with a range from 1 (extremely unsuitable) to 9 (extremely suitable). The number of participants, mean score, and standard deviation were shown in real time to the audience. Each scenario was presented and scored in turn until all had been evaluated. The outcomes were then ordered by mean score and by standard deviation. The composite results from seven focus groups, along with the composite process evaluation, are shown in Figure 7.3.2.4.1. Detailed scenario scoring data for each focus group are provided in Appendices M and N.

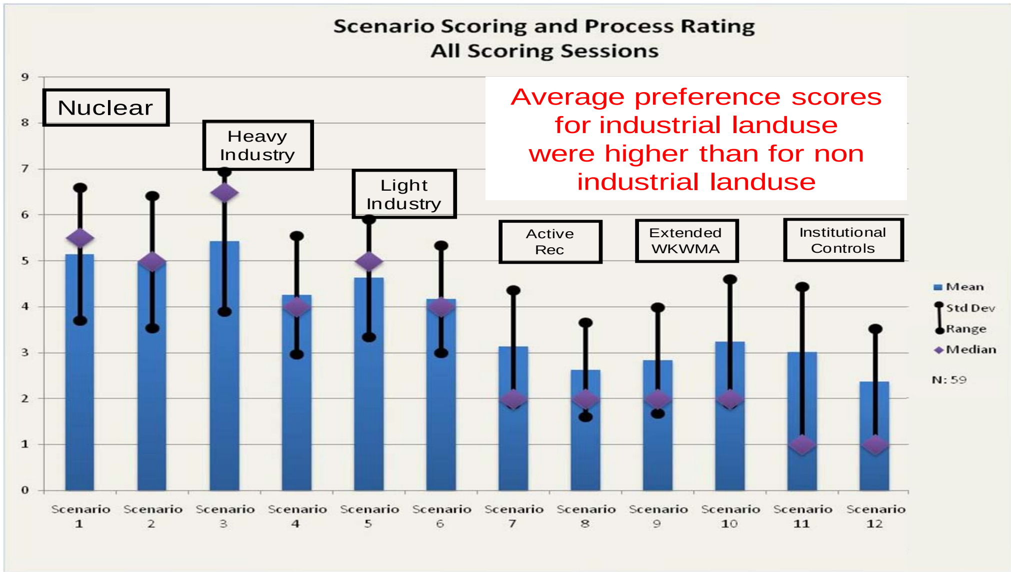

Figure 7.3.2.4.1 Composite Scenario Scores from all Focus Groups

7.3.2.5 Informational Gaps

Following the scenario evaluations, facilitators attempted to assess existing community information gaps and trusted information sources for filling those gaps. Specifically, the KRCEE team needed to determine what kinds of information focus group participants required to feel comfortable evaluating potential future uses for the site. Questions asked during this segment of the focus group included:

- What sources do you consult for PGDP-related information?
- What are the most (and least) credible sources of information about PGDP?
- What information would have helped you evaluate these hypothetical future uses for the PGDP?
- What are the best ways of delivering information about issues related to PGDP to your community?
- If we developed a website where you could obtain information about the PGDP, what type of information would you like to have? How would you like to see the information presented?

Public perception was cited frequently as key to evaluating specific land uses, with some plant workers feeling that risk perceptions in the community exceed actual hazard levels. Thus, the site's history and function were considered important information by many focus group participants. As one employee stated, "[I]t’s going to be a tough sell for the public... We all work here, and we know what’s out here, but the general public still has a very vague idea of what’s out here. The general consensus is it’s already at nuclear power plant levels of contamination. That’s what the general public already thinks." Another employee continued, "I think there needs to be a definite distinction... The public needs to realize this is no longer virgin ground. It won’t be when it’s cleaned up. So there’s a difference between what you could do with 700 acres on the other side of the county as opposed to the 700 acres here... I think that is going to drive what can be done here and what maybe should be done here or not done here."

Other participants cited a need for the public to know what physical contaminants are present at the site and what the potential consequences of those contaminants are. As one individual put it, "[W]hat’s there? If you knew, and yes, I understand some of it you can’t, but if you knew better of what’s there. You don’t have to get specific, but give generals -- hey, this is what you’re really dealing with in actuality... Just a better idea of what’s there, so you know better what they could and couldn’t do with it. Physically, what’s there?"

Similarly, community members advocated for realistic depictions of feasible cleanup levels, including accurate timelines -- "what they really could and could not do with the land on the cleanup end of it," as one participant described it. "We’ve been told for years, 'Oh, it can be cleaned.' Yeah, anything can be cleaned if you break it and take enough dirt out and put enough dirt in. Eventually, you know. You could make this into the Grand Canyon, and eventually it would be clean, but in reality it’s never going to happen. So what are we talking about level-wise? When you get into the cleaning, you’ve got to get into the real aspect of is it really feasible to do this? And realistically is anybody ever going to be able to afford to do that?" Another community member concurred, "Just level with us."

Trust issues rose to the top in discussions about information gaps. One community member asked, "What do they know that we don’t know? I mean, I know you’re talking to the Chamber of

Commerce you’re talking to DOE people. I mean you’re talking to people that actually work there that’s got a plan they’d like to see."

Regarding credible information sources, stakeholders with direct ties to the plant's operations cited US DOE as trustworthy; however, many focus group participants across the other stakeholder groups expressed distrust of government agencies in general, and of US DOE in particular, confirming the existing risk perception literature (Flynn, Slovic, Mertz, & Toma, 1990; Dantico, Mushkatel, & Pijawka, 1991; Slovic, 2000). Some community members believed that US DOE publications could be believed if they were "substantiated with scientific research, data [and] references." However, others disagreed even with this assessment. In fact, one individual stated that credible information could include "nothing from DOE because the community around here isn’t going to trust a single solitary thing they say." Another participant agreed, "You can pretty much ask anybody in this community this part. I don’t know who we trust anymore. [W]e’re so gun shy that if they said, '[W]e’re going to bring in this independent party' -- well, who got bribed? It’s to the point we don’t much trust anybody."

Some individuals called for public hearings about the PGDP. "I think what I’d like to see more than anything else is...some kind of public forum, where the people that have worked there, not experts coming in and telling their version or anything else. People that worked there could tell us what they’ve been through. I’ve talked to these people. When they tell you, 'My child died of cancer, and I gave it to them because I was bringing this home, and they told me it was safe and I’m dying of cancer now'... I think that’s the kind of information, and we need objective information, not just hysteria and things, but it’s hard for me to listen to people telling those kinds of stories and not get emotional about it."

The reliability of local media coverage also was questioned, with one participant stating, "The problem is we have local media and sometimes they're on the board. That puts a twist in there. You never know how it’s going to read." Another community member agreed that local media were not trustworthy because "they work for them."

The internet, television, and existing educational avenues were cited as potential information channels. One participant advocated, "[G]o to the schools. Get the kids and let the kids teach the parents."

Interestingly, education was cited as key by proponents of both economic and environmental concerns: "I think just an educational process of what has been done...through the years would be the first step, and I think a lot of pictures. A lot of people haven’t seen the pictures of the massive buildings and the concrete. They don’t realize if you get beyond the trees, there’s a lot of concrete sitting there." A participant from a different focus group stated, "I think...we need more education around here. Our local media’s not allowing those stories to get out."

Specifically, focus group participants expressed a wish for accessible, relatable materials. "Simplify stuff," one community member requested. "We need words we can understand," stated another. A third participant called for "Something that when you get to the end of it, you can actually remember what you started out reading -- just the basics and ways to find more information if you want it, but 'here's the basics.'"

Other participants called for the elimination of jargon and acronyms in communications about the plant. One individual said that information should be put in "terms that [community members] can put into real-life...circumstances they can understand. I think, you know, that’s what people really wanna know: how it affects them, in real time."

Some community members called for increased input from academics. One focus group participant stated, "We're gonna have to get the engineers and the science people in to let us know." However, others questioned the linkages between academia and government agencies. As one participant put it, "I wouldn't trust anything that people that have been connected with that place have to say. Part of the problem with technocracy is the people with the technical expertise to know what's going on usually have a professional stake, and they can't be objective about what's going on."

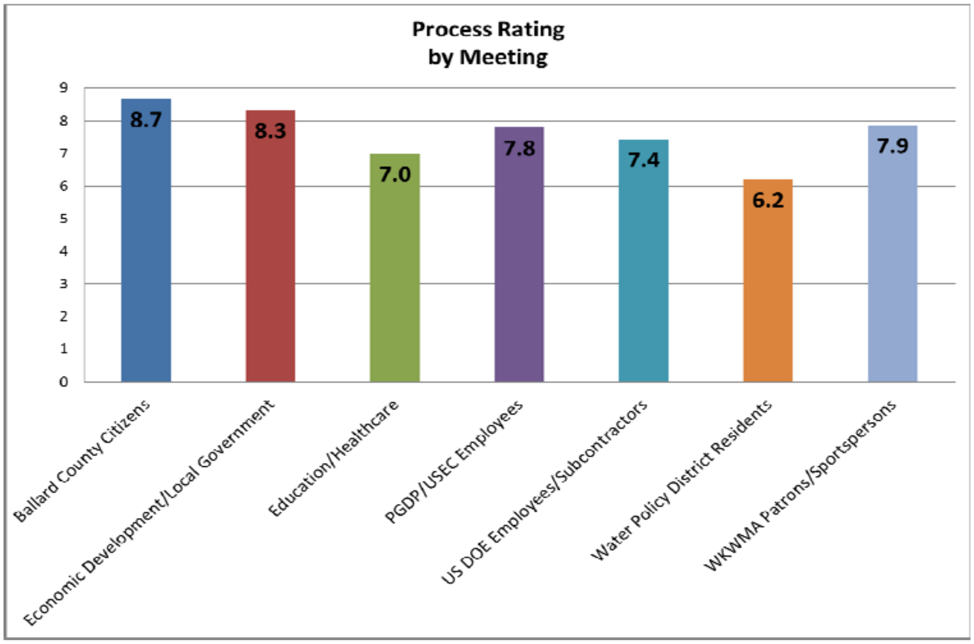

Figure 7.3.2.5.1 Focus Group Average Process Evaluation Scores

7.3.2.6 Process Evaluation

Seven of the eight focus group sessions closed with participants registering their evaluations of the focus group process through the Audience Response System. Participants were asked "How satisfied are you with this process?" and responded using the same 1-9 scale where 1 = extremely unsatisfied and 9 = extremely satisfied. Participant assessments were quite positive, with specific focus group means ranging from 6 to 8.5 and a combined mean of almost 8 for all sessions. The eighth session ended with too few participants to assure anonymity, causing the research team to forego the process evaluation for that session. A breakout of the average process evaluation scores by focus group is provided in Figure 7.3.2.5.1.

8.0 PUBLIC INFORMATIONAL AND SCENARIO SCORING MEETINGS

The research team recruited participants for both the Community Informational Meetings and the Scenario Evaluation Meetings through multiple channels (see Appendix O). An extensive advertising campaign was conducted in local and regional newspapers with a combined circulation to more than 43,000 individuals. In addition, an advertisement was placed on the second page of the *BBQ on the River* regional festival tabloid, which has a circulation of 38,000. Meeting announcements and flyers were sent to the entire project stakeholder email list of approximately sixty individuals, with a request that recipients forward the information to their own contacts in the area. Announcements and flyers also were posted in local online bulletin boards, including iList Paducah and local radio and television websites. University of Kentucky Public Relations sent press releases and media alerts to its entire west Kentucky mailing list.

8.1 PUBLIC INFORMATION MEETINGS

As discussed in Chapter 7, the stakeholder focus group process identified a shared desire for a simple, educational, unbiased approach to presenting PGDP issues, balanced against a simultaneous need to maintain the KRCEE project's focus on future site uses rather than on airing existing grievances. In response, the KRCEE team developed a public information meeting protocol that was deployed in two public meetings, one of which was held at the West Kentucky Community and Technical College in McCracken Country and the other of which was held at Ballard County High School.

After identifying information gaps during step two of the process methodology, the research team obtained answers to more than 100 questions identified by stakeholders as important factors for evaluating potential future uses of the PGDP property. These questions were broadly grouped into five major categories: 1) The Past, 2) The Present, 3) The Future, 4) Science, and 5) Cleanup. Background information on each of these topic areas was collected and posted on a website that was developed to provide greater citizen access to answers associated with relevant PGDP questions (i.e. www.paducahvision.com) and planning began for public meetings to address the information gaps.

In preparation for these informational meetings, the 100 questions were prioritized and pared down to a more manageable final set of 30 questions, with six questions for each category. Subsequent research obtained answers and appropriate documentation for each question. This information was included as one of five potential answers for each entry in a set of multiple choice questions. These questions became the basis for a slide presentation, with each question followed by a slide with the correct answer and supporting information. The presentation was integrated into a formal sequence structured much like the popular television game show “Jeopardy”. Copies of the actual slides used in the public presentations are provided in Appendix P.

During the public informational meetings, the audience first was introduced to the meeting format. Audience members were asked to use anonymous ARS keypads to select an initial question category. After the audience had been polled and the preferences displayed, the series of questions for that category were shown, with the audience asked to select the correct answer from the set of multiple choice answers for each question. After the audience answers for each question were recorded via individual keypads, the collective answers were shown to the audience, followed by the slide with the correct answer and subsequent slides with supporting documentation. In this way, the audience completed the entire set of 30 questions. After each answer and its supporting documentation were revealed, the audience had an opportunity to ask follow-up questions. Depending on the nature of the questions, the answers were provided by either the moderator (Dr. Ted Grossardt) or the technical expert (Dr. Lindell Ormsbee). At the end of the process, the participants evaluated the process using a scoring range of 1 to 9, with 1 = not a useful process and 9 – very useful process (see Figure 8.1.1). Paper comment cards provided opportunities for participants to register concerns about specific questions and/or answers and to point researchers to alternative information sources. A total of 47 participants attended the two sessions.

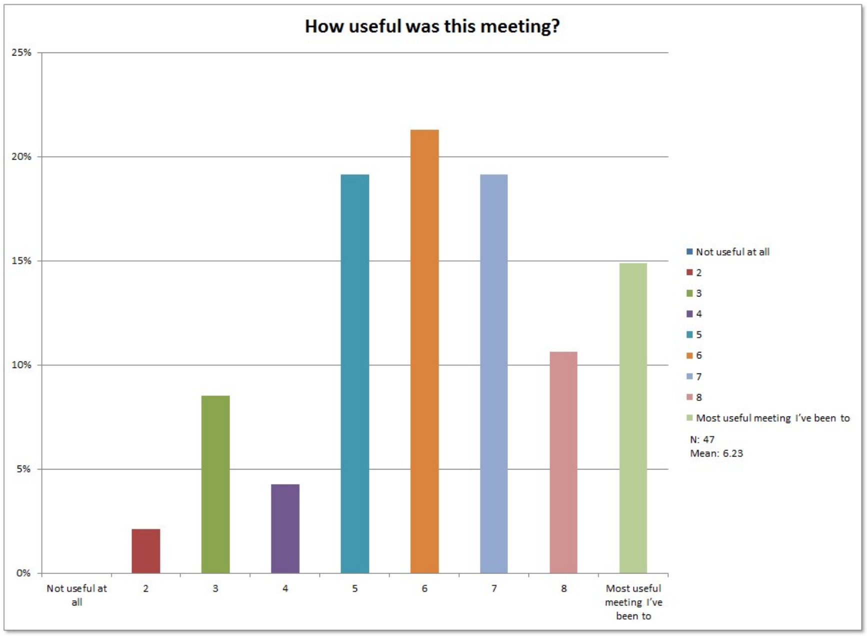

Figure 8.1.1 Public Satisfaction Scores for Public Informational Meetings

8.2 DYNAMIC VISUAL EVALUATION METHODS FOR PGDP END-STATE VISIONING PROCESS

It is useful to understand the distinctive nature of every public infrastructure project. Borrowing from the literature and their experience, the KRCEE research team evaluated several factors in developing the final community engagement protocol as well as the structure and content of both the informational and scenario scoring meetings. Such factors included: project time frame; spatial extent; complexity of the problem; process product; uncertainties; the breadth and depth of public impact; different perspectives, capabilities, and power levels; the public level of trust of governmental agencies; agency culture;, approach, and regulator/administrative environment. These factors are discussed in more detail in Appendix Q.

While the number and complexity of such factors can present challenges, steps 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 fundamental principles of fairness. For each project, the particular combinations of tools and strategies are customized to deal with its specific properties and challenges. Such was the case in this project.

The PGDP future state visioning process represents an extension of the researchers' Structured Public Involvement (SPI) protocol into the domain of environmental management and facility rehabilitation. The intent of applying the Structured Public Involvement, or SPI, process to this challenging issue is to improve the quality of the decision making process by more fairly, and more accurately, eliciting and incorporating stakeholder valuations into the PGDP future state management decisions. Decision process quality results from such criteria as the inclusion of both a large number and a wide range of stakeholders; the quality of the data obtained; the efficiency of the overall protocol in time and money expended; and, ultimately, real-time anonymous stakeholder performance evaluation of the process. SPI protocols have been applied to numerous other public infrastructure processes over the previous ten years with notable success in terms of these criteria. In particular, high process efficiency and high process quality values for large-scale open stakeholder evaluations have been documented (Bailey and Grossardt, 2001; Bailey, Grossardt and Pride-Wells, 2007; Jewell et al., 2009).

To achieve these performance aims with respect to future state visioning for the PGDP, the first step was to embed the SPI process within the larger framework for stakeholder value elicitation (Anyaegbunam et al., 2010). The SPI framework was adapted to identify key informational elements from the initial round of focus group meetings. These valuations were incorporated into land use and site properties. Using 3D visualization software, the team then converted these properties into land use plans and landscape scenarios that could be visualized and evaluated at large public forums (Grossardt et al., 2010).

The goal of the scenario scoring meetings was to build a database of community preferences for alternative future states as a decision support tool for both the local community and the project sponsors. The process of evaluation was formalized by working through the logic detailed here. Dynamic visual evaluation is defined as real-time evaluation of visualizations of future states containing an interactive element, both in the presentation media and in the value elicitation framework, allowing the team to elicit, document and evaluate the stakeholder interpretations. The dynamic visual evaluation phase helps large groups of stakeholders evaluate visualizations of feasible PGDP future states in real time, exploring the future states' qualities as perceived by a cross-section of attendees. This data becomes the basis for the community preferences model.

Although the word “visualization” is most often associated with 3D computer-generated renderings, or Virtual Reality environments, in its broad sense it means a visual representation of an environment (Andrienko et al., 2007; Petit et al., 2006). Such representations can include computer animation, still image, diorama, charette, or virtualization, i.e. an interactive 3D environment (Hughes 1998). Or, as demonstrated in previous applications of CBPC, it also can be as simple as a drawing, a schematic, or a map traced out in the dirt.

Whichever representation mode is selected, visual assessment of these images or representations is a complex problem domain (Steinitz, 1990). The two primary philosophies of visual assessment are scenario evaluation, in which one complete visual representation is compared to another, and elemental decomposition, in which a visual representation can be broken down into separate components, each of which is assumed to influence participant responses, both individually and synergistically. A more detailed discussion of the visualization theory is provided in Appendix R.

8.3 THE DESIGN VOCABULARY

The SPI protocol and, more specifically, Casewise Visual Evaluation (CaVE) require that the inputs be parameterized and that each parameter be divided into classes that are meaningful for the design team. Each potential future state, therefore, can be defined by a specific set of input properties, and the corresponding visualizations can be engineered as composites of the input factors. To create a meaningful design vocabulary, the team hosted a series of meetings with various stakeholders. The team evaluated the correspondence between what citizens felt they were responding to in the visualizations, and what the design team needed to know to convert these perceptions into usable, actionable policies, plans, and design guidelines. Following the process explained by Anyaegbunam et al. (2010), key valuation clusters among stakeholders assisted in this process.

The team then held a series of internal project meetings at which these values were brainstormed, examined and converted into properties that could be represented using dynamic visualization. From these conversations, areas of concern were identified which the project team felt would require evaluation from the citizens at large. These concerns centered primarily on issues of future land use, site cleanup, and waste disposal/storage. Further analysis of these concerns yielded four distinct sets of questions regarding the site:

- Future land use within the PGDP footprint
- Future land use of the surrounding West Kentucky Wildlife Management Area (WKWMA)
- Disposal options for future wasted generated through D&D
- Treatment options for legacy waste, in particular the burial grounds

These categories are the basis of the scenarios developed for public evaluation and are discussed in more detail below.

8.3.1 PGDP Footprint Land Use

Potential future uses of the PGDP site itself were among the most widely discussed of the scenario options. Because of the site's size and existing infrastructure, a variety of future land uses are possible, and many were suggested. These possibilities are somewhat mitigated by concerns of contamination and future waste storage. To capture the variety and extent of future land uses possible and suggested, the project team included six different classifications, varying from each extreme of land uses. These include: nuclear industry, heavy industry, light industry, recreational facilities, expanded Wildlife Management Area, and permanent site closure (institutional control).

- Nuclear Industry was suggested as a natural fit for the PGDP site because of the existing infrastructure, the existing workforce that is accustomed to working in the nuclear industry, the existing site contamination (i.e., the nuclear industry would be most likely to understand and manage the risk), and the potential to retain some well-paying jobs. Nuclear industry includes such options as a nuclear power plant, a uranium processing facility, a nuclear fuel recycling center, etc.

- Heavy Industry was suggested as a fit because of the existing infrastructure and the overall size of the site. Heavy industry could potentially replace some of the jobs and serve as a new economic driver for the region. Examples of heavy industry include auto manufacturing, steel processing, and a chemical plant.

- Light Industry was suggested as a PGDP replacement that could supply some jobs for the region but would be less intrusive than nuclear or heavy industry. Light industry, in effect, is a catch-all for a large variety of possible economic activities for the site. These include warehousing, a distribution center, a data storage warehouse, a biomass facility, and others.

- Recreational Facilities were suggested by some as a suitable replacement that would effectively clean the slate from previous land uses at the PGDP. Recreational facilities would become possible only if the site is remediated to appropriate levels. In this context, recreational facilities refer to largely unstructured recreational activities, such as hiking trails and a nature center. This future use scenario is comparable to the Fernald Nature Preserve in Ohio.

- Expanded Wildlife Management Area was suggested as a simple way of solving future land uses. The PGDP site currently is surrounded by the WKWMA and is widely used by sportspersons and others. Once site remediation is completed, the existing WKWMA could be expanded to include the PGDP site as well.

- Permanent Site Closure represents the other extreme of potential future uses for the PGDP. This option was suggested by some who perceive the land as too contaminated to ever be safely reused for other purposes. Permanent Site Closure would occur following the completion of all remediation activities, and it would be accomplished by completely surrounding the site with an impassable wall or fence.

Two other potential land uses that were not explicitly considered were residential and commercial. The researchers found no support from either the listening tour or the stakeholder focus groups for any type of residential land use at the site. As a consequence, this potential land use was excluded from consideration. The research team also found little support for any significant commercial land use, such as some type of shopping mall. As a result, explicit commercial land use also was excluded from consideration; however, it is theoretically possible that such a land use could be considered compatible with light industry.

8.3.2 Wildlife Management Area Land Use

The issue of future land uses for the site was divided into two categories: future uses of the PGDP plant site (described above) and future uses of the surrounding Wildlife Management Area. Both qualitative and quantitative data indicate that there is an overwhelming community preference to keep these land use decisions separate. It is likely that this preference relates directly to the obvious differences between the two sites' existing uses, contamination, and future possibilities. This does not mean that some level of industrial or commercial development might not be possible in this WKWMA – a concern that PACRO has raised explicitly in the past; however, for the purposes of this study, the overwhelming majority of the property would be kept as WKWMA (with a consideration for some adjustment for additional recreational facilities). The study has assumed that any such industrial or commercial development in this area would likely be offset by conversion of land in the PGDP footprint area to equivalent WKWMA property; thus, the scenarios reflect any industrial (or commercial) land use wholly within the PGDP footprint area.

The existing Wildlife Management Area is a largely undeveloped swath of land used widely by residents for horse trails, dog trials, hunting, fishing, and other outdoor activities. Future uses for this site were divided into only two categories:

- Recreational Facilities could be added to the WKWMA to increase the variety of recreational activities for the site. Consequently, recreational facilities refer to more structured types of recreation, such as soccer or baseball fields, walking paths, a fairground, and/or a racing track. The specific site for such activities was not determined by the project team, and such a decision would need to be coordinated closely with PGDP and WKWMA officials.

- Keep Existing WKWMA As Is was a second suggestion. Because the existing WKWMA already is a popular destination for outdoor activities, some participants suggested that no changes should be in order for the land.

8.3.3 Waste Disposal

A major concern repeatedly expressed by citizens centered around what to do with the many tons of waste that would result from the PGDP's decontamination and decommissioning (D&D). This EPA-mandated process requires that contaminated waste from the site be disposed in specifically engineered landfills. Options for how to proceed with this disposal include:

- Removal of D&D waste to an offsite facility was suggested by some who felt that any landfill containing nuclear waste inevitably would leak contaminants into the community. Of the three options, this by far would be the most expensive.

- All waste could be stored onsite in a waste disposal alternative (CERCLA landfill). The selection of a specific location for such a waste disposal alternative was not included as part of this process but is instead the subject of a separate US DOE public meeting process. However, visualizations depicting this option utilized the site closest to the existing DUF_6 facility, with the express acknowledgement that the landfill could be put somewhere else on the site.

- A third 'in-between' option calls for an onsite CERCLA landfill of limited size and capacity to handle some D&D waste, while some waste would be shipped offsite. This option reduces costs by storing some waste onsite, but it also reduces the overall visual effect of such a landfill on the landscape.

8.3.4 Legacy Wastes (Burial Grounds)

As described in earlier sections of this report, the PGDP burial grounds are a source of contamination and contain mixtures of known and unknown hazardous waste dating back several decades. The burial grounds take up approximately 20 acres of land in the northwest corner of the PGDP site, and how to handle this hazardous situation was an issue of concern for citizens. Two options were discussed and subsequently included in the scenarios:

- Excavating the burial grounds was suggested by some as the appropriate way to handle the existing waste. Doing so would remove the burial grounds as a future source of contamination and open up the land for future redevelopment.

- Leaving the burial grounds "as is" also was suggested as a less expensive way of handling the situation. Some felt that digging up the unknown waste could be hazardous for workers, and that the appropriate thing to do would be to "let sleeping dogs lie."

8.4 SELECTED SCENARIOS

Combinations of the four different variables (along with the associated two to six options) yield the potential for more than 70 distinct future scenarios. This problem of complexity was addressed through the use of Casewise Visual Evaluation, using a prescribed palette of chosen sample future scenarios. Essentially, the CaVE computer software uses observations or results from a smaller subset of the total number of possible future scenarios to predict preferences for the remaining scenarios using a type of fuzzy-set modeling. The accuracy of such predictions obviously is dependent upon the size and diversity of the smaller sample. For a full discussion of the theoretical and technical aspects of CaVE, see Appendix R.

For this project, twelve scenarios were judged sufficient to measure preferences for the remaining 84% of the possible scenarios. The twelve scenarios were constructed from combinations of the six different basic land use categories for the main industrial footprint: nuclear industry, heavy industry, light industry, recreation, expansion of the existing WKWMA to include the PGDP footprint, and permanent site closure, Additional land-use variations were included within the broader land use categories: 1) keeping the existing Wildlife Management Area or including additional recreational facilities; 2) keeping all future plant decommissioning waste onsite, keeping part of the decommissioning waste onsite, or shipping all decommissioning waste offsite; and 3) excavating all of the legacy waste burial grounds or only excavating part of the legacy waste burial grounds. A matrix of the selected combinations is provided in Table 8.4.1.

Once the twelve scenarios had been selected, computer visualizations were constructed for each scenario. Scenario construction details and descriptions of the software employed for this process are provided in Appendix S.

Table 8.4.1 Description of Scenarios (i.e. S# = scenario number)

S#	PGDP Land Use						WMA Land Use		Future Waste Disposal			Legacy Waste	
	Nuclear Industry	Heavy Industry	Light Industry	Recreation	Expanded WMA	Permanent Site Closure	Recreation	Keep Existing WMA	Removal	Part Onsite	All Onsite	Dig Up	Leave As
1	x							x			x	x	
2	x							x		x			x
3		x					x		x			x	
4		x						x			x		x
5			x				x			x		x	
6			x					x	x				x
7				x				x		x			x
8				x			x				x	x	
9					x		x		x				x
10					x			x		x		x	
11						x		x	x			x	
12						x	x				x		x

8.5 SCENARIO PRESENTATIONS AT PUBLIC MEETINGS

The KRCEE team conducted the first scenario evaluations at three public meetings during October 2010. A copy of the slide presentation used as part of the scenario presentations is provided in Appendix T. A summary of the results from the first three meetings (by aggregate and by individual meeting) are provided in Appendices U and V. A summary of the press coverage associated with the meetings is provided in Appendix W. A summary of the results presentation to the PGDP CAB on February 17, 2011 is provided in Appendix X. A fourth public meeting was held on April 28th, 2012 (see Appendix AA).

Because the SPI protocol is designed to be scalable and modular, the team worked toward the maximum possible participation. The larger the audience, the greater the volume of data, and the more robust the conclusions derived from the community knowledge base. At previous SPI project meetings, up to three hundred attendees have been accommodated per session, although groups of thirty to eighty are more manageable. To facilitate the participation of as many community members as possible, the meetings can be repeated in the same format at different times and at various locations in the study area. Data then can be aggregated for final evaluation. In the October 2010 round of meetings, the average total number of respondents to any one question was 103. During the April 28th 2011 meeting the average total number of respondents to any one question was 25. Meeting attendees of course had the option of participating, or not, in any particular question, due to their anonymity.

Anonymity is preserved by the electronic polling system. Each keypad possesses a unique identifier. At open public meetings, the team does not record who takes possession of which keypad; therefore, all scores are recorded anonymously and simultaneously. Moreover, all participants can see these features of the process during the meeting. These properties of transparency and integrity resist interest-group gaming and are critical in terms of delivering high levels of process justice from the viewpoint of the stakeholders. These properties account for a portion of the high performance documented in previous SPI evaluations (Bailey and Grossardt, 2010).

At the public meetings, the visualizations were shown, scored and verbally evaluated by the participants. Verbal evaluations can be of assistance in cases of high or low suitability, or where the standard deviations are large, i.e. where there is a lack of agreement about the value of the scenario. The process also elicits hidden concerns and identifies value polarities among stakeholders regarding specific features or parameters of the scenarios.

Initially, all the visualizations were shown, discussed and explained, and repeated if required. Audience members suggested navigation through the model to investigate the scenario at different scales and from different perspectives. After they were satisfied that they understood all of the scenarios and their implications, they were asked to score the scenarios anonymously using an Audience Response System (ARS). A single criterion termed “suitability” was the metric used for evaluation. The scale used is a variation of a Likert system, with a range from 1 (extremely unsuitable) to 9 (extremely suitable). The number of participants, mean score and standard deviation were shown in real time to the audience. Each scenario was presented and scored in turn until all had been evaluated. The outcomes were ordered by mean score and by standard deviation. Visualizations were inspected again. The composite results from all four public scoring meetings are shown in Figure 8.5.1. Not all participants chose to answer every question asked. The average total number of respondents to any one question was 128.

In general, more respondents tended to indicate support for industrial site scenarios associated with greater economic development opportunities, while also exhibiting a strong preference for maintaining the existing Wildlife Management Area around the current industrial footprint. Respondents also tended to favor scenarios in which legacy wastes were removed from the existing burial grounds. Finally, respondents tended to slightly favor solutions in which future decommissioning wastes were shipped off-site rather than left on site.

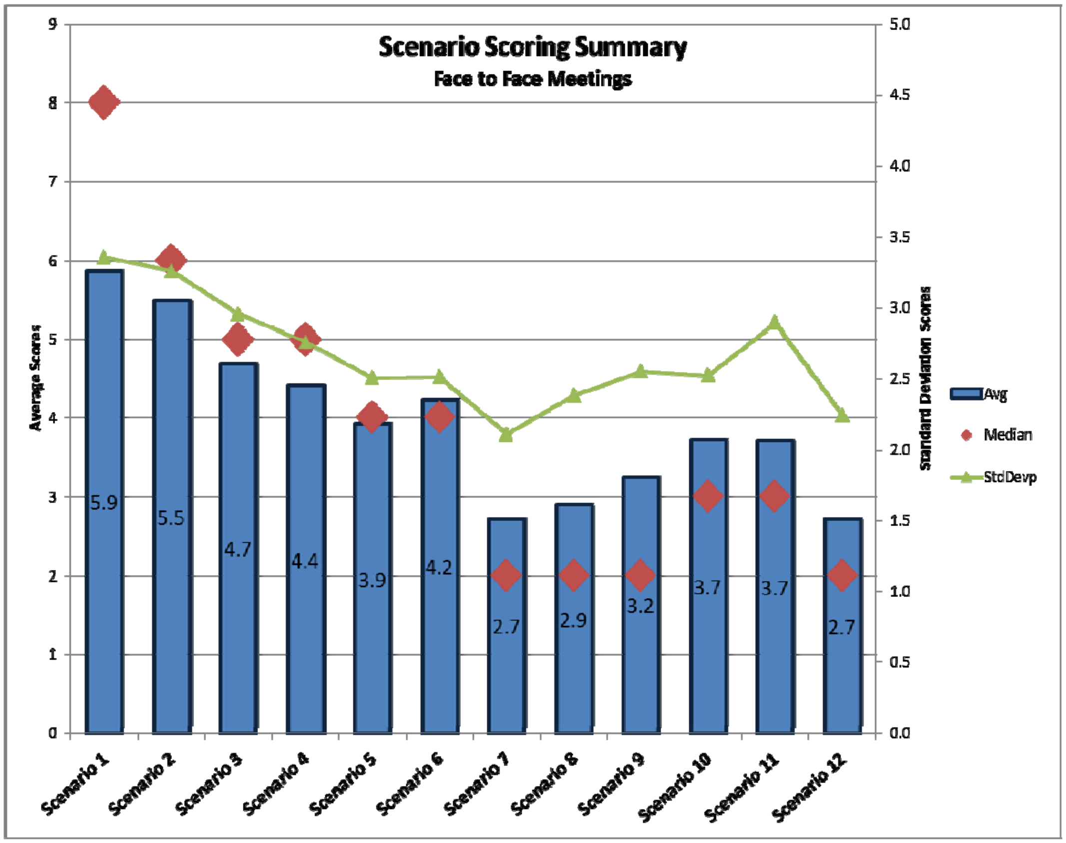

Figure 8.5.1 Pattern of Scores From Public Meetings Evaluating 12 Future Vision Scenarios (see Section 8.4 and Table 8.4.1 for description of scenario content)

After soliciting feedback on the twelve basic scenarios, the team initiated a follow-up set of questions probing desired land uses in more detail. Responses from the audience were solicited, recorded and then scored, again using the ARS. In addition, possible suggestions from the audience also were solicited. Scoring results for these more detailed land-use scenarios are provided in Figure 8.5.2.

A few observations can be drawn from this summary. Permanent site closure is less preferred than any alternative other than a strip mine. For light industry types, a biomass power plant is more preferred than a physical or data warehouse. Among the heavy industry options discussed, a coal gasification/liquefaction plant tended to be preferred to either a steel or an auto plant. In terms of hypothetical nuclear scenarios, responses indicated a slightly higher and more uniform preference for a power plant as opposed to enrichment or recycling activities. Among the "uncategorized" potential land uses that were suggested directly by public meeting participants, options that included a research function that could capitalize on the unique properties of the site had a higher mean rating than any other land uses suggested for the site. Specific research options that were suggested and highly rated included alternative energy, site remediation, and site cleanup.

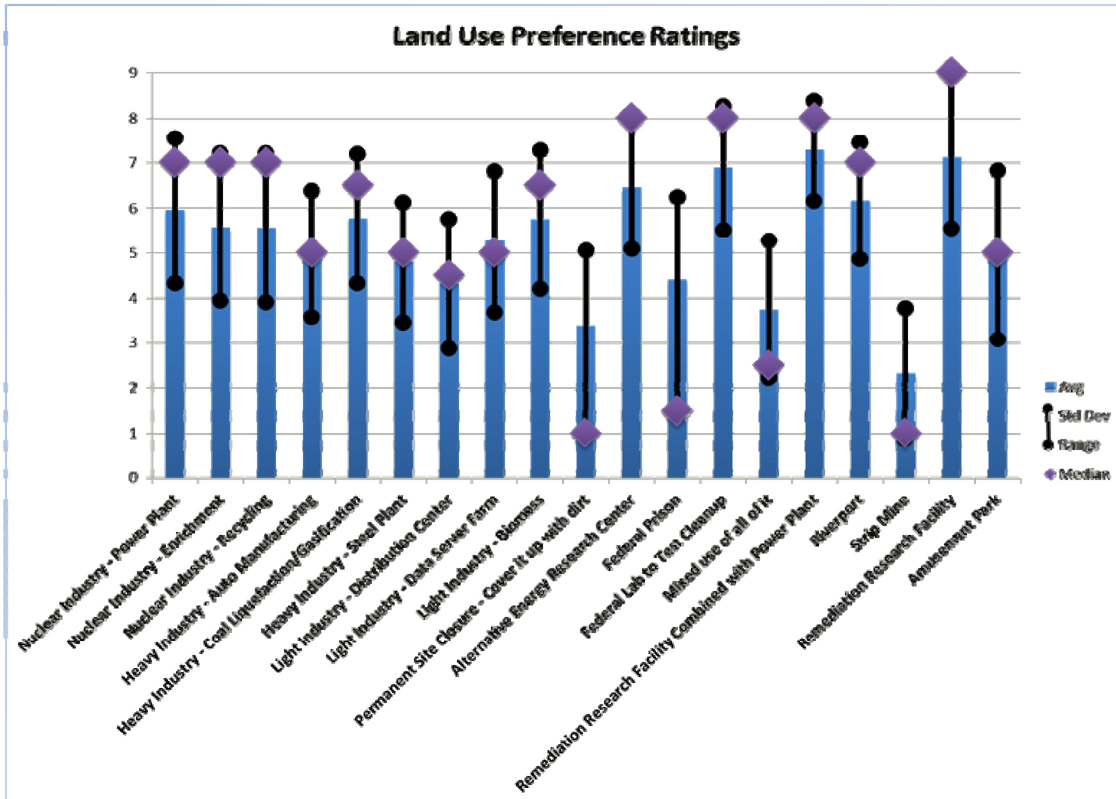

Figure 8.5.2 Detailed Land Use Scoring Results (Note: this data was not collected at the April 28th meeting due to time constraints)

8.6 WEB-BASED SCENARIO PRESENTATIONS

Based on the amount of data collected through the public meetings, a decision was made to solicit additional scenario scoring through the construction of an interactive website: www.paducahvision.com. The website included general information about pertinent categories of interest: 1) The Past, 2) The Present, 3) The Future, 4) Science, and 5) Cleanup, as well as an opportunity for visitors to experience the same guided presentation that occurred at the public meetings. At the end of the guided presentation, visitors had the opportunity to express their preferences for each of the 12 scenarios. This information was recorded electronically for analysis and inclusion in this report.

The website was promoted through advertisements in the *Paducah Sun*, the *Ballard Weekly*, the *West Kentucky News*, and the *Advance Yeoman*. In addition, the website was also promoted through an article in the Louisville Courier Journal on April 25, 2011 (see Appendix Z). Finally, the website was also promoted at through presentations at meetings of the Paducah Chamber of Commerce on April 14, 2011 (see Appendix Y) and the Paducah Rotary Club on May 4, 2011 (see Appendix AB). The site also was promoted through: 1) a tailored education program presented to five sixth grade science classes at Heath Middle School on May 16, 2011 (see Appendix AC), a mass emailing to all former project participants (see Appendix AD and AF), and 3) direct mailings to all Water Policy District residents (see Appendix AE and AF). Website data collected from April 14, 2011 through July 8, 2011 indicated that the site was visited by 713 distinct IP addresses. While a total of 156 people viewed the entire survey, only 97 people actually entered preference scores for at least one scenario. The average number of responses per scenario was 90. The composite results from all of the website responses is provided in Figure 8.6.1

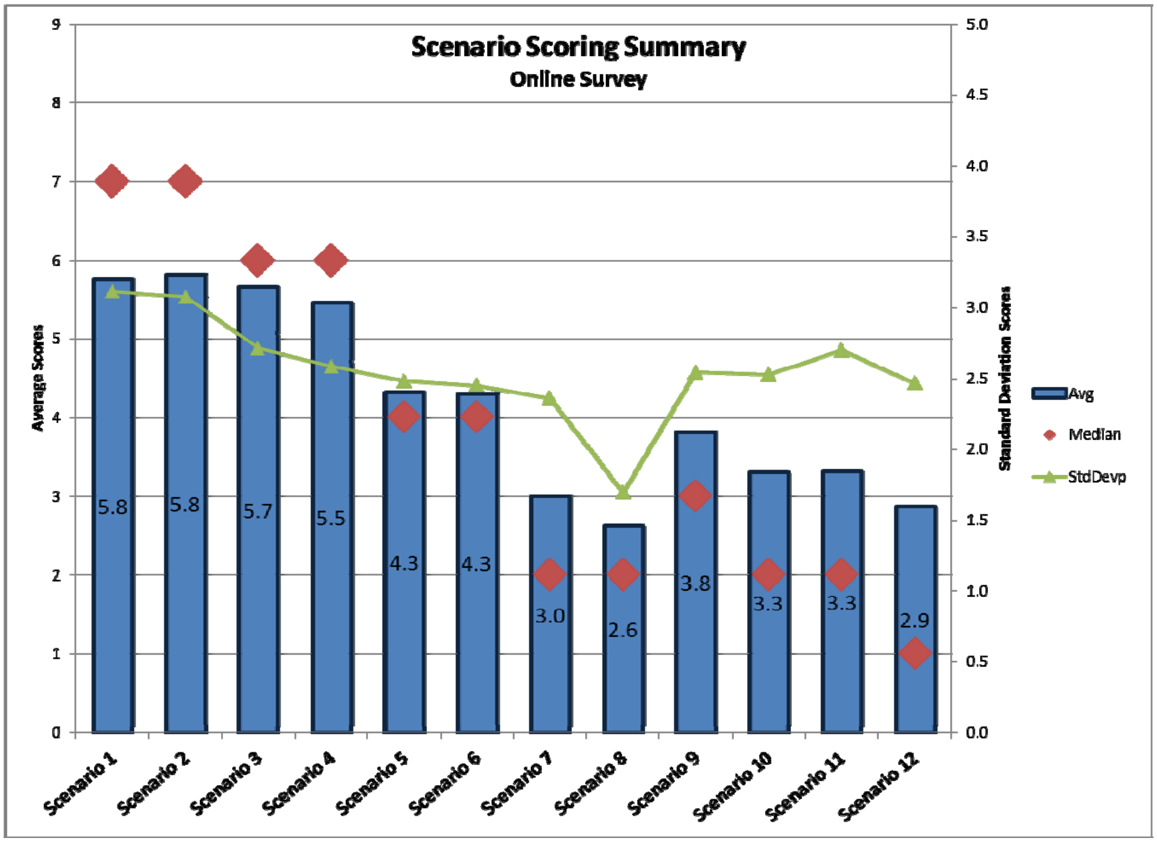

Figure 8.6.1 Pattern of Scores From Website Survey Evaluating 12 Future Vision Scenarios (see Section 8.4 and Table 8.4.1 for description of scenario content)

8.7 COMBINED RESULTS

A summary of the total combined results from the public meetings and the website surveys is provided in Figure 8.7.1. This represents responses from 218 respondents. Although preferences for various alternative scenarios were not necessarily a resounding endorsement of any particular outcome, the majority of respondents tended to favor development scenarios over non-development scenarios. Regardless of the diversity of views related to specific scenarios, the scenario presentation and evaluation process was well-received, as indicated by quantitative process evaluations and qualitative feedback from meeting participants. The combined quantitative process scores from public meetings and the online interface are provided in Figure 8.7.2.

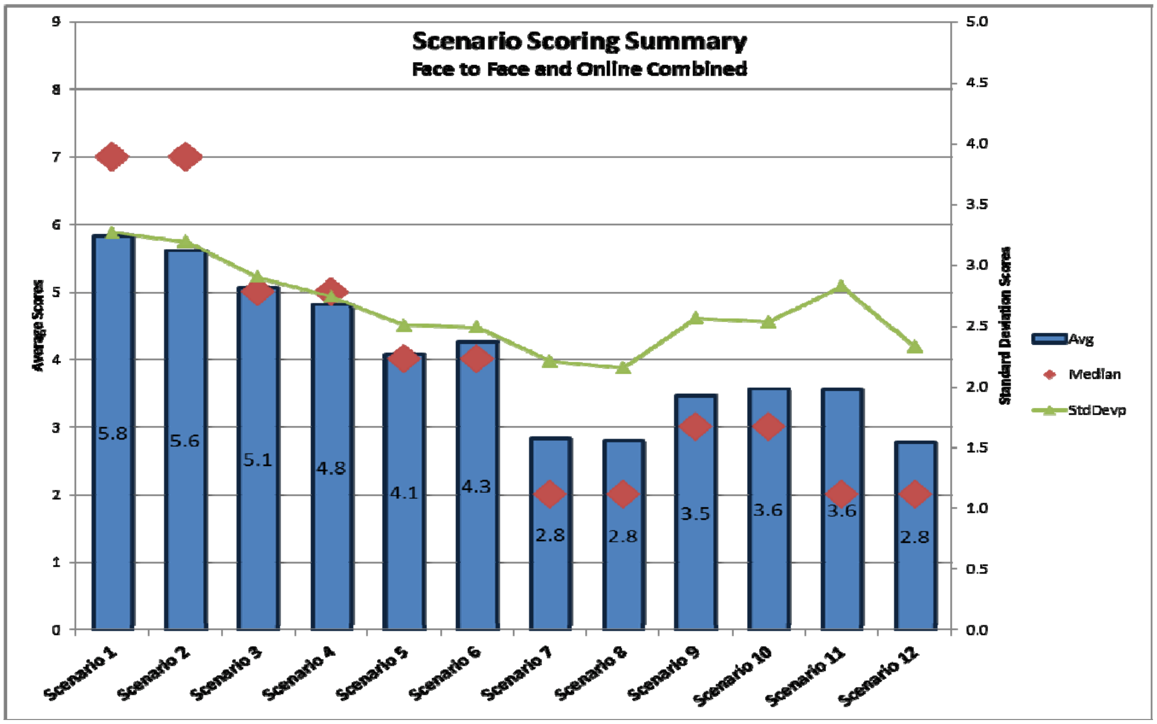

Figure 8.7.1 Pattern of Scores
From Website and Public Meeting Evaluation of 12 Future Vision Scenarios
(see Section 8.4 and Table 8.4.1 for description of scenario content)

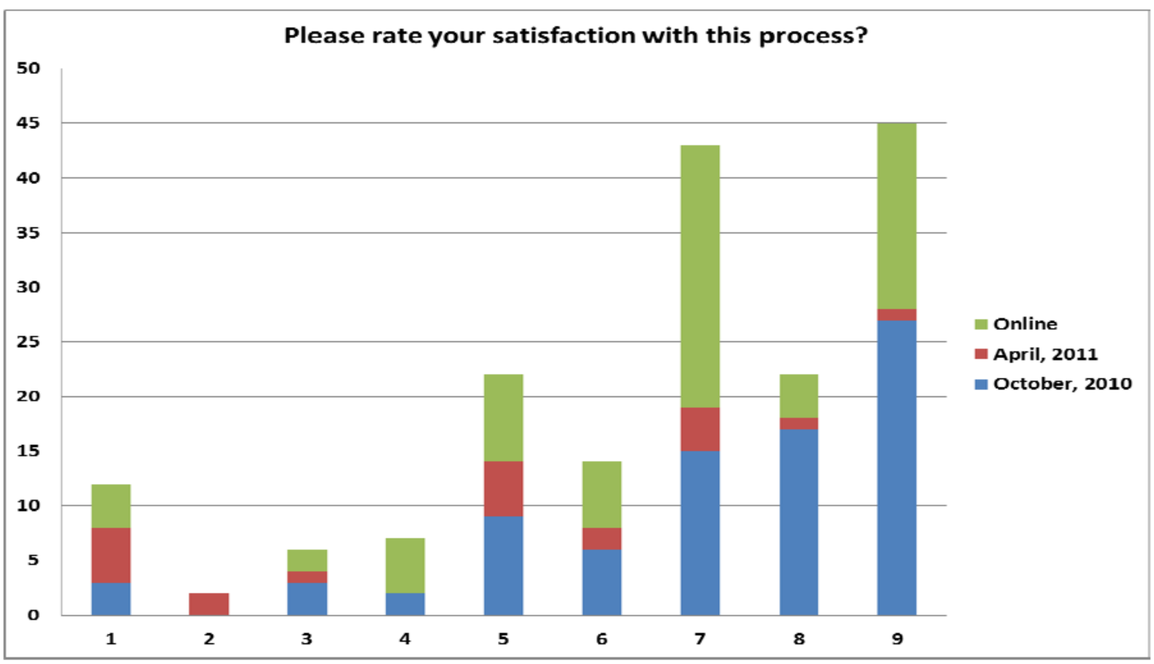

Figure 8.7.2 Process Evaluation Scores [horizontal axis – 1=least suitable to 9=most suitable] from Public Meeting and Website Responses [vertical axis – e.g. 15 people from the October meeting gave a response of 7, while 4 people from the April meeting gave a response of 7, while 24 people from the online survey gave a response of 7, etc.]

8.8 DEMOGRAPHIC ANALYSIS

To have a better sense of the general characteristics of the respondents, participants at both the public meetings and the website survey were asked several demographic questions, including age, gender, and place of residence. The responses are shown in Figures 8.8.1 through 8.8.3. Nearly half of the participants were from McCracken County, while nearly a third reported that they live in none of the counties immediately adjacent to the plant. Slightly over 50% of the participants were born before 1960, and approximately three-fifths of the participants were men.

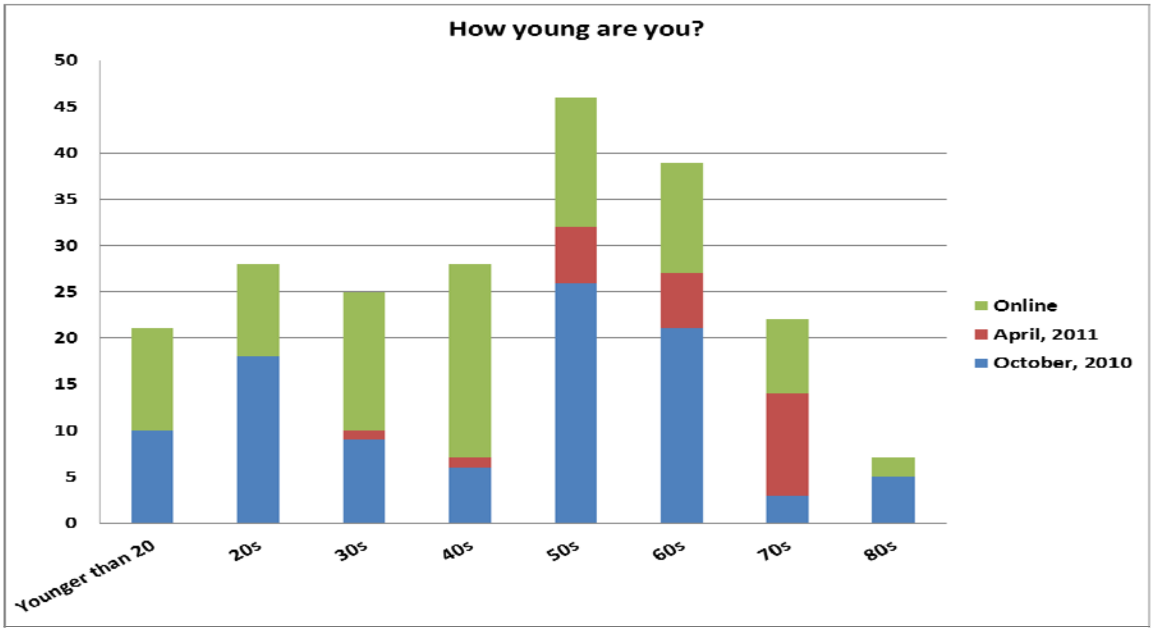

Figure 8.8.1 Age Statistics of the Public Meeting and Website Survey Participants

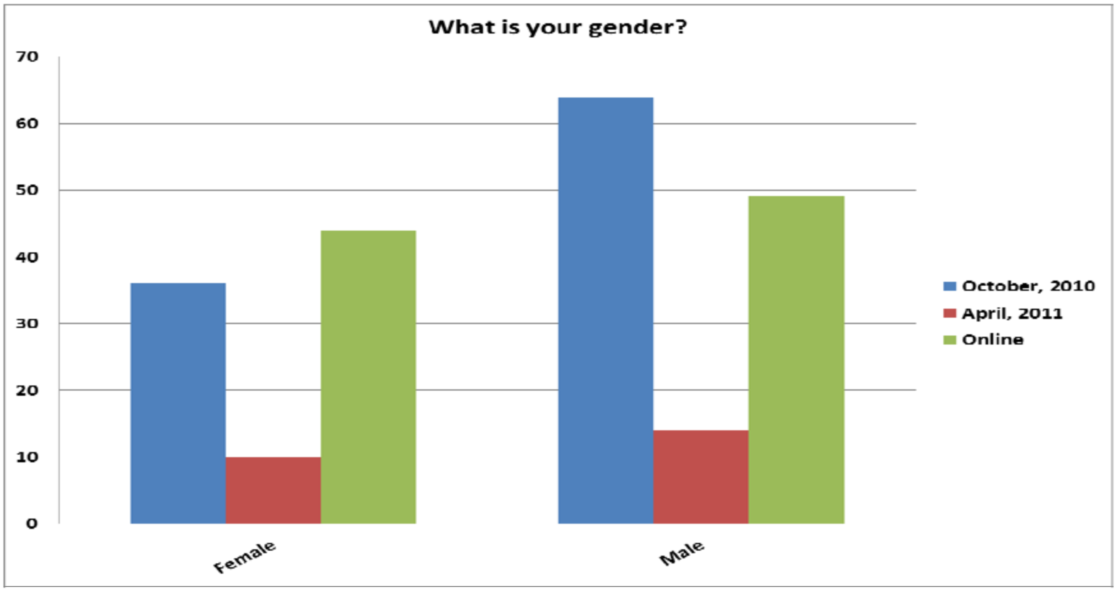

Figure 8.8.2 Gender of the Public Meeting and Website Survey Participants

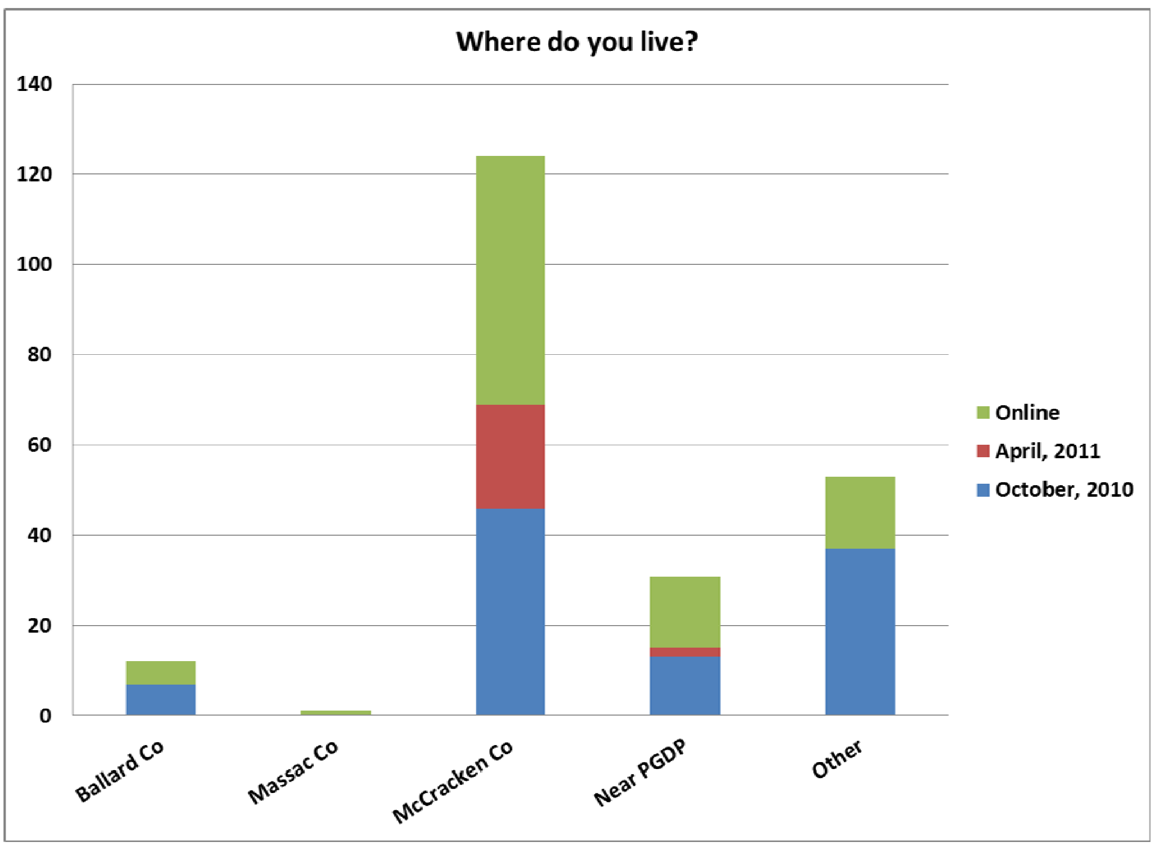

Figure 8.8.3 Residence of the Public Meeting and Website Survey Participants

9.0 DETAILED DATA ANALYSIS

While the general results from the focus group meetings and the scenario scoring meetings have been presented in Chapters 7 and 8, both additional and deeper insights into community preferences and scenario election motivations can be obtained by an expanded evaluation of the collected data sets.

9.1 FOCUS GROUP ARNSTEIN LADDER RESULTS ANALYSIS

Figure 9.1.1 represents the average Arnstein Ladder scores collected from seven different focus groups at PGDP. During the last ten years, members of the research team have collected similar data from over 2000 public participants and professionals at public meetings and at professional conferences, including the Transportation Research Board, the American Planning Association, the Environmental Water Resources Institute, and dozens of smaller conferences involving planners, civil engineers, architects, bridge designers, and landscape architects (see Figure 9.1.2). The PGDP results are consistent with that data, in that citizens agree that a) the desired level of public engagement is Level 6, defined as 'partnership' on the Arnstein ladder; and b) the actual experienced level of public engagement is between 3 (Informing) and 4 (Placation) on the Arnstein ladder. While academics have quibbled over the exact meaning of each term on the Ladder, public citizens, over the past 10 years, have had no difficulty providing assessments of the quality of their experience, and where they would like that relationship to be (Bailey and Grossardt, 2010).

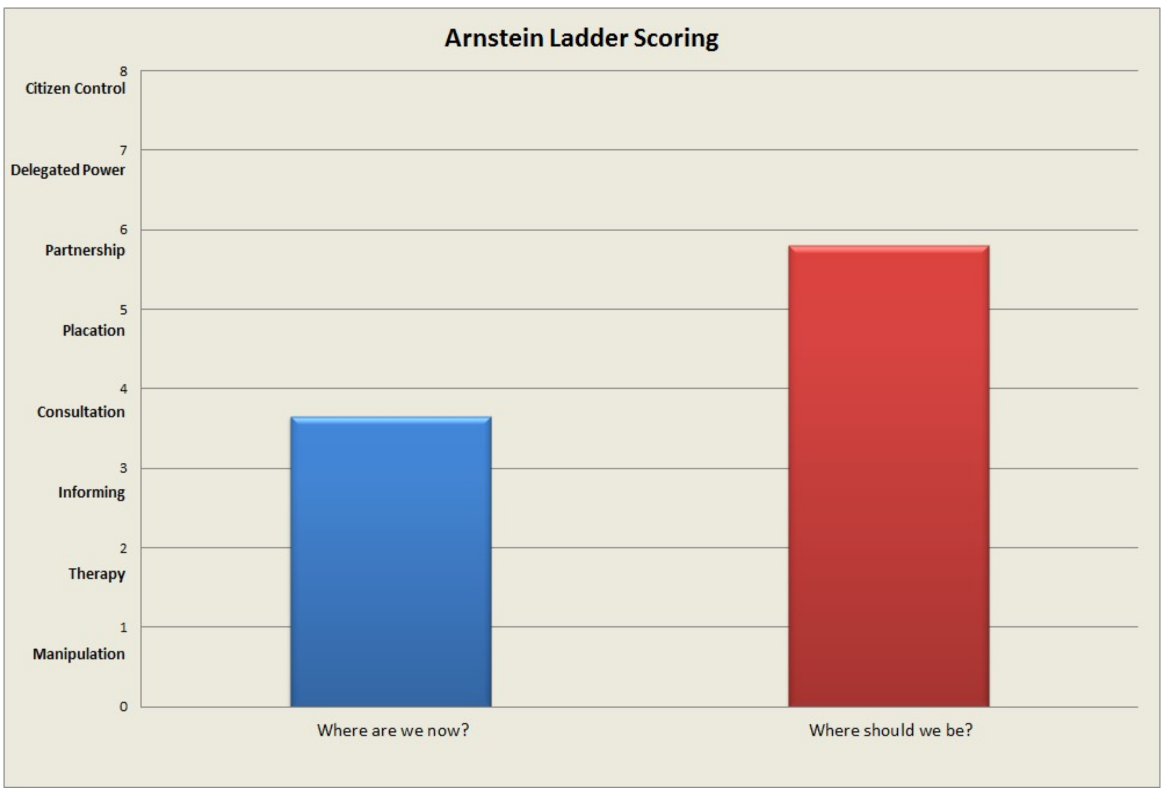

Figure 9.1.1 PGDP Focus Group Summary Arnstein Ladder Scores

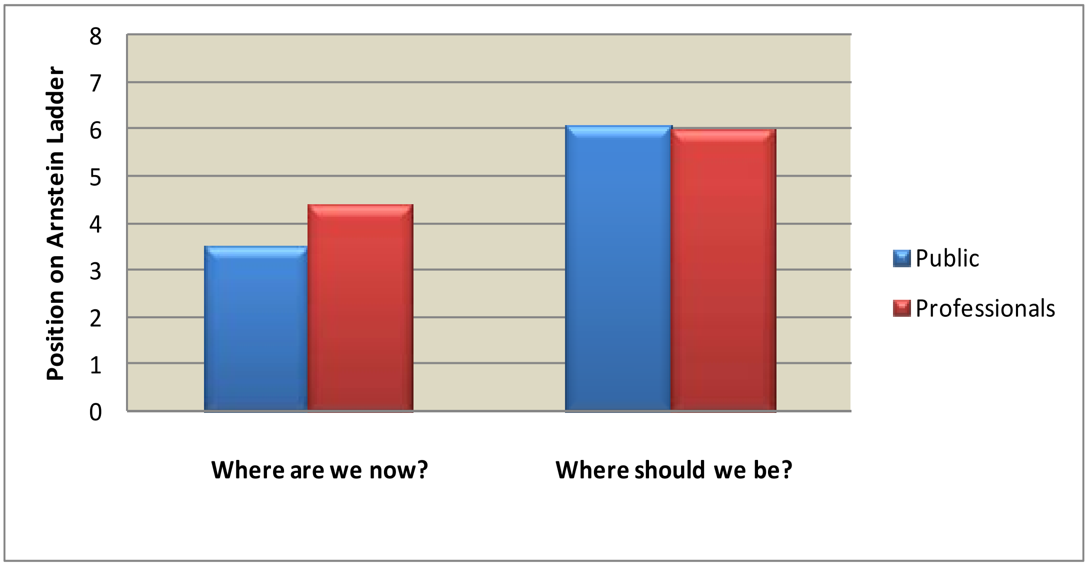

Figure 9.1.2 Summary of Arnstein Results from Professionals and > 2000 Citizens (Bailey et al., in press)

Additional insights into the diversity of perspectives are evident when comparing scores across the PGDP Focus Groups (see Figure 9.1.3). Of particular interest is the fact that groups who expressed lower levels of public involvement to date tended to have higher ideal levels of public involvement. This raises the question of directionality: do higher ideal levels of engagement negatively influence perceptions of real-world engagement activities, or do unsatisfactory past experiences increase the desire for achieving a higher ideal level of involvement? The answer could have important implications for the conduct of future community engagement activities.

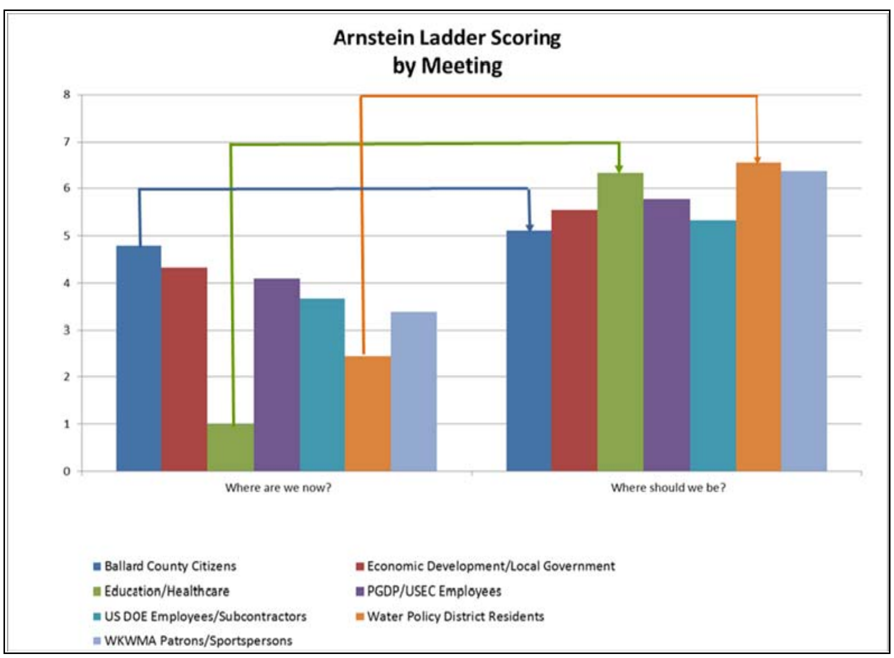

Figure 9.1.3 PGDP Focus Group Summary Arnstein Scores

Groups rating their own experiences as higher included Economic Development/Local Government group and Ballard County Citizens, which also included civic officials. In both cases, their estimations of the quality of public involvement aligned more closely with the global assessment given by professionals in Figure 9.1.2, and their ideal levels of public involvement appear somewhat tempered from that of other groups composed of ordinary citizens.

9.2 FOCUS GROUP SCENARIO SCORING RESULTS

The focus groups tested the extent to which the scenarios represented the full range of possible land uses at the site. Participants were asked to provide their preference for each scenario for ‘suitability’ for the site, where 1 = very low suitability and 9 = very high suitability. Because focus groups were not intended to be a statistically significant sample of the population, their assessments and comments helped the team identify whether the alternative scenarios effectively generated differences in scores -- that is, whether these were the conditions that mattered to people. A simple evaluation of the average scores obtained from the focus group meetings (see Figure 9.2.1) may lead one to conclude that the community as a whole tends to favor industrial land uses (i.e. scenarios 1-6) over non-industrial land uses (scenarios 7-12). However, a more thorough examination of each focus group's scoring reveals a much more diverse set of opinions.

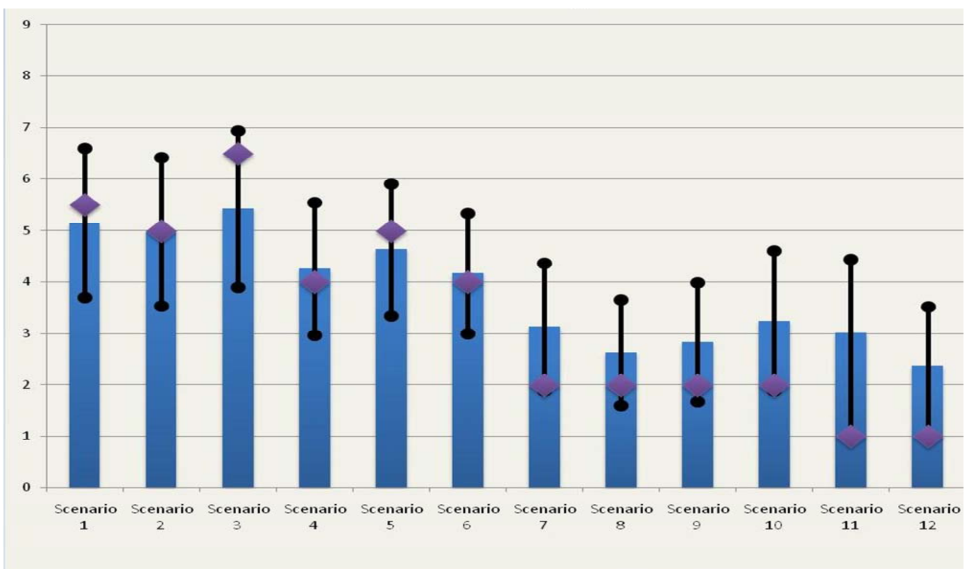

Figure 9.2.1 Summary of Focus Group Scenario Scoring

For example, the detailed scores from the PGDP/USEC employees and the Ballard County focus groups (i.e. Figures 9.2.2-9.2.3) reveal a similar pattern of land-use preferences, indicating generally favorable views of industrial land uses, including nuclear and heavy industry scenarios. In contrast, the detailed scores from the education/healthcare professionals and the WKWMA patrons/sportspersons focus groups (Figures 9.2.4-9.2.5) depict a very different pattern, showing far less favorable views of industrial land uses. Importantly, the detailed scenario scores from the water policy residents' focus group (see Figure 9.2.6) -- i.e., the group most impacted by the contaminated groundwater plume -- illustrate support for industrial options perceived as economically advantageous, with the exception of nuclear scenarios, which the group viewed unfavorably.

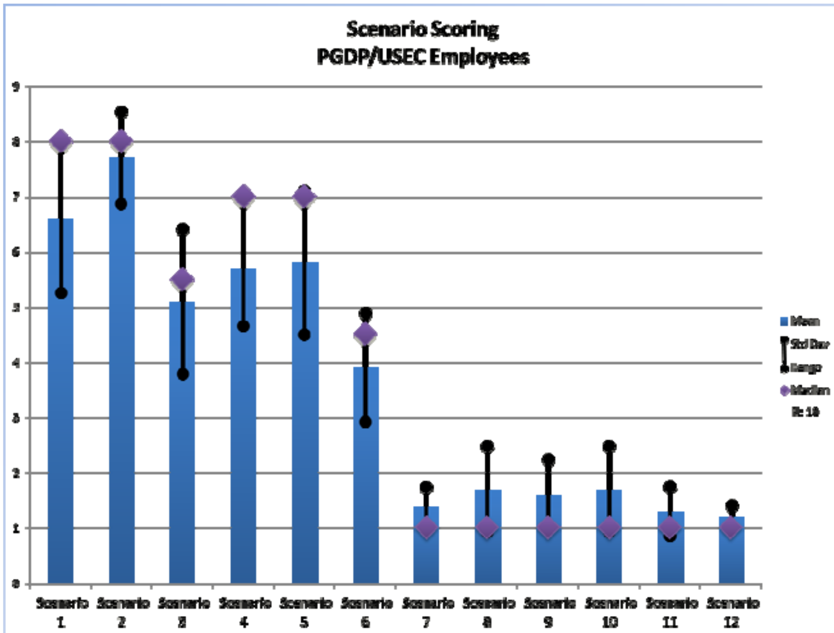

Figure 9.2.2 PGDP USEC Employee Detailed Scenario Scores

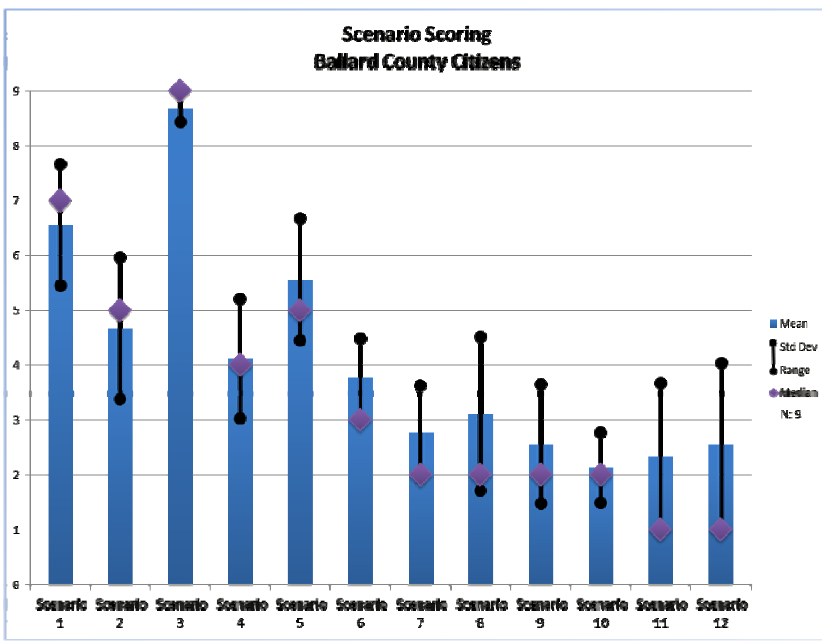

Figure 9.2.3 Ballard County Focus Group Detailed Scenario Scores

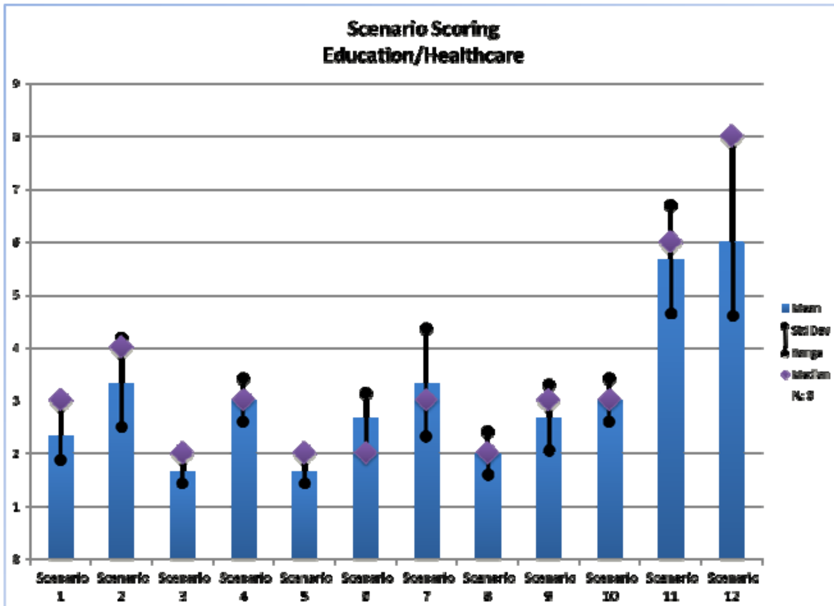

Figure 9.2.4 Education/Healthcare Professional Detailed Scores

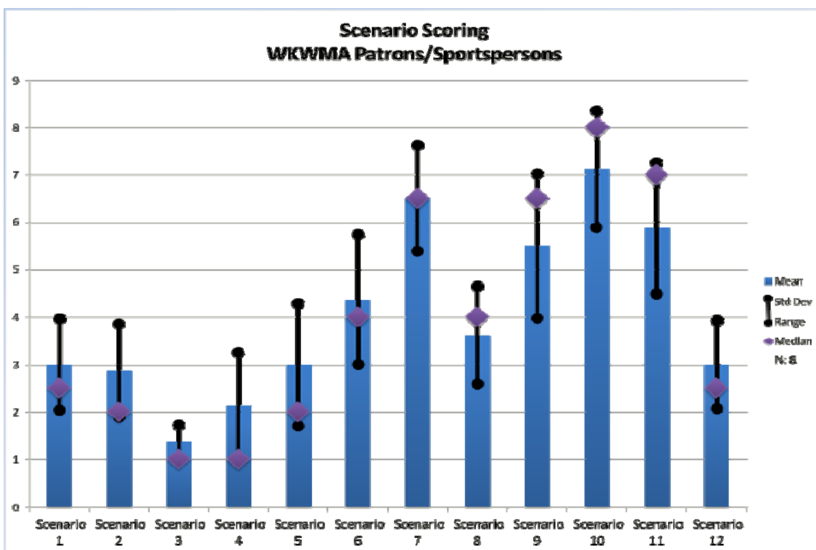

Figure 9.2.5 WKWMA Patrons/Sportsperson Detailed Scores

Chapter 7 discussed some reasons for the disparities across focus groups, which also were reflected by individuals within focus groups. It cannot be assumed that all the participants in a particular focus group shared the same preferences. These graphs represent only the average scores for each focus group and do not illustrate individual scores. Just as different focus groups had different distributions from the composite set of all the focus groups, so individuals within specific focus groups expressed different preferences from each other.

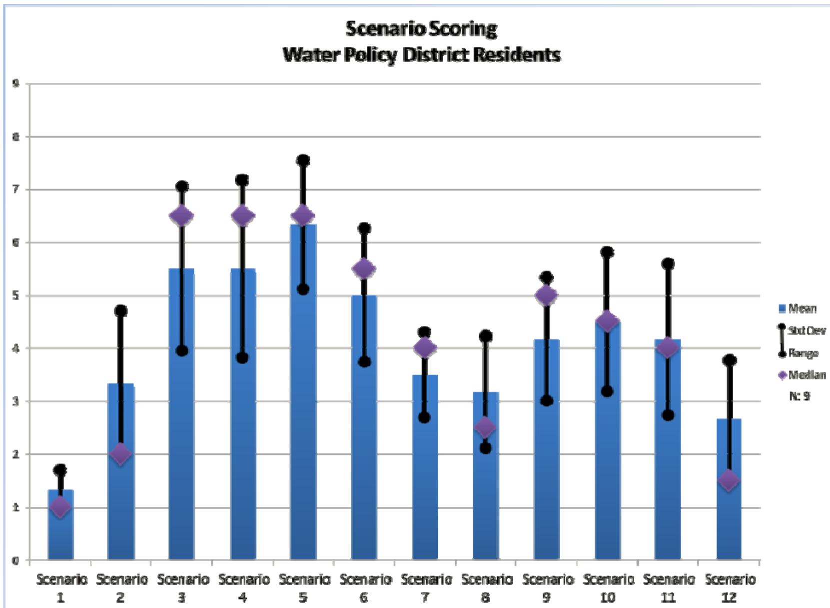

Figure 9.2.6 Water Policy Residents Detailed Scores

The variability of focus group preferences can be explored through the average scores of each focus group for the individual scenarios. For example, if one examines the differences in scores for Scenario 1, which is depicted in Figure 9.2.7 and features a Nuclear Energy Scenario which maintains the existing WKWMA, includes a CERCLA cell, and excavates all the burial grounds, one would see fairly strong support from Ballard County citizens, Economic Development and Local Government, PGDP/USEC employees, and US DOE employees and subcontractors, but much lower scores from the Healthcare/Education professionals, Water Policy District residents, and WKWMA Patrons and Sportspersons. The reverse tends to be true for Scenario 10, which is an Expanded Wildlife Management Area scenario (see Figure 9.2.8).

Additional insight can be obtained by looking at the scenario scoring, not from the perspective of which scenarios actually obtained the highest average scores, but from the perspective of which scenarios illustrated the greatest consensus of scores (either positively or negatively) across all focus groups. Statistically, this normally corresponds to scores whose mean and median are similar and whose standard deviations are low. Among the industrial land use scenarios, Scenario 6 tends to have the greatest positive consensus, while in the non-land use scenarios, Scenario 8 tends to be thought of as a poor scenario by all focus groups. These trends also are evident on examination of the detailed scenario scores (see Figures 9.2.9 and 9.2.10). Thus, Scenario 6 might be judged to impose the least adverse impacts by all the focus groups, even though it was not the most desired by any of them. Nonetheless, the average scores indicate that it was not judged significantly inferior to the other scores and was judged significantly superior to the non-industrial land use scenarios. Such information could prove valuable if the ultimate community objective is to select a future use that minimizes the level of opposition.

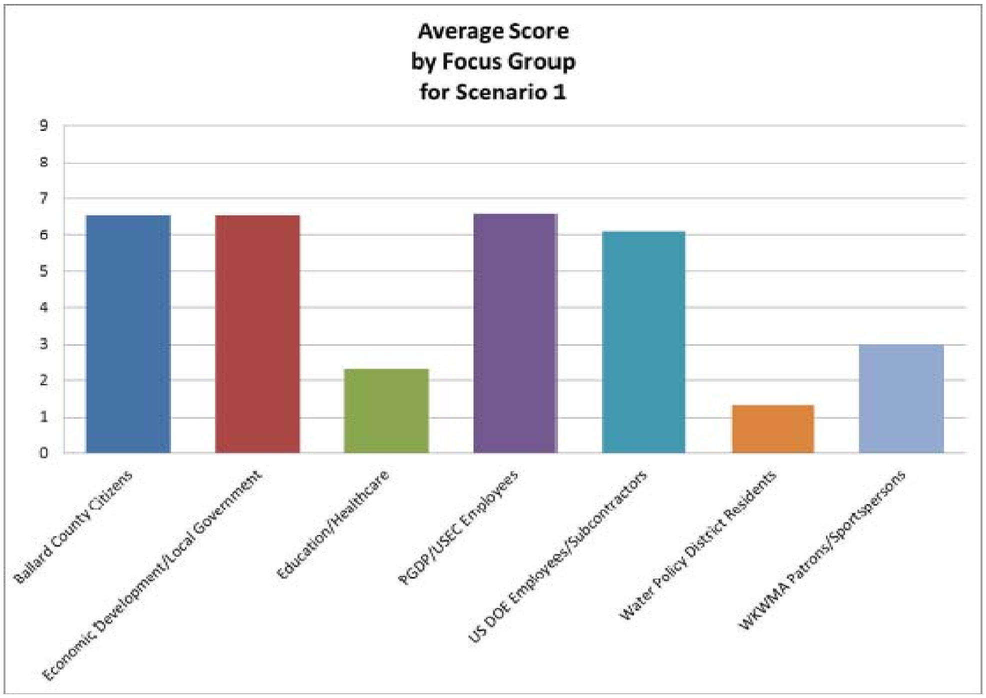

Figure 9.2.7 Focus Group Average Scores [vertical axis] for Scenario 1 (Nuclear Energy)

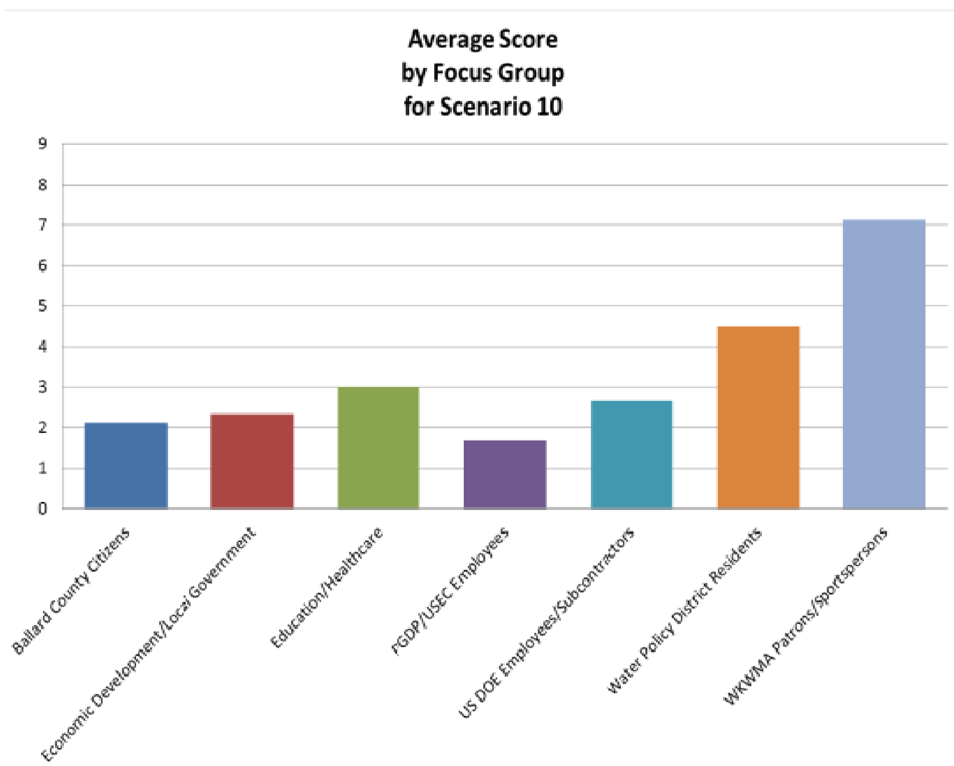

Figure 9.2.8 Focus Group Average Scores [vertical axis] for Scenario 10 (Expanded Wildlife Management Area)

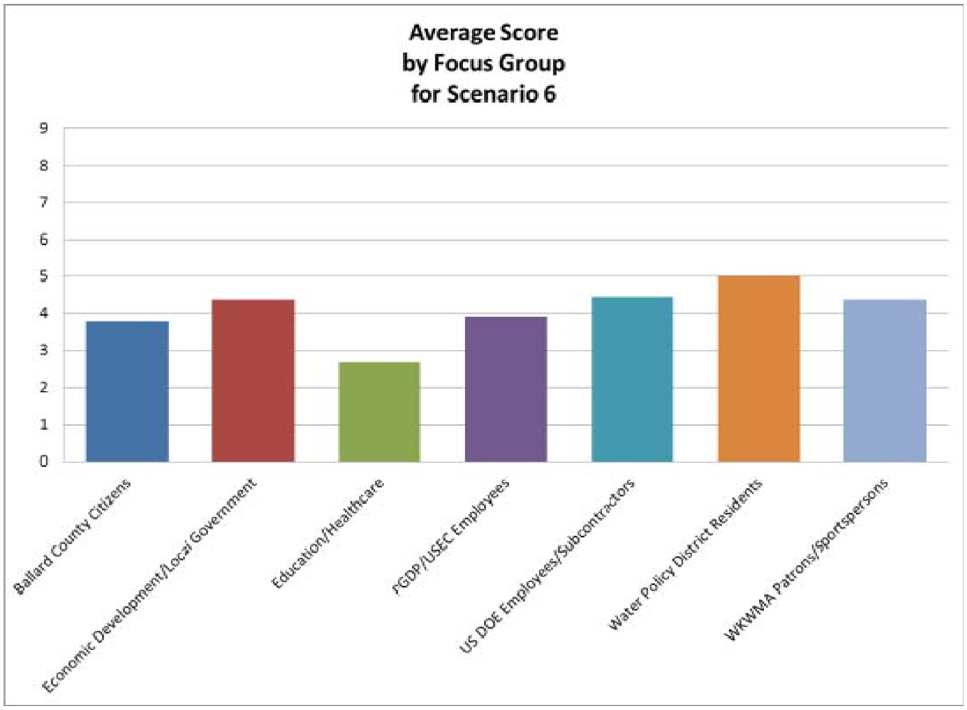

Figure 9.2.9 Focus Group Average Scores [vertical axis] for Scenario 6 (Light Industry)

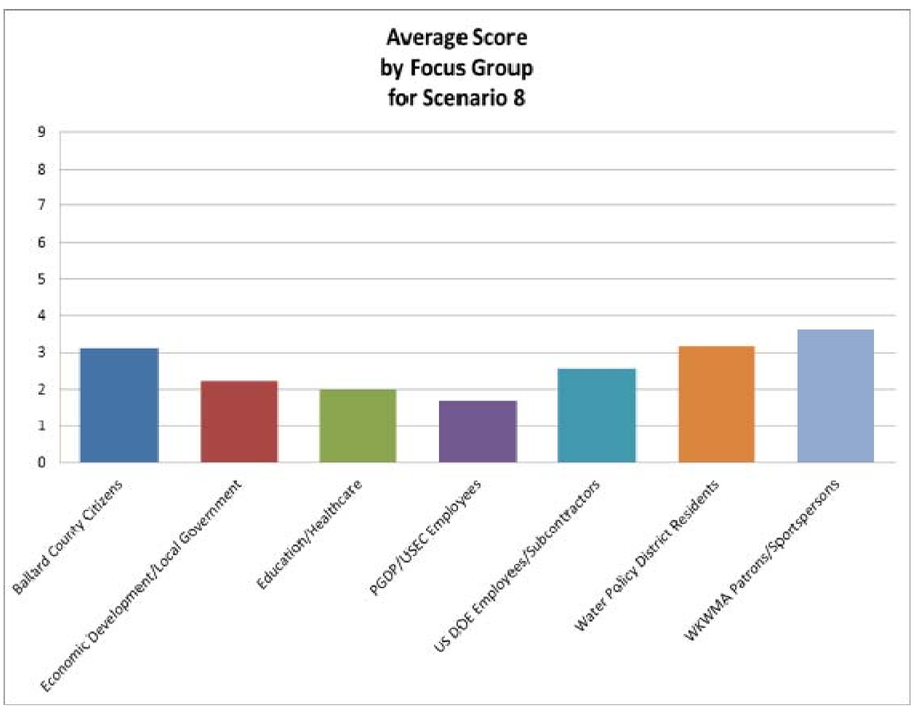

Figure 9.2.10 Focus Group Average Scores [vertical axis] for Scenario 8 (Expanded Recreational)

9.3 PUBLIC MEETING DEMOGRAPHIC DATA ANAYSIS

As indicated in Chapter 8, four different public scenario scoring meetings were held in the Paducah are during the fall of 2010 and spring of 2011. The meeting venues, dates, and number of individuals who participated in the scoring exercise are summarized in Table 9.3.1.

Table 9.3.1 Summary of Meeting Statistics

Meeting Venue	Date	Number of Participants
WKCTC Campus	October 25, 2010	56
Ballard County High School	October 26, 2010	19
WKCTC Campus	October 27, 2010	28
First Christian Church	April 28th, 2011	25

The total attendance at all four meetings was 128. With an average attendance of approximately 32. In the past, such meetings are often sparsely attended due to the inconvenience of attending an evening meeting for many people. The nature of these time conflicts is reflected in the ages of meeting participants. Attendees were concentrated in the 20-30 and the 50-70 age groupings. Community members between the ages of 30 and 50 were far less represented in the public meetings sample (see Figure 9.3.1). Unfortunately, this trend is the inverse of the region's actual demographic distribution, which is most heavily concentrated in those 30-50 age grouping (see Figures 9.3.2 and 9.3.3). The research team believes that this age category represents working parents with competing commitments, including childcare challenges, that discourage attendance.

In response to concerns about the demographic distribution of participants, the team modified its informational website (www.paducahvision.com) to include an evaluation interface for the 12 scenarios that were presented at the public meetings. This feature allowed for members of the community who could not attend public meetings to participate in the process. To replicate the public meeting protocol as closely as possible, the website included the same visual presentation, along with an audio recording of the presentation narration. The team promoted the online interface through several venues, including: 1) notices in four local newspapers; 2) direct mailings to residents who live near the facility; 3) brief announcements and distribution of flyers at other public meetings (e.g. Paducah Chamber of Commerce and Rotary Club meetings); and 4) presentations to sixth grade science class students at Heath Middle School. At the middle school, a 40-minute presentation and role-playing exercise allowed students to identify possible solutions to the potential closure of the PGDP. At the end of the exercise, students were given materials to share with their parents, along with an extra credit assignment to join their parents in taking the online survey. This middle school activity was developed specifically to inform and engage 30-to-40 year old parents, directly addressing the problematic demographic gap identified in prior data collection efforts.

The age distribution of the final total aggregate data set is provided in Figure 9.3.4. As can be seen from the figure, the addition of the online survey result has greatly reduced the 30 to 40 year old demographic hole. In fact, a more detailed examination of the data (i.e. Figure 9.3.5) reveals that the majority of online participants came from this 30 to 40 year old demographic. In addition, eleven online responses were associated with individuals aged 20 years or younger. Given that these respondents participated shortly after the Heath Middle School presentation, it is likely that they result from students working with their parents; thus, these scores also may be associated to some extent with perspectives of individuals from the 30 to 40 year old demographic.

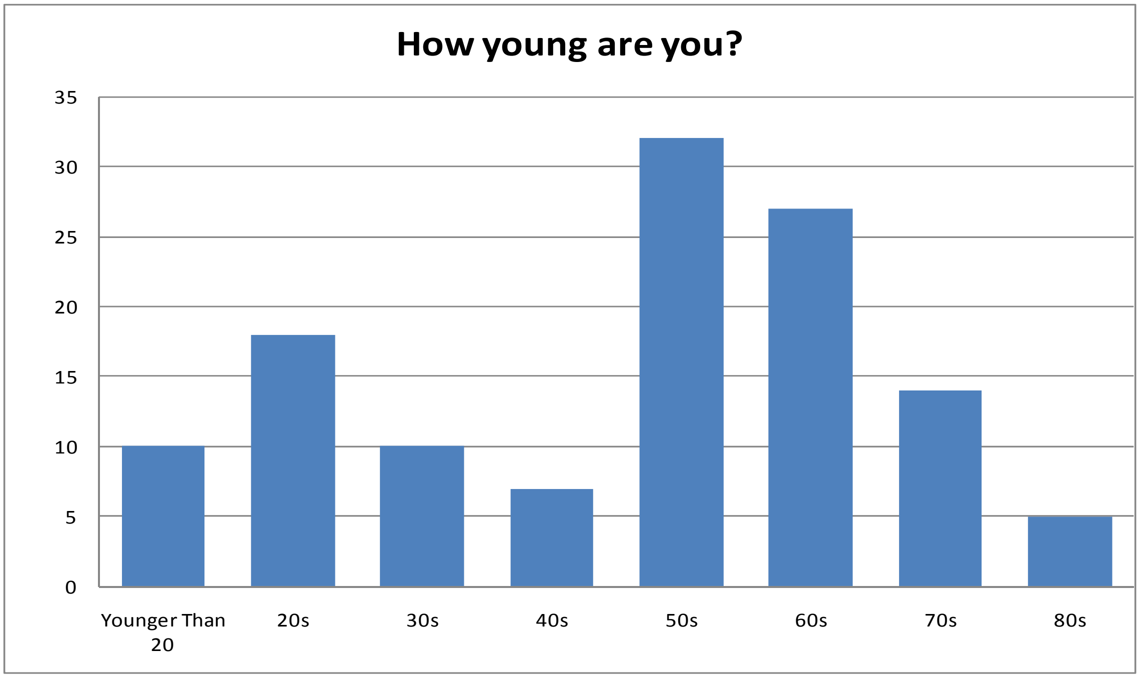

Figure 9.3.1 Distribution of Ages of Participants in Public Scenario Scoring Meetings [vertical axis = number of participants in the corresponding age range]

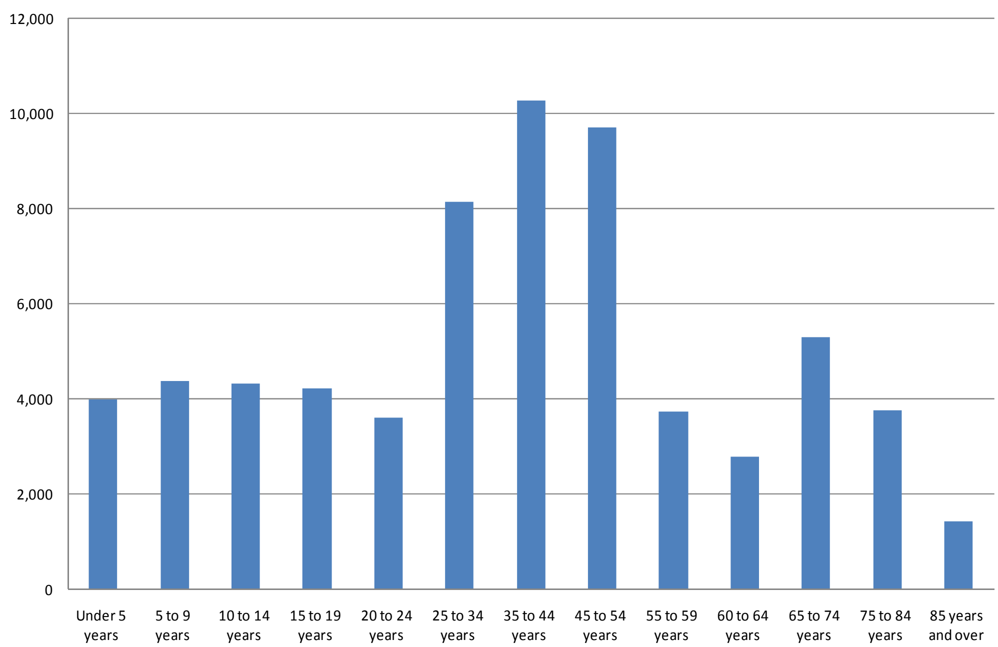

Figure 9.3.2 McCracken County Age Distribution
(*Kentucky State Data Center, accessed at http://ksdc.louisville.edu/1census.htm)*
[vertical axis = number of participants in the corresponding age range]

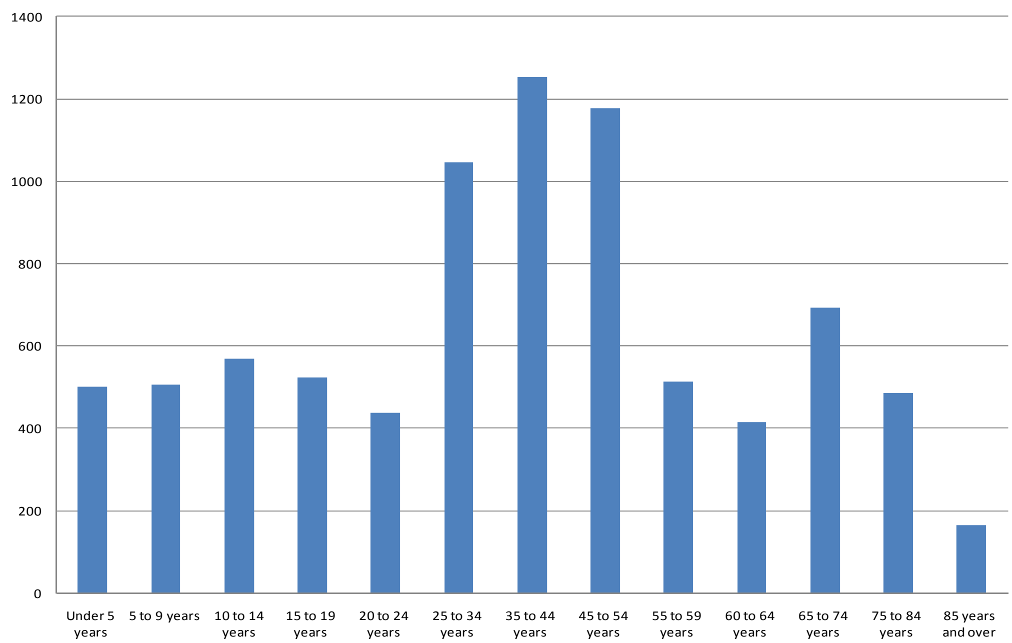

Figure 9.3.3 Ballard County Age Distribution
(*Kentucky State Data Center, accessed at http://ksdc.louisville.edu/1census.htm)*
[vertical axis = number of participants in the corresponding age range]

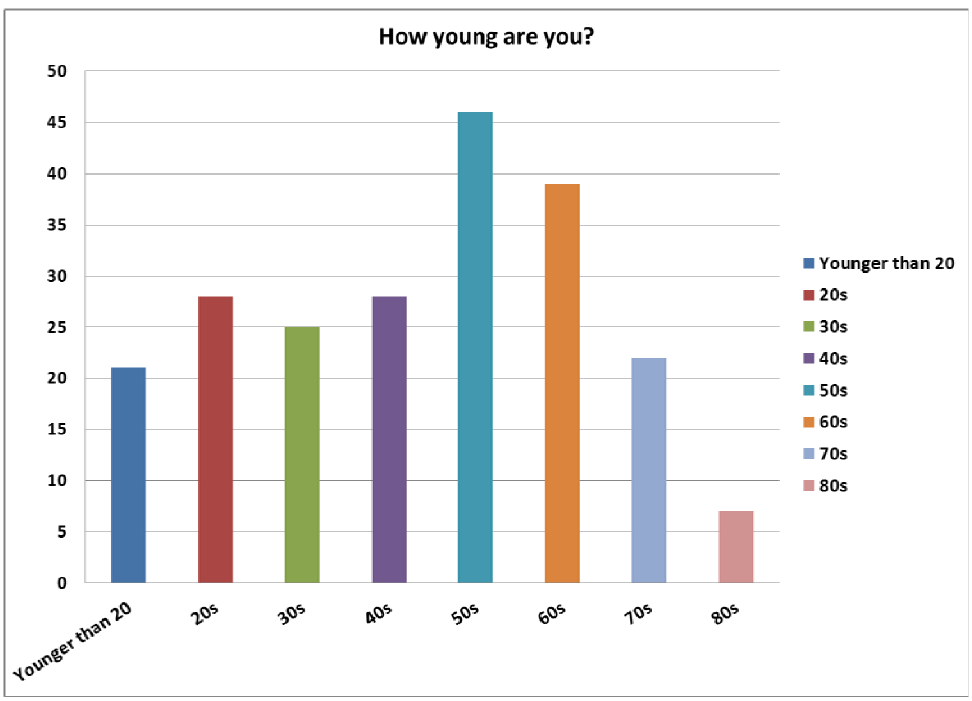

Figure 9.3.4 Age Statistics of the Public Meeting and Website Survey Participants
[vertical axis = number of participants in the corresponding age range]

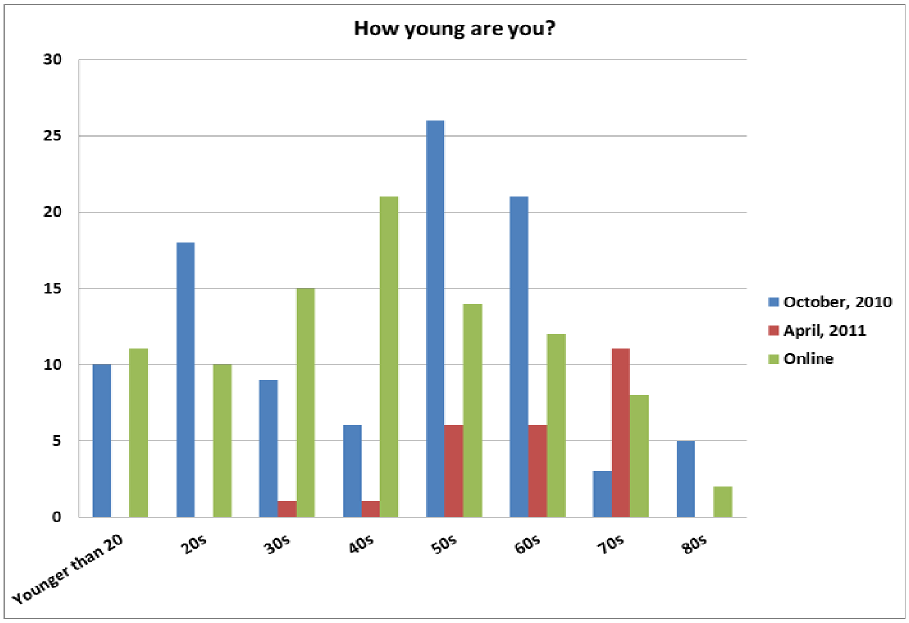

Figure 9.3.5 Detailed Age Statistics of the Public Meeting and Website Survey Participants [vertical axis = number of participants in the corresponding age range]

In addition to participant age, the team documented gender, identifying a male-to-female ratio of approximately 3-to-2 (see Figure 9.3.4). While this representation is not consistent with the underlying gender demographic of the region, which has a female composition just slightly above 50%, it was consistent across all of the data collection sources as shown in Figure 9.3.6.

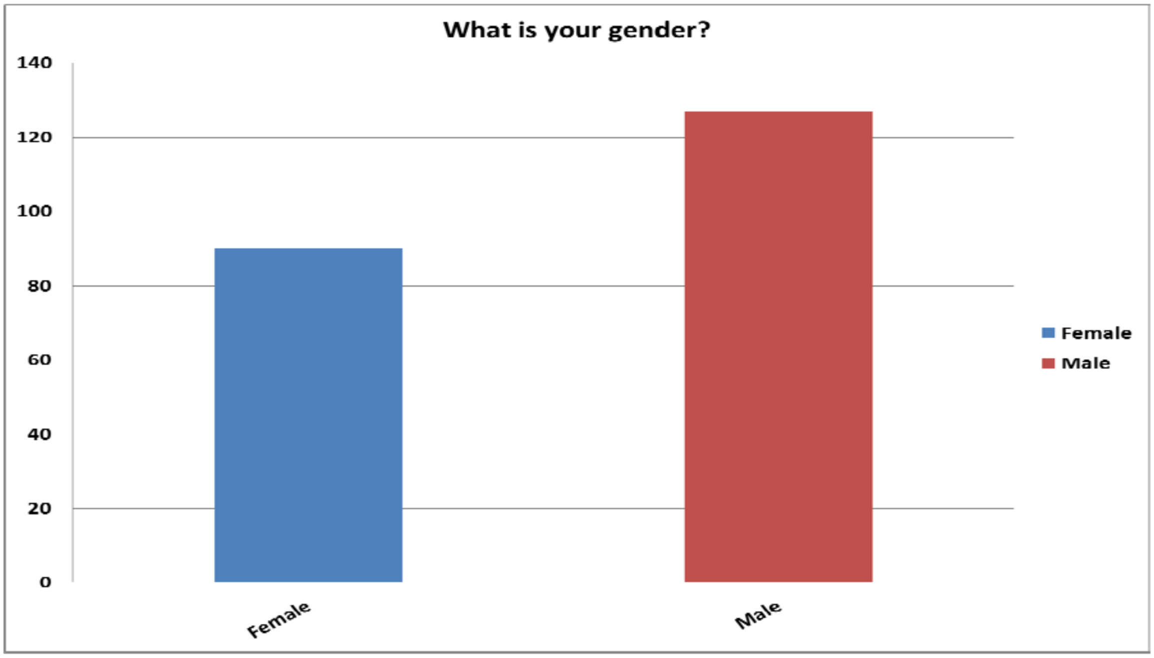

Figure 9.3.6 Distribution of Gender of the Public Meeting and Website Survey Participants [vertical axis = number of participants in the corresponding age range]

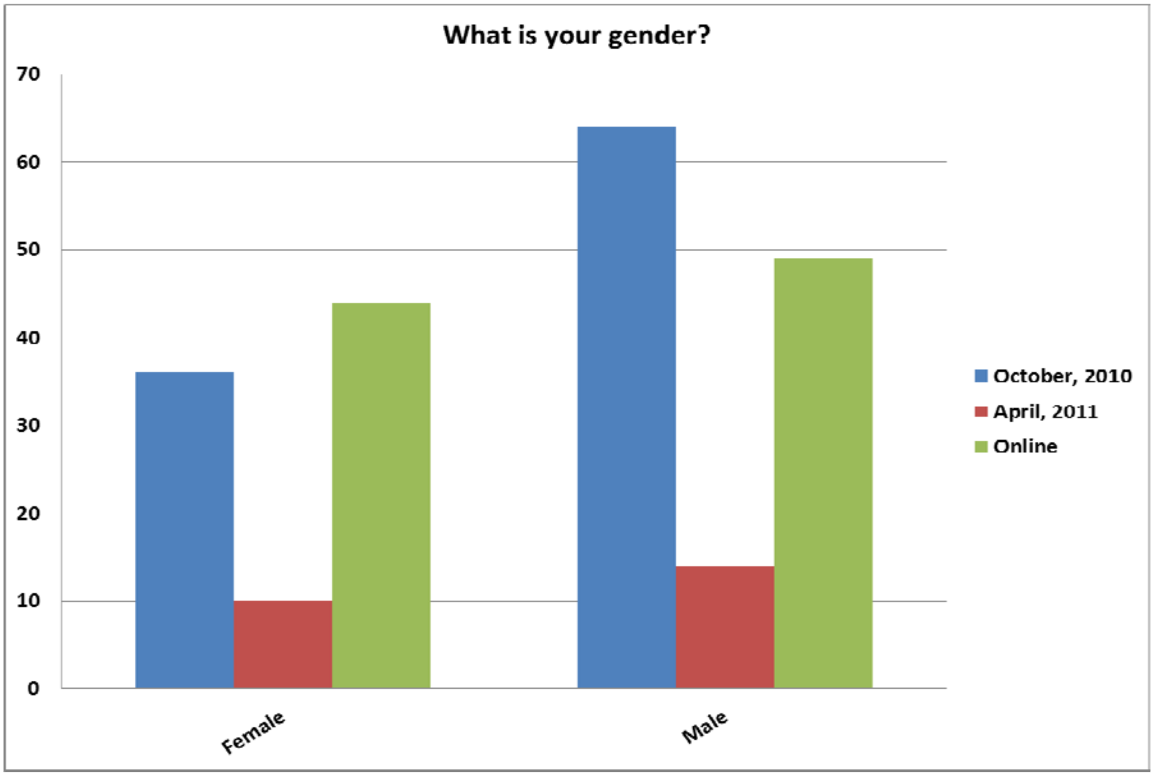

Figure 9.3.7 Detailed Distribution of Gender of the Public Meeting and Website Survey Participants [vertical axis = number of participants in the corresponding age range]

The team also presented asked participants to identify where they live (see Figure 9.3.8). Because McCracken County has approximately 10 times the population of Ballard County, the sample from McCracken County is much larger (see Figure 9.3.9). However, because McCracken County meetings included students from the local community college (e.g., the October 27th meeting), the proportion of participants from outside the immediate area -- or "Other" in Figure 9.3.5 -- was significant. No one from the Metropolis, Illinois area, across the Ohio River, attended the meetings, although at least one person from this area completed the online survey.

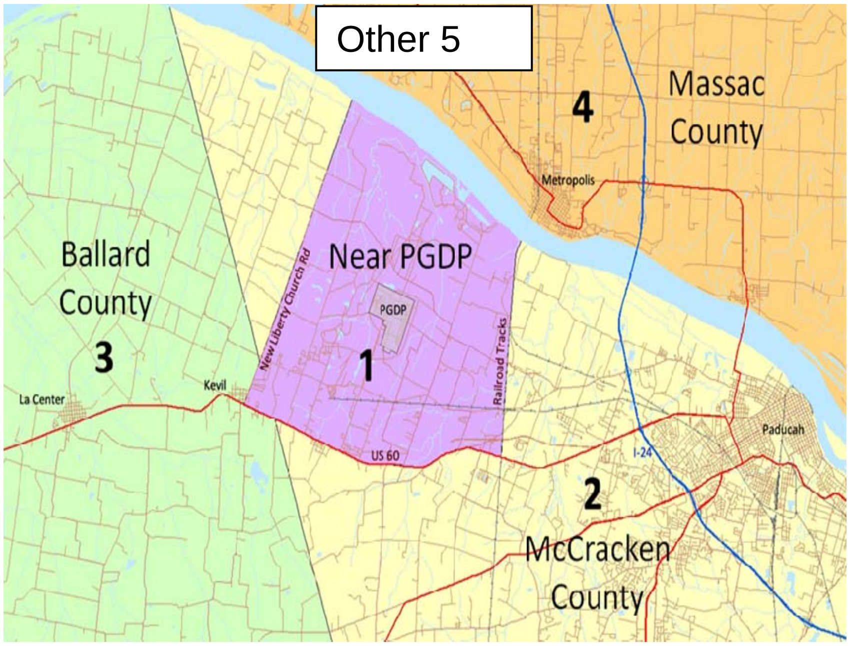

Figure 9.3.8 Map of Choices for Question: Where do you live?

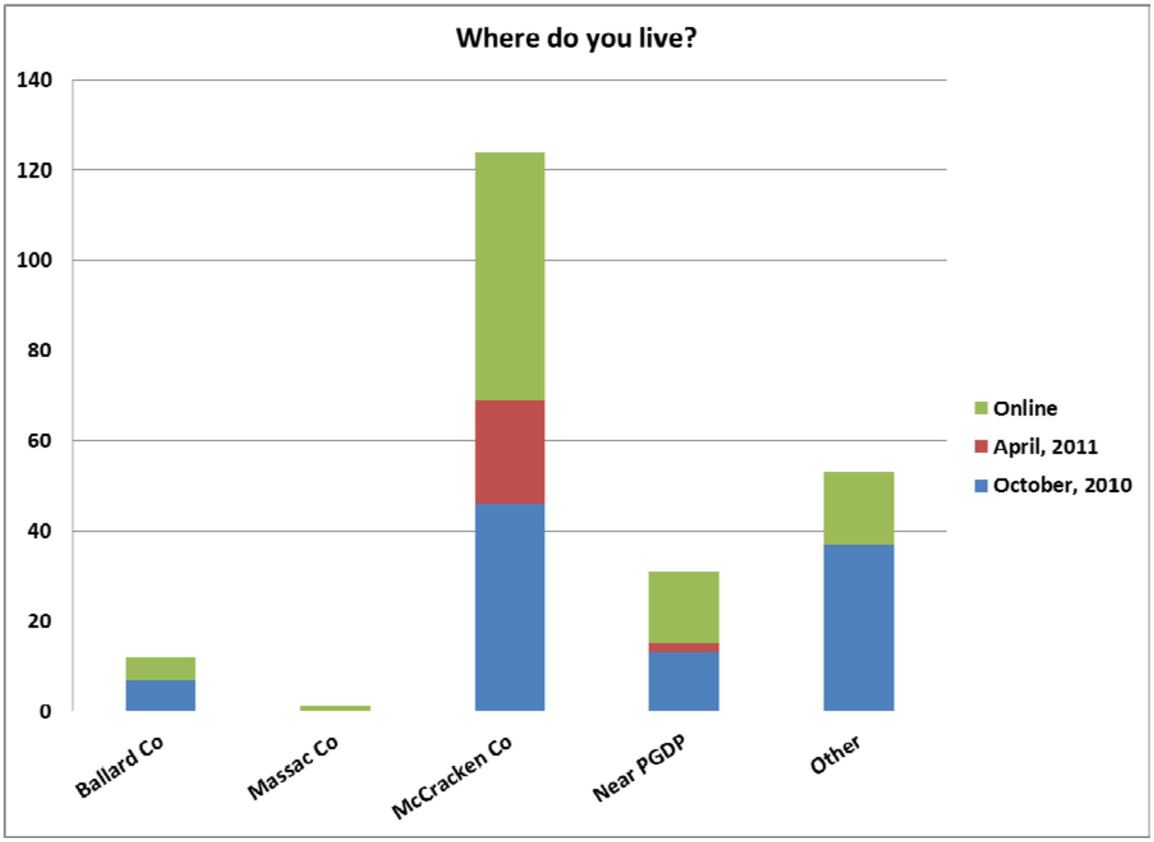

Figure 9.3.9 Distribution of Residences of the Public Meeting and Website Survey Participants [vertical axis = number of participants in the corresponding age range]

9.4 PUBLIC MEETING AND WEBSITE SCENARIO SCORING DATA ANALYSIS

9.4.1 Overview

Similar to the focus group scores, a simple averaging of public meeting and online scenario scores (Figure 9.4.1.1) could lead to a conclusion that the community as a whole favors industrial land uses (i.e., scenarios 1-6) over non-industrial land uses (scenarios 7-12). However, an examination of the detailed scoring for each scenario (e.g., Figures 9.4.1.2 and 9.4.1.3) reveals a much more diverse set of opinions.

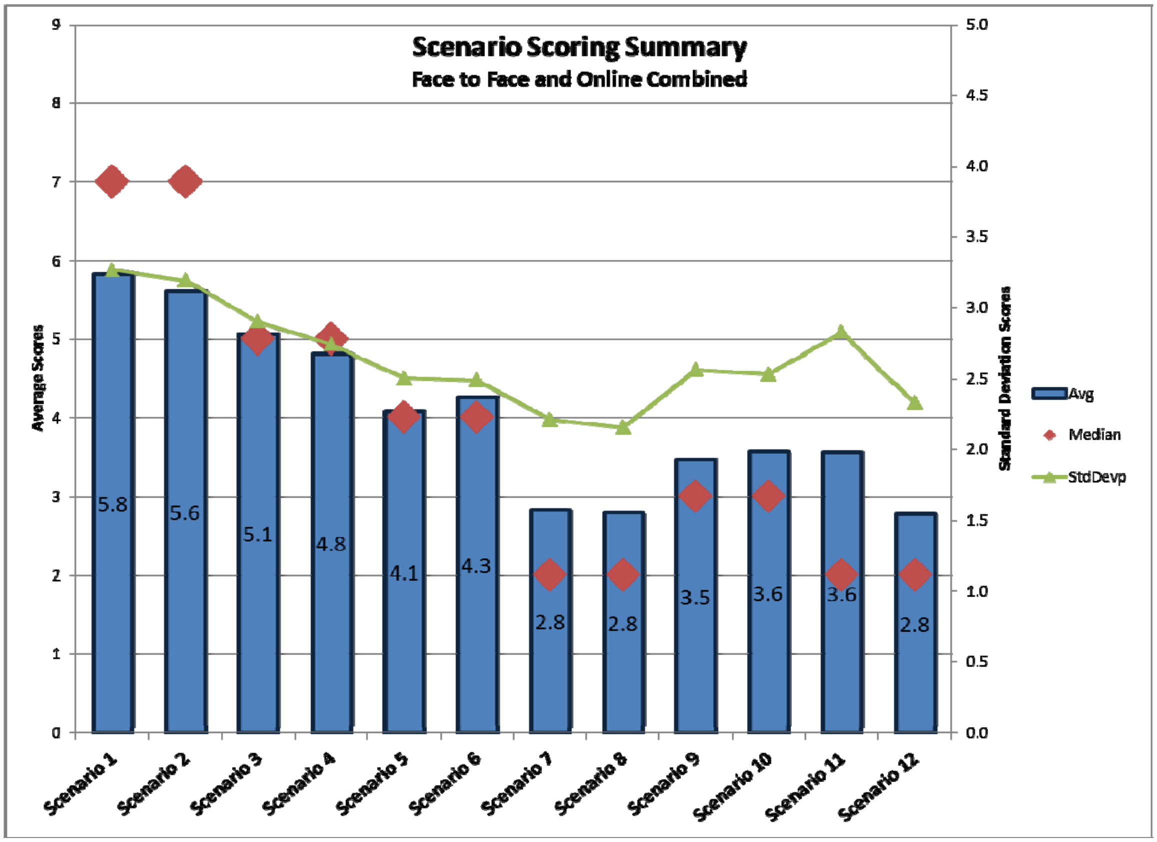

Figure 9.4.1.1 Average Scenario Scores the Public Meeting and Website Survey[vertical axis = number of participants in the corresponding age range]

As with the focus groups, no single outcome was enthusiastically endorsed by all participants. Eleven out of twelve scenarios generated the lowest possible score from at least 20% of the participants. The only exception was scenario 3, which called for heavy industry with the off-site removal of both legacy and future wastes. Similarly, the two nuclear industry scenarios generated the highest possible score from at least 25% of the participants; however, these scenarios also generated the lowest possible score from at least 20% of the participants, highlighting the extremely polarizing nature of the nuclear scenarios. Overall, the scenarios associated with the use of active recreational facilities at the site (scenarios 7 and 8) yielded the lowest scores. In both cases over 40% of the respondents gave each scenario the lowest suitability rating of 1.

As illustrated in Chapter 7, focus group discussions can provide insight into the basis for such scores. During those meetings, the nuclear industry scenarios elicited the following types of comments, illustrating the polarization of the data collected in public meetings and online:
Generally Positive Comments

- "[O]ur community, we're already in the nuclear—we feel safe with it, you know?"
- "[This scenario represents] jobs in the area, and not only just jobs, but high technology jobs."
- "[T]he idea of nuclear power is appealing to me… I'm not really opposed to having that around us as long as…it can be made safe."
- "I like the idea of a nuclear power plant, using some alternative energy sources instead of coal…"
- "If it's safe, then I say yes it is a good future use..."

Generally Negative Comments

- "It would bring a lot of jobs into the community for years to come as this thing's being built. But in the end, due to the fact that it's a nuclear power plant, you've got potential environmental disaster [and] further contamination. So I guess that would be the good and the bad. In our personal opinion, the bad outweighs the good."
- "I don't want another Chernobyl."
- "When God built a nuclear reactor, he put it 63 million miles away. That's where they ought to be."
- "This site...would have to be generating more waste, more radioactivity… We're right on the border between the seismic zones nine and ten. I just think it's totally unrealistic that when it comes down to it to think about putting a nuclear power plant out there on that contaminated site..."
- "I'm all for nuclear power as long as you do two things. One, get nuclear power that doesn't leave waste. And the second is repeal Murphy's Law."

Additional insight can be obtained by looking at the scenario scoring not from the perspective of which scenarios actually obtained the highest average scores, but from the perspective of which of the scenarios show the greatest consensus of scores (either positively or negatively) across all focus groups. Again, among the industrial land use scenarios, Scenario 6 (Light Industry) tends to show the least amount of polarization. These scores tended to be consistent with some of the earlier comments from focus group participants:

- "This seems to be one of the easier ones for the public to swallow."
- "We thought it was one of the easier [scenarios] for maybe the public to accept."
- "[This scenario represents] the continuation of jobs and employment here with light industry… That's encouraging 'cause we're all interested in continuing to have a job."

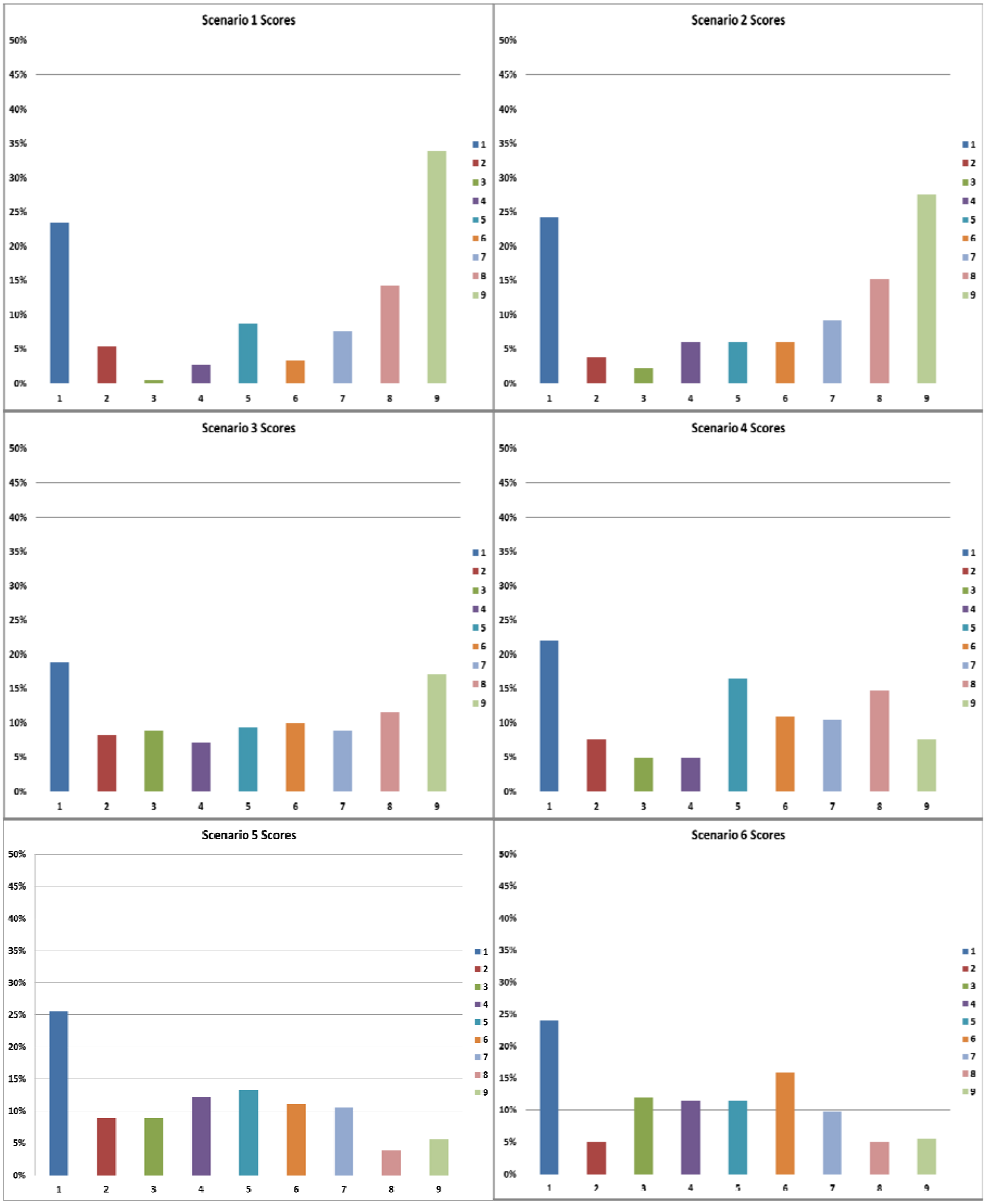

Figure 9.4.1.2 Detailed Scores for Industrial Land use Scenarios (i.e. the percentage of the participants that assigned suitability scores from 1=least suitable to 9=most suitable for each of the industrial land uses: 1&2) nuclear, 3&4) heavy industry, and 5&6 light industry)

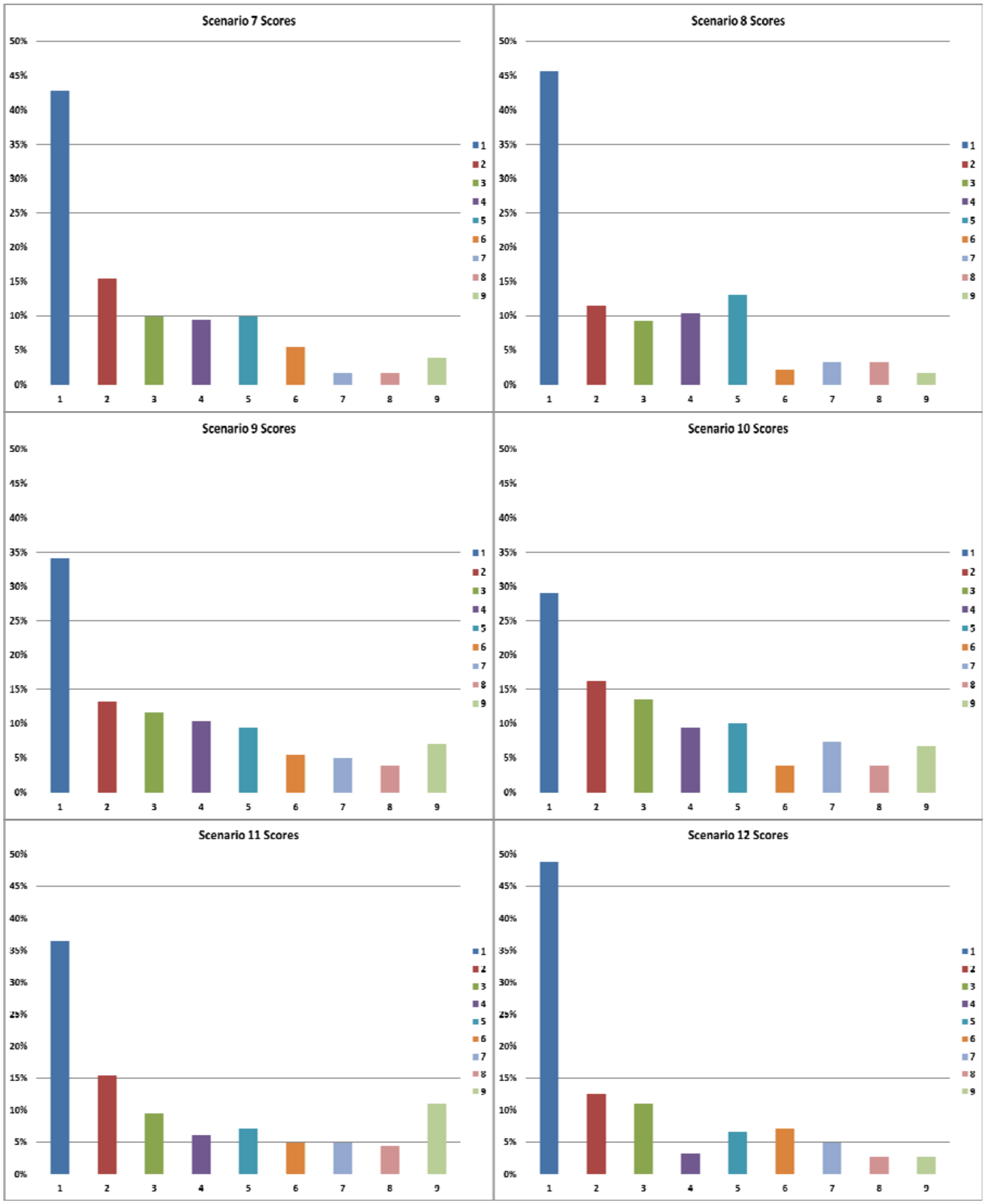

Figure 9.4.1.3 Detailed Scores for Non-Industrial Land use Scenarios (i.e. the percentage of the participants that assigned suitability scores from 1=least suitable to 9=most suitable for each of the non-industrial land uses: 7&8) expanded recreation, 9&10) expanded wildlife management area, and 11&12) institutional controls)

Nonetheless, the focus group quantitative data for these scenarios indicate even less polarization than the public meeting data, which yielded an unsuitable rating from more than 20% of the participants. The detailed results for industrial land uses seem to indicate that approximately 20% of participants consistently voted strongly against all industrial land uses. As a result, one might be tempted to conclude that these scores were generated by the same block of individuals. However, the focus group research revealed that this may not always be the case. For example it is quite possible that individuals who find a nuclear industry or heavy industry land use highly objectionable might be more accepting of light industry. Conversely, those who find a nuclear industry or heavy industry land use highly acceptable might find a light industry land use objectionable. For instance, one focus group participant who was favorable to a nuclear scenario commented that a light industry scenario made "[n]o use of the trained workforce—the nuclear workforce—[so] we thought that was a negative…"

This example demonstrates the danger of making assumptions about the preferences of different individuals by mentally assigning them to specific agenda-driven "groups." While this research team did employ a stakeholder-group framework for this project, the purpose was to insure that a diversity of opinions from all segments of the community were considered, rather than to label specific stakeholders as being uniform in their preferences. In addition, the stakeholder approach allowed input from a variety of quarters regarding the cultural suitability of project protocols before their implementation in the larger community. Contrary to presenting homogenized perspectives among specific stakeholders, the focus groups uncovered a range of motivations behind people's choices and frequently illustrated tremendous variation among individuals with similar stakes in the ultimate disposition of the PGDP site.

Among the non-industrial land-use scenarios, Scenario 10 (i.e., expanded wildlife management area, partial onsite disposal of future wastes, and excavation and removal of legacy wastes) had both a higher average score and the least negative distribution of scores. The somewhat higher mean for this scenario is related to less negative ratings, reflecting a possible judgment of lower risk by more participants. This contrasts with other scenarios that earned higher ratings with extremely high positive ratings in the face of fewer but still strongly negative ratings. The data suggest that among the non-industrial options, expanding the current and familiar land use is preferable either to a more intensive, formal recreational use or to a very restrictive, no-access approach. This judgment may be related to the lack of documentation of adverse effects from current usage on the wildlife management area. Thus, a more restrictive option may be perceived as unnecessary. On the other hand, more intensive *human* exposure, particularly involving the large numbers of children implied by recreational facilities, has no precedent on the site, leaving participants reluctant to endorse potentially more risky land uses.

The reasons for individuals' support for or opposition against a particular scenario can be quite varied. Consider the range of reasons, from economic development to cost to safety, given by participants who opposed structured recreational land use within the existing PGDP footprint:

- "You're replacing pretty much everything on this site, with the exception of the DOE offices and the DUF_6 facility, with recreational facilities despite the fact that the infrastructure is here for much more. The water treatment plant, the sewer system, power, natural gas. All of that is here. So that's really what we're looking at in this particular case is just basically resigning to the fact of just putting a recreational facility out here and not pursuing other industry..."

- "[I]t really is, we believe, a bad use because of the transportation and the utilities that are here that could support major heavy industry or light industry. There's a lot of capabilities here."

- "[We] felt...like makin' recreation inside the fence would cost more because it would take better cleanup in order to have recreation opportunities there. And could it ever be safe enough for people to want a form of recreation out there?"

- "It would be...difficult to convince the community that this area is ever gonna be clean enough to go out there with their children and do soccer, baseball, whatever it might be…"

9.4.2 Scenario Scoring Preferences by Age

Collection of demographic data such as age and gender allows for a more detailed examination of the scenario preferences. A breakout of scenario preferences by age category is provided in Figure 9.4.2.1. While the general pattern of preferences is maintained across the age groups, there are important differences to note. The largest demographic in the region has a preference pattern that is less favorable toward industrial uses and more favorable toward non-industrial uses than the older age grouping. Given that our participants are heavily weighted toward that older demographic, additional data to correct the imbalance may provide somewhat different overall preferences.

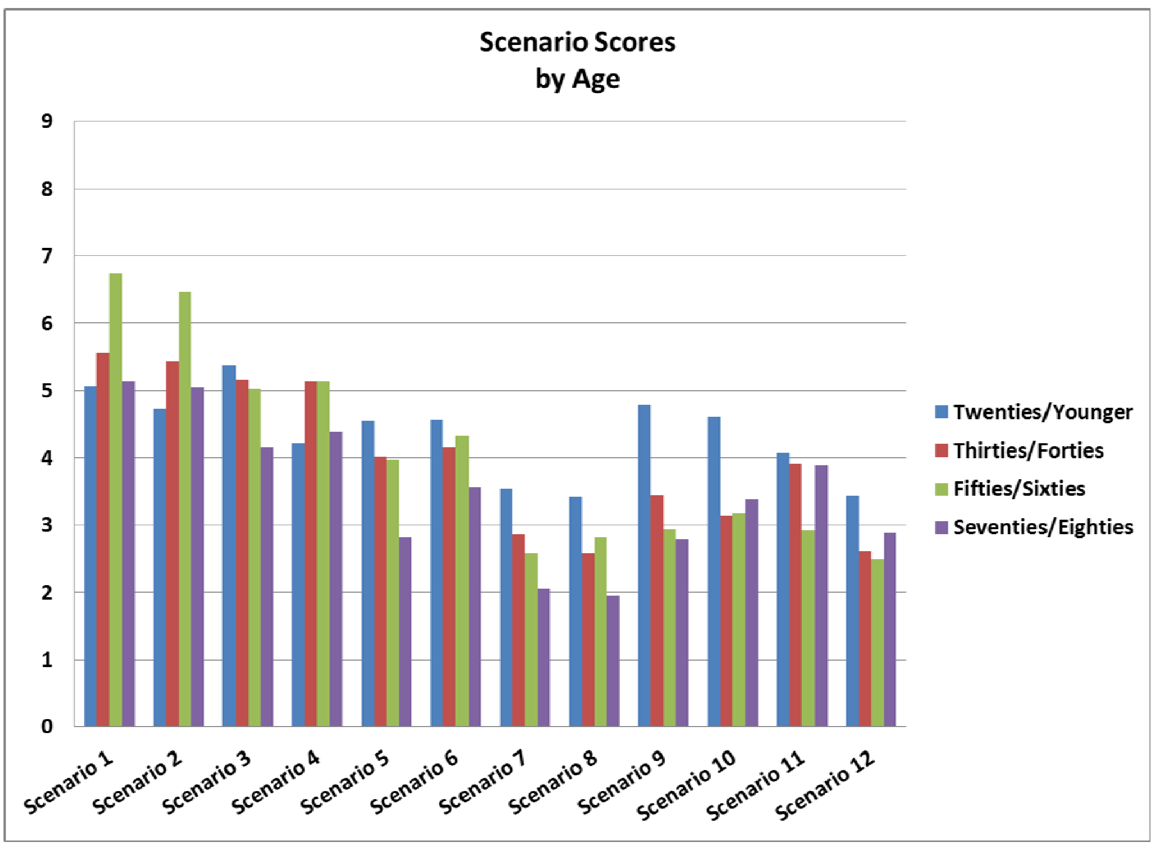

Figure 9.4.2.1 Scenarios Scores by Age

9.4.3 Scenario Scoring Preferences by Gender

A breakout of scenario preferences by gender is provided in Figure 9.4.3.1. The same observations may be made for women vs. men in the region. The relative patterns of preference between men and women were consistent; however, the strength of the preferences for the different scenarios was different, and not always directly proportional. Correcting the gender composition of the participants may well yield somewhat different summary results.

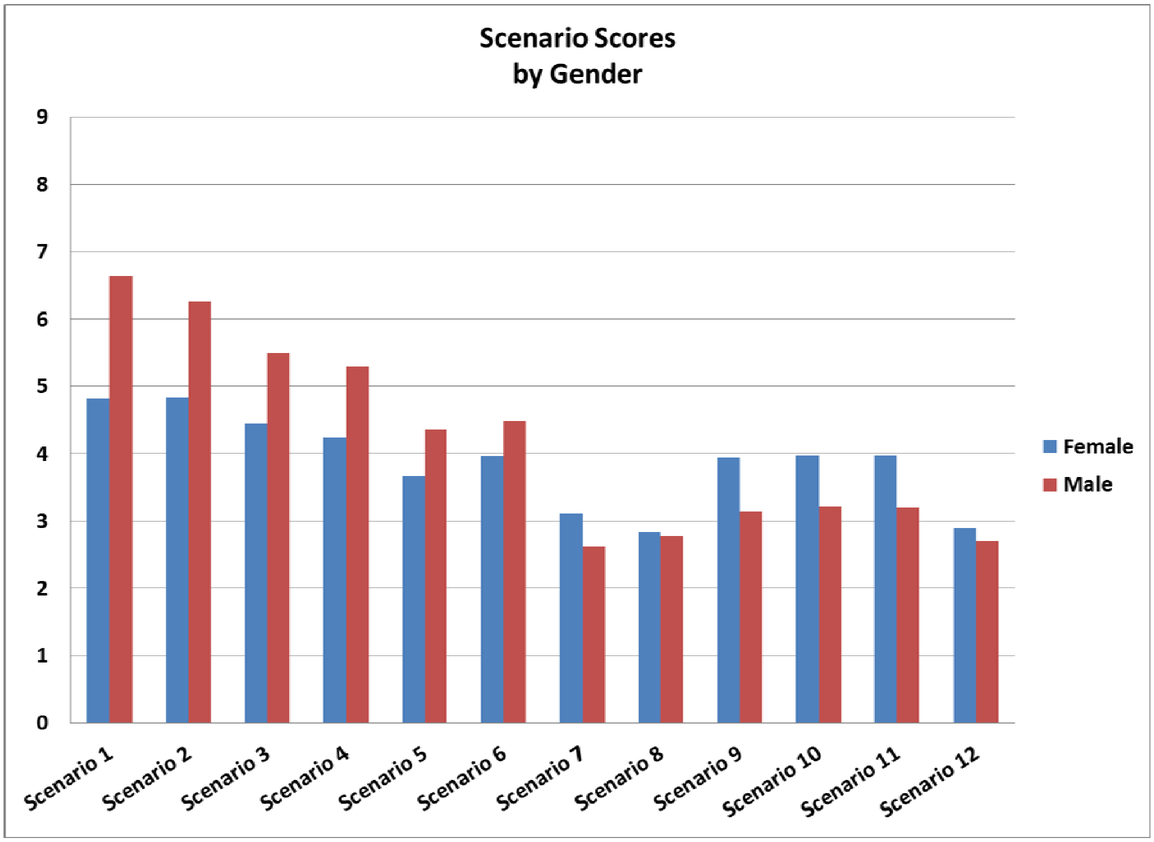

Figure 9.4.3.1 Scenario Scores by Gender

9.4.4 Scenario Scoring Preferences by Place of Residence

A breakout of scenario preferences by residence is provided in Figure 9.4.4.1. The most notable conclusion from this data is that those who lived further away had a more favorable view of the non-industrial options, including complete site closure. While Ballard County residents exhibited a strong preference for industrial uses, it should be remembered that this portion of the participant group was quite small and subject to large fluctuations in value. Interestingly, public meeting participants who self-identified as living near the PGDP provided higher average scores for the nuclear industry options than did Water Policy District focus group participants. It should be pointed out of course, that the Water Policy District represents only a part of the region identified in Figure 9.4.4.1 as “Near PGDP”; therefore, residents "Near PGDP" could include individuals who live outside the Water Policy District or perhaps may be employed at the plant, altering the balance among economic, health, and environmental concerns.

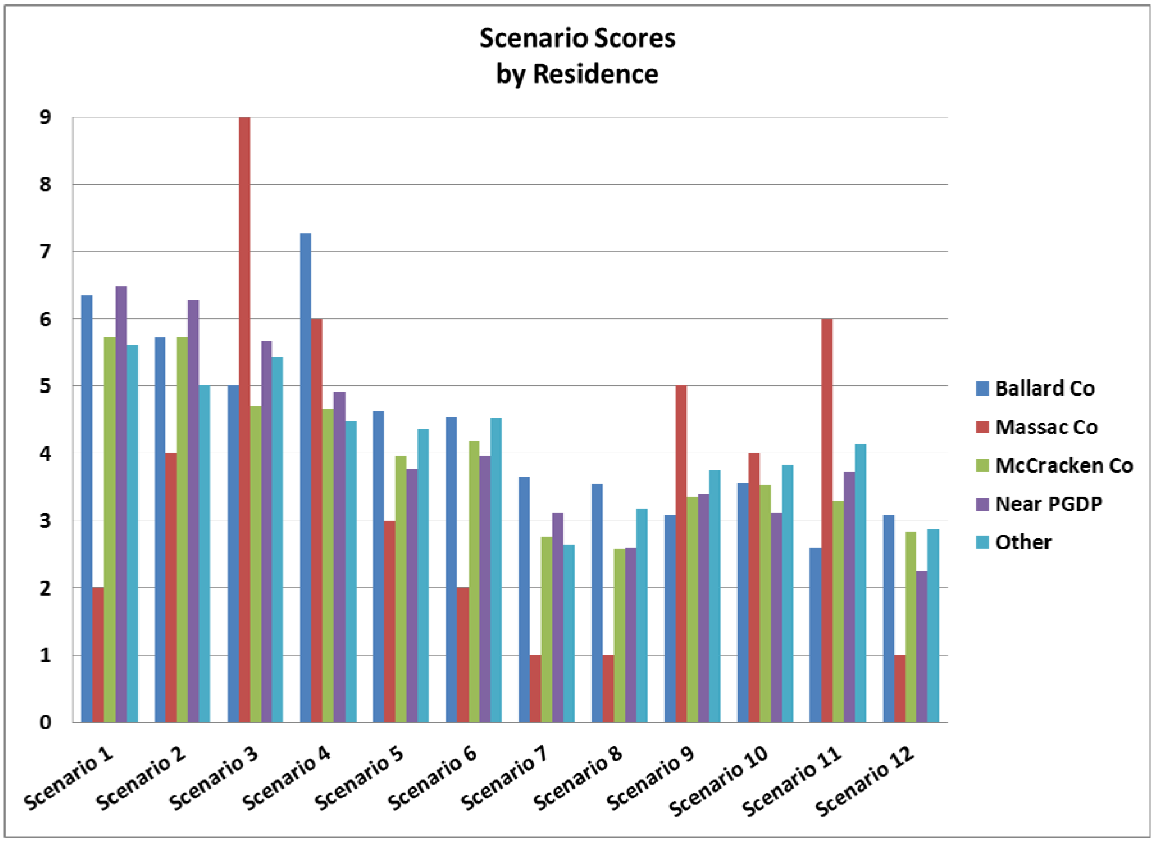

Figure 9.4.4.1 Scenario Scores by Place of Residence

9.5 DATA RELIABILITY ANALYSIS

In theory, as long as the scenario scoring process is consistent and fairly immune to changes in people's preferences over time, the external reliability can be validated by collecting new data until the resulting distribution of scores starts to converge to a fairly consistent distribution. The data collected to date tend to satisfy these criteria. As can be seen from Figures 9.5.1 and 9.5.2, the means of the data from the public meetings (128 responses) tend to mimic the mean of the online response (97 responses).

An additional implicit measure of data reliability can be inferred from a consistency in mean scenario scores across different meeting sites. While the data in Figures 9.5.1 and 9.5.2 do not explicitly satisfy this requirement, they do show consistency across the subgroups, which would be expected if the data are moving toward such uniformity. Thus, while the scores at each venue are different for each scenario, the scores do tend to track fairly consistently across the scenarios. A rank order analysis controls for the effect of changing mean scores. This analysis demonstrated that the rank order differences among scenarios are not great. This general trend can be observed across the scenarios, reinforcing the conclusion that the assembled data sets, although limited, show consistencies. This observed convergence across forums and groupings is consistent with previous large-scale public process conducted in this way, with multiple forums and stakeholder groups participating. The resultant convergence was then interpreted in this same way by research team members as well as State and Federal decision makers [Dietrich et al. 2008].

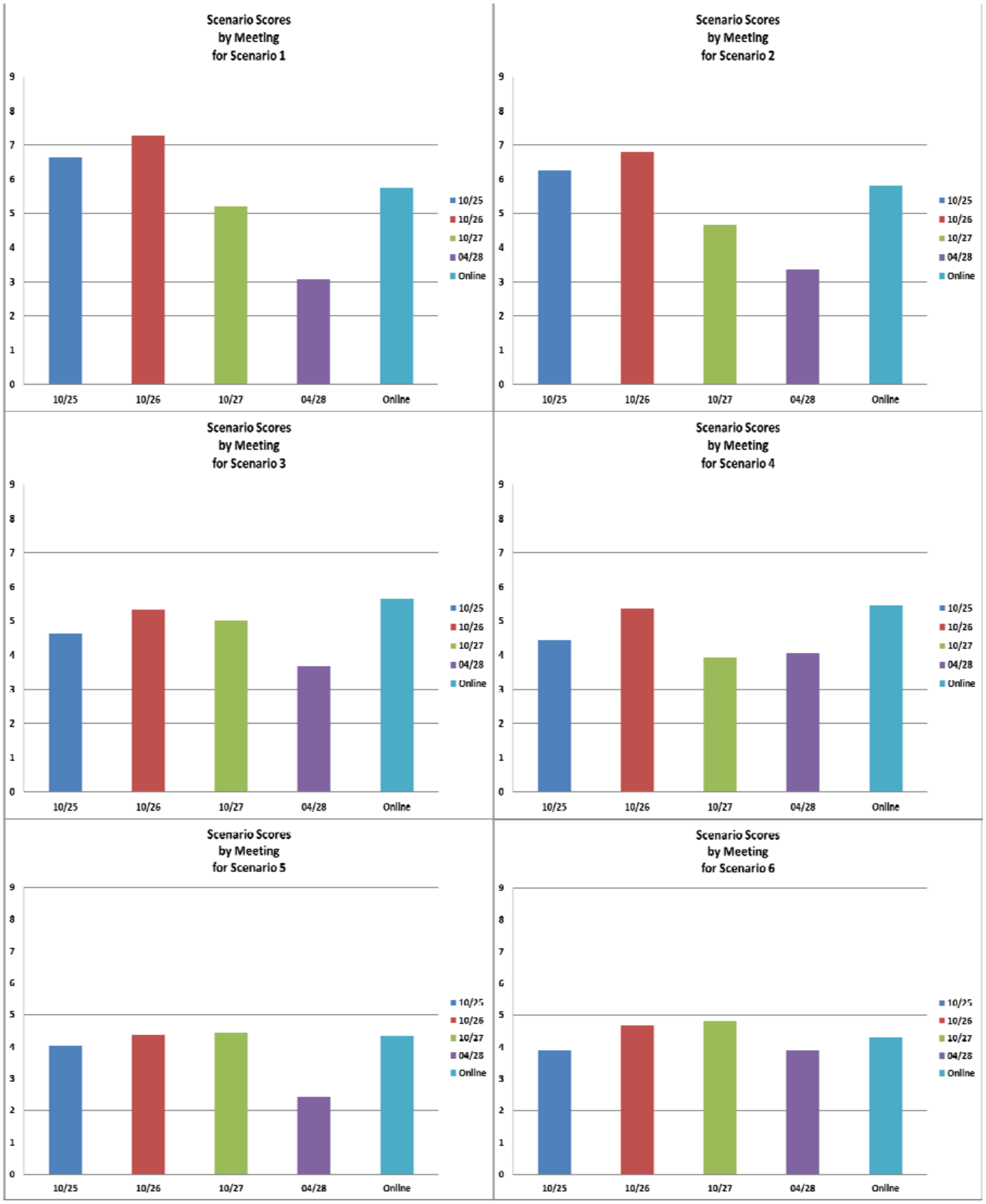

Figure 9.5.1 Industrial Land Use Average Suitability Scenarios Scores (i.e. 1 = least suitable to 9 = most suitable) Compared by Meeting Venue (Date)
[First block (blue) = 10/25, Second block (red) = 10/26, Third block (green) = 10/27, Fourth block (violet) = 4/28, Fifth block (aquamarine) =online]

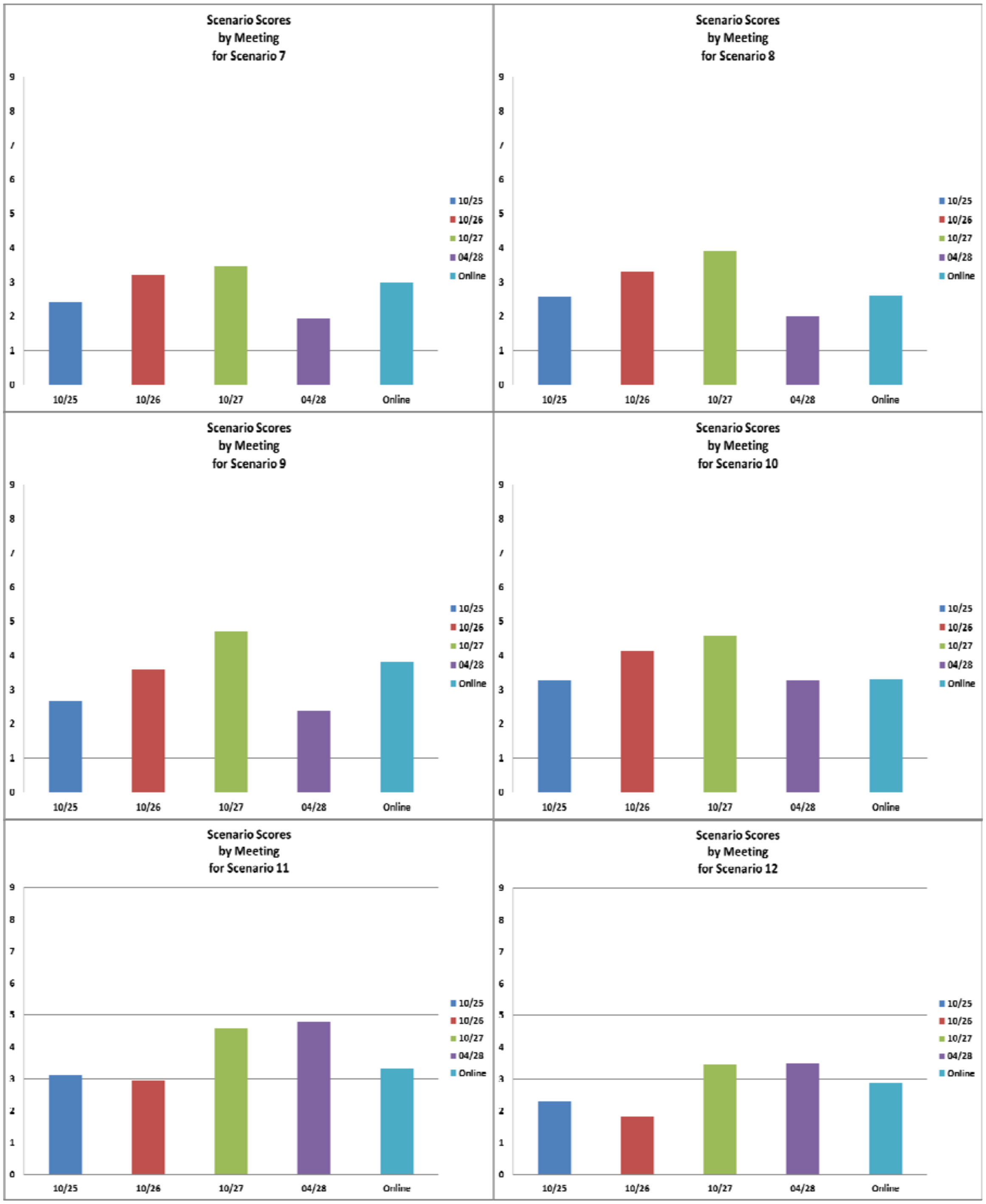

Figure 9.5.2 Non-Industrial Land Use Average Suitability Scenarios Scores (i.e. 1 = least suitable to 9 = most suitable) Compared by Meeting Venue (Date)
[First block (blue) = 10/25, Second block (red) = 10/26, Third block (green) = 10/27, Fourth block (violet) = 4/28, Fifth block (aquamarine) =online]

Finally, data reliability can also be tested by comparing data collected from the public meetings and the on-line responses with data collected from the focus groups. In theory, the data collected from focus groups should represent a reasonable sample of the larger community, since the focus groups were constructed explicitly to represent a diversity of stakeholders and stakeholder interests. A comparison between the scoring of these two groups is provided in Figure 9.5.3. While the scores for each scenario are not identical, the two series are very similar, providing additional confidence that the collected data are representative of the larger community.

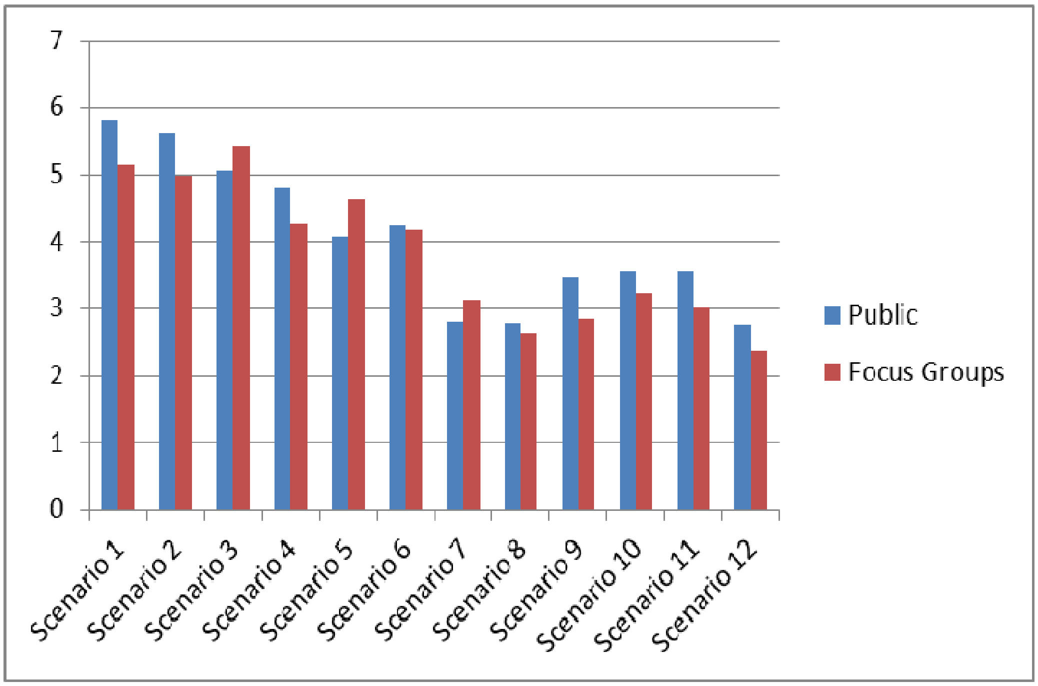

Figure 9.5.3 Comparison of Focus Group Meeting Average Suitability Scenario Scores (i.e. first/blue plot) vs Public Scenario Scoring Scores – both Public Meeting and Website Scoring (i.e. second/red plot), where Suitability Score of 1 = least suitable and a Suitability Score of 9 = most suitable

9.6 STAKEHOLDER SUGGESTED SCENARIO SCORING ANALYSIS

Following the participant scoring of the 12 scenarios, the participants were asked to provide scenarios of their own that were then scored. Among the four highest scores were participant-suggested scenarios that related to the establishment of a research facility. Detailed scoring results for each of these scenarios are provided in Figure 9.6.1. Because these ideas were offered on different days in different contexts, the number of participants scoring each scenario varies. Nonetheless, this set of options generated the most uniform positively rated options to date in the scenario rating process. However, there was still some level of opposition for all four scenarios. Most polarized of all was the Remediation Research Facility scenario, which had strong opposition from 20% of the participants but strong support from 64% of the participants. These options were not considered with any associated cleanup strategies. To attempt to do so would be somewhat confusing, since the cleanup issue is part of what defines the research center initially.

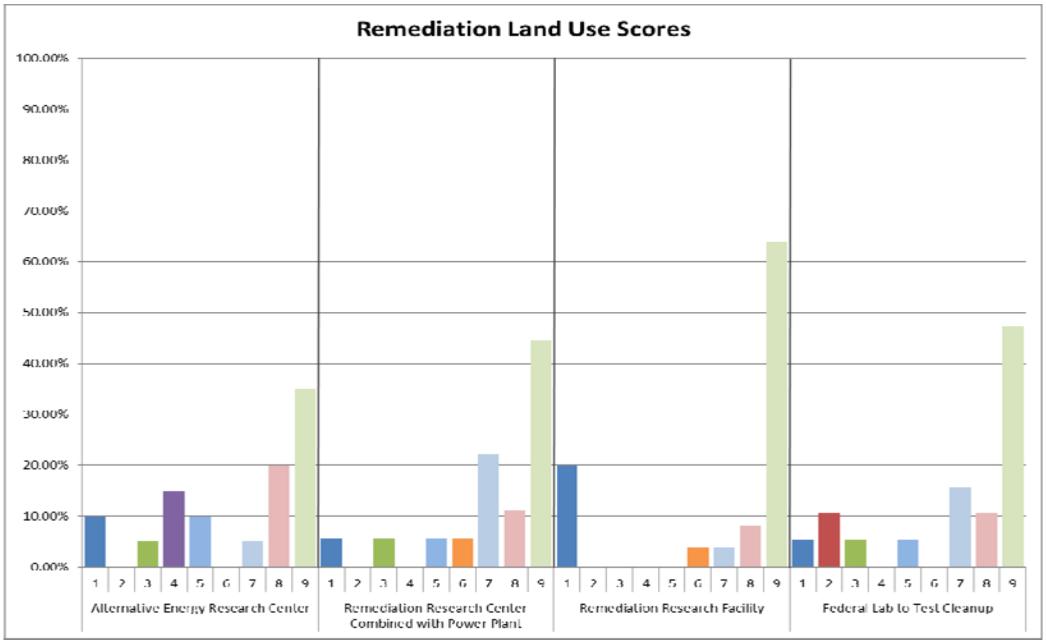

Figure 9.6.1 Detailed Scores for Stakeholder Suggested Remediation/Research Facilities (i.e. the percentage of the participants [*vertical axis*] that assigned suitability scores [*horizontal axis*] from 1=least suitable to 9=most suitable)

9.7 SECONDARY VARIABLE ANALYSIS

In addition to examining both the means and detailed distributions of scores for the different scenarios, researchers attempted to determine 1) if any of the secondary variables (i.e. WKWMA land use, future waste disposal options and legacy waste disposal options) significantly affected the scores or preferences of the six primary PGDP footprint land uses, and 2) whether the preference database can provide insight into community preferences regarding the secondary variables themselves. In general, there are two possible strategies for determining either the impact of or potential preference for secondary variables (i.e., WKWMA land use, future waste disposal, and legacy waste disposal). The first approach would be simply to ask preferences about each of the secondary variables in isolation from one another. However, experience has shown that most of the time the secondary variables are not independent of one another, nor independent of the primary variables and thus cannot be evaluated in isolation. That means that a person's preference for one secondary variable will most likely be dependent upon the associated primary variable or the stated condition or value of the other secondary variables. As a result, it is more useful to examine the secondary variables in the context of composite scenarios. However, as should be readily apparent, this is much more difficult to analyze than simply asking people's preference about a single fact. Despite such challenges there are ways that such insights can be obtained or at least inferred. These are examined in the following sections.

9.7.1 Histogram Analysis of the Impact of Secondary Variables on Primary Preferences

In general, changes in the secondary variables were not found to affect the preferences of the primary land uses preferences (at least as measured by the mean) to the extent that the participants shifted their primary land use preferences. This seems readily apparent from an examination of the distribution of average scores as shown in Figure 9.7.1.1. Although changes in the secondary variables are associated with some change in the actual scenario scores (e.g. 5.8 for Scenario 1 dropping to 5.6 for Scenario 2), the mean score for Scenario 2, is still above the scores for the remaining scenarios (e.g. the score for Scenario 2 did not drop below the score for Scenario 3). However, secondary variables did seem to impact Scenario 12 as compared to Scenario 11, with the mean score dropping from 3.6 for Scenario 11 to 2.8 for scenario 12. In Scenario 11 both the future wastes and the legacy wastes were all shipped offsite, while in Scenario 12 all the burial grounds were capped and left in place and all the future waste was kept on site. It would appear that the majority of participants preferred the institutional control scenario over the extended recreational scenarios (i.e. 7&8) if such changes in the secondary variables were made.

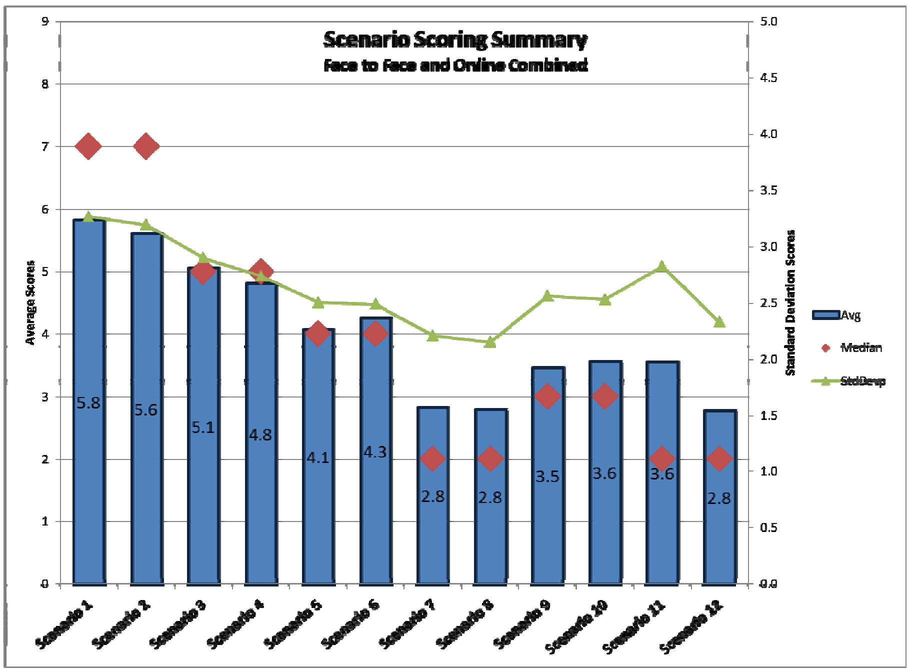

Figure 9.7.1.1 Average Scenario Scores from the Public Meetings and On-Line Scoring

9.7.2 Histogram Analysis of Preferences for Secondary Variables

One way to develop a hypothesis about the community preferences for secondary variables is to examine the scores of different scenarios that have the same primary variable (i.e. in our case the primary variable is the PGDP land use). For example, the mean scores for Scenario 12 are less than the scores for Scenario 11. This general pattern can be seen across all meeting dates, which reinforces the hypothesis that this reflects a consistent change (see Figure 9.7.2.1). Scenario 11 involves excavating the burial grounds and shipping all wastes offsite, while Scenario 12 involves capping and leaving the burial grounds in place and keeping all future wastes onsite. One hypothesis that may be developed from such a comparison is that all things being equal (i.e. the same primary land use), the community prefers that all waste (both legacy and future) be removed from the site. However, it should be pointed out, that there is another difference between Scenarios 11 and 12. Scenario 11 involves keeping the existing wildlife management area while Scenario 12 involves adding additional active recreational facilities. Thus, part of the reason for the decrease in scores might have been due to the land use change associated with the wildlife management area. Thus, while it may be hypothesized that the change in waste disposal was a more significant factor, this issue warrants closer examination.

One way to try to separate these issues would be to examine yet another scenario pair. For example, for Scenarios 3 and 4, there is a slight drop in scores (Figure 9.7.2.2). Once again, Scenario 3 involves excavating the burial grounds and shipping all wastes offsite, while Scenario 4 involves capping and leaving the burial grounds in place and keeping all future wastes onsite. However in this case, Scenario 4 involves keeping the existing wildlife management area while Scenario 3 involves adding additional active recreational facilities. The fact that the scores still go down, although not as dramatically as in Scenarios 11 and 12, would suggest that the majority of the participants (at least as characterized by the mean of their scores) prefer the elimination of all wastes from the site.

A similar type of analysis can be done by examining the differences between the scores for Scenarios 1 and 2 (Figure 9.7.2.3). In this comparison, the influence of the WKWMA land use is removed since both scenarios have the same land use option: keeping the existing WKWMA.

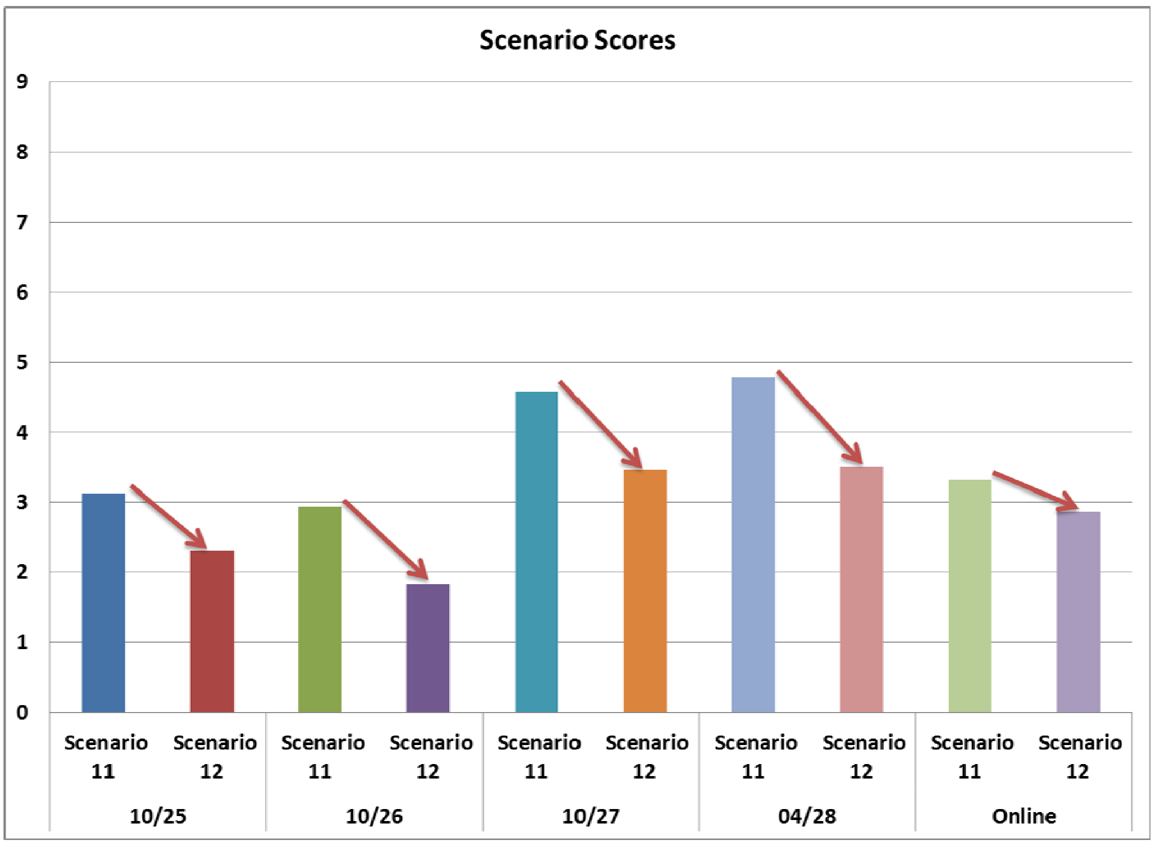

Figure 9.7.2.1 Comparison of Scenarios 11 and 12

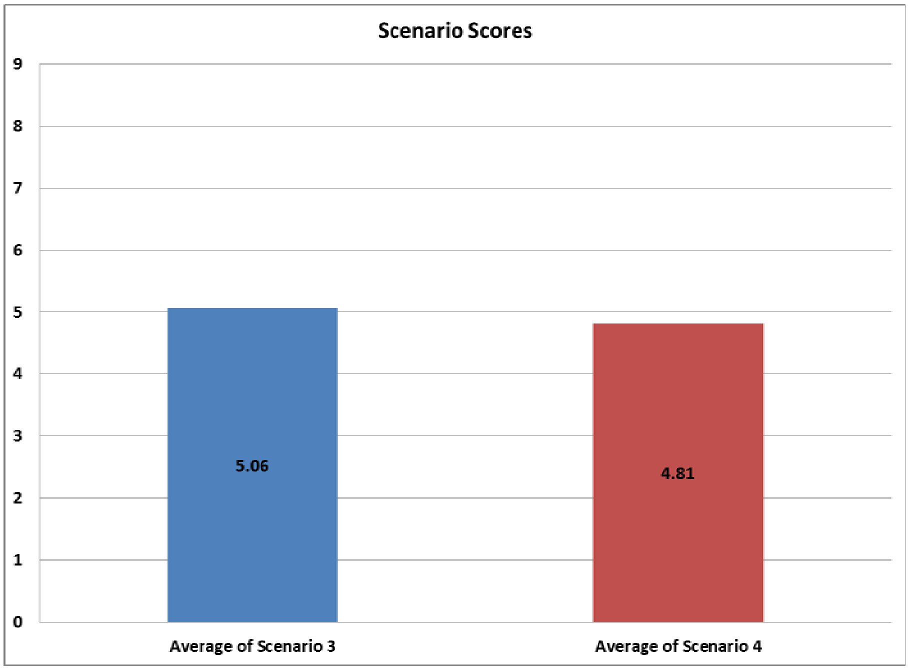

Figure 9.7.2.2 Comparison of Scenarios 3 and 4

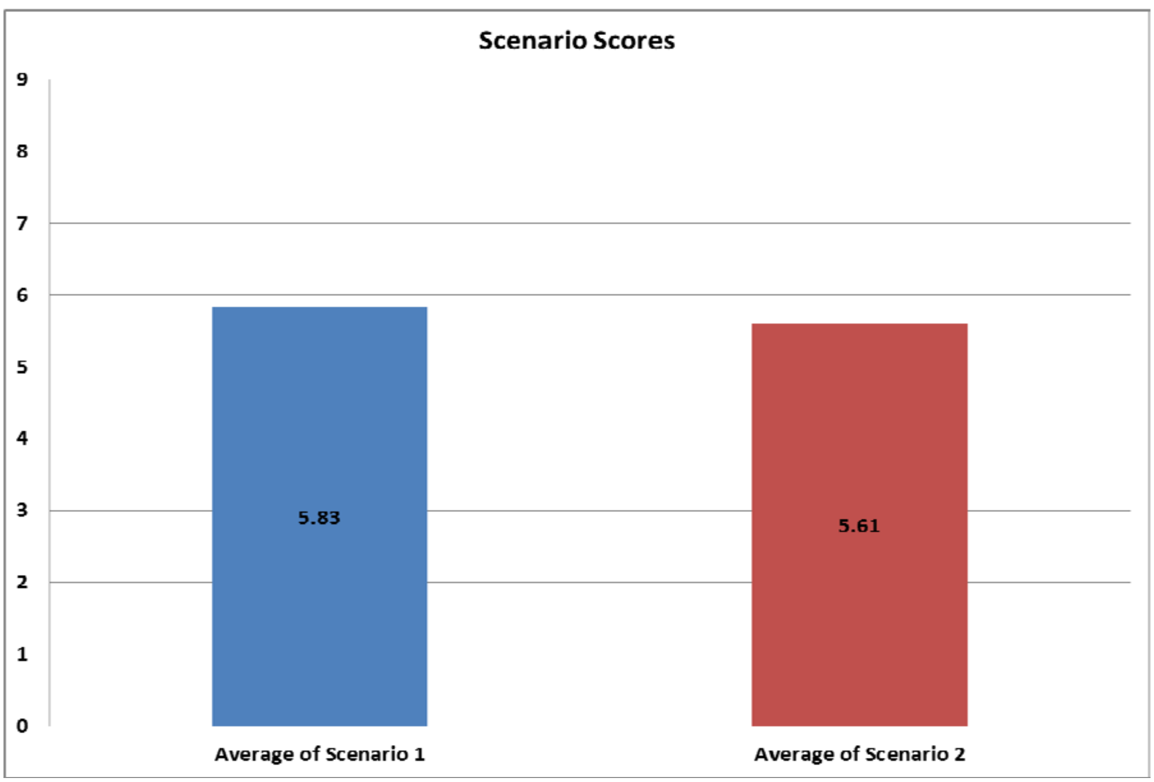

Figure 9.7.2.3 Comparison of Scenarios 1 and 2

Scenario 1 is associated with keeping all the future waste on site, while excavating all of the legacy waste. Conversely, Scenario 2 is associated with removing part of the future wastes while keeping all the legacy waste (i.e. cap and leave the landfills in place). The fact that the scores decrease seems to imply (at least in the case of the nuclear industry options) that the perceived risk posed by leaving the burial grounds in place may outweigh the perceived risk associated with managing the decommissioning wastes on site. Thus, one might hypothesize that shipping part of the wastes offsite to minimize the size of the storage cell was not enough to erase the negative evaluation of the burial grounds.

It should be emphasized that the perceived risks associated with various land use configurations were not directly measured during the scenario evaluation protocol. The criterion used for scenario adjudication was "suitability." This is a composite term for evaluation of the scenarios. The research team deliberately chose an inclusive term that permits citizens to express their value systems in ways that seemed appropriate to each of them. Among large groups, this method avoids the problem of debate breaking out regarding the relative significance of components of the evaluation and stalling the evaluation procedure.

Disaggregating the content of the "suitability" criterion would require a structured content analysis of the focus group discussions. This was not part of the study design. However, the evidence of the project supports the view that risk is implicated in the systemic adjudication of suitability. This link to risk is clear from the previous qualitative work undertaken during the CBPC protocol. For example, a number of the comments provided by the focus groups explicitly highlighted the issues of risk associated with the nuclear plant option. From section 7.3.2.2.1 in the report: "A second question focused on whether participants thought the scenarios were a good or bad future use for the site. Valuations varied based upon the ways in which speakers prioritized competing employment, environmental, health, and seismic risks, with most participants recognizing multiple areas as important considerations. <u>However, some participants expressed concerns about the increased risk related to building a nuclear power plant at the PGDP location</u>."

More than one participant at more than one forum raised this issue. See also section 8.3.1 for a discussion of risk associated with nuclear plant end-state land use. The association between certain land use possibilities and risk should not be disregarded entirely, and the text acknowledges this concern qualitatively. However to formalize and quantify the citizen risk perceptions associated with the specific land use alternatives, it would be necessary to conduct a focused evaluation protocol that deals directly with this issue. This did not fall within the existing scope of work. Nonetheless, the research does suggest the following two hypotheses:1) the majority of the community (as measured by the means of the preference scores) prefers that all the waste be removed from the site, and 2) the majority of the community has a higher priority on removal of the legacy waste than the future D&D wastes. In presenting these hypotheses there is an implicit assumption that they are valid for all of the six primary land uses. Because of the way the different scenarios were constructed, this was not explicitly examined, although some insights to this question has been provided by examining the qualitative and quantitative differences between scenario pairs (e.g. 1 to 2, 3 to 4, 11 to 12). Additional insights to these questions can be evaluated through a more detailed CaVE analysis.

9.7.3 CaVE analysis

The additional potential impacts of the secondary variables on the primary variable can also be analyzed by applying Casewise Visual Evaluation (CaVE) to the entire data set (see Appendix R for more details). Such analysis employs Fuzzy Knowledge Builder software, allowing the user to develop a three-dimensional surface (much like a three dimensional model of topography) from a limited set of observations -- in this case the preference scores from the twelve scenarios. In this problem, the scenario scoring data set the model output for each of the twelve known scenario values. The input values were the planning and land use parameters developed from the scenario table (see Figure 8.4.1). Each scenario (a set of four inputs) mapped to one output (mean suitability score for that scenario).

Because most problem applications involve more than two variables (in our case we had four: PGDP footprint land use, WKWMA land use, future waste disposal, legacy waste disposal) the user must specify or hold constant all but two of the variables in order to be able to visually inspect the results in three dimensional space (e.g. Figure 9.7.3.1). Once these variables are set, the software is then able to generate a surface based on different combinations of the remaining two variables. A series of 2D slices from the four dimensional knowledge base then can be generated. Each slice illustrates how suitability (the z-dimension of the plot) responds to changes in two of the input variables (the x- and y- dimensions of the plot), with the other two held constant in the background. The z-dimension was shaded, where the darkest shades (and highly raised surface) represent highest suitability (a mean score of 5.25 or above on the 9 point scale used for scenario evaluation), through lighter shades (and moderately raised surface) which represent moderate suitability (around 4 on the 9-point suitability index), and again slightly darker shades (and lowered surface) which represent the lowest category of suitability (a mean score of 2.8 or less on the 9-point suitability index). Thus, the full range of average preference scores from the least to the most preferred is 2.77-5.83, or 3.06 points out of full range of 9. This seemingly narrow range is to be expected given the broad range of opinions about the options, and is comparable to other large public preference processes conducted by the authors. For example, a bridge aesthetic preference process in the Kentucky/Indiana area with approximately 180 participants yielded a highest-to-lowest preference range of 4.1 out of 9.

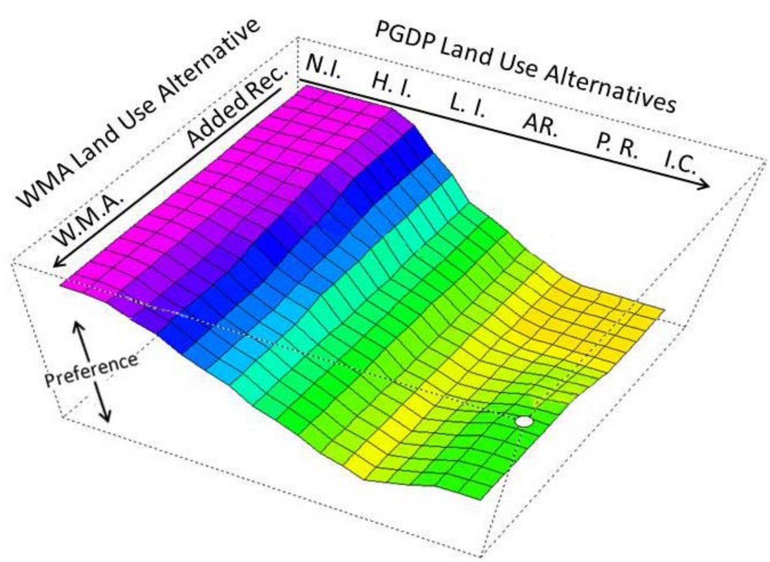

Figure 9.7.3.1 Land Use Preference Pattern When all Wastes are Removed Off Site. {Note: Preference Declines Quite Uniformly from High-intensity to Low-intensity Land Uses, with the Caveat of Some Interaction between W.M.A. Uses and the Institutional Controls Option}.

While the foregoing discussion analyzes the interactions of preferences of all participants for the PGDP site, a consistent challenge, is the bi-modalism of the raw scores themselves. In many cases the computed mean of the scores, used as a representative measure for all the scores, was actually only chosen by a rather small proportion of respondents. This trend is revealed by the relatively large standard deviations that rise and fall with the computed mean scores. This can become problematic when very fine distinctions are drawn between average scores, as we attempt to extract the maximum amount of information from the database. This overall pattern of bi-modalism is exhibited across the spectrum of participants and is not limited to face-to-face meetings, for example. It also raises the possibility that there are distinct subgroups of respondents, whose high and low preference scores interchange at opposite ends of the land use scale. This effectively results in a situation where the standard deviations are quite high in comparison to the means, making the means less reliable as an indicator of centrality (Figure 9.7.3.2). This becomes important when one is attempting to read meaning into fine discriminations between mean scores.

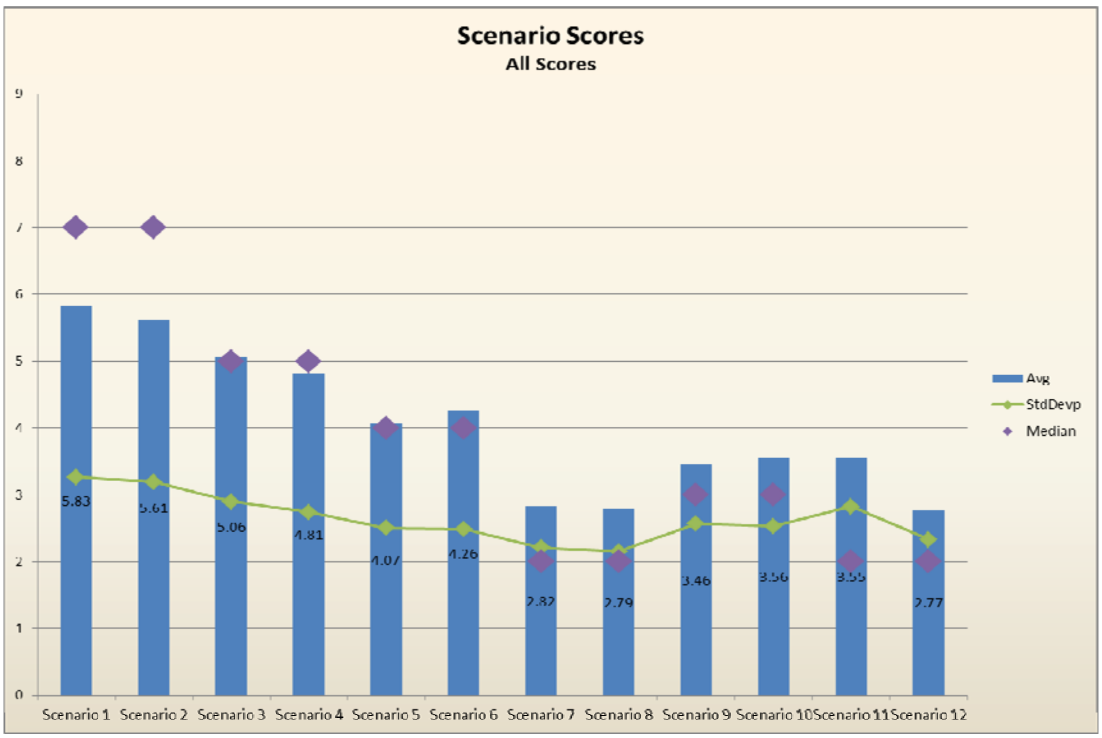

Figure 9.7.3.2 Mean Scores From All Data Sources {Note: Because of bi-modal scores, standard deviations for the overall group scores are more than 50% of the mean}.

In an effort to address this question and to better understand the data, the data were clustered to group data strings by the similarity of values and the differences between the means for each of the groups. In effect, this data clustering acted as a pattern recognition tool that helped the research team identify participants' scoring that grouped similarly by scenario. The outcome of the process was to identify the number of subgroups whose within-group scoring differences were the smallest and between-group differences were the largest.

The data clustering is most effective with complete response data, however, because missing data points create ambiguity in the groupings. While a total of 221 respondents provided some input on the scenarios, 67 failed to score all 12 scenarios. This left a net of 154 complete data sets. Table 9.7.3.1 demonstrates how the overall mean preference scores for the 154 subset of observations compare similarly to the overall 211 observation set.

Table 9.7.3.1 Comparison of Scenario Mean Scores using 154 Subset of Fully Completed Surveys vs. Including Additional 67 Partially Completed Surveys.

Scenario Number	154-sample subset mean scores	221-complete set mean scores
1	5.857	5.830
2	5.578	5.610
3	5.214	5.060
4	4.994	4.810
5	4.169	4.070
6	4.240	4.260
7	2.656	2.820
8	2.695	2.790
9	3.487	3.460
10	3.305	3.560
11	3.526	3.550
12	2.714	2.770

Using the 154 subset of fully complete data sets, the data clustering yielded three distinct subsets of respondents with similar scoring patterns. These three subgroups are discussed below.

9.7.3.1 Group 2 Analysis

Subgroup 2 is the largest, at n = 68, and responds strongly and positively to the high land use intensity scenarios, with distinct preference differences between nuclear (around 8), heavy industry (around 6), light industry (just over 4), and all other land uses (around 2). The non-industrial uses are nearly uniformly disliked, with only minor preference shifts that mirror the directions of the other two subgroups. The range of mean preference scores is quite wide for this group (over 6 points), with a highest mean score in excess of 8 and a lowest mean score below 2. Nonetheless, the standard deviations for these mean scores range from 1.6 to 2.6, so there is strong agreement within this group about the preferences (Figure 9.7.3.3).This subgroup appears to be highly focused on the perceived economic impacts of various industrial scenarios. A fuzzy set model was created to further inspect these observations, with the following results.

In Figure 9.7.3.4, Group 2 members showed a moderately decreasing preference for land uses as they progress from high intensity to low intensity when the decommissioning wastes and legacy wastes are excavated and removed from the site. Keeping the West Kentucky Wildlife Management Area (i.e. W.M.A in Figure 9.7.3.4) "as is" generates a comparatively higher preference than structured recreation facilities when the primary land use is light industrial (at "X"), and a slightly higher preference for structured recreation facilities in the surrounding W.M.A. when the plant site is devoted to recreational facilities (at "Y"). Otherwise this group is comparatively indifferent to the two considerations.

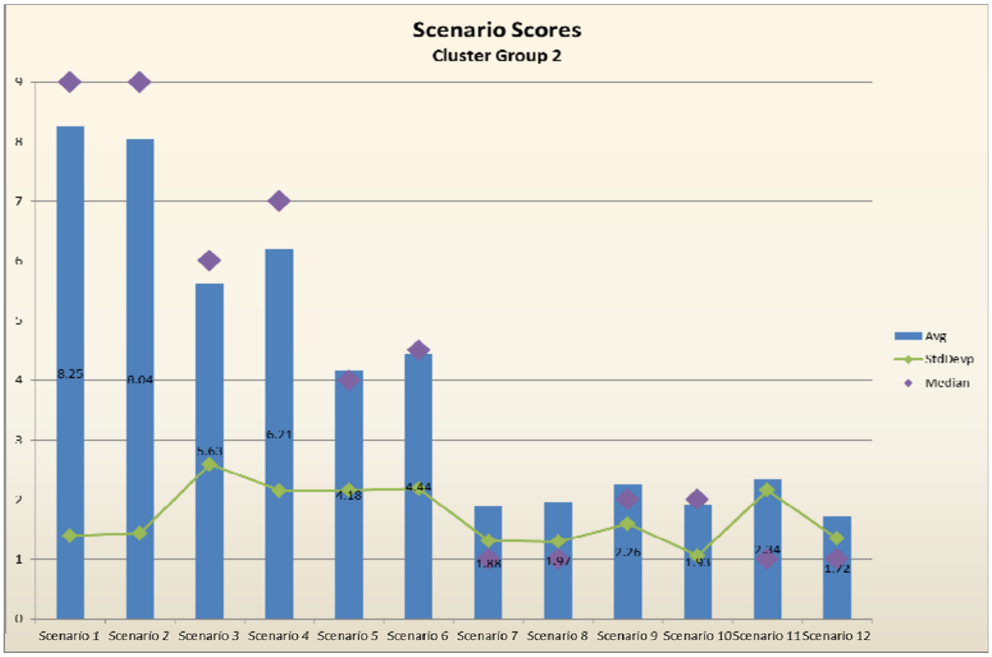

Figure 9.7.3.3 Group 2 Preference Scores by Mean, Median, and Standard Deviation for all 12 Scenarios

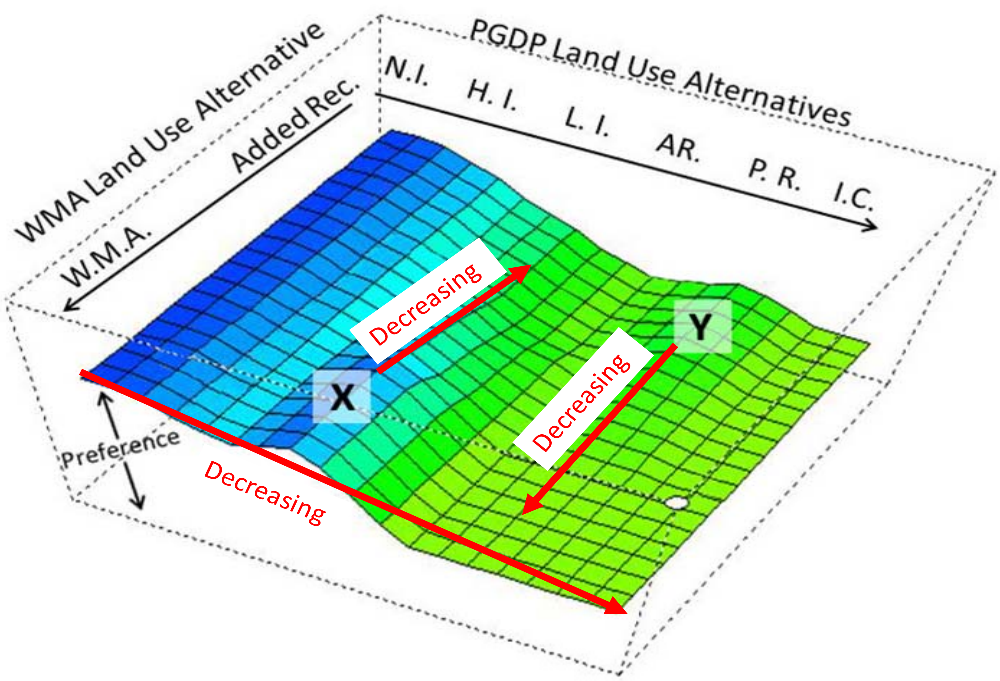

Figure 9.7.3.4 Group 2 Pattern of Land Use Preferences when all Decommissioning Waste is Shipped Offsite and Legacy Wastes are Fully Excavated

However, for the same group (i.e. Group 2), when all the decommissioning wastes are kept onsite and the legacy wastes are minimally excavated, the preference surface changes significantly (see Figure 9.7.3.5). Under these circumstances, Group 2's preferences for the decreasing intensity of land uses is more strongly stratified, with highest preference for nuclear industries and trending lower rapidly as land use intensities drop. The nuclear industry option preference is enhanced if the surrounding WMA is retained, instead of devoting part of it to structured recreation facilities.

In sum, this group's preferences respond strongly to the primary land use, and the difference in their preferences between high and low intensity land uses is increased when the cleanup strategy is designed to retain the maximum amount of waste onsite.

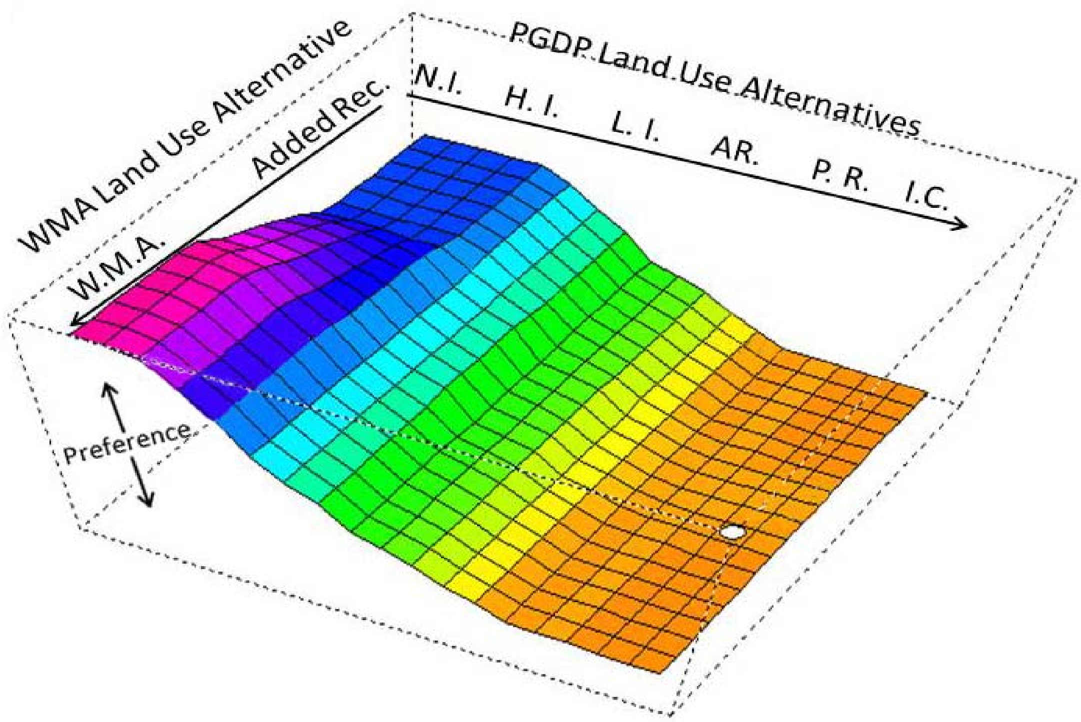

Figure 9.7.3.5 Group 2 Preferences for the 12 Scenarios When all Decommissioning Waste is Stored Onsite and Legacy Wastes are Minimally Excavated

9.7.3.2 Group 1 Analysis

Another subgroup, Group 1 (n=43), exhibits a less stratified preference pattern for the land uses overall, with scores that are moderately favorable for industrial and W.M.A. land uses, but slightly to moderately unfavorable scores for structured recreation facilities and for institutional control scenarios (Figure 9.7.3.6). Interestingly, this group provided rating differences of about one point within the nuclear and heavy industrial option pairs, but rated the differences between any of the other pairs of land uses at less than half a point, and in three pairs (light industry, structured recreation, and W.M.A. options) the within-pair difference was only about one-tenth of a point.

It appears that considerations such as the surrounding WMA treatment and cleanup alternatives matter more to this group when nuclear or heavy industry options are involved, and less under other circumstances. For example, Scenario 3 consists of removing the maximum amount of legacy and decommissioning waste from the site, and outscores its landuse pair (Scenario 4) by about one point, which is 30% of the total range of scores for this group. The range of scores for this group is narrower than Group 2, from a high of slightly under 7 to a low of slightly under 4, or about 3 points total difference. The standard deviations for these scores range from just over 2 to just below 3, indicating there is a comparatively greater difference within the scores for this group as compared to Group 2. The group's least favorite scenario was 12, (Institutional Controls) a relative (low) preference shared by Group 2.

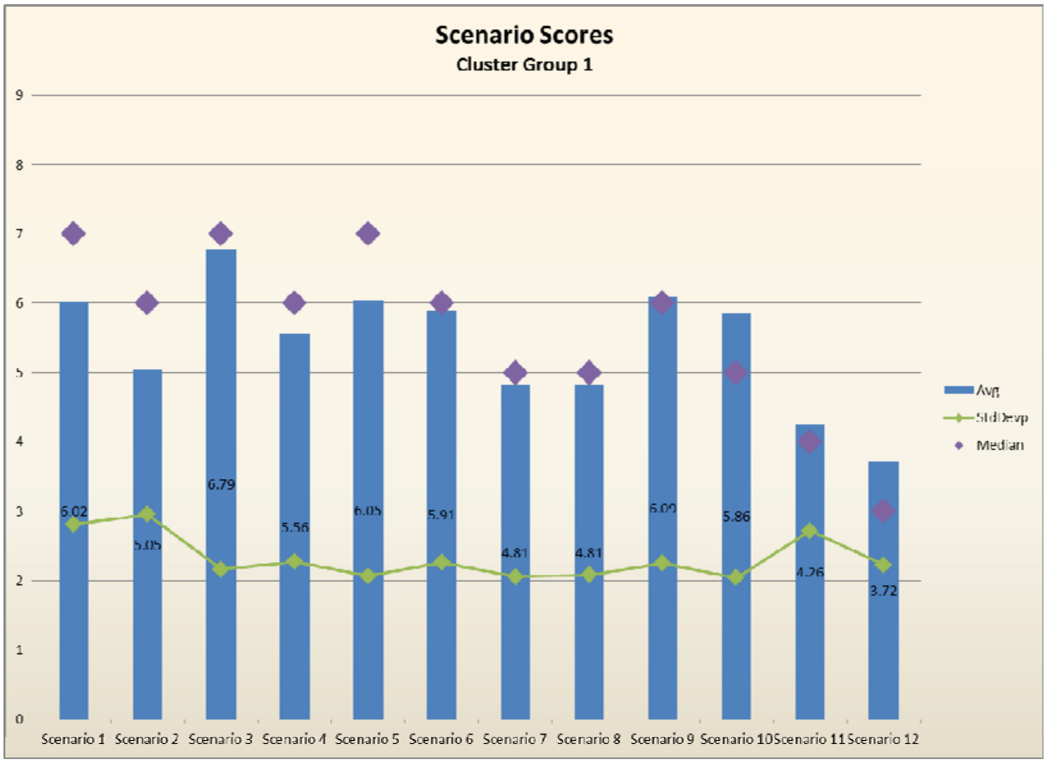

Figure 9.7.3.6 Group 1 Mean, Median, and Standard Deviation Scores for 12 Scenarios

To further understand the impacts of cleanup considerations on overall preference for this group, we chose to develop a multi-variable fuzzy set model of the preferences expressed within this dataset. This model allows us to view the interactions in somewhat more detail, as shown in Figure 9.7.3.7. This figure shows a different perspective of the preference model with the results associated with scenarios 3 overlaid on the surface. This surface models the pattern of preferences by Group 1 for all the combinations of the two cleanup aspects, Disposal of Legacy Wastes along the X axis, and the size of the decommissioning waste structure (as characterized by the Height of the Waste Disposal Alternative) on the Y axis, <u>when the primary land use is heavy industrial and the WKWMA includes structured recreation facilities</u>. Here, preference scores increase as the size of the waste structure decreases; when it is altogether absent, a complete excavation of legacy wastes increases the preference even more (lower right hand corner associated with scenario 3). This pattern of preference is similar, but not as intense for nuclear industry land uses which also retain the existing WKWMA as is (Figure 9.3.7.8). Removing the decommissioning waste has a slight positive influence on preference, as does fully excavating the legacy waste, but the combination of the two does not increase preference additionally

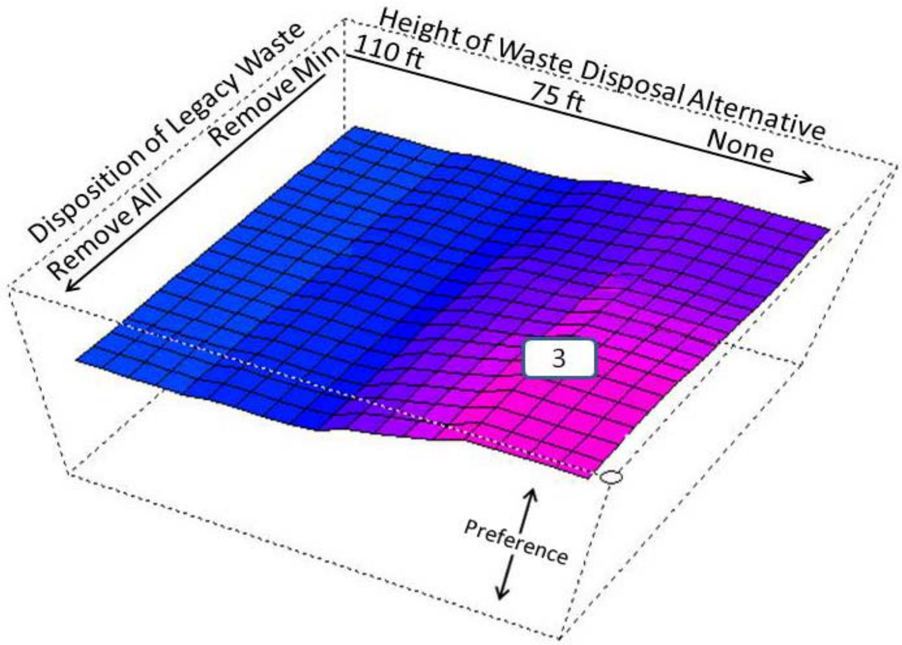

Figure 9.7.3.7 Group 1 Preference Pattern for Cleanup Combinations When Land Use is Heavy Industry with Structured Recreation in the Surrounding WMA

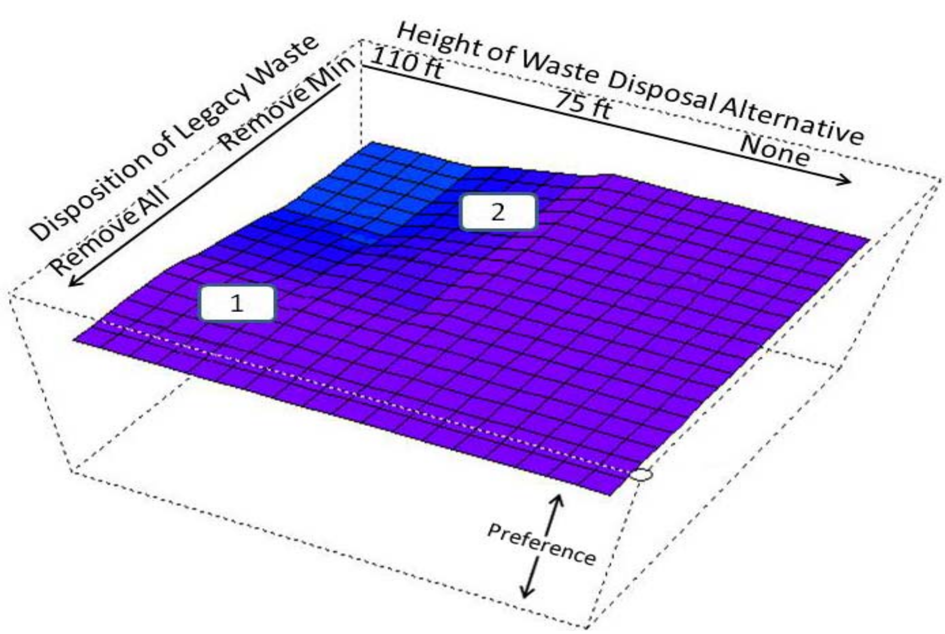

Figure 9.7.3.8 Group 1 Scenario Preferences for Nuclear Industry with Surrounding WMA kept as is with the Results for Scenarios 1 and 2

On the other end of the land use spectrum, Institutional Controls, Group 1 participants showed a slightly higher score for Scenario 11 over 12, as discussed earlier, but the difference was so small that the model surface changes by just a small amount (Figure 9.7.3.9). The overall preference for Institutional Control scenarios is lower than that for the industrial uses just discussed, however. For Group 1, then, increasing amounts of waste removal from the site increase the appeal of certain scenarios (those discussed) and the minimization of the decommissioning waste onsite has a somewhat more observable impact on preference than excavation of legacy wastes.

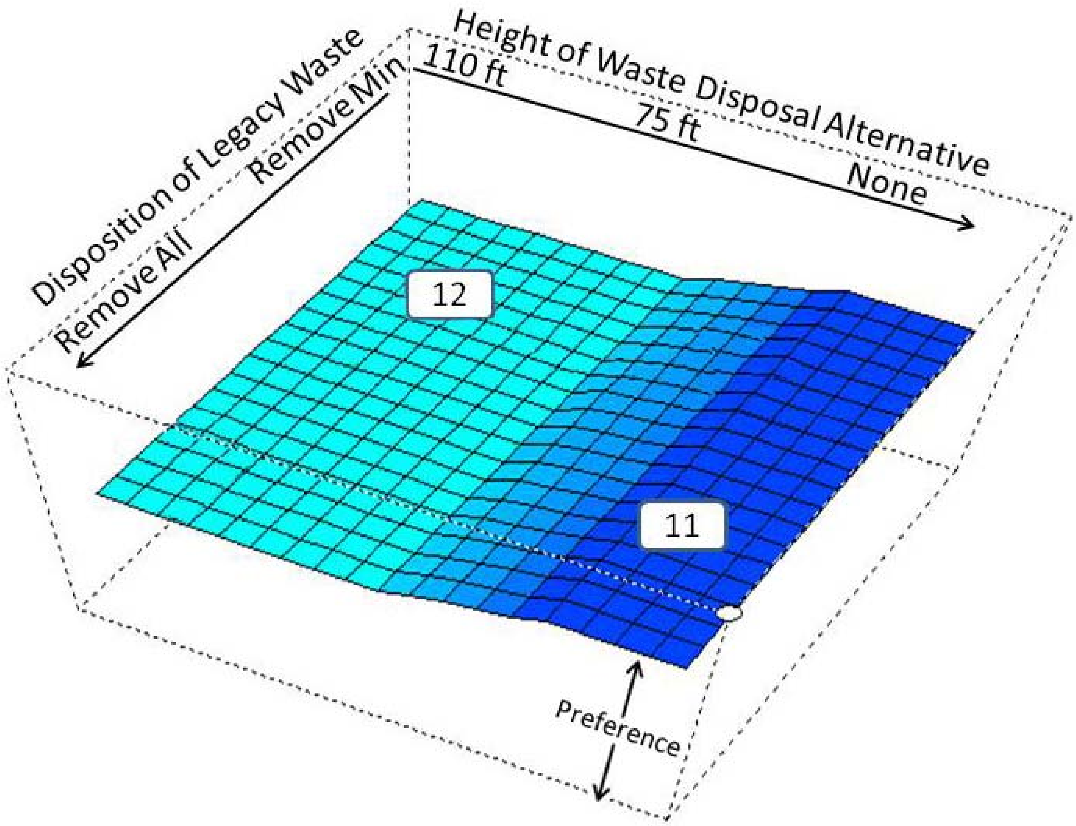

Figure 9.7.3.9 Group 1 Preference Pattern for Institutional Controls Land Use (model surface is identical regardless of keeping the WKWMA as is or adding recreational facilities) with Results for Scenarios 11 and 12

9.7.3.3 Group 3 Analysis

Notwithstanding an occasional isolated high score for an individual scenario, [e.g. 3], the third subgroup (Group 3, n = 43) polled a consistently low suitability for almost all scenarios, with only the two institutional controls scenarios mean scores even rising above a preference level of 3 (Figure 9.7.3.10). Scenario 11 scores almost 5 (neutral) with this group, while Scenario 12 scores just above 3. In essence, this group has a fairly strong dislike for every alternative at the site with the slight exception of scenario 11, which consists of removing the maximum amount of legacy and decommissioning waste from the site, maintaining the WMA surrounding the plant, and strictly limiting access to the plant site. This could be considered a preference for minimizing human exposure, in comparison to any other alternative. Similarly, Scenario 3 exhibits a local 'high' for all of the various industrial land uses (partially due to a few isolated scores of 9), and represents, again, an option where the maximum amount of legacy and decommissioning waste is removed from the site. Given that even Scenario 11 did not quite rise to neutral, one might hypothesize that the members of this group as a whole would prefer even stronger steps to minimize human exposure.

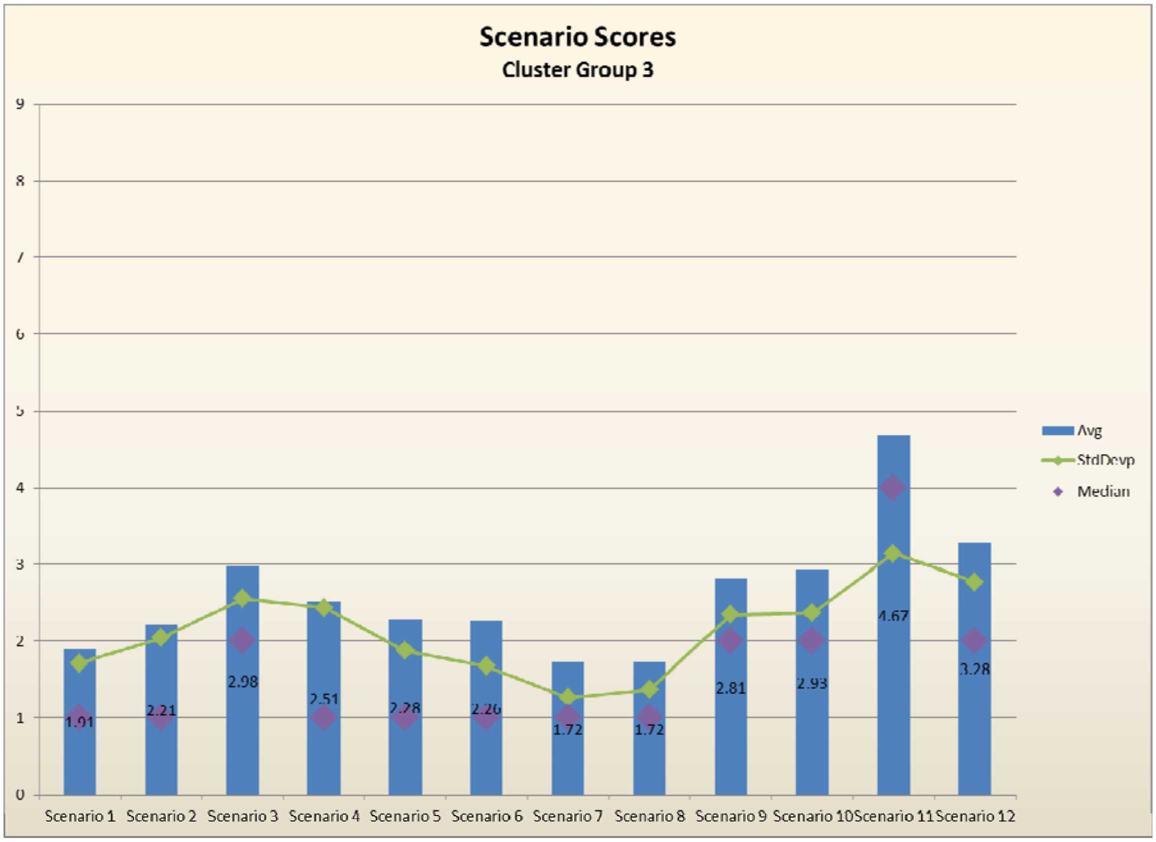

Figure 9.7.3.10 Group 3 Scenario Preferences by Mean, Median, and Standard Deviation

The range of scores for Group 3 was again relatively narrow, from just below 2 to just below 5. The standard deviations for these scores ranged from 1.4 up to 3.2 (for the highest rated scenario). It is worth noting that the standard deviations were quite high in comparison to the means themselves, and indeed varied up and down with the mean scores. To illustrate this, a scatter plot was prepared to explore the properties of the responses. This scatter plot reveals no ‘strategic’ behavior on the part of participants: rather the extremely low average scores dictate that any score that begins to move off of a median of 1 necessarily generates a higher standard deviation. Thus the standard deviation pattern is an artifact of the extremely low average scores (Figure 9.7.3.11).

Based on the results exhibited by the participants in Group 3, there is little if any additional information to be gained by attempting to impute interactive variability of preference, and so no fuzzy set modeling is presented for this group. In short, the group’s strong preference for limited exposure overrode the land use considerations themselves. This group is highly focused on cleanup considerations and strategies to minimize human exposure.

By creating these three subgroups, we have significantly reduced the standard deviation as a proportion of the mean scenario score within each group, giving us much more confidence that the mean accurately expresses a tendency within the subgroup. It is worth noting that only nuclear and heavy industrial options were rated above neutral preference by at least two of the three subgroups. Structured recreation on the plant site, and institutional control scenarios were rated below neutral by all three groups.

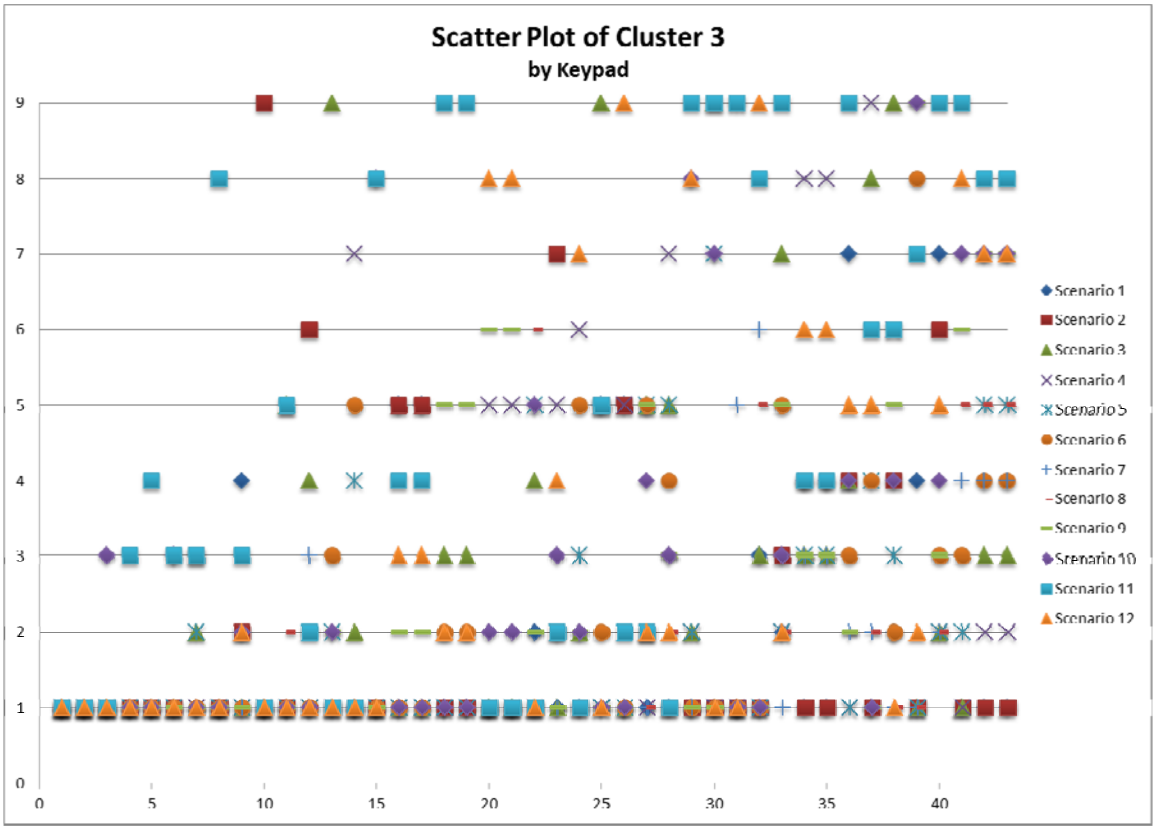

Figure 9.7.3.11 Scatter Plot of Group 3 Scores Registered by each Keypad for each Scenario. Vertical Scale Represents the preference Score, Horizontal Scale Represents each of the 43 Keypads, and Key on Right Side Indicates which Scenario (1-12).

9.7.3.4 Summary

Several things can be learned from analysis of the three subgroups. First, it is important to remember that the size of the groups cannot be considered a proxy for the proportions in the general population, as the participation levels, while broadly appropriate to the community in terms of gender and age, are not an exact scientific sample. Nevertheless, we can say that they represent three significant sets of opinions in the community that must be acknowledged as the process moves forward.

Next, it is apparent that there is not an easy solution that will please everyone, especially as concerns the disparity of issue focus between Group 2 (land use) and Group 3 (minimize exposure). It is useful to understand, though, that there is also a significant portion of the community that tends to slightly favor industrial types of land uses, and the appeal of these land uses to this segment can be enhanced by higher levels of cleanup. In this portion of the scenario range, Group 2 exhibited a weaker preference for higher levels of cleanup, but not outright opposition. Group 3 was generally opposed to all industrial land uses regardless.

It is worth noting one more aspect of the scenario scoring process. Satisfaction with the process itself was considerably higher than satisfaction with any of the scenarios. In terms of the participants, this is useful information. It tells us that, as with most public goods, different people will be impacted differently and thus the uneven nature of the distribution of goods (distributional fairness) will generally provide uneven preference ratings, as exhibited here. However, the method of making the decisions about the distribution of goods (process fairness) can be kept quite high (as it was here), and can contribute to the acceptability of the ultimate outcome.

Thus the process of developing the cleanup and land use options for the site needs to focus on both "What is to be done" in terms of fairness of impacts, but also on "How we decide what is to be done" to maintain fairness of process and thus greater acceptance of the outcomes. There remains work to be done in further refining the relationship between particular land uses, identifying new land uses, and better understanding the cleanup options as technology advances. Continuing to deploy democratic and open processes for exploring the alternatives will yield higher quality data and higher acceptance for the decisions made during the process.

9.8 PROCESS SATISFACTION SCORING ANALYSIS

The process satisfaction scoring results also were evaluated by meeting venue (date) in order to see if there was any underlying bias (either positively or negatively). These results are provided in Figure 9.8.1. As can be seen from the figure, the results appear to be fairly uniform across all three meetings, with the participants at the April 28th meeting providing slightly lower scores that at the other public meetings or the online survey. It his hypothesized that part of the reason for the lower scores at the April 28th meeting was the fact that the scenario presentation and scoring was added on to an existing neighborhood association meeting which ultimately affected the continuity of the presentation. Nonetheless, the general satisfaction of most participants was fairly high and in contrast to the comparable low Arnstein scores associated with past public meetings.

Previous experience with SPI protocols in various public goods management questions has shown that these scores can contribute to the legitimacy of the final outcomes, subject to several conditions being observed. The first is that the data set is as transparent as possible. The team has ensured this by showing the results in real time at each of the public meetings, by posting all results promptly on the project website, and by hosting regular discussions with the stakeholder groups identified in the CBPC phase to keep them updated and elicit feedback. The second is that the influence of groups that are perceived to "game" such processes is kept in proportion. The SPI protocol is designed to accomplish this using the simultaneity, transparency, anonymity and immediacy of real-time electronic polling in the public forums.

9.9 PROCESS RELIABILITY ANALYSIS

A key concern for project sponsors is the degree to which the valuations elicited as part of this process can represent those of the community at large, and hence the degree to which recommendations generated from this process can be considered reliable, legitimate and defensible by stakeholders (Fisher, 2000). The word "reliability" indicates the degree to which the conclusions reached in this report are likely to be sustainable in the face of inevitable disagreements on the part of individual stakeholders owing to the perceived inclusion and legitimacy with which the data was elicited. It does not refer in its normal system dynamics sense (Keeney et al., 1990) to the internal robustness or replicability of modeling results or the algorithms used in the preference modeling undertaken as a component of the project.

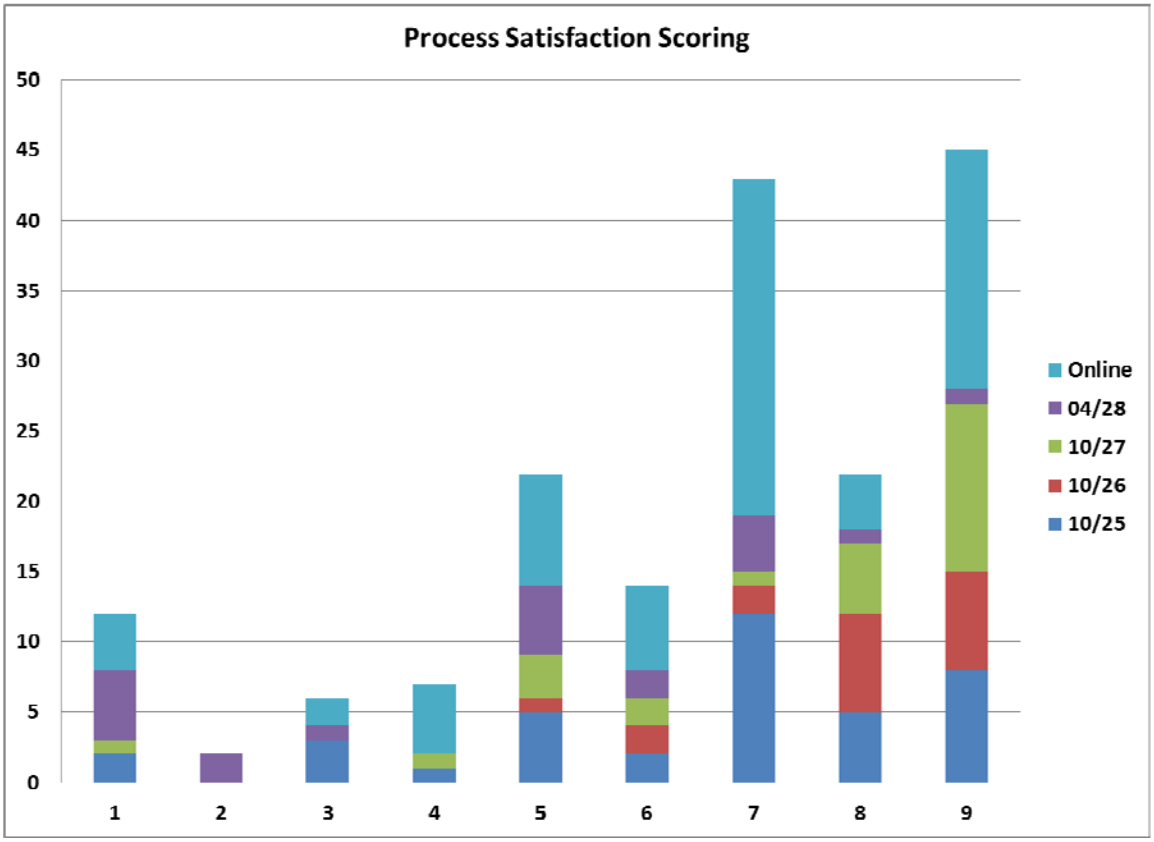

Figure 9.8.1 Participant Process Rankings broken out by Meeting Date

An extensive literature exists in the field of stakeholder participation in environmental management that discusses factors affecting the quality of this representation (Wellstead et al., 2003). Valuations that are elicited from small groups, or that are unrepresentative of the range of valuations, are not reliable for planning and management purposes. It is likely that planning or future use recommendations derived from unrepresentative data will be resisted because they will not be viewed as legitimate by large numbers of stakeholders (Rowe and Frewer, 2004). In particular, members of the public who have not been involved, either because they chose not to become involved or were not aware of the public meetings at which values were solicited, can view the results and the analyses with some skepticism.

Although it is not possible to solve these problems totally without a complete inventory of stakeholder valuations across the entire relevant population, which is infeasible for a project of this scale, there are methodological approaches that can strengthen the quality of the process and deliver a more robust data set from which future land use recommendations can be developed (Rydin and Pennington, 2000). Designing the public involvement process around specific performance aims is a critical first principle (Rowe and Frewer, 2000). This not only permits the team to measure the protocol performance objectively, but the documentation of this performance is related to the legitimacy and durability of the results achieved using data generated by the public involvement protocol (Bell, 2004).

The project team has substantial experience with large-scale public involvement in questions of environmental management and infrastructure provision (e.g. Grossardt, Bailey and Brumm, 2001; Bailey and Grossardt, 2003; Jewell et al., 2006; Bailey, Grossardt, & Pride-Wells, 2007;

Bailey and Grossardt, 2010). These projects have involved more than ten thousand stakeholders in five states over a period of more than ten years. The projects have ranged from highway and electric power transmission line corridor alignment to transportation infrastructure and environmental management questions. The methodological approach to stakeholder involvement in this project is based on the Structured Public Involvement, or SPI, protocol that was developed in 1999 by team members. The SPI approach was significantly modified to respond to earlier work conducted under the supervision of Dr. Lindell Ormsbee and the Community-Based Participatory Communication Protocol (Anyaegbunam et al., 2010). A risk communication element was included, as discussed in earlier sections of this report, prior to beginning the public involvement phase.

Some unique process challenges existed prior to the initiation of this future land use visioning project for the Paducah Gaseous Diffusion Plant. First, the levels of risk of various land use regimes and associated waste disposal regimes are not precisely known (US DOE, 1992, p.34). Numerous hydrologic and physiographic factors such as the speed of the dissolved solvent plume cannot be estimated with certainty (Ormsbee and Hoover, 2010). This is not unusual in environmental management issues but because of the sensitive nature of the PGDP and its operations, these considerations were at the front of participants' minds. Second, the values of participants from whom valuations were elicited during the focus group phase were not believed by the participants themselves to correspond necessarily with the valuations of the public at large. Third, there were generally low levels of historical trust in the sponsoring agency and hence in this project. This report does not investigate the reasons for this situation, but the team did document the confidence levels of the focus groups. The team polled the perceived and desired Arnstein Ladder levels, and the results for the perceived levels were significantly lower than those seen in the universal database (e.g. Bailey and Grossardt, 2006, 2010). These findings indicate low levels of public trust of the sponsoring agency.

As discussed previously, the Arnstein ladder measures citizen perceptions of the quality of public involvement on an eight-point scale (Arnstein, 1969). The ladder, and derivatives of it, have been used extensively in a range of fields to measure to what degree citizens feel they have been involved in matters ranging from the provision of transportation facilities (Arnstein, 1974) to healthcare services (Tritter and MacAllum, 2006).

Although there are a number of factors that condition responses to the Arnstein Ladder, trust in the project sponsor’s good faith in soliciting public input, and their proven willingness and ability to do so, are some of the dependent factors in environmental management questions (Collins and Ison, 2009).

Low Arnstein ladder levels are linked to project participation. People with profound distrust of an agency can choose to opt out of the process altogether or 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. According to the National Research Council (2008), “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” (p. 212).

We would submit that this describes many environmental issues of the day, including the PGDP. For whatever reason or reasons, the level of confidence in the US DOE regarding the PGDP is very low. The Arnstein Ladder levels documented here are congruent with the evaluation of Site-Specific Advisory Board (SSAB) functionality conducted by Battelle (2003). This particular situation is not for the team to remedy; however, it contributes to an unwillingness by the public to engage in the process. Extensive outreach has been conducted to encourage participation by the public, and the results have been modest. Conversely, those who do participate in the public meetings have a high opinion of the process. It is the team's hope that this positive experience will encourage others to invest their time in the process, as well.

In a review of US DOE SSABs, 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 tend to be risk-averse, and thus commitment-averse, an attitude that works against making open-ended commitments to decisions fashioned 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 dynamic can 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.

The research team's prior work indicates that the Arnstein Ladder can be a useful heuristic for understanding the perceptions and the aspirations of both the public and agency professionals regarding public involvement (Bailey and Grossardt, 2003, 2006). 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, as well as 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. This is important 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 their own preferences. It also reveals that professionals have a higher opinion of how well they deliver public involvement than the public does. The PGDP focus group data sets show this same trend, with those involved more closely with US DOE believing that the quality of onging public involvement is higher.

These findings are not new. They apply in various measures system wide to US DOE-supervised and other Superfund sites. They are documented in the SSAB evaluation report authored by Battelle (2003) and earlier work by team members including Dr. Ormsbee (KRCEE, 2007a).

Given this situation, there were four key process performance criteria that the team felt had to be addressed (Bailey, Grossardt, and Ripy, 2010). The first is the observed process quality, from the viewpoint of stakeholders. This metric provides an immediate evaluation of the perceived utility of the process, its efficiency, and its trustworthiness, from the viewpoint of stakeholders.

The second is the degree of representation. This can be determined by an inclusion metric, i.e. the total number of participants, and by disaggregating the total count to allow additional demographic segmentation and matching metrics to be computed, e.g. the proportion of underserved participant groups who attend the meetings can be compared with the proportion in the sample region.

The third is the clarity of the process, or its utility for the professionals who must translate stakeholder valuations into land use management plans. In previous processes, narrative evaluations have been elicited by third parties from project sponsors, subject experts and professional collaborators (e.g. FTA 2004, Michael Baker 2008). This process has not yet reached the point at which this performance metric can be evaluated because the final land use recommendations have not been developed.

The final metric is the overall efficiency. This can be computed on a benefit-cost basis using the total expenditure on public involvement as cost basis and the performance across other process criteria, e.g. the quality, inclusion and clarity criteria, as the numerator. At the present time, insufficient data exist system wide to permit this efficiency metric to be compared with other processes. Ultimately, it is expected that formal selection criteria will be developed and that documenting other aspects of process performance is a necessary, if not sufficient, step in that direction.

To evaluate the stakeholder process perceptions, the team employs a Q-metric, i.e. a stakeholder process “Quality” metric. At the conclusion of each public meeting, the public attendees are asked to evaluate the quality of the process from their perspective on a Likert scale of 1 through 9 points, where “1” is “awful” and 9 is “wonderful.” 1 to 9 is used because the TurningPoint electronic polling system keys used at these meetings correspond with each integer available. This data is normalized using a 1 to 10 point scale to allow comparison with the historical SPI database (e.g. Bailey and Grossardt, 2010). The results from this project are summarized in Figure 9.9.1 as broken out by each meeting venue. The chart shows a frequency distribution of the quality evaluations. The stakeholders who attended the meetings felt that the process was highly effective. A mean stakeholder satisfaction score of 7.3 across all meetings, when normalized to a 10-point scale. This performance evaluation is consistent with that undertaken in previous SPI protocols (e.g. Bailey and Grossardt 2003, 2007, 2010, and Jewell et al. 2006). This performance evaluation is unique in the PGDP case and in nuclear project literature.

It is interesting to note that the mean of the first three public meetings is very similar to the mean score from the on-line responses. The mean of the fourth meeting is hypothesized to be lower than the other means due to several issues, the primary issue being a change in the meeting protocol. In the case of the fourth meeting, the protocol was appended to an existing quarterly neighborhood meeting that went beyond the originally anticipated time frame. As a result the time associated with the protocol had to be compressed which ultimately led to a less than ideal implementation.

It is possible that access constraints and knowledge constraints, as well as the supposition that the process being used is as unproductive to attend as typical public meetings, disincentivize attendance and participation. Unsolicited verbal commentary from several meeting attendees validates this viewpoint. These phenomena are not necessarily related to people’s valuations of specific outcomes. Using a method that effectively decouples participants’ attachments to outcomes from their adjudication of process quality is critical to the success of projects of this type, which deal with controversial facilities.

Prior to the kickoff at the first public meeting, some verbal conflict broke out between two groups of participants. This was suspended by the facilitator when the meeting started. By the end, the participants were focused on the data and the options being discussed, and there was a voluntary rapprochement between several of those who had earlier exchanged critical comments. Although it is not realistic or feasible to expect that even a highly transparent, accountable process of this type will eliminate all conflict, the observed behavior over time and the overall mean process evaluation scores indicate that despite some participants' suspicions of one another's motives and their hostility towards each others' viewpoints, they all felt that the process performed well.

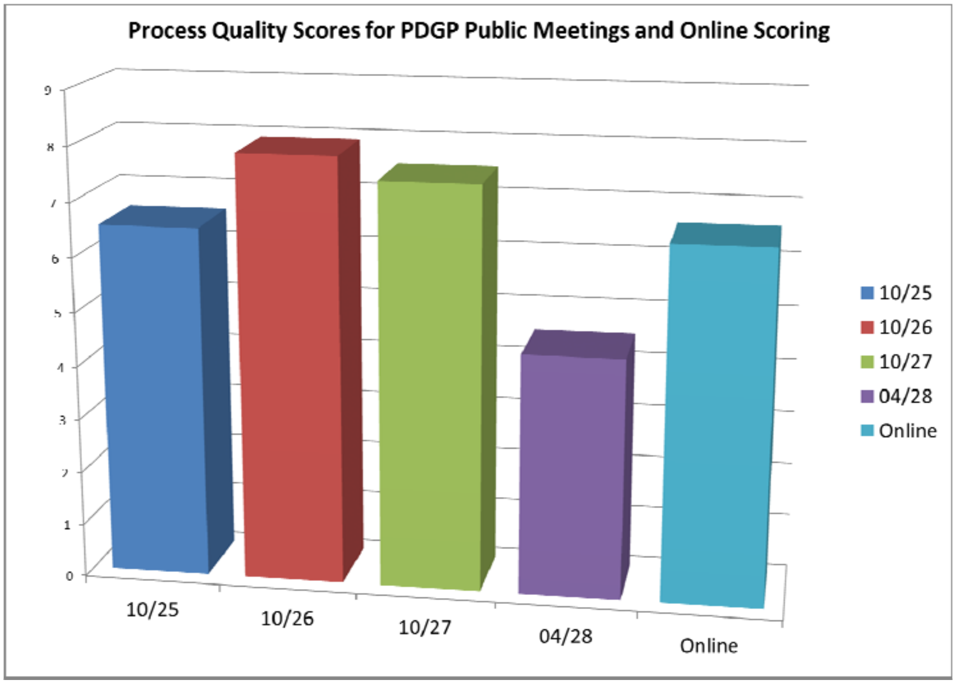

Figure 9.9.1 Stakeholder Q-metric for PGDP Public Meetings and Online Scoring (Note: Y axis = process quality score: 1=awful to 9 = wonderful).

With respect to the potential correspondence between valuations documented here and those of the public who did not attend, the project team cannot know if the people who did not attend the meetings possess valuations that are more, or less, polarized than those who were polled. However, experience of large-scale public involvement with modular, repeated meetings across a similar multi-county geographic scale has shown that if a certain number of meetings are conducted, each following a modular format eliciting identical data, patterns begin to repeat in the data (Bailey et al., 2007). The same experienced was observed in this case.

In the past, team members have performed a range of comparisons both between the values elicited at different public meetings, and between different groups within the same meeting, using such two-sample unpaired t-tests and ANOVA procedures. For example, the Area Advisory Team (AAT) – the SSAB equivalent for one of the Louisville bridge projects – wanted to know if their valuations for the bridge design proposals accorded with the public valuations. This involved eighteen separate two-sample unpaired t-tests to determine if the mean valuations provided by the AAT for each potential bridge scenario matched those provided by the general public. In twelve cases it did; in six cases, it did not (Bailey et al., 2007). The project sponsors agreed that all stakeholder data would be aggregated before being used for bridge model input so the final results reflect this aggregation.

Thus, the problem of involving large groups of citizens effectively, in ways that matter to them and that deliver useful data to the project sponsor, are not unique to the PGDP study. The specific technical nuclear issues are different than bridge design or powerline routing, but the principles of ensuring maximal public participation by delivering an efficient, high-quality process, that elicits directly useful data relevant to project alternatives, and that incentivizes further participation because of its efficiency and quality, adjudicated by participants themselves, are similar across a range of public goods questions. The theory of distributive justice that the authors used as the framework for developing the SPI protocol is intended to be universal (Bailey and Grossardt 2011), even if the specifics of project application are not. The fact that the process performance evaluations are high in the PGDP case, and that they are consistent with numerous other large-scale public involvement issues that have been addressed using SPI protocols, is significant. This finding supports the conclusion that efficient process can be designed using these principles even in highly controversial applications.

The SPI process can address in a limited way citizen perceptions of the lack of utility of public meetings. However, these citizens have to attend to see and feel how different it can be. In the case of PGDP, verbal commentary from several of the attendees at project meetings – and almost every other SPI project, dating back to 2000 – supports the view that people normally do not come to what they perceive will be adversarial public meetings or hearings that feature a small proportion of attendees verbalizing at a microphone. There is still a ceiling to the proportion of people who will come to a formal meeting but in no way have current methods reached this theoretical participation ceiling. This participation ceiling is not fixed demographically. It depends on stakeholder perceptions of the quality of the process and its accessibility with respect to both time demands and location. Previous published third-party evaluations of SPI processes provide evidence in the form of citizen narratives asking why there aren't more people present (e.g. FTA 2004, p.57. "Why aren't my neighbors here?" etc.).

In one case during the PGDP process, a local planner attended one of the scheduled meetings. He found the public involvement process different and more useful than he expected, to the degree he stepped forwards and volunteered himself to assist in recruitment for another meeting. He often deals with neighborhood groups with respect to land use planning issues for the city, and his forum offers the opportunity to elicit valuations from a group of stakeholders who may currently be less heavily invested either than environmental activists or plant workers. This unsolicited approach from a professional who is already experienced with mandated and National Environmental Protection Act (NEPA)-related public events and public involvement methods is a positive testimonial to process quality.

This planner was not associated with the PGDP future visioning project. His volunteerism was entirely due to the fact he observed the utility and performance he saw in the method at one of the October 2010 public meetings. The team accepted his generous offer of help which ultimately resulted in the implementation of an abbreviated scenario evaluation protocol at the West End Neighborhood Association meeting on April 28th, 2011. Although the time budget was one hour, instead of 90 minutes, all twelve scenarios were evaluated as before. Public satisfaction at this meeting was slightly lower than at the previous three. This is likely because the attendees came for the WENA agenda and were not primarily motivated by the PGDP visioning process. Despite the abbreviated sampling protocol, some of them felt that the process took too long. Nevertheless, at this meeting, useful data was obtained from a group that had not previously been sampled.

In addition to discussing the reliability of the deliverable model built with the data harvested thus far, the team wishes to point to a methodological path that could profitably be followed, i.e. one that would build directly on the valuable work that has already been done by team members in previous projects as well as other US DOE officials and site representatives.

For this project, the team has recorded documentary evidence for certain forms of methodological success. Although the SPI developers have documented similar results before in other large processes, this is the first application of this approach to nuclear plant remediation. It is encouraging to see process performance results that are statistically comparable with previous work and to observe other phenomena that attest to process quality such as testimonials from professionals who direct public involvement in the area, and from experienced advisory panel members, are also manifesting here. These data on process design and quality are significant.

It should be remembered that the primary purpose of CaVE was to investigate if significant nonlinearities were present in the citizen suitability adjudications. In terms of the five land-use variables, for example, the team wished to investigate if particular major land uses were more susceptible to suitability variation with decommissioning waste removal than others, or which were more influenced by WKWMA configuration.

It is well known in the field of multi-criteria evaluation that preferences are intransitive (e.g. Saaty 1980, 1994). Similarly, the rationale for using this approach is that citizen suitability adjudications cannot be expected to be linear and additive with respect to the land use factors being evaluated. For example, placing the decommissioning waste onsite may not have the same suitability impact on a nuclear plant primary land use, as it does on a light industry primary land use. The methodology explicitly recognizes this probability and seeks to measure these nonlinearities.

The fact that such significant nonlinear relationships were not identified in the current limited data set does not invalidate the use of the technique. The research problem is analogous to using an inferential statistical technique such as linear regression to investigate a potential relationship between two variables, x and y. Data is collected and then subjected to an analysis. The fact that such an investigation reveals a p-value of 0.9, for example, suggesting that the relationship is 90% likely to exist by chance, and that therefore, using a standard a-value of 0.05, no statistically significant relationship is found to exist between x and y, does not obviate the test or defeat the rationale for applying it to the data set. It is necessary to employ the test to make the determination that such relationships do not exist, or that they cannot be considered statistically significant. This selection of method is independent of the outcome of the statistical test. It adheres to normal scientific logic.

In this project, standard inferential statistical techniques cannot be used because there is inadequate sample size. Therefore, the use of fuzzy system inference is logically necessary if such an investigation is to be conducted. This is consistent with numerous applications of fuzzy system analysis to domains such as ecosystem analysis under conditions of nonlinear system response and limited sampling knowledge.

In previous applications of the CaVE method to planning and land-use configuration alternatives, numerous compound, nonlinear citizen suitability functions have been revealed (e.g. Bailey, Grossardt and Pride-Wells 2007, Bailey et al. 2007, Bailey et al. forthcoming). These discoveries prompted the project team to define new visualizations that presented these configurations, and to evaluate them in a second round of public meetings to validate the model predictions. In those cases, the model predictions have been found to be robust. This was sufficient reason to use this approach for the PGDP land use suitability evaluation.

These effects are not evident from an inspection or comparison of the raw data or simple descriptive statistics for two reasons. First, because they deal with the suitability of scenarios that were not shown and evaluated. Second, because they involve expected nonlinearities and conclusions drawn using additive logics may not be valid e.g. suitability decrements associated with one form of onsite decommissioning waste disposal for one primary land use cannot be guaranteed to apply to other primary land uses in this way.

In the PGDP end-state land use case, the first-order function, i.e. the primary land-use typology, was much more significant in driving the citizen suitability evaluations than the combinations of other land-use properties such as decommissioning waste disposal regime or WKWMA configuration. Put another way, for most given major land use typologies (e.g. nuclear plant, or heavy industry) the citizen suitability did not vary significantly when different waste regimes were employed, or different WKWMA configurations were defined.

As for measuring how process reliability compares with previous efforts to involve the public in such projects, this project demonstrates higher achievement against two metrics than what has been done before. The literature on US DOE Superfund sites and their stakeholder management processes clearly points to the problem of representation during public involvement procedures related to these sites. For example, the 2003 Battelle report draws attention to the problem of CAB members being uncertain about how their preferences and values reflect those of the broader public. The authors did not propose a specific methodology to verify. In this case, the total number of participants, ~285 if the focus groups are included, is higher than previous efforts of this type at this site. Therefore, even if they are not philosophically ideal, the model and conclusions derived are objectively more defensible when compared with previous efforts.

For the reasons discussed above, the team believes that the sample is more representative and more reliable than previous documented efforts. But it is not fully reliable in this external sense. The research team believes that these realities do not diminish the accomplishments of the process so far. This process shows stronger external reliability than the CAB-based procedures that were evaluated for multiple Superfund sites by Battelle. It also contains Q-metric data, which is unique to this process. This is greatly helpful in establishing a quality benchmark for the input that is independent of the sponsor, or the sponsor's perceived relationship with stakeholders. This performance data augments the reliability of the model because it means that challenges to the stakeholder perception of process validity must be supported by equally hard data about alternative legitimacy or otherwise.

It is important to place the results within the broader context of effective public involvement in environmental management. Although the Q-metric is promising, and unique to PGDP in the field of nuclear enrichment plant land use planning, and although verbal stakeholder feedback and post-meeting activities were moderately to strongly positive, the limited total inclusion achieved means that the recommendations derived are not as reliable as they could be if the participant count could be raised. To strengthen this reliability, the team believes that it would be useful to point to a series of stakeholder meetings at which not only similar mean preferences were documented, but also similar distributions of preference across the range of options were observed. The data presented here indicates that the methodological approach is justified. From this point on, enriching the valuation database requires nothing more onerous than repeating the modular meetings using the same visualizations, questions and format. Simply repeating enough of the meetings in the same form would help move towards the ultimate, but not simple or easily-achieved, goal of more reliable recommendations.

10.0 PUBLIC ENGAGEMENT PROCESS: GUIDELINES AND POLICY ANALYSIS

10.1 PROJECT PROCESS AND PRIOR GUIDANCE FROM US DOE CLEANUP PROEJCTS

The project team benefitted from at least two prior studies of US DOE cleanup processes, which guided this project's design and improved understanding of this project's position within other concurrent public outreach processes at the site. The two most relevant studies, both funded by US DOE, were *The Politics of Cleanup* (Energy Communities Alliance, 2007), provided to the team as general guidance, and the Battelle (2003) report. A separate body of research regarding cleanup and large public processes also proved useful for generating this report (Panel on Public Participation in Environmental Assessment and Decision Making, 2008; Bieirle and Cayford, 2002).

Because the US DOE studies are most relevant, even including some information derived from engagement concerning the PGDP site, we will rely most heavily on them as a set of guidelines for the analysis of both our particular process and the other implicated processes related to the site. In addition to providing an objective basis for a critical assessment of the public engagement process implemented by KRCEE, such an analysis also may prove beneficial to US DOE in the context of its own public engagement processes being implemented in Paducah.

Given an initial project charge to "[d]evelop and integrate public, stakeholder, regulatory, & technical community visions through meetings and stepwise development of a PGDP End-State Vision Document," as well as to "[i]ntegrate activities of public, stakeholder, regulatory, & technical personnel," a brief discussion of previous and current integration strategies is both warranted and beneficial.

According to the Battelle report (2003), stakeholders affected by US DOE sites were particularly concerned about:

1. Their ability to obtain the information they need to identify their interests, frame issues, and get them on the agenda

2. The nature of the decision-making process and their opportunity to have meaningful influence on decisions important to the community

3. Their standing with US DOE-EM as stakeholders and their relationship with EM personnel

4. The absence of mechanisms to hold US DOE accountable for its commitments.

These findings corroborate those from *The Politics of Cleanup*, which lists four categorical areas of activity and recommendations as "[t]he elements for creating a successful cleanup" (p. 31). They are:

I. Goals: Developing Goals and Identifying the Future Use of the Site.

II. Actions: Accomplishing Cleanup by Focusing on and Refining Goals Throughout the Cleanup Process.

III. Communications: Engaging the Community Through Consultation, Coordination, and Ongoing Dialogue.

IV. Conflict Resolution: Resolving Conflicts to Achieve Goals.

Arrayed within these four areas are 15 different recommendations. In the following section, each of the relevant recommendations of *The Politics of Cleanup* will be evaluated and addressed in the context of the current study.

***The Politics of Cleanup* Recommendation #1: All Parties Must Collaborate — The federal government, local governments, community members, state and federal agencies, and Congress must collaborate when developing the cleanup goals and future use vision for the site.**

The Politics of Cleanup cites examples of different levels of government, different agencies, and the US DOE's advisory groups disagreeing with US DOE on the specific nature of the cleanup to be pursued, even when the parties agreed generally on future land use. These disagreements resulted in Congressional intervention or a combination of state and federal agencies negotiating with US DOE over cleanup outcomes (p. 33).

Collaboration is challenged by projects that are spatially extensive and link people across longer distances. The PGDP Future Vision project impacts a rather large region, with different scales attached to different aspects of the plant. Dozens of acres of buried materials date back several decades, and their exact contents are not fully understood. There is the question of how best to dispose of plant demolition wastes, estimated to constitute a mound covering ~100 acres to a depth of ~100+ feet. The site is underlain by several thousand acres of contaminated groundwater containing both industrial solvents and radionuclides, directly affecting nearby residents and leading to the constitution of a "Water Policy District". The labor shed for the plant is even larger, covering several counties, and recreational activities in the surrounding wildlife management area attract enthusiasts from across the country.

Consequently, the project team's Future Vision protocol has attempted to reach different affected constituencies through strategic meeting locations, or, in the case of the wildlife management area users, meeting timings that coincided with events that drew users from a multi-state area.

Collaboration is adversely impacted by geographic scale from the point of view of sponsoring agency(s) also, 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 project responsibility, 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 five agencies at different levels. Beyond the national agencies implicated in environmental cleanup, there are regional ones. A TVA plant supplies power and forms the northern boundary of the facility, while the West Kentucky Wildlife Management Area surrounds the facility on the other three sides. The Kentucky Geological Survey has developed and implemented a site-specific seismic network in Western Kentucky, with at least one seismic station at the PGDP that will be key for future determinations about risks associated with various activities. Further, US EPA and the Kentucky Division of Waste Management may affect waste disposal issues.

The project team engaged each of these entities to ascertain the possible implications, to them, of different future scenarios for PGDP. For example, while TVA operates the power plants that provide the electricity to the current PGDP facility, TVA has no particular objection to the possibility of the site being converted to another power plant in close proximity to theirs. Their user base is defined as the area south of the Ohio River, while a new power plant could help supply energy further north on the grid. Such information exchanges were designed to help define the extent, from a governmental agency point of view, of the possible land uses at the site. Our team is not responsible, however, for attempting to measure or reconcile differing agency positions regarding the site.

The team’s major charge is to gather and summarize a coherent picture of the community’s preferences for future land uses at the site. Land-use choices and cleanup levels and types have implications for each other, and, as *The Politics of Cleanup* has pointed out, different entities within the process have strongly differing preferences for the nature of the cleanup associated with a particular land use. We included general cleanup options as part of the future land use scenarios for the public to evaluate. In this way we allowed land-use preferences to be conditioned by cleanup preferences in the future scenario evaluation process.

The specific results obtained to date from scenario evaluations are discussed elsewhere in the report. We can confirm, based on both quantitative and qualitative data gathered in our meetings, that the participants do indeed make joint evaluations about the desirability of a particular scenario. That is, they consider the extent to which the scenario is a coherent future use, taking into account the extent to which the land use options will be impacted by, or will impact, a particular cleanup feature or property. Even in cases where they have strong preferences for a particular land-use type, the suitability of that land use type is conditioned by different cleanup regimens.

While this process is being pursued, US DOE has simultaneously pursued another public process, asking overlapping questions about future land use and particular aspects of the cleanup. This process is not integrated or coordinated in any way with the team’s process. The Future Vision project team has been able, by specific request, to obtain summaries of the results of the meetings, but has not been proactively involved in any of these meetings. This lack of coordination works directly against this recommendations of *The Politics of Cleanup*, and we anticipate that these disconnected processes will work against the goal of gaining a common understanding of community preferences for two reasons.

First, citizens who attend one or more of these disparate meetings are confronted by different kinds of questions, posed in different ways, with differing sets of background information provided, and the results gathered and compiled in different ways. Thus, the ability of the community to provide coherent feedback may be undermined by incompatible data-gathering types and analysis methods. Second, because our work indicates that community judgments are made jointly, i.e. by considering both land use and cleanup options together, processes that separate the two sets of questions will not accurately measure those joint preferences.

Further, polling the community on the “importance of consensus," as is being done in the parallel waste disposal meetings, is not helpful. The scenario-suitability data gathered from the citizens to date exhibits significant differences of opinion around the scenarios that nevertheless show higher “average” scores, e.g. the nuclear industry and heavy industry land uses. It is not realistic, and possibly counterproductive, to expect to somehow force a “consensus” given such data. This project finding is supported by earlier research, including Battelle (2003). Further pursuit of “consensus” by those undertaking public involvement will involve selective exclusion of opinions and options and, subsequently, will entail needless controversy that undermines the legitimacy of any data that are collected. The strong desire to quickly generalize toward a single solution must be resisted, so that a clear and accurate understanding of all community preferences can be gathered.

The team thus reaffirms **the need to adhere to Recommendation #1 in *The Politics of Cleanup* across the totality of the project, to ensure that true collaboration results in accurate results from the community**.

***The Politics of Cleanup* Recommendation #2: Know the Rules — The law defines the cleanup process and the opportunity to participate in the process.**

Because the decision environment is quite complex, it is not unusual for the public to misunderstand where ultimate authority lies for decisions about the PGDP's future. Even the Future Vision project team needed to conduct background research to understand that, for example, under Federal Advisory Committee Act (FACA) guidelines, US DOE has the ultimate authority to decide who serves on the Citizens Advisory Board. This has important implications for the CAB's responsibilities and for role that it should be expected to play. Recent Site-Specific Advisory Board events at PGDP and neighboring sites, such as the well-publicized CAB resignations at Piketon, OH, clearly show the consequences of eroding trust by appearing to control CAB membership in ways that are not open to public inspection. The first goal of FACA, to ensure "balancing committee membership" (Brennan and Nielson 2009, p.2), is not perceived as being maintained. Clarity about the CAB member selection process and the group's subsequent composition are key factors in determining the community's relationship with and trust levels in the CAB (e.g. Blackburn et al. 2009). These concerns directly implicate the CAB's role in end-state land-use visioning, in waste disposal alternatives, and in other processes involving the plant future.

The complexity of the PGDP future use question also can lead to contradictory expectations from the general public, as the research team must acknowledge that US DOE has ultimate authority to make decisions about the site's future. This point, combined with past public experiences with the agency, yields considerable public skepticism about the worth of public input. Creation of a clearer public involvement 'organization chart' that clarifies the decision-making relationship between US DOE, the CAB, and all public processes, consistent with the language of FACA may help alleviate some of these issues.

***The Politics of Cleanup* Recommendation #5: Understand Community Values — To properly collaborate, the parties must work to understand the values of the community, and must work to incorporate such values into the planning process.**

As part of the project team's hybrid approach to this process, community values were of great importance for future visioning of the PGDP. As described in Chapter 7 of this report, a number of in-depth stakeholder focus groups were held with the explicit aim of identifying community values and how they might pertain to particular aspects of future visioning. Across eight focus groups, the following values were considered essential to the Paducah community:

- Safety and security
- Clean and healthy environment
- Employment
- Strong sense of community, e.g. collaboration and friendliness

- Good educational system
- Religious/moral community
- Good infrastructure
- Cultural vibrancy

These values were agreed upon by most participants, with some participants adding a qualifier that none of these values were attainable without the availability of good jobs for people in the community. As one focus group participant explained, "Unless we have the kinds of jobs that industry affords where people can make enough money to buy a home and educate their children, you're not going to be able to have the other items that make for a good community."

In addition to the recurrent theme of economic stability, focus group participants also emphasized the need to maintain a clean and healthy environment for future generations in the community. Thus, while good paying jobs may be the most immediate and pressing issue for many stakeholders, environmental considerations were also of major concern.

Effective future visioning for the PGDP must take into consideration the above values when any decisions are made pertaining to future land use or cleanup. Focus group participants indicated that future land uses, such as nuclear, heavy or light industries, would most likely address their economic concerns. However, cleanup issues also must be balanced into the decision. As was argued elsewhere in this report, **all efforts should be made to incorporate – or at least not oppose – the core community values** described above.

The Politics of Cleanup **Recommendation #6: Education Is Essential — The parties must take the time to educate each other on the technical and policy issues underlying the cleanup and to commit staff resources to engage each other. Discussions, which need to take place throughout the process, must also include the question of technical risk and perceptions of risk, recognizing perceptions of risks posed do not always align with the technical risk.**

The issues surrounding the future disposition of the PGDP properties, as well as the associated remediation issues, are extremely complex. While US DOE has endeavored to address this recommendation in various ways in the past, primarily through the DOE Education Center, the CAB, and public meetings, more innovative ways are needed to reach a community that may be perceived as either apathetic or antagonistic. To their credit, US DOE has solicited the help of the KRCEE at the University of Kentucky to begin addressing this issue. As part of this project, the team solicited questions of concern from the public. These questions then were researched and the resulting answers presented both at a series of public meetings and through the www.paducahvision.com website. In addressing information gaps associated with the PGDP, it is essential that sources deemed credible by the community be identified and consulted to insure both informational accuracy and community acceptance.

The Politics of Cleanup **Recommendation #10: All Parties Must Take Into Account Post-Cleanup Requirements – Cleanup completion typically means that contamination will be left in place; thus, identifying sources of long-term funding and clarifying the roles of the affected parties are essential.**

From the point of view of the PGDP Future Vision process, the long time frames are a major challenge. 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 rely on the efficacy of any decision they might make based on predictive models. Given that the timing of the PGDP decommissioning is uncertain, participants' preferences become more speculative. However, in an effort to address this challenge, the hypothetical future scenarios created for this project were composed and presented at a level of generality and in a progressive fashion (low intensity land use to high intensity land use) to allow participants the most practical method for discovering and relaying their preferences.

Regarding the stability of participant preferences over time, the team's work in other contexts has shown that, when input is drawn from a larger proportion of the community, later evaluations (six months to one year later) of alternatives will be quite consistent with the earlier sets of preferences. Thus, increasing the number of people participating in the process will help to ensure the stability of the preference data over time. The team is making extensive efforts to broaden the opportunities for input from community members for this and other reason(s). This preference stability declines, of course, if significant new facts emerge over the extended time frame which would reasonably be weighed by those expressing their preferences about future scenarios.

A corollary of the problem of increasing unreliability over time is the need to consider monitoring strategies. Any current planning should include a method to specify decision making in the years beyond those implicated in the future scenarios, as pointed out by *The Politics of Cleanup*:

> In order for these cleanup projects to be ongoing assets for the affected community, the stewards must be identified and agreed to by all of the parties and have the funds necessary to implement long-term stewardship activities. Ideally, as cleanup actions are being designed, long-term funding management requirements and funding needs will be identified as well. Achieving this goal, however, has proven difficult. (p. 43)

The time frame for the PGDP vision is arbitrarily bounded at approximately ten years hence, but the nature of some of the issues to be addressed, especially underground water contamination, have 100 year timelines, twice as long as the PGDP has existed. Thus, current preferences are most applicable to the near term, and longer term monitoring and management will be of public concern.

This consideration is an opportunity for US DOE, as research by Fischer (2000) has shown that the public is willing to accept more risk when they have a stronger hand in the long-term management of that risk. This is consistent with work by Rawls that argues that, under conditions of uncertainty as to whom will be impacted, people will act to minimize the most adverse outcomes (Rawls, 1971). In the case of PGDP, many future vision preferences expressed by participants include judgments about their acceptance of various levels of risk. These judgments might be altered if a clear role is defined for the public in long-term site management. Currently, the community's direct role has not been made an explicit component of the Future Vision process, primarily because US DOE has not yet agreed that it is a negotiable topic.

As *The Politics of Cleanup* points out, no site can ever be completely "cleaned up," so the long term plan should include a mechanism for the community to be involved in dealing with a site that is still contaminated, just less so. As a result, **a long-term, community-based management plan be should be considered closely**. The community may deem more flexible cleanup regimens acceptable if they have more direct control over decision-making regarding future events. Without an express and formally-agreed-to role, the community's most rational response to the large levels of uncertainty inherent in the project is to demand the maximum levels of cleanup possible over the time frame in which they do still have some input. This is exhibited in the data analysis portion of the report, where preference for similar land-use proposals is differentiated by increased levels of cleanup, and those contamination issues with the greatest amount of relative uncertainty (i.e., the burial grounds) generate a stronger cleanup preference than the larger, but more carefully managed, Waste Disposal Alternative.

***The Politics of Cleanup* Recommendation #11: The Parties Must Build a Working Relationship — All parties must take the necessary steps to develop and maintain trust, accountability and openness.**

The Politics of Cleanup observes that "…there are three categories of people — passionate community members, elected officials, passively interested community members — and each group requires differing public involvement processes" (p. 49).

It will come as no surprise to anyone that agency projects can be greatly affected by the level of public trust for the agency in question. People with profound distrust of an agency can choose to opt out of the process altogether or can 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. The National Research Council (2008) panel summarized this issue: "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" (p. 212).

This factor was significant for the design of informational workshops hosted in October 2010. The project team addressed this concern directly by asking focus group stakeholders which data sources would be most helpful to support their deliberations and, ultimately, the public scenario evaluations. Various responses included a desire for non-US DOE sourced data, and even data from Russian scientists involved in the analysis of the 1986 Chernobyl event. These responses should not be taken to mean that the citizens trust Russian scientists more than the US DOE-sponsored risk evaluations. More likely, in view of the other data, it means that a large number of citizens are not sure in whom to place trust, and that in the face of such uncertainty, they desire access to the maximum diversity of information sources possible. This finding is helpful for designing more effective processes. It means, for example, that any strategy that relies on uncritical public acceptance of US DOE data, risk evaluations and other documentation, is likely to fail. The team took note of this and ensured that, for example, the documentation available on the PGDP visioning website contained a variety of information sources including credibly independent material as adjudicated by stakeholders.

This particular situation cannot be remedied in the course of one visioning project; however, it contributes to the public's unwillingness to engage in the process. Extensive promotional efforts have encouraged public participation, but the results have been more modest than the team would have liked. Conversely, the project team has documented that those who do participate in the team's public meetings have a high opinion of the quality of the process. It is the team's hope that this positive experience will build trust in team activities over time and that it will encourage others to invest their time in the process, as well. This expectation is consistent with the commentary provided by non-aligned professionals during the public meetings at Paducah in October 2010. It also is consistent with third-party evaluations of the participation incentivization effect of previous SPI protocols; for example those conducted in lower-trust environments for transit-oriented visioning in low-income minority neighborhood (Federal Transit Administration IDEA Report, 2004) and large bridge design (Dietrick et al. 2009).

The SPI process can address in a limited way citizen perceptions of the lack of utility of public meetings. However, these citizens have to attend to see and feel how different it can be. In the case of PGDP, verbal commentary from several of the attendees at project meetings – and almost every other SPI project, dating back to 2000 – supports the view that people normally do not come to what they perceive will be adversarial public meetings or hearings, functioning as karaoke nights. There is still a ceiling to the proportion of people who will come to a formal meeting but in no way have current methods reached this theoretical participation ceiling. This participation ceiling is not fixed demographically. It depends on the stakeholder perceptions of the quality of the process, and its accessibility with respect to both time demands and location. Previous published third-party evaluations of SPI processes provide evidence in the form of citizen narratives asking why there aren't more people present (e.g. FTA 2004, p.57. "Why aren't my neighbors here?" etc.).

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 the past effects of the PGDP, 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.

Similarly, there are many existing and potential sources and 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 the PGDP, extensive monitoring efforts already are conducted by US DOE and its contractors. What is not clear is the extent to which the monitoring output is available to, or has credence with, the general public or specific portions of the public.

In order to more fully integrate POC Recommendation #11 into ongoing future vision activities associated with the PGDP site, US DOE may want to consider **adopting and formalizing a real-time, transparent, process satisfaction input process at all public meetings**. This will accomplish two things: a) It will assure those attending that they have, and can see that they have, a visible voice in the process; and b) it will begin to aid DOE in distinguishing between effective and ineffective public processes, thereby taking the first steps toward creating an ongoing process based on public process approval, helping to foster trust.

***The Politics of Cleanup* Recommendation #12: Be Organized — Local governments and the community must be organized and proactive, and strive to speak with one voice.**

As project complexity increases, it is likely that the number of identifiable affected subgroups will increase as well. It is easy to begin to identify, as we have, a wide range of subgroups that have clear potential impacts from a change at the 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 that it is impacted has been identified and included.

“Speaking with one voice” should not be confused with “Consensus regarding the best solution.” It is not realistic to expect that the community will have a singular opinion about the best Future Vision. Even our preliminary data confirms that there are likely significant differences between different members of the community. However, that does not preclude a process that ensures that a unified and coherent *understanding* of the community’s complex preferences is gathered and interpreted. Part of the team’s strategy to address this is to ensure the delivery of open public meetings so that anyone may self-select to participate in the preference expressions, without needing to have been pre-qualified by the project team. Further, because the SPI open meeting process provides equal voice to all participants, no adjudication is made by the project team as to the legitimacy or relative importance of any given participant’s interest. Rather, our attention is turned to assuring participation and input across the demographic spectrum of the members of the community, whether defined by age, gender, or location. Maintaining this factual and perceived openness and equity is critical in maintaining process integrity (Battelle, 2003).

Neither is it realistic to expect local elected officials to somehow divine the complex spectrum of community preferences that our preliminary data suggests, as it is precisely our charge to gather and characterize that information. Thus, given sufficient representative data from the community, this project can greatly aid local governments in the goal to “…speak with one voice.”

In order to more fully integrate *Politics of Cleanup* Recommendation #12 into ongoing future vision activities associated with the PGDP site, US DOE may wish to consider **focusing on a democratic and transparent process that ensures the accuracy of preference measurement from the entire community**, and accept that no one solution will be universally endorsed by all.

***The Politics of Cleanup* Recommendation #14: Following the Minimum in the Law Is Not Enough — Minimum regulatory requirements are insufficient to support substantive public involvement; the parties must develop public involvement processes that are tailored to site-specific needs, recognizing that process is different from negotiations.**

The PGDP is a highly complex decision environment, as it is composed of considerations about many potential types of cleanup, both above and below ground. In addition, land use of both the immediate facility and the surrounding landscape, some of which is underlain by the contamination discussed earlier, must be included in future visioning. This land-use future visioning process is itself composed of considerations about the options for economic activity that will ‘replace’ the existing activities, as well as all of the attendant, typical economic development considerations, such as site suitability, regional location, and so forth.

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. 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 (including 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 most public processes to date. As discussed in Chapters 8 and 9, however, the team’s use of the SPI scenario methodology with CaVE modeling is specifically designed to address this challenge.

In the case of the PGDP, the factors listed above are presumed to influence each other in ways that are currently only generally 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.

Further, the levels of risk of various land uses and the associated waste disposal options are not precisely known (US DOE, 1992). Numerous hydrologic and physiographic factors such as the speed of the dissolved solvent plume cannot be estimated with certainty (KRCEE 2007a). This is not unusual in environmental management issues, but because of the sensitive nature of the PGDP plant and its operations, these considerations are at the front of the minds of participants.

The team explored the interactions of the alternative land use/cleanup combinations at some length with the extensive focus group process. At the end of that phase, we were satisfied that the most important conditional cleanup considerations about future land use were those involving surface contamination and the handling and disposal of surface materials and contaminants. This is because the physical location and arrangement of these materials has the most potential to impinge on different anticipated land uses. Conversely, while the treatment and attenuation of the contaminated water plumes is important, the choices among different treatment strategies have little implication for near-term land use decisions.

Because of the complexity of the cleanup possibilities, **further efforts are needed to adequately document the public's preference for the various future land use combinations, especially as they relate to specific cleanup strategies**. This outreach should be aimed at accomplishing two goals: first, the overall number of public participants needs to be increased in order to more accurately sample the full demographic; second, public preference needs be more directly sampled for specific clean up combinations as they relate to the highly-rated land-use preferences already gathered in this public outreach process.

***The Politics of Cleanup* Recommendation #15: Engage Each Other Regularly — The parties must substantively engage each other throughout the entire cleanup and reuse planning process.**

These types of projects typically are difficult to execute, as the nature of the outcome is expected to be negotiated among many of the relevant parties. This process 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.

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 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.

To more fully integrate *The Politics of Cleanup* Recommendation #15 into ongoing future vision activities associated with the PGDP site, US DOE may want to consider **adopting a public involvement strategy that incorporates the principle of ongoing and/or iterative engagement with the community, including open public forums, throughout the life of the cleanup process and post-cleanup site management.** Such iterative approaches are commonplace in other public goods processes, and increasingly valuable as the time frame of a project lengthens (Bailey et al., 2007). This can be accomplished within the current ‘project-based’ approach to public involvement, provided the entire strategy is expressly built to address, and is evaluated by, specific public process metrics in terms of process quality, output quality, process efficiency per community member, and breadth of inclusion.

11.0 SUMMARY AND CONCLUSIONS

11.1 PROJECT GOALS AND GUIDELINES

This report has focused on assessing community based land use suitability perspectives and scores for the future use of the PGDP site, given the site's pending closure by US DOE. In addition to providing the community with a definitive record of the diversity of values and preferences, the research team hopes that the study's results also will inform and guide US DOE in the final formulation of its future vision for the facility as well as their community engagement process in general.

The key for creating any community-driven future vision is the fullest possible involvement of local stakeholders at every stage of the visioning process. A guiding document throughout the PGDP Future Vision Project, ECA's *The Politics of Cleanup* explicitly advocates for such involvement, with members of Superfund communities joining federal and state regulators and contractors to meet site cleanup goals in a way and to a degree that allows sites to remain or once again become assets. The ECA affirms that two-way communication that engages communities through consultation, coordination, and ongoing dialogue is essential for developing appropriate cleanup goals and for identifying future uses for Superfund sites like the PGDP. *The Politics of Cleanup* therefore calls for all parties, including community members and government agencies, to collaborate in the development of site cleanup goals and future use visions.

The ECA asserts that successful collaboration requires mutual understanding of community values, as well as cooperation toward incorporating these values into the planning process. According to ECA, successful environmental cleanups go beyond risk reduction and the minimization of federal government liability; success is predicated on substantively incorporating local community values into the cleanup and visioning processes. In certain cases, the incorporation of these values has led to cleanup efforts that extend beyond that which would be anticipated for a strictly risk-based cleanup. The sole way to ensure that sites can become assets for affected communities is to engage local stakeholders in determining how both the cleanup and the future use goals support or advance local needs. *The Politics of Cleanup* predicts that cleanup or future use decisions that are made unilaterally by government agencies without input from community members run the risk of being fundamentally inconsistent with local needs, as well as with the core values held by local governments and others in the affected community.

According to the ECA, two-way communication means that all parties must educate each other on technical and policy issues that underlie cleanup decisions, committing staff and other resources toward mutual engagement. Discussions need to take place throughout the process and must include issues related both to technical risk and to perceptions of risk, recognizing that the two do not always align (Slovic, 2000). Not only must community members be educated about technical risk by federal and state agencies and contractors, but federal and state agencies and contractors must be educated by the community about its history, goals, and needs.

Regarding risk communication at Superfund sites, the ECA strongly recommends that federal agencies enter into dialogue with local governments and community members to better understand community perceptions of risk – perceptions that often vary from community to community and even among different members of the same community. Such dialogues present the greatest opportunity for various parties to reconcile disparate perspectives about risk, thus facilitating agreement on difficult cleanup decisions. Such decisions, even technical ones, often are not solely technically based.

The KRCEE project was designed to maximize citizen engagement, as characterized by the Ladder of Citizen Participation (Arnstein, 1969), while simultaneously incorporating the recommendations of *The Politics of Cleanup*. Not only did the ladder provide a philosophical guideline for the team, it provided a quantitative way to gauge public perceptions about past levels of community involvement, as well as preferences for future involvement.

In previous studies, most citizens have scored past levels of involvement in public processes somewhere between informing and placation in the Tokenism section of the ladder; however, the majority of those polled in the past have indicated desired levels of participation somewhere between partnership and delegated power in the Citizen Power section of the ladder (Grossardt et al., 2010). In other words, and perhaps unexpectedly for some agencies and policymakers, most members of the public see a role for technical expertise in planning processes, while very few people feel that complete citizen control is necessary to achieve optimal outcomes. These past results are consistent with the results recorded during the current Future Vision process.

Methodologically, this project demonstrates the utility of integrating the CBPC and SPI processes. While CBPC focus groups provided important insights into existing information gaps and community values, the two processes collaborated to address those information gaps, and SPI's democratic platform allowed participants to express quantitatively how the community values translate into assessments of specific potential outcomes. Thus, this study demonstrates the utility of an integrated strategy that the research team hopes will provide a template for addressing future complex problems that involve public participation from numerous stakeholder groups.

11.2 SUMMARY OF PROJECT ACCOMPLISHMENTS

The distinct accomplishments of the project may be summarized as follows:

1) Developed an effective process for public engagement that integrates:

    - Community Based-Participatory Communication (a basis for qualitative analysis)
    - Structured Public Involvement (a basis for quantitative analysis)
        - Unique use of visual instruments for discussion facilitation
        - Provides framework for citizen ownership of process
        - Provides an effective methodology for solicitation of community values

    - Structured Public Involvement (a basis for quantitative analysis)
        - Use of computer visualizations for composite analysis of complex multi-faceted issues
        - Public empowerment through anonymous use of keypads
        - Public accountability through real-time process evaluation
        - The ability to demographically and anonymously measure who is in the room, and to track the varying pattern of their preferences

2) Developed an effective process for public engagement that:
    - Assesses and incorporates community values
    - Fosters community trust by providing accountability and transparency:
        - Stakeholder Pilot Group
        - Real-time results via key pads
        - Arnstein Ladder

- Provides equal voice to all participants
- Anonymous key pads

3) Developed a process that has applicability to future DOE public engagement opportunities

4) Identified the diverse stakeholder groups

5) Identified and documented community:

    - Values
    - Concerns
    - Data needs
    - Trusted data sources

6) Documented community experiences and expectations with public engagement process:

    - Community does not expect full citizen control
    - Present expectations may be influenced by past experiences

7) Assembled a significant amount of relevant project information into a single repository and published through www.paducahvision.com

    - Informational narrative summaries
    - FAQ
    - Document database
    - Computer generated scenario visualizations

8) Documented community preferences

9) Provided an analysis of past DOE community engagement processes at the PGDP in light of *The Politics of Cleanup* by ECA (2007) and *An Evaluation of DOE-EM Public Participation Programs* by Battle (2003).

11.3 SUMMARY OF FOCUS GROUP ANALYSIS

1) The diverse members of the community share the same common community values:

    - Safety and security
    - Clean and healthy environment
    - Employment
    - Strong sense of community, e.g. collaboration and friendliness
    - Good educational system
    - Religious/moral community
    - Good infrastructure
    - Cultural vibrancy

2) The community has a significant level of distrust of DOE. The following factors have contributed to this phenomenon:

- Historical secrecy (breeds urban legends)

- Past environmental practices (e.g. ATSDR Report)

- Perceptions of health impacts (e.g. NIOSH Study, newspaper and magazines articles)

- Perceptions that past community engagement activities are focused on regulatory process requirements rather than on a sincere attempt to partner with the public. Possible reasons for this phenomenon include:

    - Possible perception that issues are too complex for citizens to understand
    - Negative experiences with previous public involvement processes
    - Fear of losing control of public meetings
    - Lack of turnout for public meetings
    - Lack of an effective strategy to truly involve the public

All of these factors can create serious challenges for implementing the relevant recommendations of *The Politics of Cleanup Report,* which was specified as a roadmap for this project to follow.

3) The team found that some stakeholders did not feel the CAB represented their interests. In one case the team encountered a local elected official who had never even heard of the CAB. This is a significant finding in light of US DOE's ongoing efforts to increase public participation in their decision making process. The team did not find that this observation reflected poorly on the CAB or the members of the CAB, who have demonstrated a significant commitment to the issues associated with the PGDP. Instead, the team found this observation to be consistent with the experiences of other communities and the findings of Battelle's 2003 Report "An Evaluation of DOE-EM Public Participation Programs" which found:

    - "Some persons expressed concern that DOE may be moving toward a strategy of 'one-stop shopping' through the advisory boards, overlooking the need to reach out to, provide opportunities for, and take into account, the interests of less-involved citizens. At every site, respondents emphasized that the boards are not a substitute for the public" (page 27).

    The team found that the CAB possesses significant expertise and talents that are invaluable to the public engagement process in the role of a technical or community advisory group, however, the team feels that their current use as a perceived representative of the public or the belief that they indeed truly represent the public is misguided and counterproductive to an effective public engagement process. The team believes there are more direct and efficient ways to assess the will of the general community than trying to use the CAB as a surrogate for that community and have outlined such a process in this project.

11.4 SUMMARY OF SITE SUITABILITY RESULTS ANALYSIS

The results of the land use suitability analysis may be summarized as follows:

1) Of the range of six major possible land use options for the PGDP footprint, the industrial land use options scored higher than the non-industrial land use options. However, use of only the

average scenario scores for the entire data set as a basis of evaluation or even comparison can be misleading.

- While more participants supported a nuclear industry option than opposed it, the preference scores were strongly polarized at either end of the preference scale. A similar pattern of preference was also observed for both light and heavy industry.

- Heavy industry land uses received the second highest mean score among the industrial land-uses, but also received the least opposition.

- Among the non-industrial land use options, the expanded wildlife management option received the most favorable response, although only marginally better than the institutional control option. The structured recreation option received the lowest mean scores among the non-industrial land use options.

- By breaking the participant preferences down into three subgroups, we are able to identify three distinct patterns of preference in the community, and to illuminate the composition of the overall pattern of scoring noted above.

    - One set of participants (“Group 2”) values high-intensity land uses over low-intensity land uses, and these difference are increased under conditions where the maximum amount of legacy and decommissioning wastes are kept onsite. This group’s mean scores range from less than 2 to more than 8.
    - Another set of participants (“Group 3”) moderately values maximum removal of legacy and decommissioning wastes, coupled with minimum human exposure. They have low to very low preferences for any other scenarios. Their mean scores ranged from less than 2 to just under 5.
    - A third set of participants (“Group 1”) exhibits a slight preference for higher intensity land uses over lower-intensity land uses, and their preference for nuclear and heavy-industry options were increased when accompanied by some combinations of legacy waste and decommissioning waste removal from the site. This is in contract to Group 2, where removing larger amounts of legacy and decommissioning waste from nuclear and heavy industry scenarios actually increased preference. Group 1’s preference pattern scores ranged from just under 4 to just under 7.

2) Based on the data collected to date, it would appear that the different subgroups’ preferences between different land uses were affected differently by the following factors: 1) the land use of the property surrounding the PGDP industrial footprint, i.e. property that has been currently licensed to Kentucky as part of the WKWMA, 2) the disposition of the current burial grounds, and 3) the disposition of future wastes associated with the D&D of the facility.

3) Based on the data collected to date, it would appear that the majority of the respondents oppose the construction of any structured recreational facilities within the existing WKWMA. However, this hypothesis should be tested with additional focused surveys.

4) Based on the data collected to date, it would appear that two of the three subgroups generally favor removal of all of the burial grounds, while one does not. This preference is

generally interdependent with the actual land use. However, this hypothesis should be tested with additional focused surveys.

5) Similarly, two of the three subgroups somewhat oppose the construction of a new waste disposal facility on site, while the third group favors it. This support is, again, in some cases interdependent upon the associated land uses. Reasons for opposition included:

- Environmental and health concerns
- Potential negative impacts on future site development

Among the reasons for supporting such a waste disposal facility were:

- Job security (individuals from USEC and US DOE employee community)
- Discourage competing interests (WKWMA patrons)
- Unethical to ship our waste to others (individuals from the environmental community)

6) The solicitation of additional scenarios from the public produced an additional land-use scenario category (Research Facility) that received average scores greater than the best score (i.e. 6.4) of any of the six hypothetical land uses presented by the project team:

- Alternative Energy Research Center (6.5)
- Remediation Research Center Combined with Power Plant (6.9)
- Remediation Research Facility (7.2)
- Federal Lab to Test Cleanup (7.1)

The research facility was suggested independently at all three public scoring meetings. With one notable exception, this land-use category, which echoes a previous CAB recommendation, received very little opposition.

11.5 LAND-USE SUITABILITY ANALYSIS LIMITATIONS

The work so far has shown that the land use suitability modeling process is sound and that useful information can be gained from the scenarios regarding the cleanup approaches and land uses. A total of 218 responses were recorded at either one of the four public meetings or through the on-line survey. A total of 67 individuals were also involved in the stakeholder focus group process. An examination of the mean scores as obtained from the focus group meetings, the public meetings and the on-line survey reveal a fairly consistent distribution of responses which tends to suggest that the total sample size is representative of the distribution of perspectives from the total community.

All public engagement process will typically involve some limitations. This study is no exception. Potential limitations of the study include:

1) "Self-selection" by the participants

- Participants were those who had the time/interest/ability/trust in the process to participate and, therefore, may or may not be truly representative of the actual population.

2) Length of the study (history/maturation issues)

- Ongoing US DOE Waste Disposal Alternative meetings
- University of Louisville Worker Epidemiological Study was published between focus groups and public meetings
- Potential impact of the Fukushima nuclear accident on preferences for a nuclear power plant (although the majority of respondents at the April 28 meeting indicated the event would not change their opinion of the nuclear landuse option).

11.6 PROCESS ANALYSIS RESULTS

The PGDP community-driven vision project provides an important case study for future agency community engagement practices. Current risk communication models that focus on the divisions between technical expertise and the lived experience of community members can deepen rather than bridge perceived divides. This project marks an opportunity to begin replacing adversarial, retrospectively-oriented approaches with collaborative, forward-looking processes. To the extent that this report's content resonates with other communities facing similar challenges, it has effectively fulfilled the common case study goal of "elucidat[ing] features of a broader population" (Seawright and Gerring, 2008, p. 294).

As Altheide (2010) notes, "[T]he prevailing context of risk communication is fear, or something to be dreaded, avoided, and even intervened against in order to keep us safe" (p. 145). By identifying the spaces in which common ground exists among diverse stakeholders, participatory processes can shift communication away from this fear focus and toward communicative convergence, which Sellnow et al. (2009) state should be “the primary objective in risk communication” (p. 12). The extensive and rich detail contained within this report points to a number of values shared across stakeholder groups, including economic stability, environmental responsibility, and the centrality of trust-building and accountability with any future use. While these core values are, in part, responses to past experiences and perceived deficiencies related to the PGDP, they also provide a starting point for future discussions about site-related matters.

This report reflects a community attempting to balance perceived economic, environmental, and health risks in evaluating the PGDP's future. An example drawn from focus groups vividly illustrates this point. When discussing the disposition of future PGDP D&D wastes, several individuals who self-identified as environmentalists stated that such materials should be shipped elsewhere due to concerns about the potential risk to the local community of keeping wastes onsite. However, others who also self-identified as environmentalists held the opposite opinion, stating that the wastes should be kept onsite because they felt it would be more immoral to ship “our” wastes elsewhere and potentially increase the risk to other people in other communities. If one only examined their preferences in isolation, one might erroneously conclude that these two groups of individuals had radically different values based on their stated preferences. In reality, they shared similar values but held different views about the best way that those values could be implemented. This example provides significant insight into the complexities of the various issues associated with the PGDP, further underscoring the danger of assuming the motives of individuals solely on the basis of stated preferences. This observation raises hope for a more productive dialogue when dealing with such contentious issues, through a foundation that begins with the common values and visions that were identified across all focus groups. The processes developed and implemented in this project can provide such a foundation, as well as a framework for improving relations between US DOE and PGDP stakeholders.

If the recommendations of *The Politics of Cleanup* are to be fully achieved, Public Engagement can no longer be viewed as a single project, or as an add-on to a larger project. It also cannot be viewed as a series of disjointed projects. Instead, it must be viewed and implemented as an ongoing, iterative, and evolving process that:

- Involves the total community
- Is tailored to the local community
- Incorporates community values
- Fosters collaboration
- Provides accountability and invokes trust
- Continues to inform and educate stakeholders
- Provides for an inclusive and truly democratic way for the concerns and preferences of the local citizens to be both heard and valued

In this context, we believe the results of this study should not be viewed solely as a means to an end, as important as the findings may be, but instead as the first step toward building a more effective process of public engagement. We believe that the methodologies that have been brought together in this project provide the tools and strategies to achieve such a goal.

Given a specific charge to "develop and **integrate** public, stakeholder, regulatory, & technical community visions thru meetings and stepwise development of a PGDP End-State Vision Document," the project team found that many of *The Politics of Cleanup* recommendations, as well as insights from the earlier Battelle study (2003), assisted in identifying and addressing project challenges. We, the project team, wish to reiterate the importance of enabling the public to establish defined goals for future visioning. The project team's public involvement process is one step in that direction, but more steps are needed. Further, the findings from these processes should have "meaningful influence" when it comes to decision making. Specific findings of the study that relate to the integration objective are summarized as follows:

- The team found that adherence to *The Politics of Cleanup* Recommendation #1, **"All Parties Must Collaborate,"** was critical across the totality of the project to ensure that true collaboration results in accurate results from the community.

- The team also found that **a long-term, community-based management plan was highly desirable** because more flexible cleanup regimens may be acceptable to the community if they have more direct control over decision-making regarding future events.

- Both qualitative and quantitative study data underscore the need for US DOE **to adopt and formalize a real-time, transparent process-satisfaction input process at all public meetings**. This will accomplish two things: 1) it will assure those attending that they have, and can see that they have, a visible voice in the process; and 2) it will begin to aid US DOE in distinguishing between effective and ineffective public processes, thereby taking the first steps toward creating an ongoing process based on public process approval and helping to foster trust.

- The team determined that the public engagement process could be improved by adopting **a more democratic and transparent process that ensures the accuracy of preference measurement from the entire community**, accepting that no single solution will be universally endorsed by all.

- The data collected as part of this study underscore the importance of community values in the development and implementation of potential future visions for the site. **All efforts should be made to incorporate – or at least not oppose – core community values.**

- The PGDP CAB is comprised of a wide range of local expert stakeholders and has performed a useful, focused technical decision-support role for many operational aspects. Brennan and Nielson (2009) note that "the Paducah CAB has generated a number of recommendations that together have increased attention on identification and disposition of potentially recyclable materials, such as nickel" (p. 9). This technical decision-support role, however, is quite distinct from the larger, open data-elicitation process needed to support legitimate, community-wide end-state land-use recommendations. The CAB, through continuous engagement with the many detailed issues associated with the site, has developed a sophisticated technical understanding of the issues, and this capacity should be employed to greatest extent possible to help maximize the effectiveness of the public involvement process. However, expecting the CAB to substitute or stand in for public opinion or broad-based public involvement process is contrary to the stated FACA mission for such boards.

- In light of this observation, this study has provided not only an assessment of existing land-use preferences but also a methodology that can be employed to assess future preferences in the face of changing circumstances. Consistent with such a methodology, the research team believes **the CAB is uniquely positioned to support this process through: a) scoping and pretesting of scenarios prior to public evaluation protocols; b) recruitment of additional citizens to the process; and c) detailed debriefing analysis of data gathered from large public meetings.** Such a role could allow the CAB to assist in gathering and analyzing widespread community preferences rather than serving as a perceived surrogate for community preferences, thus leveraging effective community engagement toward a more comprehensive, inclusive community solution.

- The experiences of the project team have highlighted the need for **more effective integration of all public involvement processes on the PGDP project**. As mentioned elsewhere in this report, the development of an integrated vision was part of the original project charge to the research team; however, parallel but uncoordinated public land-use input processes yielded confusion on the part of the public, and thus confusion for US DOE on the meaning of the feedback.

- Based on the feedback received from the participants in the study, the research team believes that US DOE should strongly consider **adopting a public involvement strategy that incorporates the principle of ongoing and/or iterative engagement with the community, including open public forums, throughout the life of the cleanup process and post-cleanup site management.** Such an approach can alter the relationship between US DOE and the community, allowing US DOE to enjoy greater confidence in its ability to pursue site cleanup and the community to enjoy greater confidence in its ability to deal with the inevitability of new information over the long term.

- As part of that strategy, the team suggests that US DOE strongly consider adopting a set of metrics that will quantitatively characterize the quality of its public involvement processes. The team used the Arnstein Ladder and process satisfaction ratings to gain understanding of how the community surrounding PGDP felt about prior processes, their expectations for future processes, and their opinions of the processes the team has executed to date. As demonstrated in public processes over the past 10 years that have been carried out by the team, systematically gathering these metrics has a salutary effect on the quality of public engagement and can serve as an effective long-term management tool for US DOE. Moreover, this result will support the stated aims of the public involvement process and larger Federal aims, such as the President's Open Government directive (White House, 2009) that charges agencies with ensuring "transparency, participation and collaboration" in the delivery of public involvement.

12.0 RECOMMENDATIONS

The meetings conducted as part of the study yielded very high participant satisfaction ratings as evidenced by the anonymous data that was collected from participants. Because the participants were able to verify for themselves that their scores, and all other scores, were being recorded transparently, they were more likely to have increased confidence in the results, and thus were more likely to expend the effort to participate. Willingness to participate, to volunteer the time and effort to attend a public meeting, has been a major challenge of this project and others connected to discussions about the present and future conditions at the PGDP. We are hopeful that the methodologies developed as part of this study will provide an effective tool for use in overcoming past skepticism about previous attempts at pubic engagement so as to create as accurate and robust a picture of community preferences as possible.

Based on the perceived success of the methodologies employed in this study, the following recommendations are suggested:

- Although clearly important, the results of this study should not be viewed as a means to an end, but rather as the first step toward building a more effective process of public engagement. It is highly recommended that US DOE consider use of the developed methodology in their future stakeholder engagement process. The research team sees a potential facilitation role for the CAB in such a process that should be investigated and considered.

- A comprehensive website, www.paducahvision.com, was developed as part of this project to provide significant historical and technical information about the PGDP. It is recommended that US DOE consider continued support for this website, either directly through US DOE itself or through the CAB.

- As the study progressed, it became apparent that stakeholder preferences for future land uses at the PGDP are influenced somewhat by the extent and degree of anticipated environmental remediation at the site, as well as other environmental factors. It also became apparent that community preferences for different cleanup options could be influenced by future land use choices. Although hypotheses about some of these later relationships were developed in the course of this research, their explicit evaluation was not part of the scope of work for this project. As a consequence, we would recommend that US DOE consider using the developed methodologies to further investigate this issue. Of most immediate concern, is the selection of a waste management alternative for future D&D wastes (e.g. a CERCLA cell).

- Given the increasingly likelihood of the plant closure, US DOE and the local community should initiate a formal process to help facilitate such a transition. This recommendation echoes the 2004 CAB recommendations. The research team finds that many of these recommendations are still valid and encourages the community and US DOE to revisit them in light of the increasing probability of plant closure. In particular, relevant decision makers should investigate the feasibility of establishing some type of formal research facility at the site that would focus on the development and/or testing of innovative remediation methods or technologies for alternative energy. Such a land use was suggested at each of the public meetings and was strongly supported by a majority of the participants.

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APPENDIX A: ENVIRONMENTAL AND HEALTH ISSUES

A.1 SUMMARY OF RELEVANT FEDERAL REGULATIONS

The federal regulations governing environmental management and clean-up activities at the PGDP are listed in the following table and summarized in the following sections. More detailed descriptions of the programs as implemented at the PGDP can be found in the 2008 Paducah Annual Site Evaluation Report, which is the source of the information that follows (DOE, 2010). Perhaps the most significant regulation with regard to ongoing and proposed remediation activities is CERCLA.

A.1.1 CERCLA

Because the PGDP has been designated a national Superfund site, clean up of the site is governed or controlled by the federal Superfund Cleanup Process. This process is outlined in-depth on US EPA's website at: http://www.epa.gov/superfund/cleanup/index.htm. According to this site, the Superfund process

> begins with site discovery or notification to US EPA of possible releases of hazardous substances… Once discovered, sites are entered into the Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS), US EPA's computerized inventory of potential hazardous substance release sites… Some sites may be cleaned up under other authorities. [US] EPA then evaluates the potential for a release of hazardous substances from the site through a nine-step Superfund cleanup process. Community involvement, enforcement, and emergency response can occur at any time in the process. A wide variety of characterization, monitoring, and remediation technologies are used through the cleanup process.

The US EPA website contains the following table describing the steps of the Superfund process:

Table A.1.1 The Nine Steps of the CERCLA Cleanup Process (EPA, 2010)

PA/SI	Preliminary Assessment/Site Inspection Investigations of site conditions. If the release of hazardous substances requires immediate or short-term response actions, these are addressed under the Emergency Response program of Superfund.
NPL Listing	National Priorities List (NPL) Site Listing Process A list of the most serious sites identified for possible long-term cleanup.
RI/FS	Remedial Investigation/Feasibility Study Determines the nature and extent of contamination. Assesses the treatability of site contamination and evaluates the potential performance and cost of treatment technologies.
ROD	Records of Decision Explains which cleanup alternatives will be used at NPL sites. When remedies exceed 25 million, they are reviewed by the National Remedy Review Board.

RD/RA	Remedial Design/Remedial Action Preparation and implementation of plans and specifications for applying site remedies. The bulk of the cleanup usually occurs during this phase. All new fund-financed remedies are reviewed by the National Priorities Panel.
Construction Completion	Construction Completion Identifies completion of physical cleanup construction, although this does not necessarily indicate whether final cleanup levels have been achieved.
Post Construction Completion	Post Construction Completion Ensures that Superfund response actions provide for the long-term protection of human health and the environment. Included here are Long-Term Response Actions (LTRA), Operation and Maintenance, Institutional Controls, Five-Year Reviews, Remedy Optimization.
NPL Delete	National Priorities List Deletion Removes a site from the NPL once all response actions are complete and all cleanup goals have been achieved.
Reuse	Site Reuse/Redevelopment Information on how the Superfund program is working with communities and other partners to return hazardous waste sites to safe and productive use without adversely affecting the remedy.

Superfund Cleanup Process (adapted from www.epa.gov/superfund/cleanup/index.htm)

A.1.1.1 CERCLA Nine Evaluation Criteria

Before a final decision is made on a particular remediation project, the project must be evaluated using the following nine CERCLA criteria. These criteria require that the party conducting the cleanup (i.e., DOE and its contractors at the PGDP) must inform and receive input from the community about any proposed cleanup strategies.

A.1.1.1.1 Threshold criteria (Mandatory)

• Overall protection of human health and the environment – the primary objective of remedial action; determines whether an alternative provides adequate overall protection of human health and the environment. This criterion must be met for all remedial actions.

• Compliance with Applicable or Relevant and Appropriate Requirements (ARARs) –whether an alternative meets Federal and State environmental statues, regulations, and other requirements that apply or are relevant and applicable to the site. This criterion must be met for remedial alternative to be eligible for consideration. A waiver of ARARs can occur if specific CERCLA criteria for waiver authorization are met.

A.1.1.1.2 Primary balancing criteria

• Long-term effectiveness and permanence –the magnitude of the residual risk and the ability of an alternative to maintain long-term protections after RAOs have been set.

• Reduction of toxicity, mobility, and volume through treatment – evaluation of the anticipated performance of the treatment technologies that may be employed in a remedy. Reduction of toxicity mobility and/or volume contributes toward overall protectiveness.

• Short-term effectiveness –evaluation of the speed with which the remedy achieves protection. It also refers to any potential adverse effects on human health and the environment during the construction and implementation phases of a remedial action.

• Implementability – technical and administrative feasibility of a remedial action, including the availability of materials and services needed to implement the selection solution

• Cost –evaluation of the capital, operational, maintenance, and present value costs for each alternative

A.1.1.1.3 Modifying criteria

• State acceptance –whether the state concurs with, opposes, or has no comment on the preferred alternatives based on review of the Proposed Plan feasibility study.

• Community acceptance –the general public response to the Proposed Plan, following a review of the public comments received during the public comment period.

A.1.2 RCRA

Regulatory standards for the characterization, treatment, storage, and disposal of solid and hazardous waste are established by the Resource Conservation and Recovery Act. Waste generators must follow specific requirements outlined in RCRA regulations for handling solid and hazardous wastes. Owners and operators of hazardous waste treatment, storage, and disposal facilities are required to obtain operating and closure permits for waste treatment, storage, and disposal activities. The PGDP generates solid waste, hazardous waste, and mixed waste (i.e., hazardous waste mixed with radionuclides) and operates four permitted hazardous waste storage and treatment facilities. The closed C-404 Hazardous Waste Landfill also is managed under requirements of the RCRA regulations and permit.

A.1.3 TSCA

In 1976, the Toxic Substances Control Act (TSCA) was enacted with a twofold purpose: (1) to ensure that information on the production, use, and environmental and health effects of chemical substances or mixtures is obtained by the EPA; and (2) to provide the means by which the EPA can regulate chemical substances/mixtures. Polychlorinated biphenyl (PCB) containing equipment and wastes are managed under TSCA. The facilities operated by USEC utilize equipment that contains PCB capacitors as well as transformers, electrical equipment, and other miscellaneous PCB equipment. Both radioactive and nonradioactive PCB wastes are stored onsite in units that meet TSCA and/or TSCA-UE-FFCA compliance requirements, as applicable. Nonradioactive PCBs are transported off-site to EPA-approved facilities for disposal. Radioactively contaminated PCB wastes are authorized by the TSCA-UE-FFCA for long-term onsite storage at the Paducah site (i.e., beyond two years). Technology for the treatment and/or disposal of radioactively contaminated PCB wastes is being evaluated.

A.1.4 Clean Water Act

The Clean Water Act (CWA) was established primarily through the passage of the Federal Water Pollution Control Act Amendments of 1972. The CWA established the following four major programs for control of water pollution:

(1) Regulating point-source discharges into waters of the United States;
(2) Controlling and preventing spills of oil and hazardous substances;
(3) Regulating discharges of dredge and fill materials into "waters of the United States"; and
(4) Providing financial assistance for construction of publicly owned sewage treatment works.

The PGDP is regulated for point source discharges under a Kentucky Division of Water (KDOW) permit for effluent discharges to Bayou Creek and Little Bayou Creek (KPDES Permit No. KY0004049). This permit became effective November 1, 2006, and is enforced by KDOW. The permit calls for monitoring as an indicator of discharge-related effects in receiving streams and applies to the following four DOE outfalls: 001, 015, 017, and 019.. The current version of the permit will expire on October 31, 2011.

A.1.5 Clean Air Act

Authority for enforcing compliance with the Clean Air Act (CAA) and subsequent amendments resides with EPA Region 4 and/or the Kentucky Division for Air Quality (KDAQ). The Paducah site complies with federal and state rules by implementing the CAA and its amendments. The largest air emission sources in 2008 were the Northwest Plume Groundwater System (NWPGS) and the Northeast Plume Containment System (NEPCS). These systems are interim remedial actions (IRAs) under CERCLA that address the containment of groundwater contamination at the Paducah site. These systems remove trichloroethylene (TCE) contamination from the groundwater by air stripping. At the NWPGS, the TCE-laden groundwater passes through an air stripper to remove the TCE. The off-gas from the air stripper then passes through a carbon adsorption system to remove the TCE prior to atmospheric discharge. At the NEPCS, a cooling tower system acts as an air stripper for TCE. Concentrations of TCE in the Northeast Plume are sufficiently low that a carbon adsorption system is not required to keep emission below regulatory thresholds.

A.1.5.1 Asbestos

Numerous facilities at the Paducah site contain asbestos materials. Compliance programs for asbestos management include identification of asbestos materials, monitoring, abatement, and disposal. Procedures and program plans delineate scope, roles, and responsibilities for maintaining compliance, as applicable, with US EPA, Occupational Safety and Health Administration, and Kentucky regulatory requirements.

A.1.5.2 Airborne Emissions of Radionuclides

Airborne emission of radionuclides from US DOE facilities is regulated under 40 *CFR* § 61, Subpart H, the National Emission Standards for Hazardous Air Pollutants regulations. The Radiation/Environmental Monitoring Section of the Radiation Health and Toxic Agents Branch (RHTAB) -Department for Public Health - Kentucky Cabinet for Health Services conducts annual site ambient air monitoring. Ambient air data are collected annually at ten sites surrounding PGDP to measure radionuclides emitted from Paducah site sources, including potential fugitive emissions.

A.1.6 National Environmental Policy Act

The National Environmental Policy Act (NEPA) requires an evaluation of the potential environmental impact of certain proposed federal activities. In addition, an examination of alternatives to certain proposed actions is required. In accordance with the 1994 US DOE Secretarial Policy Statement on NEPA, preparation of separate NEPA documents for environmental restoration activities conducted under CERCLA no longer is required. Instead, the US DOE CERCLA process includes "NEPA values." The NEPA values are environmental issues that affect the quality of the human environment. Documentation of NEPA values in CERCLA documents allows the decision makers to consider the potential effects of proposed actions on the human environment. Additional regulations related to NEPA include: 1) The National Historic Preservation Act of 1966, and 2) The Endangered Species Act of 1973.

A.1.7 Emergency Planning and Community Right-to-Know Act

Also referred to as Title III of the Superfund Amendments and Reauthorization Act (SARA), the Emergency Planning and Community Right-to-Know Act (EPCRA) requires reporting of emergency planning information, hazardous chemical inventories, and releases to the environment.

A.2 HISTORY OF HEALTH INVESTIGATIONS

Anecdotal evidence has led some residents who live near the PGDP to conclude that plant operations have contributed directly to diseases within the local community, including various forms of cancer. Similar concerns are shared by some former plant employees. Such concerns have been investigated by both national and state newspapers and magazines, including *The Washington Post* (Warrick, 1999), *The Louisville Courier Journal* (Carroll and Malone, 2006), and *The New Yorker* (Mason, 2000) and by independent scientists (Paschenko, 2005; ISAR, 2005). More recent scientific investigations have looked at the potential impacts of exposure to TCE (Rice, 2005; Gash et al., 2008)

Several federal agencies are charged with investigating the health impacts associated with environmental exposures. These include the Agency for Toxic Substances and Disease Registry (ATSDR) and the National Institute for Occupational Safety and Health (NIOSH). Both organizations either have conducted or have funded health studies related to the PGDP. The results are summarized below.

A.2.1 ATSDR Investigation

The Agency for Toxic Substances and Disease Registry (ATSDR) is the lead US public health agency responsible for implementing the health-related provisions of CERCLA. ATSDR assesses the presence and nature of health hazards at specific Superfund sites, helping to prevent or reduce further exposures and illness resulting from those hazards and expanding the knowledge base about the health effects of exposure to hazardous substances.

ATSDR works closely with state agencies to use the best science, to take responsive public health actions, and to provide trusted health information to prevent harmful exposures and diseases related to toxic substances. ATSDR provides funding and technical assistance to states and other partners through cooperative agreements and grants to identify and evaluate environmental health threats to communities. These resources enable state and local health departments and other grantees to further investigate environmental health concerns and to educate communities.

ATSDR representatives visited the PGDP site in May 1994, as part of a program to evaluate US DOE NPL sites and to develop workplans for such sites. Some community health concerns were identified during this site visit and during ATSDR's participation in six US DOE public meetings in June 1994, May 1995, July 1995, November 1996, January 1998, and July 1999 (ATSDR, 1995; 1997; 1998).

Community concerns also were provided to the agency via written correspondence, telephone conversations, informal meetings, and public availability sessions. In 1995, ATSDR solicited concerns from community members by direct mail inquiry: a package containing a query letter, an information brochure about ATSDR, and a self-addressed business reply envelope that was mailed to approximately 1,700 community members. A total of 60 people responded to this mailing. In May 1996, ATSDR held five public availability sessions in Paducah and Heath, Kentucky to solicit additional concerns. The public availability sessions were informal and allowed citizens to discuss their health concerns related to the site, one-on-one, with an ATSDR team member (ATSDR, 1996). Staff from ATSDR and Boston University gathered concerns by attending several PGDP Community Advisory Board (CAB) meetings and US DOE technical presentations. All in all, ATSDR received about 500 community concerns. These concerns are discussed in Appendix B of their final report. Most were related to the incidence of cancer, the incidence of other illnesses, and the possibility of exposure through various media (ATSDR, 2002).

ATSDR staff members visited the site in January 1996 to discuss the agency's public health assessment (PHA) process, along with ATSDR's data needs, with US DOE and LMES officials (ATSDR, 1996). In March 1996, ATSDR representatives again visited the area, this time discussing the PHA process with citizens, gauging the community's interest in public availability sessions, and meeting with the newly formed PGDP Citizens Advisory Board (CAB) and local health officials (Boston University, 1996). ATSDR representatives toured the Western Kentucky Wildlife Management Area (WKWMA) with a community member and staff from Kentucky's Department of Fish and Wildlife Resources and Kentucky's Department for Environmental Protection (ATSDR, 2002).

ATSDR representatives visited the area in December 1996, to gather relevant demographic and land-use data and to investigate possible exposure pathways in the community near the facility (ATSDR, 1997). In June 1997, the ATSDR team conducted another site visit to address the CAB and to meet with various officials and residents in the area (ATSDR, 1997). In February 1998, ATSDR staff attended the CAB meeting and conducted the first public meeting for the *Draft Programmatic Environmental Impact Statement for Alternative Strategies for the Long-Term Management and Use of Depleted Uranium Hexafluoride* (ATSDR, 1998). In July 2000, ATSDR staff attended US DOE's public meeting on the Groundwater Operable Unit Feasibility Study and the CAB meeting. On September 11, 2000, an ATSDR representative addressed Active Citizens for Truth (ACT), a local community group, to discuss ATSDR and the agency's role at the PGDP site (ATSDR, 2002).

In March 2001, ATSDR released a preliminary public health assessment for off-site migration of hazardous substances from PGDP to the surrounding community, as well as the potential health effects to community members from exposure to these substances. A public health assessment is a written, comprehensive evaluation of available data and information on the release of hazardous substances into the environment in a specific geographic area. Such releases are assessed for current or future impact on public health. Following this report, ATSDR also released a health consultation in February 2002, providing an exposure assessment of airborne nickel and other metal particulates from historic smelter operations at the PGDP. A final public health assessment was released in May 2002. The executive summary of the final report is provided in Appendix B. Details of the health assessment can be found at the following website: http://www.atsdr.cdc.gov/HAC/PHA/HCPHA.asp?State=KY.

A.2.2 NIOSH Investigation

The final ATSDR public health assessment addressed potential off-site exposures to radioactive and non-radioactive substances released from the PGDP; however, it did not address *on-site* exposures of PGDP workers to radioactive or hazardous materials. Workers may be expected to be exposed to higher levels of radioactive and hazardous materials than the general public but should be trained in the use and safe handling of hazardous materials. In addition, worker exposures should be monitored (ATSDR, 2002).

Since 1997, the United States Enrichment Corporation (USEC), which currently operates the gaseous diffusion plant, has been required to meet worker safety and health standards developed by the Department of Labor, Occupational Safety and Health Administration (OSHA); the plant also must meet standards developed by the U.S. Nuclear Regulatory Commission (NRC). Before the plant was privatized, however, the facility was subject to the U.S. Department of Energy regulations and standards but was exempt from external regulation and enforcement (ATSDR, 2002).

The U.S. Department of Health and Human Services, Centers for Disease Control, National Institute for Occupational Safety and Health (NIOSH) is responsible for researching potential health hazards experienced in the workplace and for providing recommendations for exposure standards to OSHA. NIOSH is research-oriented and is not a regulatory agency. NIOSH has conducted studies of workers in the gaseous diffusion plants at Oak Ridge, Paducah, and Portsmouth (ATSDR, 2002).

In response to concerns about past and present radiation and chemical exposures at the PGDP, NIOSH funded a collaborative study by the University of Louisville, the University of Kentucky, and the University of Cincinnati to evaluate health impacts on 6,820 workers employed at the plant from 1952 to 2003 (Chan, et al., 2010). According to the study results, “[O]f specific concern was exposure to uranium hexafloouride and the presence of transuranic materials including neptunium and plutonium”. With the exception of lymphatic and hematopoietic cancers, the “PGDP workers experienced lower mortality rates from all deaths and all cancers compared with the US reference populations” (Chan et al., 2010) Although these results may initially seem unexpected or counter-intuitive, they are consistent with previous studies identifying “the healthy worker effect” – a phenomenon in which workers with stable jobs providing health benefits, including more frequent check-ups and health monitoring, tend to be healthier that the general public, even thought their potential exposure risks may be greater than the general public. Another possible explanation for this result can be attributed to “the healthy worker survivor effect”, “which tend[s] to diminish exposure-related, long-term risk estimates because workers who remain employed tend to be healthier than those who terminate” (Chan, et al., 2010).

A.3 EXECUTIVE SUMMARY OF THE 2002 ATSDR REPORT

(available online at http://www.atsdr.cdc.gov/HAC/pha/pha.asp?docid=792&pg=1#sum)

The U.S. Department of Energy (DOE)'s Paducah Gaseous Diffusion Plant (PGDP) was added to the U.S. Environmental Protection Agency's Superfund National Priorities List (NPL) on May 31,1994, because elevated concentrations of trichloroethylene (TCE) and technetium 99 (Tc-99) were found in off-site groundwater (residential wells). The Superfund law (CERCLA) requires that the Agency for Toxic Substances and Disease Registry (ATSDR) conduct a public health assessment for all sites listed on the NPL. This public health assessment evaluates contaminant distributions, community health concerns, and available health outcome information to determine the potential for community exposures to hazardous substances and the resulting adverse public health effects.

The plant, which is about 10 miles (16 kilometers) west of Paducah, Kentucky, began operation in1952. PGDP produces enriched uranium with a higher than natural concentration of uranium 235, processing a gaseous form of uranium (uranium hexafluoride). TCE was used as a solvent to clean metal parts. Tc-99, a radioactive constituent of reprocessed uranium, was introduced at the site when uranium used in reactors was reprocessed and used at the site. This public health assessment presents an evaluation of these and other chemical and radioactive contaminants in *human* exposure pathways. ATSDR also considered other hazards--such as accidents involving the depleted uranium cylinders stored at and potentially transported to and from this site--in evaluating the public health effects of past, current, and future PGDP operations on the surrounding community.

According to the information reviewed by ATSDR, under existing conditions and normal operations, the Paducah Gaseous Diffusion Plant site poses no apparent public health hazard for the surrounding community from *current* exposure to groundwater, surface water, soil and sediment, biota, or air."No apparent public health hazard" means that people may be exposed to contaminated media near the site, but that exposure to the contamination is not expected to cause adverse health effects. We define "current" as ranging from 1990 to the present. This conclusion assumes the effectiveness of access restrictions to Little Bayou Creek, the outfalls, and the North-South Diversion Ditch; the fish advisories issued for Little Bayou Creek and some of the ponds in the Western Kentucky Wildlife Management Area; and existing regulation of discharges to air and surface water.

In the future, the rupture or destruction of one or more depleted uranium cylinders from a transportation accident involving a fire, a plane crash, severe weather, or natural disasters would create *an urgent public health hazard for anyone near the damaged cylinders*. Weather conditions and duration of exposure would affect the distance from the cylinders at which there would be a hazard; however, for transportation accidents, we predict that (1) the maximally exposed individual would be 100 feet (30 meters) or less from the cylinders and (2) an urgent public health hazard could exist out to 230 feet (70 meters) from the cylinders. Less-severe health effects could be experienced by individuals within several thousand meters of the cylinders. *These types of accidents or incidences are unlikely but must continue to be recognized as possible.*

In our assessment, historical groundwater exposure to TCE and lead was a public health hazard for children routinely drinking water from four residential wells. This means that long-term exposure occurred at concentrations that may have caused adverse health effects in children. A future groundwater exposure pathway could exist if new wells are drilled into the northwest or northeast plumes. No current exposure pathways to contaminated groundwater exist, but the current restrictions between DOE and the property owners do not restrict the drilling of new wells by future owners of this land. Although it is unlikely, potential future exposures could occur if new wells are drilled into these plumes.

Groundwater exposures to vinyl chloride (a degradation product of TCE) and acute air exposures to uranium and hydrogen fluoride are an indeterminate public health hazard for past and potential future exposures. This means that the information available is incomplete.

Information on vinyl chloride exposures is incomplete because the detection limits (DLs) in most analyses of samples from tested residential wells were well above the levels of concern. Also, not all residential wells in or near the plume were tested for vinyl chloride. Future groundwater monitoring DLs for vinyl chloride and other TCE degradation products should be sensitive enough to determine whether concentrations exceed health-based guidelines. However, there appears to be no current exposure to vinyl chloride since these wells are not being used.

Past short-term or acute air exposures to uranium and hydrogen fluoride pose an indeterminate public health hazard, because total release quantities and completed exposure pathways are uncertain. The worst reported accidental release happened at 4:00 am on November 17, 1960.Potentially hazardous uranium and hydrogen fluoride concentrations, estimated using air dispersion models, reached off-site areas, but because the accident occurred at 4:00 a.m., it is not known if any residents were exposed. If people were exposed at the concentrations estimated by the model, adverse health effects may have resulted. Also, in the past, it has been reported that UF_6 was released at night through jets on top of the process buildings to accelerate the reduction of UF_6 concentration in the process gas system in order to perform maintenance and inspection on process gas equipment. These releases, called "midnight negatives", potentially contained significant quantities of uranium and hydrogen fluoride; however, the quantities released and the frequency of releases is unknown. Currently, we have no reports of health effects related to these releases; however, if data become available suggesting that health effects did occur, we will re-evaluate the need for follow up activities.

Past long-term or chronic uranium and hydrogen fluoride exposures were below levels of public health concern.

ATSDR representatives reviewed available health outcome data, such as cancer registries and vital statistics. We evaluated the data using age-adjusted rates, concentrating mostly on nine general types of cancer. The health outcome data reviewed do not apply specifically to small groups of people who have been, or could be, exposed to PGDP contaminants. The data are recorded for larger areas (area development districts or counties) which include many people with no exposures to contaminants from the site (approximately 63,000 in McCracken County, 8,000 in Ballard County, and 15,000 in Massac County). The population of concern for the exposure pathways in the PDGP area (approximately 15 to 90 persons) is small. The associations between exposure from this site and any adverse health effects would be obscured or distorted by the presence of the much larger unexposed population.

ATSDR has collected people's concerns from the communities around PGDP for this public health assessment. Many people expressed concerns related to the incidence of cancer and other illnesses in the area and the possibility of exposure to contaminants through various media. Community concerns and our responses are presented in the main part of this document.

Based on the data and information obtained and evaluated for this public health assessment, ATSDR recommends the following:

1. All depleted uranium shipments to and from PGDP should continue to be shipped in transport cylinders or over packs approved for transport by the appropriate regulatory authorities.
2. Put in place institutional controls that prevent installation of new wells in the contaminated groundwater plume areas.
3. Prevent the future use of contaminated wells by such means as disconnecting water pipes to homes or businesses and plugging or dismantling the wells.
4. Encourage residents who are concerned about lead in their drinking water to have their water tested. (Lead did not appear to be related to the groundwater plumes.)
5. Continue groundwater monitoring, including monitoring in areas possibly affected by the plumes and areas near Little Bayou Creek, Bayou Creek, and the North-South Diversion Ditch.
6. Ensure that detection limits of degradation products of TCE, such as vinyl chloride, in the groundwater analyses are sensitive enough to determine whether concentrations exceed health-based guidelines.
7. Continue monitoring the McNairy Aquifer wells to detect possible migration of contaminants from the Regional Gravel Aquifer--if monitoring wells do not create a conduit for vertical migration.
8. Continue to restrict access to Little Bayou Creek, the outfalls, and the North-South Diversion Ditch. Determine if existing signage adequately restricts public access to the southwest inactive landfill and the adjoining area.
9. Continue monitoring biota to ensure that it is safe to consume.
10. Develop a spatially and statistically consistent soil sampling program to assess accumulation of airborne contaminants in residential areas.

Several of these recommendations may already be addressed by actions taken by DOE or other agencies. These actions are discussed in the Public Health Action Plan in the main part of this document.

ATSDR staff will continue to monitor environmental issues and remedial activities at PGDP, as well as proposals related to storage and transport of the depleted uranium cylinders. The interpretation, conclusions, and recommendations provided in this public health assessment are based on the data and information referenced. Additional data could alter those conclusions and recommendations. The conclusions and recommendations are site specific and should not be considered applicable to any other situation.

A.4 SUMMARY OF TYPES OF WASTES AT THE PGDP

In general, the wastes found at the PGDP can be lumped into eight categories (DOE, 2010a). These include:

(1) *Hazardous waste*—Waste that contains one or more of the wastes listed as hazardous under Resource Conservation and Recovery Act (RCRA), a federal law which governs the disposal of solid and hazardous wastes, or waste that exhibits one or more of the four RCRA hazardous characteristics: (1) ignitability, (2) corrosivity, (3) reactivity, and (4) toxicity.

2) *Mixed waste*—Waste containing both a hazardous component regulated under RCRA and a radioactive component regulated under the Atomic Energy Act.

(3) *Transuranic waste*—Waste that contains more than 100 nanocuries of alpha-emitting transuranic isotopes per gram of waste (a radioactive unit of measurement), with half-lives greater than 20 years.

(4) *Low-level radioactive waste (LLW)*—Radioactive waste not classified as high-level or transuranic.

(5) *PCB-containing and PCB-contaminated waste*—Waste containing or contaminated with polychlorinated biphenyls (PCBs), toxic organic compounds previously used in transformers, capacitors, and coolants, which were banned for US commercial use in 1979.

(6) *Asbestos waste*—Asbestos-containing materials from renovation and demolition activities.

(7) *Solid waste*—Primarily industrial/construction debris that is disposed of in landfills.

(8) *PCB radioactive waste*—PCB waste or PCB items mixed with radioactive materials.

Table A.4.1 Estimate of PGDP Wastes by Waste Category (US DOE 2010a)

Waste	LLW (yd^3)	LLW/ RCRA (yd^3)	LLW/ RCRA/ TSCA (yd^3)	LLW/ TSCA (yd^3)	RCRA (yd^3)	TSCA (yd^3)	Nonhazardous Solid Waste (yd^3)	Total (yd^3)
Asbestos	3,700	0	24,800	0	0	4,000	1,000	33,500
Concrete	377,400	800	0	0	0	0	393,300	771,500
General Construction Debris	425,800	2,900	0	0	0	2,900	235,400	667,000
Other Dry Solids	46,000	100	5,300	200	500	700	4,200	57,000
Scrap Metal	407,800	200	0	0	0	3,700	68,800	480,500
Soil	1,286,300	29,100	0	0	16,100	1,700	376,300	1,709,500
Total	2,547,000	33,100	30,100	200	16,600	13,000	1,079,000	3,719,000

A.5 SUMMARY OF THE BURIAL GROUNDS

The burial grounds are assigned an official US DOE solid waste management unit (SWMU) number. The contents of each burial ground is summarized in Table A.5.1. A map showing the exact location of each SWMU is provided in Figure A.5.1.

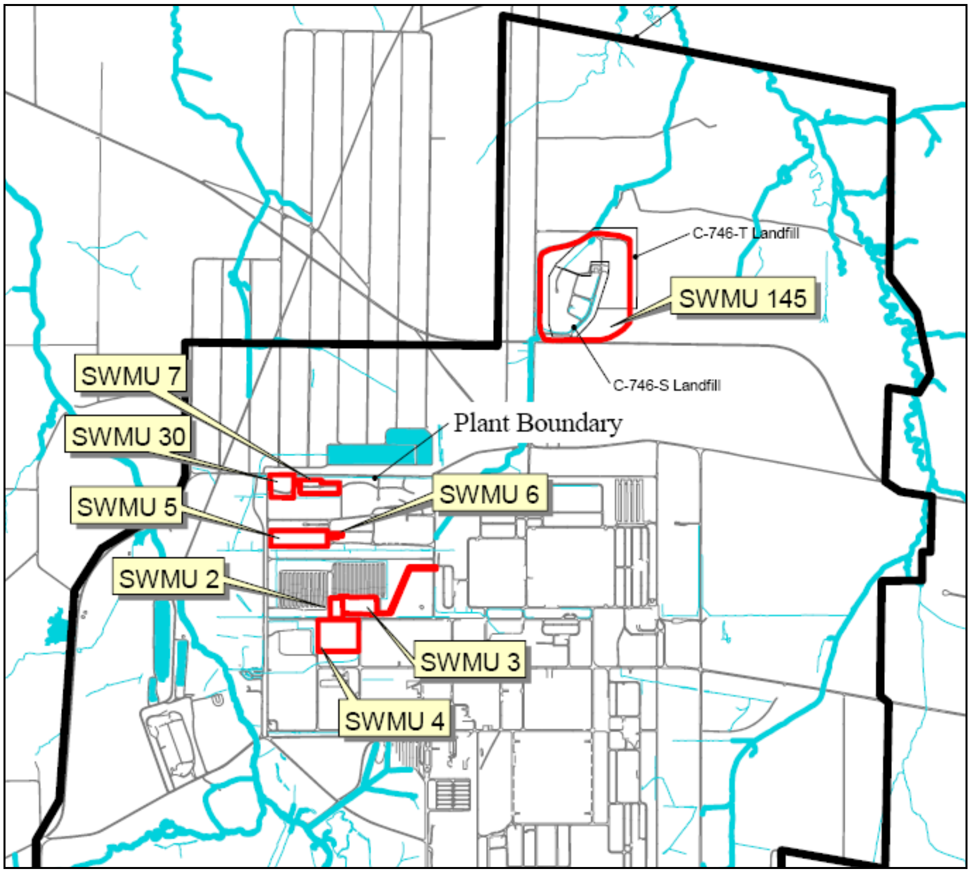

Figure A.5.1 Location of Burial Ground SWMUs (US DOE, 2008c)

Table A.5.1 Summary of Burial Ground at the PGDP (US DOE 2008a)

Burial Ground	Contents	Quantity
SWMU 2: C-749 Uranium Burial Ground	Uranium, Petroleum Based Synthetic Oils, TCE	Uranium: 539,000 lbs. Oils: 59,000 gal. TCE: 450 gal
SWMU 3: C-404 Low-Level Radioactive Waste Burial Ground	Uranium, some contaminated with TCE, radionuclides and metals, Smelter Furnace Liners, EP Toxic wastes D006, D008, D010	Uranium: 6.6 mil lbs. EP Toxic Wastes: approximately 450 drums.
SWMU 4: C-747 Contaminated Burial Yard and C-748-B Burial Area	Contaminated and uncontaminated trash, scrap equipment with surface contamination from enrichment process	Land Area: 7.4 Acres
SWMU 5: C-746-F Classified Burial Yard	Security classified wastes, radionuclide contaminated wastes	Contaminants: uranium, 99-technetium, tritium, Cobalt-60, and other metals
SWMU 6: C-747-B Burial Ground	Consists of five burial pits; H, I, J, K, and L.	See Below
SWMU 7: C-747-A Burial Ground containing pits B, C, D, E, F1-F5, and G. (See Below)	Non-combustible mixed waste, some contaminated equipment. Contaminated concrete, uranium contaminated scrap metal.	More contaminants: uranium, arsenic, beryllium, cadmium, copper, nickel, and zinc. TCE and degradation products. Land area: 23,100 ft^2
SWMU 30: C-747-A Burn Area	Combustible trash and residue	
SWMU 145: P-Area Residential/Inert Landfill Borrow Area	Construction and demolition debris: concrete, roofing material, wire, wood, asbestos	More waste: tarry material containing elevated levels of uranium and technetium. Land Area: 44 Acres

A.5.1.1 SWMU 6 Burial Pits

SWMU 6 actually contains several separate burial pits. Each pit has been given a unique letter designation. A summary of the contents of the pits is provided below (DOE, 2008a).

Area H: Magnesium Scrap Burial Area. The location contains magnesium scrap generated in the machine shop. A total of about ten drums of scrap were buried during midsummer 1971.

Area I: Exhaust Fan Burial Area. Eight exhaust hood blowers removed from C-710 were discarded in 1966 to this pit. These blowers, 15in. diameter weighing 100lbs each, were contaminated with perchloric acid. The blowers are spaced about 4-feet apart in pit.

Area J: Contaminated Aluminum Burial Area. This hole contains about 100 to 150 drums of aluminum scrap including nuts, bolts, plates, trimmings, etc., that were generated in the converter and compressor shops. These materials were buried around 1960-1962.

Area K: Magnesium Scrap Burial Area. This location contains about 20 drums of magnesium scrap generated in the machine shop and buried on September 3, 1968, and on December 23, 1969.

Area L: Modine Trap Burial Area. A single contaminated condensation trap for a Modine heater was buried in this area. The cold trap was about 4ft in diameter, about 15ft long, weighing about 5000lbs. This trap was buried on March 5, 1969.

A.5.1.2 SWMU 7 Burial Pits

The SWMU 7: C-747-A Burial Ground also contains several different burial pits, summarized as follows:

Pit B: This pit is approximately 60ft X 172ft and contains noncombustible trash and contaminated and noncombustible material and equipment. According to the Phase II SI geophysical survey, the actual excavation extends beyond the designated boundaries and may connect with the adjacent burial pit (Pit C).

Pit C: This pit is approximately the same size at Pit B. Based on Phase II geophysical survey, Pit C and Pit B may be one continuous pit. Historic records indicate that both Pit B and Pit C received the same materials.

Pit D: Approximately 15ft by 99ft, this pit contains documented buried material that includes uranium-contaminated concrete pieces of reactor tray bases from C-410, which were used during the fluorination process of uranium tetrafluoride and uranium hexafluoride.

Pit E (Outside the eastern boundary of SWMU 7 and within the C-746-E Contaminated Scrap Yard): Approximately 15ft X 143ft, this pit contains documented material that includes uranium-contaminated concrete pieces of reactor tray bases.

Pit F1-F5: These five small pits (approx. 20ft X 80ft) contain documented material that includes uranium-contaminated scrap metal and equipment, as well as empty uranium and magnesium powder drums.

Pit G: Approximately 27ft X 122ft, this pit contains documented burial material that includes noncombustible trash, as well as contaminated noncombustible material and equipment.

A.6 SUMMARY OF THE LANDFILLS

The plant operates four permitted hazardous waste storage and treatment facilities (the K, S, T, and U landfills), as well as one closed hazardous waste landfill -- (C-404), all of which are managed under RCRA regulations and permitting. The locations of each of these landfills is shown in Figure A.6.1. A summary of the contents of each landfill is provided in the following sections:

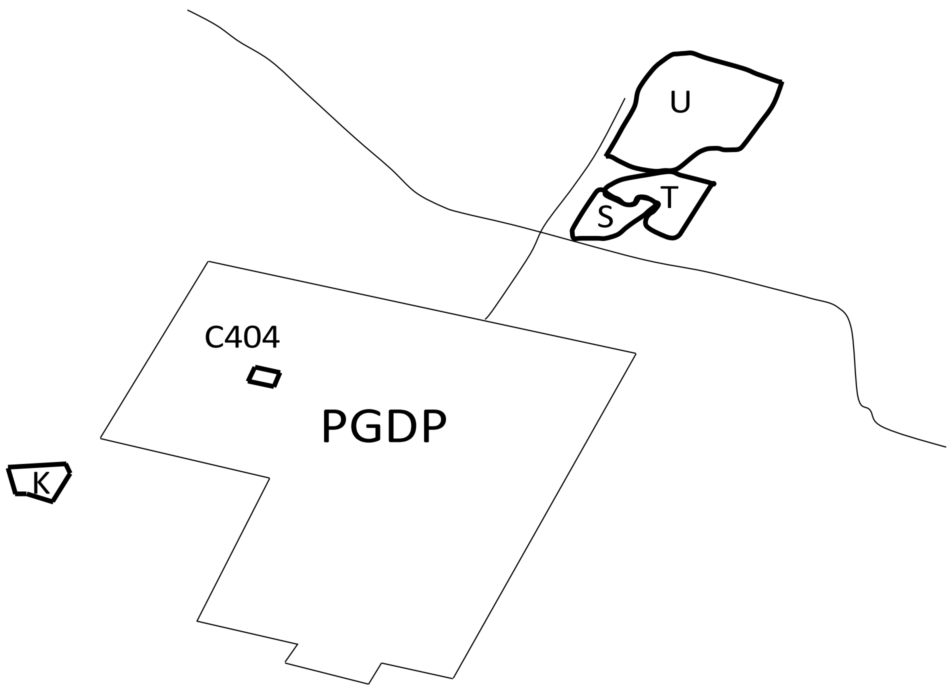

Figure A.6.1 Relative Location of Landfills at the PGDP

A.6.1 K Landfill

The *C-746-K Landfill* (SWMU 8) covers about 6.8 acres southwest of the industrialized portion of PGDP. A sanitary landfill from the early 1950s through the early 1980s, this landfill is known to contain both burned and unburned sanitary trash, along with fly ash from coal burning operations. Before 1967, trenches were cut in the ash to form burn pits. After 1967, the trash was buried in the ash without burning. Sludge from the C-615 Sewage Treatment Plant reportedly was used as fill material. C-746-K possibly contains some radionuclide-contaminated trash.

US DOE closed the landfill in 1982 by covering it with a 6-inch clay cap and an 18-inch vegetative cover. Seepage points were identified in a ditch adjacent to the unit in January 1992. This landfill subsequently underwent a remedial investigation (RI), and a record of decision eventually was executed. Corrective actions taken included: 1) installation of riprap along the creek bank to prevent direct contact with the seeps; 2) re-contouring of the landfill cap to promote rainfall runoff; 3) implementation of institutional controls; and 4) long-term monitoring. The US DOE placed deed restrictions on the landfill in 1997. Possible contaminants associated with the landfill are solvents and metals.

A.6.2 S Landfill

The *C-746-S Residential Landfill* (SWMU 9) is covers about 5 acres north of the PGDP's industrialized portion. This sanitary landfill was used from 1981 to 1995. Before the construction and permitting of the C-746-S Landfill, the area was used for the disposal of scrap and waste. C-746-S consists of 6 cells, each of which was lined with 12 inches of clay. The landfill permit allowed the disposal of industrial operations refuse, debris, and combustible and noncombustible garbage. Trash was compacted daily and covered with 6 inches of soil.

The Kentucky Division of Waste Management (KDWM) issued a permit for the construction of the C-746-S Residential Landfill in April of 1981. In July 1993, US DOE complied with required modifications to landfill operations designed to promote groundwater and surface water protection, completing a certified closure of the last landfill cell in June1995. A continuing groundwater and surface water monitoring program is in place to trigger corrective action, if necessary. The landfill is a potential source of solvents, metals, and radionuclides.

A.6.3 T Landfill

The *C-746-T Inert Landfill* (SWMU 10) covers approximately 8.4 acres adjacent to the C-746-S Landfill (SWMU 9). The KDWM issued a permit for the construction of the C-746-T Inert Landfill in February of 1985. Used for the disposal of industrial trash from 1985 through 1992, this landfill contains concrete, wood, and rock, with steam plant fly ash used as filler material.

The C-746-T operating permit required that the waste be covered with clay and a vegetative cover for closure. US DOE completed a certified closure of the landfill in November 1992. A continuing groundwater and surface water monitoring program is in place to trigger any necessary corrective actions. The landfill is a potential source of solvents, metals, radionuclides, and asbestos.

A.6.4 U Landfill

The *C-746-U Landfill* (SWMU 208) is an operating RCRA Subtitle D solid waste landfill located directly north of the C-746-S&T Landfills. It covers 59.7 acres and includes a liner and leachate collection system. This landfill started receiving waste in 1997. Accepted wastes include construction debris, industrial waste, asbestos material, incinerator ash, tires, paper, cardboard, and plastics. Leachate from the C-746-U Landfill is treated at PGDP before being released to KPDES-permitted outfalls. No releases to groundwater are known to have occurred from this landfill.

In August 2006, KDWM issued a letter to US DOE that placed the C-746-U Landfill into groundwater contamination assessment. The letter stated that contaminants had exceeded either MCLs or statistical limits calculated relative to concentrations found in upgradient wells. A groundwater assessment plan has been developed to identify the actions that US DOE will take to determine if the contamination is coming from the C-746-U Landfill or from another source. Once the source is identified, appropriate cleanup actions will occur.

A.6.5 C-404 Landfill

The only PGDP hazardous waste facility that requires groundwater monitoring is the C-404 Landfill. This low-level radioactive waste burial ground was used for the disposal of uranium-contaminated solid wastes until 1986, when it was determined that gold dissolver precipitate in the landfill constituted hazardous waste under RCRA. The landfill was covered with a RCRA-compliant cap and certified as a closed hazardous waste landfill in 1987.

APPENDIX B: SUMMARY OF PAST US DOE CLEANUP ACTIVITIES

Since the discovery of off-site contamination off-site, US DOE has implemented several environmental management and remediation projects for the PGDP. According to the most recent Annual Site Environmental Report (US DOE, 2010) these have included:

- Imposed land use controls (fencing and posting) to restrict public access to contaminated areas in certain outfall ditches and surface water areas (1993).

- Extended municipal water lines as a permanent source of drinking water to affected residents to eliminate exposure to contaminated groundwater (1995).

- Constructed and implemented groundwater treatment systems for both the Northwest and Northeast Plumes to reduce contaminant migration (1995 and 1997, respectively).

- Rerouted surface runoff away from highly contaminated portions of the North-South Diversion Ditch (NSDD) to reduce potential migration of surface contamination (1995).

- Excavated soil with high concentrations of PCBs in on-site areas to reduce off-site migration and potential direct-contact risks to plant workers (1998).

- Removed and disposed of "drum mountain", a contaminated scrap pile potentially contributing to surface water contamination, so that a potential direct-contact risk to plant workers would be eliminated and an off-site migration risk would be reduced (2000).

- Applied *in situ* treatment of TCE-contaminated soil at the cylinder drop test site using innovative technology to eliminate a potential source of groundwater contamination (2002).

- Removed petroleum-contaminated soil from SWMU 193, the former McGraw Construction Yards and current Southside Cylinder Yards, to eliminate a potential source of groundwater contamination (2002).

- Completed installation of a sediment control basin at Outfall 001 to control the potential migration of contaminated sediment (2002).

- Completed a treatability study that demonstrated the effectiveness of the six-phase heating technology for *in situ* treatment of dense nonaqueous-phase liquid at C-400 (2003).

- Completed installation of a retention basin and excavation of the on-site portions of the NSDD, which removed a source of direct-contact risk to plant workers and a potential source of surface water contamination (2004).

- Investigated potential source areas contributing to the Southwest Plume, the results of which remain pending (2005).

- Completed D&D of the C-603 Nitrogen Facility (2005).

- Performed an SI near the C-746-S&T Landfills and determined that TCE groundwater contamination is from SWMU 145, the Residential/Inert Landfill and Borrow Area (2006).

- Disposed of approximately 30,500 tons of scrap metal, which eliminated a potential direct-contact risk to plant workers and a source of surface water contamination (2006).

- Completed D&D of the C-402 Limehouse (2006).

- Initiated remedial design/action for volatile organic contamination in soil and groundwater at the C-400 Cleaning Building (2006).

- Completed D&D of the C-405 Incinerator (2007).

- Completed remedial action field investigation for the Burial Ground Operable Unit (2007).

- Completed D&D of the C-746-A West End Smelter (2008).

- Completed D&D of the C-342 Ammonia Disassociator Facility (2008).

- Demolished two 60-year-old water towers (2009).

- Completed DMSA characterization (2009).

- Completed DMSA disposition (2009).

- Neared completion of legacy waste removal (2009).

- Completed C-400 Phase I construction and started testing (2009).

- Reused C-342 ammonia tanks at C-746-U Landfill (2009).

- Completed C-746-D yard excavation (2009).

- Began accelerated D&D of 3 inactive facilities (ARRA-funded) (2009).
- Started surface water hot spot removal (2009).

- Started removal of two soil facilities (2009).

- Started expansion of groundwater monitoring wells network (2009).

- Completed sitewide flyover (2009).

- Completed Phase I of C-400 source removal (2010)

- Complete accelerated ARRA-funded work (2010)

- Completed Soils and Surface Water actions (2010).

- Completed decision documents for SW Plume (2010).
- Issue BGOU Feasibility Study (2010).
- Completed Soils Remedial Investigation(2010).
- Completed enhancement of monitoring well network (2010)

APPENDIX C: EXECUTIVE SUMMARY OF THE 2004 DOE RISK-BASED END STATE REPORT

(available online at http://www.paducahvision.com/c/document_library)

In 2002, the Department of Energy's (DOE) Office of Environmental Management (EM) established a set of corporate projects to lead EM's response to the *Top to Bottom Review*. One of these projects has resulted in the production of policy and guidance that directs DOE sites to submit a site-specific Risk-based End State (RBES) vision document. In accordance with that policy (DOE Policy 455.1, *Use of Risk-based End States*) and its implementing guidance (*Guidance for Developing a Sit specific Risk-based End State Vision*), as amended, the Paducah Gaseous Diffusion Plant (PGDP) has prepared this draft RBES vision and variance report for PGDP.

This draft report uses a standardized approach to meet the objectives for the RBES report contained in the guidance. This approach relies on the presentation of a series of maps and conceptual site models (CSMs) that depict the relationship between PGDP and its surroundings. The maps and CSMs are intended to present and allow comparisons between current and future land uses; depict hazards and risks to affected or potentially affected populations or receptors; serve as a planning tool for site management; facilitate communication of risks during discussions with stakeholders; allow tracking of expected and actual cleanup results; and serve as a communication tool for public meetings in regard to cleanup activities, current PGDP missions and requirements, and future land use. The maps follow a standardized hierarchical approach that depicts the PGDP RBES in regional-, site-, and hazard-specific contexts.

The CSMs are produced only in a hazard-specific context. In the CSMs and their associated text, various responses to achieve site cleanup are presented. These presentations are not meant to be pre-decisional, but are meant to introduce examples of actions that may be completed to reach the RBES. The selection of specific actions will be made in accordance with applicable law and agreements. Once the final RBES vision is developed, DOE will further evaluate the cleanup activities and the strategic approaches at PGDP to determine if it is appropriate to pursue changes in the PGDP baseline.

Any decision to pursue changes to the baseline will include factors beyond those presented in the RBES report, including input from involved parties. If DOE ultimately decides to seek changes to current compliance agreements, decisions, or statutory/regulatory requirements, then those changes will be made in accordance with applicable requirements and procedures. Currently, PGDP, located in Paducah, Kentucky, is the nation's only operating uranium enrichment facility.

Missions performed at PGDP are the enrichment mission, a uranium conversion mission, and an environmental cleanup mission. The enrichment mission began in the early 1950s and involves producing enriched uranium for commercial uses through a gaseous diffusion process. At present, the facilities and infrastructure used to produce enriched uranium are leased to the United States Enrichment Corporation (USEC). The uranium conversion mission, which was recently initiated, involves the construction and operation of a facility that will convert depleted uranium hexafluoride (DUF_6) currently stored at PGDP less reactive uranium forms and the subsequent disposal of the converted uranium. Finally, the environmental cleanup mission involves work performed under a Federal Facility Agreement (FFA), as well as some work outside of the FFA.

The current portion of the cleanup mission under the FFA is to investigate and address existing environmental contamination and to D&D those facilities currently leased to USEC once the DP

Note that stakeholders have not had an opportunity to provide input to this draft RBES report, including the variances identified. Once stakeholder input is received, this draft RBES report and the variance summary it contains will be modified as appropriate. Additionally, this draft report presents potential actions to address hazards that could be used to reach the RBES. These presentations are not meant to be pre-decisional but are meant to introduce examples of actions the may be completed to reach the RBES. The selection of specific actions will be made in accordance with applicable law and agreements.

The portion of the cleanup mission not included in the FFA includes the characterization and appropriate disposal of legacy waste and materials found in DOE Material Storage Areas (DMSAs) and continuation of waste management activities. Consistent with the RBES guidance and the missions at PGDP, the following nine hazard areas were identified at PGDP:

Hazard Area 1 – Groundwater Operable Unit (GWOU): This hazard area encompasses both the sources of contamination to groundwater and the three dissolved phase plumes that originate within the industrialized area of PGDP and extend off-site.

Hazard Area 2 – Surface Water Operable Unit (SWOU): This hazard area encompasses the sources of surface water contamination found within the industrialized portion of PGDP, including plant ditches, and two creeks, Bayou and Little Bayou Creek, located outside of the industrialized portion of PGDP, which run both on and off DOE property.

Hazard Area 3 – Burial Grounds Operable Unit (BGOU) (Group 1). This hazard area includes three burial grounds that contain buried waste and/or soil that are not believed to serve as a source of groundwater contamination but for which the current planned end state and RBES differ.

Hazard Area 4 – Surface Soils Operable Unit (SSOU). This hazard area encompasses all areas containing contaminated soils that do not impact the GWOU or SWOU and that are not part of other hazard areas.

Hazard Area 5 – Permitted Landfills. This hazard area includes two permitted, closed landfills, the currently operating permitted landfill, and, under future conditions, a potential “CERCLA Cell” that would be used to dispose of debris and other materials generated during GDP D&D.

Hazard Area 6 - BGOU (Group 2). This hazard area includes of four areas that contain buried waste and/or soil that are not believed to serve as a source of groundwater contamination but for which the current planned end state and RBES do not differ.

Hazard Area 7 - Legacy Waste and DMSAs. This hazard area encompasses legacy waste found at storage locations at PGDP and potentially contaminated debris, surfaces, and soil found in DOE Material Storage Areas (DMSAs) located throughout PGDP.

Hazard Area 8 – Cylinder Yards and DUF_6 Conversion Facility. This hazard area is composed of the cylinder yards that contain DUF_6 in cylinders and the conversion facility currently under construction.

Hazard Area 9 – GDP Facilities. This hazard area is composed of the GDP facilities and infrastructure that will undergo decommissioning and decontamination (D&D) once the current uranium enrichment mission is ended. This hazard area also includes any sources to the GWOU and SWOU not addressed in the other hazard areas.

Each of these hazard areas, except for the portions of the dissolved phase groundwater plumes and Bayou and Little Bayou Creek located off DOE property, is in locations where current and future expected land uses are industrial or recreational. Some areas overlying the groundwater plumes or adjacent to the creeks are rural residential.

Under current conditions, risks at all hazard areas are at or below levels of risk that fall near the bottom of EPA's acceptable risk range for site-related exposures (E-06). This level of risk, which is called a *de minimis* level of risk in this report, is attained under current conditions through access and institutional controls. However, unmitigated risks or risks that potentially could exist in the absence of these controls exceed the upper end of EPA's acceptable risk range for site-related exposures (E-04) at some locations. These risks are driven by the presence of chlorinated solvents (primarily trichloroethene [TCE] and its breakdown products) in groundwater and by the presence of polychlorinated biphenyls (PCBs), polynuclear aromatic hydrocarbons (PAHs), metals, and radionuclides (primarily the uranium isotopes) in soil and sediment.

Under the RBES, risk at all hazard areas will be at *de minimis* levels. These levels will be attained through the following actions:

- Continued access and institutional controls (e.g., capping, controls on groundwater use);
- Monitored natural attenuation of sources of groundwater contamination (TCE source areas) and the dissolved phase plumes with continued access and institutional controls;
- Excavation and on and off site disposal of contaminated surface soil and sediment to attain a target risk of 1E-04 to receptors consistent with current and future land use and an average PCB concentrations within exposure units of 25 ppm in industrial areas and 1 ppm in recreational areas;
- Characterization and offsite disposal of legacy waste; and
- On- and off-site disposal of debris from D&D of facilities and infrastructure. In order to identify variances between the RBES and the current PGDP baseline, a current planned end state also is presented for each of the hazard areas.

Under the current planned end state, risk at all hazard areas also will be at *de miminis* levels. These levels will be attained through the following actions:

- Continued access and institutional controls (e.g., capping, controls on groundwater use);
- Response actions to reduce the concentration of TCE and other solvents in subsurface areas that act as sources of groundwater contamination;
- Response actions to reduce TCE concentrations in the dissolved phase plumes;
- Monitored natural attenuation of sources of groundwater contamination (TCE source areas) and the dissolved phase plumes following completion of response action to reduce TCE concentrations;
- Active measures to reduce TCE concentrations in groundwater discharged to surface water;

- Construction of sediment control basins;

- Excavation and off-site disposal of surface and subsurface soil and sediment to attain a target risk of 1E-06 for hypothetical residents and an average PCB concentration of 1 ppm within exposure units in industrial and recreational areas;

- Excavation and off-site disposal of wastes from burial grounds; and

- On- and off-site disposal of debris from D&D of facilities and infrastructure.

Using this information, the following ten variances were identified (RBES response action listed first):

1) Enhanced institutional controls to limit groundwater use versus continuation of PGDP Water Policy to limit groundwater use – affects Hazard Areas 1, 6, and 9;

2) Monitored natural attenuation for groundwater source areas, with either enhanced institutional controls or continuation of the PGDP Water Policy, versus active treatment of groundwater source areas using heating technologies, with continuation of the PGDP Water Policy – affects Hazard Areas 1 and 9;

3) Monitored natural attenuation for groundwater source areas, with either enhanced institutional controls or continuation of the PGDP Water Policy, versus excavation of groundwater source areas (burial grounds), with continuation of the PGDP Water Policy – affects Hazard Area 1;

4) Monitored natural attenuation for the dissolved phase groundwater plumes, with either enhanced institutional controls or continuation of the PGDP Water Policy, versus active treatment for the dissolved phase plume using oxidation technologies, with continuation of the PGDP Water Policy – affects Hazard Area 1.

5) Continued monitoring of discharges of groundwater to surface water versus actions to reduce contaminant levels in groundwater discharged to surface water – affects Hazard Area 1;

6) Cleanup levels for soil and sediment in industrial areas set at targets of 1E-04 (under an industrial scenario) and PCBs of 25 ppm and cleanup levels for soil and sediment in recreational areas set at targets of 1E-04 (under a recreational scenario) and PCBs of 1 ppm versus cleanup levels for soil and sediment in industrial and recreational areas set at targets of 1E-06 (under a residential scenario) and PCBs of 1 ppm – affects Hazard Areas 2, 4, 8, and 9;

7) Continued monitoring of contaminant levels in surface water at outfalls versus construction of sediment control basins to reduce contaminant migration in surface water – affects Hazard Area 2;

8) Capping of certain burial grounds versus excavation of certain burial grounds – affects Hazard Area 3;

9) Construction of potential CERCLA Cell versus no construction – affects Hazard Area 5; and

10) Cleanup levels for soil and/or decontamination of surfaces in industrial areas set at targets of 1E-04 (industrial) and PCBs of 25 ppm versus targets of 1E-06 (residential) and PCBs of 1 ppm – affects Hazard Area 7.

Subsequent to the delineation of the variances between the RBES and the current planned end state, barriers in achieving the RBES and recommendations to address these barriers are discussed. In the discussion, the affected organizations that DOE needs to work with are identified, the affected organizations' views are noted, and a path forward for DOE is presented.

APPENDIX D: PGDP CAB 2004 RECOMMENDATIONS

(available online at http://www.paducahvision.com/c/document_library)

Consensus Recommendation: 04-07

Title: End State Vision for the Paducah Gaseous Diffusion Plant Site

Background:

In November 2002, the Paducah Gaseous Diffusion Plant (PGDP) Citizens Advisory Board (CAB) requested that the U.S. Department of Energy (DOE) provide a list of topics for the CAB to work from in developing recommendations. In DOE's response, the CAB was asked to focus on long term stewardship, specifically the CAB's End State Vision for the PGDP site.

In June 2003, the Long-Range Strategy/Stewardship task force began the process of obtaining input from the community for an End State Vision. The first meeting was attended by representatives of the CAB, DOE, the Kentucky Department of Waste Management, the West Kentucky Wildlife Management Area (WKWMA), the Greater Paducah Economic Development Council (GPEDC), the Paducah Area Community Reuse Organization (PACRO), Active Citizens for Truth (ACT), and the Coalition for Health Concerns. Also present were the McCracken Judge Executive, the Mayor of Paducah, the Paducah City Manager, and members of the public. In more recent meetings, the Board has also discussed this recommendation with the McCracken County Administrator.

Following development of the End State recommendation in draft form, presentations were made to various groups and organizations to obtain comments and suggestions on specific points contained within the recommendation. This information was presented to the PACRO Finance and Executive Committee, the Ballard County Chamber of Commerce, the Paducah Chamber of Commerce, ACT, and to the Paper, Allied-Industrial, Chemical, and Energy Workers Local 5-550. Comments received from these meetings that were applicable have been incorporated into this recommendation. Throughout the eight-month process, the CAB's objective has been to include and represent the community in this matter.

Current Status:

To develop an End State Vision, certain facts concerning the current situation of the PGDP site must be considered. The United States Enrichment Corporation (USEC) leases the uranium enrichment facilities from DOE. While USEC has announced plans to build and operate a centrifuge facility in Ohio, replacing the older Paducah operation, there remains a possibility that use of the Paducah site could continue beyond 2010. Additionally, DOE has yet to announce if the Paducah site will transition immediately into Decontamination and Decommissioning (D&D) upon USEC's departure from the site, or if the site will be placed on standby while determining national energy needs.

Another event, redefining Paducah's future, is the construction of a Depleted Uranium Hexafluoride (DUF6) Conversion Facility. Operation is scheduled to continue until 2030 or beyond and is viewed by the CAB as the first step in reindustrialization of the Paducah site. The progress by DOE in areas such as the North-South Diversion Ditch, the DUF6 Conversion Facility, Six-Phase Heating Technology, Scrap Metal Removal, and the characterization and disposition of the DOE Material Storage Areas is considered a major step forward in developing a safe, reusable site.

The uncertainty of the future of the gaseous diffusion process coupled with reindustrialization (DUF6), which has already begun; do in fact help define the End State Vision of this CAB. It is, however, the belief of this CAB that decisions made today regarding the end state of the PGDP will provide guidance for future generations as they implement and update this End State Vision.

Concern:

As the CAB worked toward its End State Vision, three items emerged as primary concerns:

• Environmental remediation as currently planned may not be sufficient to fully protect human health and the environment in the future without the possibility of reoccurring issues.

• Environmental remediation as currently planned may not be sufficient to allow the Paducah community every opportunity in reindustrializing the site, and thereby protecting and building upon the economic impact this site has on the region.

• If this community waited until USEC ceased operations and environmental remediation was completed before acting on its end state vision, many years that could have been productively used for reindustrialization planning and development would be lost.

Goal:

The three concerns stated above share a common and single solution; the level of environmental remediation must be sufficient to allow this community control of its future. Therefore, the goal of the Paducah CAB's End State Vision is as follows:

To protect human health and the environment while preparing for a viable economic future for the Paducah site.

Recommendation:

To achieve the goal of the CAB's End State Vision, the following recommendations are submitted:

1. DOE is encouraged to structure environmental remediation activities to allow continued nuclear and non-nuclear industrial use of the existing industrialized area and to continue recreation/wildlife use of those areas presently leased to the WKWMA.

2. DOE begin investigating means to modify security access to non-USEC leased areas, allowing the reindustrialization process to move forward.

3. DOE begin consultation with PACRO, GPEDC, and other involved parties to inventory and investigate buildings and facilities to determine potential reindustrialization value.

4. DOE decontaminate the buildings, facilities, and surrounding grounds (scheduled for reuse) to the level necessary to allow this community every opportunity to obtain non-nuclear tenants for the site.

5. DOE begin physical rehabilitation of infrastructure facilities identified as having potential for the reindustrialization process.

6. DOE thoroughly characterize any contamination remaining at the site and adjoining property, after all environmental remediation activities are complete. This will allow the issuance of state and federal "covenant not to sue", or an equivalent document, for future tenants and property owners.

7. DOE should investigate all possible alternatives to the proposed Comprehensive Environmental Recovery, Compensation, and Liability Act (CERCLA) waste disposal facility. There are four gaseous diffusion process buildings that have little, if any, potential for reindustrialization. The footprints of these buildings could be used for an above-ground concrete encapsulation of final D&D waste. This option is more acceptable to the community and may lower long-term costs for both Environmental Management (EM) and Legacy Management (LM).

8. DOE plan and initiate removal of all burial grounds within the industrial area. The potential for contaminant migration in the air, soil, groundwater and surface water is greatly increased if the burial grounds remain. The unexcavated burial grounds will negatively impact future industrial options for the site.

9. DOE, within two years, resolve the issue of institutional controls, compensation, or "buy out" with the property owners affected by off-site groundwater contamination.

10. DOE begin a public information/involvement process as soon as possible to educate the community on the transition from the Office of EM to the Office of LM, specifically addressing issues such as, but not limited to, long-term taxpayer costs (is the best financial decision for EM also the best financial decision for taxpayers throughout LM activities) LM monitoring of the site, and, if necessary, responding to new or migrating contaminants.

11. DOE remove sources and potential sources of off-site groundwater contamination.

12. DOE is encouraged to begin immediately working with the local communities to explore possibilities which address the three concerns listed above. The CAB offers the following as a means to begin achieving the common goal of this community:

    • Provide on-site facilities for environmental remediation/innovative technology companies.

    • Provide on-site facilities for the research being performed by the University of Kentucky for neptunium removal from nickel and use of converted depleted uranium. Upon success of this research, provide the necessary production facilities.

    • Explore the potential for the on-site development of Hazardous Material and Emergency Response Training facilities.

    • Explore the possibility of establishing an energy research technology park at the site.

Approved by Consensus March 18, 2004

APPENDIX E: JIM SMART PRESENTATION

End State Vision for the PGDP
Dr. Jim Smart
December 13, 2007

(available online at http://www.paducahvision.com/c/document_library)

Background

- November 2002, the CAB asked DOE for input regarding a list of topics that the Board would work from for the upcoming year.
- DOE responded that the CAB should focus on long-term stewardship and develop an End State Vision for the PGDP.
- The CAB sought input and conducted research to develop a preliminary vision that incorporates the needs of the community.
- The CAB submitted the recommendation to DOE in March 2004 and requested a written response by October 1, 2004.
- Based on the significance of this issue to the entire community, the CAB requested a very detailed response to the concerns addressed in the recommendation.
- A DOE response has not been received.

End State Vision

- To protect human health and the environment while preparing for a viable economic future for the Paducah site.

Implementation of Goal

- Continued industrial use of existing industrialized areas.
- Continued recreational/wildlife use of the areas presently leased to the West Kentucky Wildlife Management Area (WKWMA)
    - DOE should deed non-industrialized areas to the WKWMA but maintain a buffer zone for any further reindustrialization efforts.

Specifics to Achieve End State Vision
It was recommended that:

- DOE investigate ways to modify security access for the reindustrialization process to move forward.
- DOE consult with the Paducah Area Reuse Organization (PACRO) and the Greater Paducah Economic Development Council (GPEDC) to investigate buildings currently scheduled for Decontamination and Decommissioning (D&D) to determine any possible value.
    - Buildings scheduled for re-use should be completely decontaminated
- DOE thoroughly characterize any contamination remaining at the site.
    - Contacts with reindustrialization companies should include an indemnity clause that states are not responsible for existing contamination (Brownfield regulations).

- DOE use the footprint of the four large process buildings for disposition instead of an on-site CERCLA waste disposal facility
    - Proposed CERCLA cell would be a 70 acre waste landfill that may impact reindustrialization.
    - Encapsulate waste, mixed with concrete, in existing buildings.
    - May simplify future monitoring.
- DOE remove all burial grounds
    - Reindustrialization without top secret dump sites is more attractive to interested companies.
- DOE rehabilitate infrastructure
- DOE resolve issue of institutional controls for off-site groundwater contamination
    - Enter a long-term agreement with those affected by DOE's Water Policy.
- DOE consider the taxpayer when making financial decisions
    - Concern that local taxpayers will be left the cost of rehabilitation later.
    - Need to look into the current cost to DOE versus the cost to the taxpayer on a long-term basis.
- DOE's Office of Environmental Management (EM) keep public informed about the transition process to the Office of Legacy Management (LM)
    - Address monitoring of air and water and spread of remaining pollutants.

Reindustrialization Possibilities

- Encourage environmental remediation companies with innovative technologies to occupy area (do not want new polluters or re-polluters)
    - Possible examples of companies that might meet reindustrialization criteria:
        - Clean-up of contaminated nickel.
        - Establish facility for Hazardous Material (HAZMAT) Training as well as Emergency Response Training that can be utilized by companies in the tri-state area.

Summary

The CAB should modify or leave the recommendation in its original state and resubmit to DOE for a response.

APPENDIX F: EXECUTIVE SUMMARY OF THE 2008 DOE END STATE VISION REPORT

(available online at http://www.paducahvision.com/c/document_library)

In 2002, the U.S. Department of Energy's (DOE's) Office of Environmental Management (EM) established a set of corporate projects to lead EM's response to the *Top to Bottom Review* (DOE 2002a). One of these projects has resulted in the production of policy and guidance that directs DOE sites to submit a site-specific end state vision document. In accordance with that policy (DOE Policy 455.1, *Use of Risk-based End States)* and its implementing guidance *(Guidance for Developing a Site-specific Risk based End State Vision),* as amended, and the notes from the DOE Risk-Based End State (RBES) Next Steps Workshop, the Paducah Gaseous Diffusion Plant (PGDP) has prepared this End State Vision Document for PGDP. Similarly, consistent with the notes from the DOE RBES Next Steps Workshop, this report is a dynamic document that will be updated as needed to reflect actual decisions from the ongoing Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process at the site.

This report uses a standardized approach to meet the objectives contained in the guidance. This approach relies on the presentation of a series of maps and conceptual site models (CSMs) that depict the relationship between PGDP and its surroundings. The maps and CSMs are intended to present and allow comparisons between current and future land uses; depict hazards and risks to affected or potentially affected populations or receptors; serve as a planning tool for site management; facilitate communication of risks during discussions with stakeholders; allow tracking of expected and actual cleanup results; and serve as a communication tool for public meetings in regard to cleanup activities, current PGDP missions and requirements, and future land use. The maps follow a standardized hierarchical approach that depicts the end state vision in regional-, site-, and hazard-specific contexts. The CSMs are produced only in a hazard specific context.

In the CSMs and their associated text, various responses to achieve site cleanup are presented. These presentations are not meant to be pre-decisional, but are meant to introduce examples of actions that may be completed to reach the current planned end state or potential end state alternative. The selection of specific actions will be made in accordance with applicable law and agreements. Using the information in this report, as well as information developed during implementation of cleanup and investigation activities at PGDP, DOE will continue to evaluate the cleanup activities and the strategic approaches at PGDP to determine if it is appropriate to pursue changes in the PGDP baseline.

Any decision to pursue changes to the baseline will include factors beyond those presented in this report, including input from stakeholders. If DOE ultimately decides to seek changes to current compliance agreements, decisions, or statutory/regulatory requirements, then those changes will be made in accordance with applicable requirements and procedures.
Currently, PGDP, located in Paducah, Kentucky, is the nation's only operating uranium enrichment facility. Missions performed at PGDP are the enrichment mission, a uranium conversion mission, and an environmental cleanup mission.

The enrichment mission began in the early 1950s and involves producing enriched uranium for commercial uses through a gaseous diffusion process. At present, the facilities and infrastructure used to produce enriched uranium are leased to the United States Enrichment Corporation (USEC). The uranium conversion mission, involves the construction and operation of a facility that will convert depleted uranium hexafluoride (DUF_6) currently stored at PGDP to less reactive uranium forms and the subsequent disposal of the converted uranium. Finally, the environmental cleanup mission performed under a Federal Facility Agreement (FFA) and other environmental compliance agreements.

The current portion of the cleanup mission under the FFA is to investigate and address existing environmental contamination and to decontaminate and decommission (D&D) those facilities currently leased to USEC once the gaseous diffusion plant (GDP) ceases operation. The portion of the EM cleanup mission addressed by other agreements includes, for example, the characterization and appropriate disposal of legacy waste and materials found in DOE Material Storage Areas (DMSAs) and continuation of waste management activities.

Consistent with the end state visions guidance and the missions at PGDP, the following nine hazard areas were identified at PGDP. (Please see Table ES.1 for summary information about each of these hazard areas.)

• Hazard Area 1 – Groundwater Operable Unit (GWOU): This hazard area encompasses both the sources of contamination to groundwater (i.e., spill areas) and contaminants migrating via groundwater from burial grounds located in the industrialized area of PGDP and three dissolved-phase plumes. [Two of these plumes (i.e., the Northwest and Northeast Plumes) extend off DOE-owned property.]

• Hazard Area 2 – Surface Water Operable Unit (SWOU): This hazard area encompasses the sources of surface water contamination (i.e., waste, sediment, and soils) found within the industrialized portion of PGDP, including plant ditches. This hazard area also includes two creeks, Bayou and Little Bayou Creek, located outside of the industrialized portion of PGDP, which run both on and off DOE property.

• Hazard Area 3 – Burial Grounds Operable Unit (BGOU) (Group 1). This hazard area includes two burial grounds that contain buried waste and/or soil that are not believed to serve as a source of groundwater contamination, but for which the current planned end state and potential end state alternative differ.

• Hazard Area 4 – Soils Operable Unit (SOU). This hazard area encompasses all areas containing contaminated soils that do not impact the GWOU or SWOU and that are not part of other hazard areas. This hazard area also encompasses the soil and rubble areas that have been identified both on and off DOE property that may contain contaminated soils or materials (DOE 2007b).

• Hazard Area 5 – Permitted Landfills. This hazard area includes two permitted, closed landfills, and the currently operating permitted landfill. Also, as a planning assumption, this hazard area includes under future conditions, a potential CERCLA Cell, that would be used to dispose of debris and other materials generated during GDP D&D.

• Hazard Area 6 – BGOU (Group 2). This hazard area includes four areas that contain buried waste and/or soil that are not believed to serve as a source of groundwater contamination and for which the current planned end state and potential end state alternative do not differ.

• Hazard Area 7 – Legacy Waste and DMSAs. This hazard area encompasses legacy waste found at storage locations at PGDP and potentially contaminated debris, surfaces, and soil found in MSAs located throughout PGDP.

Table F.1. PGDP Summary Table of Hazard Areas in the End State Vision Document

Hazard Area[a]	Contaminant Extent	Source Media	Main contaminants[b]	Media potentially impacted	Remediation status	Status of Risk Information	
						Ecological receptors	Health Risks
1 GWOU	Diffuse, includes plumes and sources	Soil, waste, DNAPL	Solvents, radionuclides	GW, SW, Sediment	SI complete for SW Plume. Sampling ongoing for Little Bayou seeps. RI complete for C-747 Burial Yard. RCRA closure of C-404 Burial Ground. Removal Action complete for C-747-C Oil Landfarm. Interim ROD for NW and NE Plume. ROD for C-400 source area signed. Implementation of ROD remedy ongoing. TCE degradation analysis initiated. Sitewide groundwater model being revised.	SRAs complete	BRA complete
2 SWOU	Sources, drainage system, ditches, creeks	Soil, scrap, sediment	Metals, PCBs, PAHs, radionuclides	SW, Sediment	Limited SIs complete for Sewer System. Removal Action complete for scrapyards. ROD for NSDD in industrial area. SI completed for internal ditches and Bayou and Little Bayou Creeks.	SRA for some areas	SRA for some areas
3 BGOU (Group 1)	2 sites	Waste, soil	Metals, PAHs, radionuclides	Soil	RI complete for C-747-B Burial Ground. SI complete for Landfill Borrow Area. RI complete for BGOU.	SRAs for 2 sites	BRAs for 2 sites
4 SOU	Dispersed	Soil	Metals, PAHs, PCB, radionuclides	Soil	SIs complete for some areas RI scoping initiated for sitewide SOU. Investigation underway for soil areas.	Not available	SRAs for some areas
5 Permitted Landfills	3 sites & potential CERCLA Cell	Waste, soil	Solvents, metals, asbestos, radionuclides	Soil, GW, SW, Sediment	SI completed for closed C-746-S and C-746-T Landfills. Groundwater Assessment being planned for C-746-U. Scoping and conceptual design initiated for potential CERCLA Cell.	SRA for 1 site	BRA for 1 site
6 BGOU (Group 2)	4 sites	Waste, soil	Metals, PAHs, radionuclides	Soil, GW, SW, Sediment	RI complete for BGOU. ROD and Corrective Actions implemented for C-746-K Landfill.	SRAs complete	BRAs complete
7 Legacy Waste and DMSAs	Dispersed, includes DMSAs	Waste, soil	Metals, PCBs, PAHs, solvents, radionuclides	Soil, SW, Sediment	Characterization and removal in progress.	Not applicable	Not applicable
8 Cylinder yard and conversion facility	"Hot spots"	Facility, cylinders, soil	Uranium hexafluoride	Soil, SW, Sediment	Conversion facilities being constructed Investigation of facilities and cylinder yards will occur when mission is complete.	Not applicable	Not applicable

Table ES.1 PGDP Summary Table of Hazard Areas in the End State Vision Document (Continued)

Hazard Area[a]	Contaminant Extent	Source Media	Main contaminants[b]	Media potentially impacted	Remediation status	Status of Risk Information	
						Ecological receptors	Health Risks
9 Gaseous Diffusion Plant Facilities	"Hot spots," buildings	Facilities, soil	PCBs, metals, solvents, radionuclides, asbestos.	Soil, SW, sediment	RA complete for C-402 and C-405, ongoing for C-746-B, and pending for remainder of inactive facilities and C-410/C-420 Feed Plant. Investigation of operating facilities will occur after plant shutdown	Not available	SRAs for C-410/ C-420 and C-340

Notes:

BGOU – Burial Grounds Operable Unit
BRA – Baseline Risk Assessment
CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act
DMSA – DOE Material Storage Area
DNAPL – dense nonaqueous- phase liquid
GW – Groundwater

GWOU – Groundwater Operable Unit
LBayou – Little Bayou Creek
NE – Northeast
NSDD – North- South Diversion Ditch
NW – Northwest
RA – Remedial Action
RCRA – Resource Conservation and Recovery Act

RI – Remedial Investigation
ROD – Record of Decision
SI – Site Investigation
SOU – Soils Operable Unit
SRA – Screening Risk Assessment
SW – Surface Water
SWOU – Surface Water Operable Unit

[a] Please see Chapter 4 for additional information about the sites included in each hazard area.

[b] Primary solvent contaminants include trichloroethene; *cis*- and *trans*-1,2-dichloroethene; vinyl chloride; 1,1-dichloroethene; carbon tetrachloride; chloroform; ethylbenzene; benzene; tetrachloroethene; and xylenes.

Primary radionuclide contaminants include ^{234}U, ^{235}U, ^{238}U, ^{99}Tc, 137Cs, ^{230}Th, ^{232}Th, ^{241}Am, ^{237}Np, ^{238}Pu, ^{239}Pu, ^{240}Pu, ^{226}Ra, ^{90}Sr, and ^{60}Co.

Primary metal contaminants include antimony, arsenic, beryllium, cadmium, chromium, copper, lead, manganese, mercury, molybdenum, nickel selenium, silver, thallium, uranium, vanadium, and zinc.

Semivolatile organic compound contaminants in addition to PCBs and PAHs include dioxins, furans, and pyrene.

PAHs included as contaminants are benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, acenaphthene, acenaphthylene, anthracene, fluoranthene, naphthalene, and pheneanthrene.

PCBs included as contaminants are Aroclor 1016, 1221, 1232, 1242, 1248, 1254, and 1260.

• Hazard Area 8 – Cylinder Yards and DUF_6 Conversion Facility. This hazard area is composed of the cylinder yards that contain DUF_6 in cylinders and the conversion facility currently under construction.

• Hazard Area 9 – GDP Facilities. This hazard area is composed of the GDP facilities and infrastructure that will undergo D&D once the current uranium enrichment mission is ended. This hazard area also includes any sources to the GWOU and SWOU not addressed in the other hazard areas.

Each of these hazard areas, except for the portions of the dissolved-phase groundwater plumes and Bayou and Little Bayou Creeks located off DOE property, is in a location where current and future expected land uses are industrial or recreational. Some areas overlying the groundwater plumes or adjacent to the creeks in areas not on DOE property are rural residential.

Under current conditions, risks at all hazard areas are at or below levels of risk that fall near the bottom of EPA's acceptable risk range for site-related exposures (10^{-6}). This level of risk, which is called a *de minimis* level of risk in this report, is attained under current conditions through access and institutional controls. However, unmitigated risks or risks that potentially could exist in the absence of these controls exceed the upper end of EPA's acceptable risk range for site-related exposures (10^{-4}) at some locations.

These risks are driven by the presence of chlorinated solvents [primarily trichloroethene (TCE) and its breakdown products] in groundwater and by the presence of polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), metals, and radionuclides (primarily the uranium isotopes) in soil and sediment.

Under the potential end state alternative, risk at all hazard areas will be at *de minimis* levels. These levels will be attained through the following actions:

• Continued access and institutional controls (e.g., capping, enhanced controls on groundwater use);

• Response action at major source areas to reduce the concentration of TCE and other solvents in subsurface that acts as a long-term source of groundwater contamination;

• Monitored natural attenuation of secondary sources of groundwater contamination (TCE source areas) and the dissolved-phase plumes with continued access and enhanced institutional controls;

• Natural attenuation to reduce TCE concentrations in groundwater discharged to surface water;

• Excavation and on and off-site disposal of contaminated surface soil and sediment to attain a target risk of 1×10^{-4} to receptors consistent with current and future land use and average PCB concentrations within exposure units of 25 ppm in industrial areas and 1 ppm in recreational areas;

• Capping of burial grounds;

• Characterization and on- and off-site disposal of legacy waste; and

• On- and off-site disposal of debris from D&D of facilities and infrastructure.

In order to identify variances between the potential end state alternative and the current PGDP baseline, a current planned end state also is presented for each of the hazard areas. Under the current planned end state, risk at all hazard areas also will be at *de minimis* levels. These levels will be attained through the following actions:

• Continued access and institutional controls (e.g., capping, maintain current controls on groundwater use);

• Response actions at major and secondary source areas to reduce the concentration of TCE and other solvents in subsurface that acts as a long-term source of groundwater contamination;

• Response actions to reduce TCE concentrations in the dissolved-phase plumes;

• Monitored natural attenuation of sources of groundwater contamination (TCE source areas) and the dissolved-phase plumes following completion of response action to reduce TCE concentrations;

• Natural attenuation to reduce TCE concentrations in groundwater discharged to surface water;

• Construction of sediment control basins;

• Excavation and on- and off-site disposal of surface and subsurface soil and sediment to attain a target risk of 1×10^{-6} for hypothetical residents and an average PCB concentration of 1 ppm within exposure units in industrial and recreational areas;

• Excavation and on- and off-site disposal of wastes from burial grounds;

• Characterization and on- and off-site disposal of legacy waste; and

• On- and off-site disposal of debris from D&D of facilities and infrastructure.

Note that, except for the on-site portion of the North-South Diversion Ditch (NSDD) and the DMSAs (which are part of Hazard Areas 2 and 7, respectively), no final cleanup levels for soil or groundwater have been established at PGDP. (The PGDP FFA does not establish specific cleanup targets.)

The cleanup levels discussed above are values projected to be used under either the potential end state alternative or current planned end state. For the on-site portion of the NSDD, the cleanup levels were established in an interim Record of Decision (DOE 2002b) and were set using an industrial worker scenario (cancer risk target of 1×10^{-4}, hazard target of 3, and radiation dose target of 25 mrem/yr). For the DMSAs, the cleanup levels for final closure were established in an Agreed Order (DOE 2003d) and were set using a residential scenario (cancer risk target of 1×10^{-6} and hazard target of 1). It is the regulators' position that meeting the closure requirements under the Agreed Order does not relieve DOE from the requirement to meet CERCLA cleanup standards; therefore, even after meeting the clean closure standards under the Agreed Order, additional response actions may be required for some DMSAs under CERCLA.
Using this information, the following nine variances were identified (potential end state alternative response action listed first):

1. Enhanced institutional controls to limit groundwater use versus continuation of PGDP Water Policy to limit groundwater use – affects Hazard Areas 1, 5, 6, and 9;

2. Active treatment of the primary groundwater source area using heating technologies and monitored natural attenuation with either enhanced institutional controls or continuation of the PGDP Water Policy, versus active treatment of multiple groundwater source areas using heating technologies, with monitored natural attenuation and continuation of the PGDP Water Policy – affects Hazard Areas 1 and 9;

3. Monitored natural attenuation for groundwater source areas (burial ground), with capping and either enhanced institutional controls or continuation of the PGDP Water Policy, versus excavation of groundwater source areas (burial grounds), with continuation of the PGDP Water Policy – affects Hazard Area 1;

4. Monitored natural attenuation for the dissolved-phase groundwater plumes, with either enhanced institutional controls or continuation of the PGDP Water Policy, versus active treatment for the dissolved-phase plume using oxidation technologies, with monitored natural attenuation and continuation of the PGDP Water Policy – affects Hazard Area 1.

5. Continued monitoring of discharges of groundwater to surface water versus actions to reduce contaminant levels in groundwater discharged to surface water – affects Hazard Area 1;

6. Cleanup levels for soil and sediment in industrial areas set at targets of 1×10^{-4} (under an industrial scenario) and PCBs of 25 ppm and cleanup levels for soil and sediment in recreational areas set at targets of 1×10^{-4} (under a recreational scenario) and PCBs of 1 ppm versus cleanup levels for soil and sediment in industrial and recreational areas set at targets of 1×10^{-6} (under a residential scenario) and PCBs of 1 ppm – affects Hazard Areas 2, 4, 8, and 9;

7. Continued monitoring of contaminant levels in surface water at outfalls following “hot spot” removal versus “hot spot” removal and construction of sediment control basins to reduce contaminant migration in surface water and continued monitoring – affects Hazard Area 2;

8. Capping of certain burial grounds versus excavation of certain burial grounds – affects Hazard Area 3; and

9. Cleanup levels for soil and/or decontamination of surfaces associated with DMSAs in industrial areas set at targets of 1×10^{-4} (industrial) and PCBs of 25 ppm versus targets of 1×10^{-6} (residential) and PCBs of 1 ppm – affects Hazard Area 7.

Subsequent to identifying the variances, the following challenges to achieving the potential end state alternative were identified:

• Public and regulator acceptance of the range of options included in enhanced institutional controls is uncertain.
• DOE policy may limit options that may be included in enhanced institutional controls.

• Current planned end state assumes that monitored natural attenuation for groundwater contamination will need to be augmented by source and plume actions to reduce contaminant concentrations within a “reasonable” period.

• Regulators’ position is that technical impracticability (TI) waiver would be available only after a demonstrated, site-specific technology failure.

• Regulators' position is that the current fence line, as opposed to the DOE property boundary, should be used as the point of exposure for the purpose of developing cleanup levels.

• Regulators' position that capping and institutional controls are inadequate to achieve long-term protection to human health and environment, meaning burial grounds should be excavated.

• Commonwealth of Kentucky's position is that all cleanup activities must attain cleanup levels established using residential exposure scenario and a cancer risk and hazard target of 1×10^{-6} and 1, respectively, rather than using an exposure scenario consistent with expected future use and a cancer risk and hazard target of 1×10^{-4} and 1, respectively.

• Commonwealth of Kentucky's position is that all PCB cleanup activities in industrial areas must attain a 1 ppm cleanup level rather than a Toxic Substances Control Act (TSCA)-based 25 ppm cleanup level.

• Need for additional data for some hazard areas before a decision can be made.

Recommendations to address these challenges are as follows:

• Initiate further discussions with the public to determine acceptability of acquisition of property rights ranging from deed notices and permanent groundwater use restrictions to property purchase.

• Initiate further discussions with the regulators to determine willingness to consider enhanced institutional controls in conjunction with monitored natural attenuation in lieu of certain source and plume actions.

• Initiate further discussions with the regulators to discuss willingness to consider establishing points of compliance and exposure at property boundary based on enhanced institutional controls and monitoring.

• Revisit DOE policy concerning acquisition of property rights (ranging from deed notices and permanent groundwater use restrictions to property purchase).

• Complete technical investigations [e.g., BGOU Remedial Investigation (RI), etc.] to support discussions with the regulators and public.

• Initiate discussions with regulators to 1) determine the appropriateness of requiring a demonstrated failure, given the national performance data, and 2) determine what would be required to decide whether a TI waiver should apply.

• Initiate further discussions with regulators to 1) seek agreement that cleanup standards for proposed actions will be set based upon current and future land use for the area in question, 2) gain agreement that cleanup standards will be set based on the CERCLA risk range (10^{-6} to 10^{-4}), and 3) seek agreement that national TSCA cleanup standards for PCBs for low occupancy (e.g., industrial) areas (25 ppm) should be adopted for industrial areas and that national TSCA standards for PCBs for high occupancy (e.g., 1 ppm) should be adopted for recreational areas.

The potential end state alternative, current planned end state, and the variances between the two end states that are presented in the report were discussed with the stakeholders at a series of meetings held in January, February, March, and April 2004 and an update was subsequently presented in October 2005. A summary of these activities and the stakeholder comments and input received is presented the appendix to the report.

This 2007 update contains the following significant changes when compared to the previous report:

• Updated information for the SWOU, based on the recently completed SWOU (On-Site) Site Investigation;

• Updated information for the GWOU, based on the recently initiated implementation of ROD remedy;

• Added information regarding the identification of soil and rubble areas that may contain contaminated soils or materials both on and off DOE property;

• Modified title to be consistent with the Portsmouth DOE Facility document; and

• Added information regarding PGDP cleanup strategy consistent with the Site Management Plan. Solid Waste Management Unit 3 moved from Hazard Area 3 (BGOU – Group 1) to Hazard Area 1 (GWOU) to be consistent with the GWOU strategy and some recently collected information regarding possible contaminant migration from this unit.

APPENDIX G: BOBBY ANN LEE PRESENTATION

(available online at http://www.paducahvision.com/c/document_library)

Scenario Planning Process*

1. Assemble a Team
2. Select a Timeframe
3. Identify Trends and Uncertainties
4. Scenarios: Facilitator, CAB & Select Stakeholders
5. Identify Trend Indicators: Facilitators & CAB
6. Identify Key Success Factors: Facilitators & CAB
7. Identify Core Competencies: Facilitators & CAB

* From Cornell University Planning course, Michael J. Hostetler, Author

CAB Discussion at Annual Retreat – September 2008

1. Assemble a Team
   -6-8 people recommended

2. Select a Timeframe for the Scenarios
   - 20 years from now at the PGDP site

3. Identify Trends and Uncertainties

Political	**Economic**
Cultural	**Demographic**
Technological	**Other**

- Trends are factors that influence the site and have a known pattern
- Uncertainties are important factors, but their direction is unclear

Political Trends

- Local economic development – tax base and job creation[1]
- Public participation in environmental decision-making for a better effectiveness[2]

Economic Trends

- Cost analysis of government activities – decreasing DOE-EM budget past three years[3].
- High cost of environmental clean-up[3]

Cultural Trends

- Increased public awareness of environmental issues

- Lack of confidence in government agencies and risk analysis

Demographic Trends

- Census data for Paducah: No growth[4]
- Increased energy and natural resources demand[5]

Technological Trends

- Advances in environmental clean-up methodology[6]
- Advances in the nuclear power industry[7]

Tracking Trends & Uncertainties

- Changes in trends and uncertainties may have significant impact on future uses of the site
- Trend indicators will need to be identified and then monitored

Political Uncertainties

U1. Will the transition in government administrations increase funding for environmental clean-up activities at DOE?

U2. Will regulators and stakeholders agree with DOE clean-up strategies and decision-making?

Economic Uncertainties

U3. Will rising costs of energy and increase funding for environmental management activities at DOE?

U4. Will local communities be able to attract organizations (business/government) to the remediated site to maintain jobs and tax base?

Cultural Uncertainties

U5. Will a more diverse group of stakeholders play a proactive role in environmental management decision-making?

U6. Will clean-up strategies remediate contamination to levels acceptable by the local communities?

Demographic Uncertainties

U7. Will D&D at the site increase job opportunities and population in Paducah?

U8. Will the Paducah strategic plan to increase tourism increase industrial and/or recreational use of the site?

Technological Uncertainties

U9. Will new generation of nuclear technology be expanded and increase funding for environmental management at the site?

U10. Will innovations in other energy technologies increase funding for environmental management at the site?

Matrix to Determine <u>Independent</u> Uncertainties

	U1	U2	U3	U4	U5	U6	U7	U8	U9	U10
U1		0	0	+	?	?	?	?	?	?
U2			-	+	+	+	-	+	+	+
U3				+	?	+	+	+	+	+
U4					+	+	+	+	+	+
U5						+	+	+	+	+
U6							+	+	+	+
U7								+	+	+
U8									+	+
U9										+
U10										

(+) Positive Correlation	(0) No Correlation
(-) Negative Correlation	(?) Unclear Correlation

Independent Uncertainties

	Will local communities be able to attract organizations to the remediated site?		
Will DOE funding for environmental clean-up activities change?		Reactive Participation	Proactive Participations
	Increase Funding	S1	S2
	Decrease Funding	S3	S4

Long-Range Stewardship Subcommittee

October 2008	Scenario Planning/End State	Tabulate tends and uncertainties for Scenario Planning
December 2008	Scenario Planning CAB Team and Facilitator	Develop plan to hold stakeholder meetings for next 6 months
February 2009	Framework for the Four Potential Scenarios	Site Tour D&D Buildings
April 2009	Initiate Stakeholder Meetings	Develop full descriptions of the four scenarios
June 2009	Continue Stakeholder Meetings	Develop full descriptions of the four scenarios
August 2009	Continue Stakeholder Meetings	Develop full descriptions of the four scenarios

References:

[1] City of Paducah, http://paducahky.gov/paducah/strategic-plan-paducah
[2] United Nations, http://www.millenniumassessment.org/en/index
[3] Dept. of Energy, http://www.mbe.doe.gov/crOrg/cf30.htm
[4] Census Bureau, http://quickfacts.census.gov/qfd/states/21/21145.html
[5] National Science Foundation, http://www.nsf.gov/geo/ere/ereweb/acere_synthesis_rpt.cfm
[6] Office Science Technical Info, http://www.osti.gov/bridge/product.biblio.jsp?osti_id=7441
[7] Zink, John C. "DOE rises to nuclear waste challenges." Power Engineering. May 2003: 16[1]

APPENDIX H: 2008 DOE PUBLIC INFORMATION MEETING

PADUCAH
Remediation Services
A Portage Shaw Joint Venture Company

761 Veterans Ave.
Kevil, KY 42053

January 16, 2009

CPI-L-0007

Mr. Reinhard Knerr, Paducah Site Lead
Portsmouth/Paducah Project Office
U.S. Department of Energy
P.O. Box 1410
Paducah, Kentucky 42002-1410

Dear Mr. Knerr:

DE-AC30-06EW05001: FEEDBACK SUMMARY FROM THE TWO PUBLIC INFORMATION EXCHANGES HELD IN NOVEMBER 2008

On November 18 and 20, 2008, the U.S. Department of Energy hosted two public information exchanges. Many of the attendees completed questionnaires. Enclosed is a summary of those questionnaires and associated comments.

If you have any questions or require additional information, please contact Joe Tarantino at (270) 441-5011.

Sincerely,

Russell Boyd

Russell Boyd, P.E., Site Manager
Paducah Remediation Services, LLC

RB:JT:kje

Enclosures:
1) Compilation of feedback on site's future
2) Listing of comments
3) Feedback sheet

In accordance with the requirements of Contract DE-AC30-06EW05001 and as acknowledged by the above signature, I hereby certify that the information provided in this transmittal has been prepared in accordance with all applicable requirements and the information is, to the best of my knowledge and belief, true, accurate, and complete.

cc w/enclosures:
AR
File-DCC/DMC-RC

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rob.seifert@lex.doe.gov

WHAT DO YOU THINK ABOUT THE SITE'S FUTURE?

What Factors Are Important To You?

Results

	Importance				
	Not Important				Very Important
	1	2	3	4	5
Jobs	0	1	6	9	25
Future Use of Site	0	0	5	11	24
Material Reuse/Recycling	0	1	4	11	24
Speed of Cleanup	3	5	14	8	10
Waste Disposal Options	0	2	8	12	18
Cost to Taxpayer for Cleanup	0	2	6	10	22

41 participants

Results

BLUE-Industrial Area

What do you think is an appropriate use for this area after cleanup is complete?

Recreational	11
Industrial	27
Commercial	11

Do you think this area is appropriate for a nuclear facility?

Yes—26 No—10

If this area is reused for industry, what type of jobs/industry would you want?

Chemical	14
Nuclear	17
Heavy Manufacturing	22
Light Manufacturing	19
Government Service Center	11
Commercial Service Center	10
Energy Park	20

RED-Buffer Area

What do you think is an appropriate use for this area after cleanup is complete?

Recreational	14
Residential	3
Industrial	26
Commercial	14

Do you think this area is appropriate for a nuclear facility?

Yes—22 No—12

If this area is reused for industry, what type of jobs/industry would you want?

Chemical	14
Nuclear	17
Heavy Manufacturing	20
Light Manufacturing	19
Government Service Center	12
Commercial Service Center	10
Energy Park	19

Public Information Exchange Feedback November 2008
Comments
(Use industrial area as) new county jail.
When the area is re-used, how clean will it be?
You all did a great job.
Nuclear energy is not a great idea. I do not think it would attract people to this area. We need things that will bring consumers and their money. This piece of land has already been misused. We should not repeat history. Let's make some profits!
I would love to see a local greenscape with an education center for local school children and other community members. The impact of a once-polluted site becoming a nature-scape would be tremendous.
(Use industrial area as) a wildflower plot, or perhaps a nature preserve with an emphasis on native plants and attracting native species.
This land has been used by the government/DOE for so long. I believe it's time to give back to nature and recreation areas LBL style.
(Use industrial area as) a nature preserve.
More jobs to the area is my main goal. USEC provided a lot of jobs, and I would like to see a new facility that provides the same quality of jobs. The industry that provides the most jobs the better.
Outstanding graphics. All of the DOE people were knowledgeable and helpful.
:)
I like that this information is coming early on. The cleanup on this area should be continued. Future use and waste disposal should be handled as environmentally-friendly and sustainably as possible.
(Use of both blue and red areas as) wildlife/nature.
Very good displays.
(Use industrial area as) industrial park. Similar industry—Nuclear power plant!
Red and blue areas may be appropriate to exchange.
Nice presentation! Let's have more!
Everyone was very helpful. All of my questions were answered very well. :)
It would be helpful for the community to see the progress of cleanup at the site by offering limited community tours.
I want to know more about the public's role in this process.
Concerned about offsite dumping areas many years ago.

Note – Comments listed above are direct quotes collected during the public information exchange.

What do you think about the site's future?

What factors are important to you? (Rate the importance of each, 1 = not important, 5 = very important)

①②③④⑤ Jobs
①②③④⑤ Future use of the site
①②③④⑤ Material reuse/recycling
①②③④⑤ Speed of cleanup
①②③④⑤ Waste disposal options
①②③④⑤ Cost to taxpayer for cleanup

Please answer these questions about the current Industrial Area.
(Blue area of the map on reverse side of this sheet)

What do you think is an appropriate use for this area after cleanup is complete? (Check all that apply)
❍ Recreational ❍ Industrial ❍ Commercial
❍ Other (Please specify) ____________________

If this area is reused for industry, what type of jobs/industry would you want? (Check all that apply)
❍ Chemical ❍ Nuclear ❍ Heavy manufacturing ❍ Light manufacturing
❍ Government service center ❍ Commercial service center ❍ Energy park

Do you think this area is appropriate for a nuclear facility? ❍ Yes ❍ No

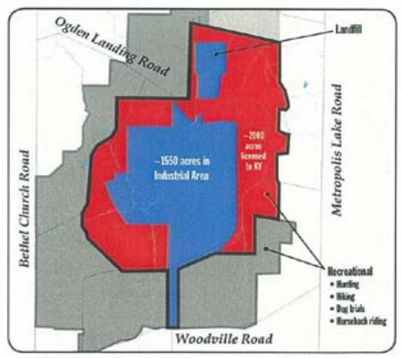
Please answer these questions about the area currently licensed to Kentucky.
(Red area of the map on this sheet)

What do you think is an appropriate use for this area after cleanup is complete? (Check all that apply)
❍ Recreational ❍ Residential ❍ Industrial ❍ Commercial
❍ Other (Please specify) ____________________

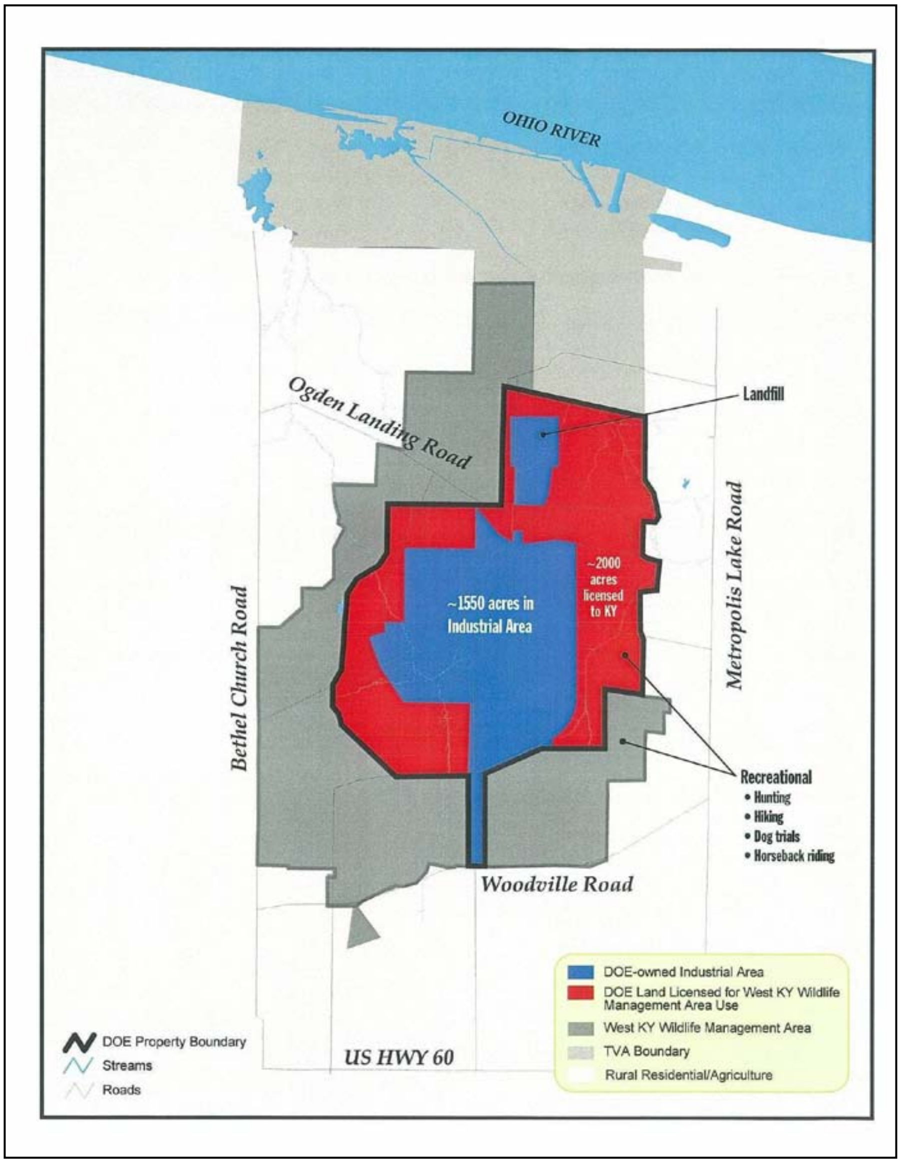
If this area is reused for industry, what type of jobs/industry would you want? (Check all that apply)
❍ Chemical ❍ Nuclear ❍ Heavy manufacturing ❍ Light manufacturing
❍ Government service center ❍ Commercial service center ❍ Energy park

Do you think this area is appropriate for a nuclear facility? ❍ Yes ❍ No

Additional comments? ____________________



More map detail on Reverse of this sheet


OHIO RIVER
Ogden Landing Road
Landfill
Metropolis Lake Road
Bethel Church Road
~1550 acres in Industrial Area
~2000 acres licensed to KY
Recreational
• Hunting
• Hiking
• Dog trials
• Horseback riding
Woodville Road
US HWY 60
DOE Property Boundary
Streams
Roads
DOE-owned Industrial Area
DOE Land Licensed for West KY Wildlife Management Area Use
West KY Wildlife Management Area
TVA Boundary
Rural Residential/Agriculture

APPENDIX I: 2009 DOE PUBLIC INFORMATION MEETING

PADUCAH
Remediation Services
A Portage Shaw Joint Venture Company

761 Veterans Ave.
Kevil, KY 42053

May 1, 2009

CMP-L-0003

Mr. Reinhard Knerr, Paducah Site Lead
Portsmouth/Paducah Project Office
U.S. Department of Energy
P.O. Box 1410
Paducah, Kentucky 42002-1410

Dear Mr. Knerr:

DE-AC30-06EW05001: FEEDBACK SUMMARY FROM THE PUBLIC INFORMATION EXCHANGE HELD IN MARCH 2009

On March 24, 2009, the U.S. Department of Energy hosted a public information exchange concerning future waste disposal options for the Paducah Gaseous Diffusion Plant site. Many of the attendees completed questionnaires. Enclosed is a summary of those questionnaires and associated comments.

If you have any questions or require additional information, please contact Joe Tarantino at (270) 441-5011.

Sincerely,

Daniel B. McDonald, Site Manager
Paducah Remediation Services, LLC

DBM:JT:ams

Enclosures:
1. Summary of public comments
2. Compiled list of comments
3. Feedback sheet

cc w/enclosures:
AR
File-DMC-RC

In accordance with the requirements of Contract DE-AC30-06EW05001 and as acknowledged by the above signature, I hereby certify that the information provided in this transmittal has been prepared in accordance with all applicable requirements and the information is, to the best of my knowledge and belief, true, accurate, and complete.

e-copy:
alicia.scott@prs-llc.net
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marcie.blankenship@lex.doe.gov
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myrna.redfield@prs-llc.net
nstanisich@portageinc.com
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reinhard.knerr@lex.doe.gov
rick.keeling@prs-llc.net

What is Important to You?

Please take a moment and let us know what you think. Your comments will assist us in the writing of the Feasibility Study for Waste Disposal Options and help us address your questions at our next public information exchange.

RATING SCALE

1	Least important
2	Somewhat less important
3	No opinion
4	Somewhat important
5	Important

Please rate each of the following:

1. Impact to current land use at the site should be minimized. ①②③④⑤
2. The potential for industrial reuse should be maximized. ①②③④⑤
3. Visibility of a potential landfill to the general public should be minimized. ①②③④⑤
4. Creation of local jobs at the site. ①②③④⑤
5. Cost impacts to the taxpayers should be minimized. ①②③④⑤
6. Other? Please provide details.

A. How helpful was this public information exchange at

Providing information? ①②③④⑤

Giving you an opportunity to provide input? ①②③④⑤

B. What did you like about tonight's meeting?

____

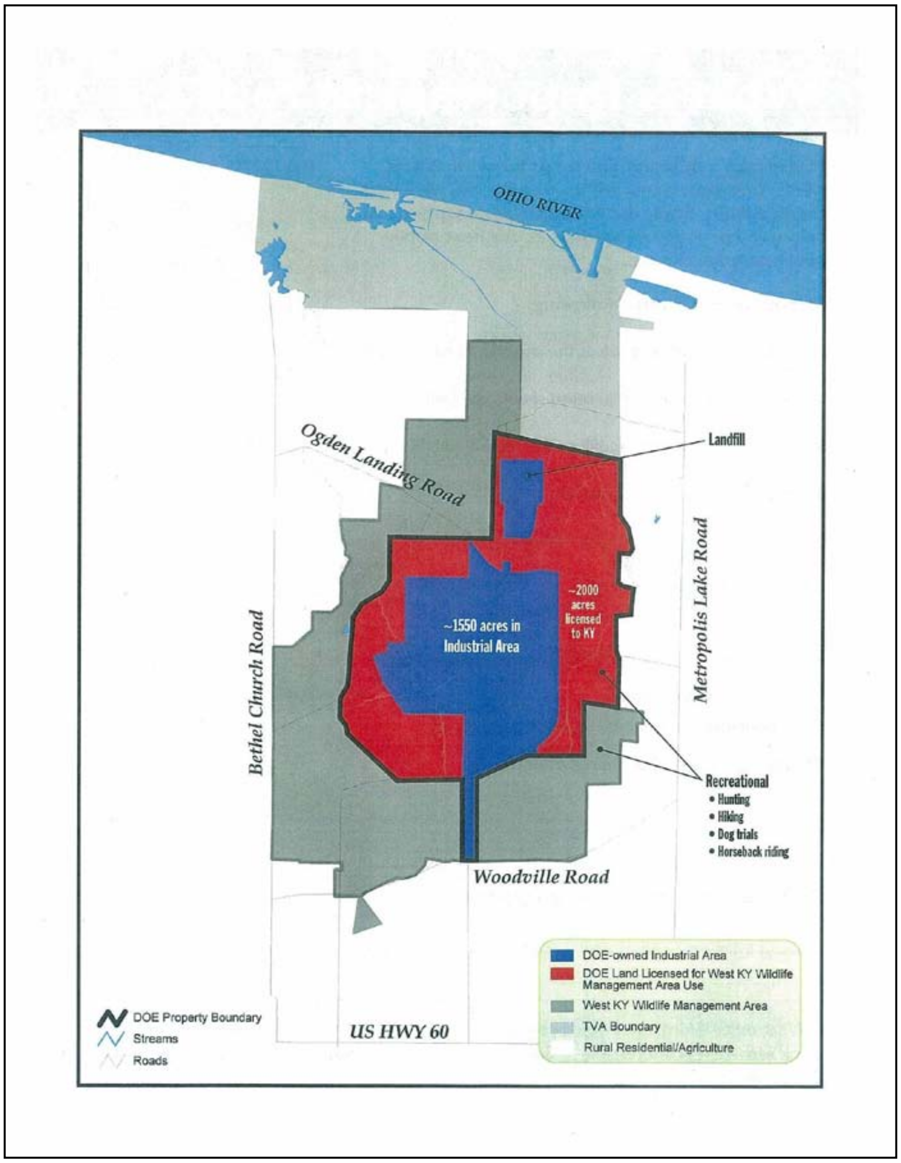
____

C. What didn't you like about tonight's meeting?

____

____

D. What other information would you like to be presented at the next meeting (please check each item of interest)? ___ Seismic ___ Transportation ___ Long-term monitoring
Other items of interest ________________________________


OHIO RIVER
Ogden Landing Road
Landfill
Metropolis Lake Road
Bethel Church Road
~1550 acres in Industrial Area
~2000 acres licensed to KY
Recreational
• Hunting
• Hiking
• Dog trials
• Horseback riding
Woodville Road
US HWY 60
DOE Property Boundary
Streams
Roads
DOE-owned Industrial Area
DOE Land Licensed for West KY Wildlife Management Area Use
West KY Wildlife Management Area
TVA Boundary
Rural Residential/Agriculture

SUMMARY OF COMMENTS FROM MARCH 2009
WASTE DISPOSAL OPTIONS
PUBLIC INFORMATION EXCHANGE
April 16, 2009

Attendees were asked to rate several questions from 5 (important) to 1 (unimportant).

	Question	Responses	Average
1	Impact to current land use should be minimized	34	3.3
2	The potential for industrial reuse should be maximized	37	4.4
3	Visibility of a potential landfill to the general public should be minimized	37	2.9
4	Creation of local jobs at the site	37	4.1
5	Cost impacts to the taxpayer should be minimized	37	4.0
	Attendees were asked to rate the effectiveness of the meeting on a 1-5 scale, with 5 being the best.		
	How helpful was this public information exchange at providing information?	35	4.3
	How helpful was this public information exchange at giving you an opportunity to provide input?	31	4.4

Response Range by Question (Most common response shaded in green)

	Important (5)	*Somewhat Important*	*No Opinion (3)*	*Somewhat Unimportant*	*Unimportant (1)*
1	5	11	9	7	2
2	22	9	5	1	0
3	7	2	11	13	4
4	22	9	4	1	1
5	17	11	4	3	2

What information would like to see at the next meeting?

Seismic	Transportation	Long-term Monitoring	Other
15	9	15	11

Other information requests included:

1. Locations for potential on-site disposal facility
2. Transportation risk assessment
3. Environmental impacts
4. Comparison of "real" risks; how toxic is this waste
5. Specific economic impacts of each alternative

Other issues of importance mentioned included:

1. Provide "numerous" public information exchanges
2. Maximize green jobs
3. Give consideration to those living around the plant

Specific likes/dislikes about meeting location/format/presentation of materials

Likes	Dislikes
Multimedia approach	It seemed a decision for on-site disposal has been made
Staff present to discuss topics	Material too general, more specific details needed; panel discussion would have been warranted
Use of movie to provide details	No explanation of why there is a problem and why taxpayers are paying for it
Use of Maiden Alley Cinema	Too few details on "what if" scenarios
Organization/design of materials	Needed more information about possible contents of potential on-site facility
Easy to grasp materials; graphic in nature, not technical, and lacking in flow charts	Seismic information too technical for general public

Feedback from March 24, 2009 Public Information Exchange Questionnaires

March 24, 2009 Public Information Exchange

Survey form results and comments

Survey results ranked from 1 (not important) to 5 (very important)

	Impact to current land use at the site should be minimized	The potential for industrial reuse should be maximized	Visibility of a potential landfill to the general public should be minimized	Creation of local jobs at the site	Cost impacts to the taxpayers should be minimized	Other	How helpful was this public information exchange at providing information	How helpful was this public information exchange at giving you an opportunity to provide input	What other information would you like to be presented at the next meeting	seismic	transportation	long-term monitoring	Other.
1	2	4	3	5	2		3	2					
2	5	4	2	3	3		5	5				√	
3	4	5	1	5	5		5	5				√	Location.
4		5	1	5	5		4	3					
5	2	5	2	5	3		5	5		√			
6	3	5	2	5	5	(A)	5	5		√	√		This was too complicated for this meeting.
													Transportation, need a simple risk assessment.
7	3	4	4	4	3		4	4				√	
8	3	5	3	3	1		4	4			√		
9	3	4	3	5	5		5			√	√	√	
10	4	5	3	5	5	(B)	5	5		√			What about transportation of waste by RIVER to save money?
11	3	5	3	5	5		5	5		√			
12		5	5	5	4		5	5				√	
13	4	5	1	5	4		5	5					
14	4	5	2	5	1		5	5				√	
15	2	2		3	5	(C)							
16	3	5	3	4			4				√		
17	3	4	5	4	4	(D)	5	5					
18	5	5	2	2	2	(E)	4	5			√		Land-use-impacts to biota- site hydrology.
19	5		5	1	5		5	5				√	
20	4	4	2	4	5								
21	5	5	3	5	5		5	5				√	
22	4	5	2	5	4		4	4		√		√	
23	3	3	3	5	3		4	4		√	√		
24	2	3	4	5	5		5	5			√		
25	5	3	5	5	5		5	5		√			
26		5	5	3	5		4						
27	4	3	2	5	4		4	4		√	√	√	Environmental impact and mitigation.
28	?	4	5	2	4		4	1					
29	2	5	2	4	4		4	4		√		√	Job creation, ecological impact.
30	2	4	2	4	2		4	4		√		√	
31	1	4	2	4	5		4						Evaluation/comparison of real risks - just how "toxic" is this stuff? & is it worth "cleanup?"
32	4	3	3	4	4		5	5		√		√	
33	4	5	3	5	4		5	5		√	√	√	Economic impact on each disposal options.
34	4	5	3	4	5		4	4		√			
35													
36	4	5	2	5	5	(F)	4	5					Present technical talks about the subject.
37	3	5	5	5	4		4	4					Long-term monitoring of former employees & families near site.
38	2	5	2	5	4		4	4		√		√	
39	1	5	1	5	5					√	√	√	Seismic lines for the 3A study appear to be mis-interpreted.

03/25/09 Rev 1

Feedback from March 24, 2009 Public Information Exchange Questionnaires

Additional factors to consider

(A)	Provide numerous opportunities for public input such as this meeting. Continuous education is important.
(B)	Green Jobs! Maximize protection of environment AND maximize "GREEN JOBS" locally.
(C)	Consideration for the people whose property surrounds the plant.
(D)	Use third party to facilitate communications.
(E)	Make sure Life Cycle Costs are utilized for cost/benefit analysis.
(F)	1. Above ground storage 2. Dry sludges 3. Immobilize in concrete

Responses to other questions

What did you like about tonight's meeting	What didn't you like about tonight's meeting
Informative, important to community to understand full impact of DOE action.	More info on containers, specifics on design and materials used.
Offering an interface with the public.	
Information atmosphere, I like seeing the results of the past polls conducted at public meeting.	Consider leaving some material at Maiden Alley past the meeting date. On-going display that is updated at regular intervals.
Good Information.	
Very good presentation w/key staff available for questions.	It seemed a decision had already been made to build on site storage.
Very informative.	
Sense of community - we're all in this together.	
Good job. Good information. Open to discussion. Well organized.	
Presentation.	
	We want nuclear power plant there!
Availability of key staff to discuss issues.	
Film followed CERCLA and was balanced.	There appears to be a strong bias toward on-site. Allow public to make informed decision.
Multimedia - good information.	DOE's CERCLA process is flawed in too much emphasis on what option DOE "Wants" vs. Other Alternatives.
People answering questions & concerns were helpful.	Please consider holding this meeting in the neighborhoods - W. Paducah, Kevil, etc.
The movie gave a good introduction of the upcoming work.	
Video.	
Excellent video, relaxed atmosphere.	
Location at the Maiden Alley Cinema.	
Design and appearance.	Map on the back? What is that for?
This is my first opportunity to explore this subject.	Way too general!!! Appears to be a "meet and great vs. serious exchange of information. I would have benefited from a panel discussion.
Location, materials to take home & review.	Map on the back of questionnaire not indicated.
Easy to understand. Very few "FLOW CHARTS" GRAPHIC in nature/ not too technical.	
Improving awareness - esp. considering it involves tax-payer $.	No explanation about how we got into this "mess" & why taxpayers are saddled w/paying for it.
Self guided at my own pace. Volume of information.	Too few details on "What Ifs"
Information was well presented and communicated in a way community members, like myself, could fully understand.	
Informative setting.	There were a lot of people standing around with name tags, but I did not know who they were, they were talking to each other rather than public.
Availability to discuss issues/questions with SMEs.	Some potential sites not feasible, but included anyway. Nothing on potential cell contents of public concern.
Setting was nice. Presentations overall were good.	
Video clip was excellent and tastefully done!	Seismic/tectonic information was way too technical for the public.
	It did not see to be well attended by the general public. Perhaps site was not centrally located and had limited parking.

APPENDIX J: PRELIMINARY STAKEHOLDER IDENTIFICATION LIST

1. US DOE (site, regional, federal)
2. Kentucky Energy & Environment Cabinet (Division of Waste Management)
3. Kentucky Cabinet for Health & Family Services (Radiation Control Branch)
4. Paducah Remediation Services (PRS)
5. US Environmental Protection Agency
6. Landowners in the Area
7. Water Policy District Residents
8. General Public
9. Economic Development Council
10. Governor's Office
11. Employee Unions
12. City of Paducah
13. McCracken County Government
14. Ballard County Government
15. Paducah Area Community Reuse Organization (PACRO)
16. Western KY Economic Development Council
17. Citizens Advisory Board
18. US Fish & Wildlife Service
19. KY Department Fish & Wildlife
20. Senator Mitch McConnell
21. Senator Jim Bunning
22. Representative Ed Whitfield
23. State Senators
24. State Representatives
25. Active Citizens for Truth
26. Media
27. Chamber of Commerce
28. Extension Office
29. Conservation District
30. Western Kentucky Wildlife Management Area
31. West Kentucky Community and Technical College
32. University of Kentucky - Paducah Campus
33. Gun Clubs
34. Dog Clubs
35. Public Schools
36. Tennessee Valley Authority (TVA)
37. Kentucky Transportation Cabinet
38. Metropolis, IL Government
39. Farm Bureau
40. Professional Clubs
41. Service Clubs
42. Tourism Council
43. Arts Council
44. Churches

APPENDIX K: IRB FOCUS GROUP MEETING PROTOCOL

Focus Group Discussion Protocol
PGDP Future Use Vision Project

Expected Knowledge/Info Outputs

1. The preferred and the unacceptable future use scenarios/combinations of scenarios for the PGDP and its environs among various community groups.

2. How the various groups in the community name and frame the following issues related to future use scenarios/combinations of scenarios for the PGDP and its environs:

   - Opportunities,
   - Strengths,
   - Challenges,
   - Weaknesses,
   - Threats,
   - Fears,
   - Risks,
   - Concerns, and
   - Solutions.

3. The overall quality of life goals, values of the community and, specifically, the priority quality of life goals and values that influence the decisions of various groups in the community regarding future use scenarios for the PGDP and its environs.

   - What is valuable to the community?

4. Any additional information the various community groups need to make the best decisions about the future use scenarios for the PGDP and its environs.

   - The most accessible and trusted channels for receiving such information.

PREPARATION

Checklist of items to bring:

To prepare facility for focus group:	To conduct focus group:
_ Digital Tape recorders	_ **Form A:** Why are we here: Format for oral presentation of informed consent
_ Blank name tents	_ **Form B:** Informed consent form/project description
_ Markers (various colors)	_ **Form C:** Demographic survey forms
_ Food	_ **Form D:** Scenario preference polling questions

			(using keypads)
_	Signs (directions to room)	_	**Form E:** Evaluation of Focus Group Discussion process (using keypads)
_	Pens/pencils	_	PGDP Future Use Visualization packets & trigger questions
_	Tape (to post signs)	_	Copies of the executive summaries of “The Politics of Cleanup” and DOE “Risk-Based End State”
_	Laptop, LCD projector, screen	_	Keypads
_	Minimum of 5 flip charts	_	2 easels for flip charts

Prior to Arrival of Participants

Arrive 20-30 minutes early to assure that the facility will be ready on time (you may be in the position of using the room directly after someone else) and to prepare the facility for your group. For instance, you may need to make adjustments to make the best use of the room and furnishings to facilitate discussion. (1) Put out signs to help the respondents find the appropriate room. (2) Arrange furnishings for discussion format, place blank name tents and writing materials for participants, reserve moderator and note taker locations with name tents. (3) Arrange how food service should take place. (4) Set up tape recorders. (5) Set up laptop, screen and LCD system.

INSTRUCTIONS FOR RUNNING THE GROUP

A. As Participants Arrive

(1) Welcome participants and invite them to select some food/beverage and take a seat. (2) Tell them where the restroom is.
(3) As soon as all the participants are done eating, explain the project and the Informed Consent form using **Form A**: “Why Are We Here?” Reiterate that participation is voluntary and that any participants who do not want to continue the study can leave
(4) Distribute **FORM B**: The Informed Consent and Project Description
(5) Briefly describe the project for participants using a PowerPoint of the Project Description in **FORM B.**
(6) Ask participants to write their nicknames, first names or pseudonyms on both sides of the tent so that all participants can see each other's names or nicknames--this encourages discussion.
(7) Ask participants to introduce themselves,
(8) Request participants fill out **FORM C**: The Demographic Survey.
(9) Administer the first page of FORM E using key pads; describe the Arnstein Ladder conceptualization of public involvement and ask participants to anonymously register where they feel their past levels of public involvement in PGDP-related issues has fallen.
(10) Begin the discussion.

B. Warm up

1. First, please ensure that you've written your first name or a nickname on both sides of the tent so we all can see everyone's name. Thanks. I'd like to begin by finding out what you like and what you dislike about living in the Paducah area with PGDP as your neighbor. For example, what is your favorite thing about living in the area?

Sometimes, you'll need to prompt further by offering alternatives. This is a discussion training exercise. Call on people by first name, and ask one follow-up question about whatever they say. The follow-up question can be anything that makes it clear that you have been listening and that encourages the respondent to add something more. This helps get the respondents used to the idea of probing for more info. As you conduct this exercise, also look for information that naturally leads into our discussion.

Call on people in a seemingly random order, rather than moving around the table, because the randomness better approximates how discussions happen. Moving around the table sets a different tone and could lead to people patterning their comments only after their neighbor has spoken.

2. If you go outside this building and ask someone "what is the temperature right now at this spot?" there is a right answer and a wrong answer that you can check with a thermometer. However, what we are discussing today is how you and your friends feel about things, and there could be as many different opinions as there are people in this room. Guess what? Every one of those opinions is right! Remember, we aren't here to convince anyone of something in particular or to change anyone's mind. We are here to discuss things and to hear what each and every one of you has to say.

Sometimes, you will find that many people in the room have your opinion, and other times you will be the only one with that opinion. But it is important for us to learn about all the opinions because even if you are the only one in this room who holds that opinion, there may be thousands of other people in your community who feel just as you do. Most importantly, every opinion counts -- so please feel free to share your thoughts.

C. DISCUSSION OF PARTICIPANTS' OVERALL QUALITY OF LIFE GOALS AND VALUES

Participants' descriptions of their ideal city of residence

This activity is designed to elicit the overall quality of life goals and values of participants

OBJECTIVE

1. Identify what is valuable to participants

HOW TO CONDUCT THIS ACTIVITY

Facilitator explains the objective of this activity.

Now that we have discussed what makes this area a desirable place to live, let's carry that a bit further and imagine the ***ideal*** *place to live. Try to visualize a community that would meet all of your needs and wants. Now, let's try to describe that community in as much detail as possible.*

Ask participants to describe in as much detail as possible three factors that would influence his/her choice of an ideal city of residence. These factors are written out on a flipchart.

After listening to the individual descriptions, the facilitator asks the following questions to generate discussions:

1. How does this region measure to these ideal regions we've heard about today?
2. Which of the ideal city characteristics are the most important to you and why?

D. Discussion of Visualizations of Sample future use scenarios

The preferred and the unacceptable future use scenarios/combinations of scenarios for the PGDP and its environs among various community groups

Visualizations of Sample Scenarios

This activity uses computer-generated visualizations of sample future use scenarios.

Objectives

Seeing and discussing these visualizations can help the community members:

- Think about the various possible future use scenarios.
- Share their knowledge and experiences about additional possible scenarios.
- Evaluate and appreciate the various issues related to various possible future use scenarios.

The activity is most effective if focus group participants work in small groups to examine and discuss the visualizations that they receive. After each small group has examined their visualization, they should explain to the whole group what they think the visualization represents and the issues related to the visualization such as opportunities, strengths, challenges, weaknesses, threats, fears, risks, concerns, and solutions. The group presentations can help to engage participants in a dialogue about various scenarios and their possible effects on their community. This activity is also an icebreaker that immediately engages the participants in sharing their ideas and perceptions at the beginning of the focus group.

Materials: Visualizations of Sample future use scenarios (four scenarios to be Selected Randomly from among eight unmarked visualization packets)

How to conduct this activity

Introduce the activity by asking the participants to form small groups of 3 to 4 people. Then assign one visualization packet to each small group. Display the three questions listed below on an easel pad that is visible to all participants:

1. *What do you think this represents?*
2. *Do you think this is a good or bad future use scenario for the PGDP site? Why?*
3. *What do you think the consequences of this scenario may be for you, your family and your community? Explain.*

Explain the scenario visualizations as just a sample of what is possible for the future use of the plant site. Give the following instructions to the participants

"Please look carefully at the visualization that has been assigned to your team. Then discuss the questions listed on the easel pad. Make sure everyone in your group has a chance to look at the visualization and has an opportunity to express his or her ideas. When you finish, your group will be asked to make a two-minute oral report about your observations and ideas, while the visualization is shown to the rest of the group."

After a maximum of ten minutes, ask each group to tell the whole group what they think the visualization represents and what the consequences will be for the community. ***As each group is presenting their visualization, you should also display the same visualization for the entire group.***

Probes:

After each group has made its brief report, engage all present in a whole group discussion using the following probes

1. What do these scenarios mean for the community?
2. How do these scenarios relate to your lives? Your families? Your communities?
3. What are the most important issues related to these scenarios: opportunities, strengths, challenges, weaknesses, threats, fears, risks, concerns, and solutions?
4. What are the barriers to implementing these scenarios?
5. In what ways can these barriers be overcome?
6. What other scenarios/combinations of scenarios can we consider for the plant site and why?
7. Think back to our earlier discussion about what makes this area a special place to live and what characteristics would define the ideal place to live. (Review these on the flip chart.) Now, which of the scenarios discussed today would reinforce what makes this area special? Which would bring this region closer to the ideal characteristics described by participants? Why?

Use keypads to poll participants' scenario preferences.

E. Identifying knowledge gaps and community trusted information channels

OBJECTIVES
This activity should help us to understand participants' information-seeking behavior and information use, both of which are crucial to effectively meeting their information needs. This activity may also lead to the discovery of novel information behavior and user profiles that can be used to enhance existing information models or even develop new ones.

HOW TO CONDUCT THIS ACTIVITY
Use questions and probes to discover participants' information needs and their sources of credible information about issues in general and specifically about the plant and its operations.

DISCUSSION QUESTIONS
1. What types of information do you usually seek about the PGDP and its operations?
2. What sources do you consult for this type of information? *[Let people volunteer responses first then probe with these choices.]* Do you ask friends, neighbors, go to the library, watch television, read it in magazines, go on the Internet?

3. Why do you use these sources? What problems have you had getting information that you want (examples: hard to find, too technical, didn't relate to my situation, confusing navigation online etc.)?
4. Which is the most credible source of information about PGDP?
5. Which sources of information about PGDP are the easiest to understand and most helpful to you?
6. Which sources of information about PGDP are the hardest to understand and least helpful to you?
7. What information do you think is most important to the community about PGDP and its activities?
8. What are the best ways of delivering information about issues related to PGDP to your community? *[Let people volunteer responses first then probe with these choices.]* Printed materials like brochures? Video? Extension officers? Etc.
9. If we could develop a web site where you could obtain information about the PGDP, what type of information would you like to have? How would you like to see the information presented?

Use keypads for evaluations of the focus group process Using Forms D and E (use both sides)

Conclusion
We have had a great discussion and you have offered very valuable insights and opinions.

Is there anything we missed during this discussion on the future use of PGDP you would like to add?

I want to thank all of you for coming and participating in our discussion. Please remember that we agreed at the start of our discussion that everything that was said in this room is confidential.

Once again, thank you.

Informed Consent Procedures for the PGDP Future Use Vision Meetings

We are doing an interesting study for which we need your help. In order to proceed we need your verbal consent.

I am going to ask 10 questions to explain the purpose of the study. I will then answer each of these questions. We will get into more detail about the project as we go through the evening; however, the University of Kentucky Institutional Review Board, which guides research projects, mandates that we cover this material and gain your consent to participate in this focus group prior to discussing the project in more depth. Please feel free to ask questions about the focus group process at any time. Your questions about the overall Future Vision process will be addressed later in this presentation.

1. Who are we?
   We're a team of researchers from the Kentucky Research Consortium for Energy and the Environment located at the University of Kentucky. We are conducting this study to assist the local community in identifying a vision for the future use of the Paducah Gaseous Diffusion Plant site.

2. Why are we here?
   We're here to explain the study to you and to ask you to be involved in this important project. If you agree, you will participate in a discussion about what should be done with the plant and surrounding areas when the plant is decommissioned and about the best means of achieving the objectives for the greater benefit of your community. The information you provide to us today will help us learn more about what the community thinks and wants for the plant and its surrounding areas and how best to achieve these wishes. We also want to find out what additional information you need about the process and what the best means of getting that information to you is. During this meeting, we will discuss the concerns and major issues that are important to your community in relation to PGDP and the best use of the plant in the future. I will guide the discussion, listen to, and record your ideas.

3. What are we asking you to do and why?
   During the past few years, several groups of people from your community and from many organizations, including the DOE, have suggested numerous future uses for the PGDP and the land surrounding it. We'll show you a sample of these suggestions and ask you to evaluate them based on what you think will be in the best interest of your family and the community
   - *Which suggestions do you think make sense, are worth doing, and would you support and why?*
     - *Which suggestions do you think don't make sense and why?*
     - *What are your recommendations and why?*

4. Why were you asked to participate in this study*? **(ADAPT FOR OTHER CLUSTERS, e.g. EMPLOYEES OF THE PLANT)***
   You are members of the Paducah community and you and your family live close to the Plant. You and people like you are the group most affected by the plant and its operations.

5. Why do we need your permission and how will you grant us permission to participate?
   All studies of this type require that the participants be told what the study is about and what they are being asked to do. That is what we are doing now. We will also give you a two-page description of the project goals and your role in the project. If you agree all you need to do is to take part in a discussion.. During the discussion you can choose to participate or not participate at any time, or to leave at any time.

6. What are the risk/benefits for you if you decide to participate in this study?
   As far as we know there are no risks from participating in this study. There are a number of benefits. By participating in this study, your views may affect the decisions about what should be done with the plant and its environs, when current operations end. By sharing your ideas and experience with us, you will be part of a sample of about 90 community members from Paducah and surrounding counties who are working with the project team to ensure that the voice and opinions of all community segments are taken into consideration when a decision is made about the future of the plant and its surroundings.

7. Will you receive any rewards for participating in this study?
   You will receive no rewards for participating in this study other than a free meal. You will receive the free meal whether of not you chose to participate in the study.

8. What will it cost you to participate in this study?
   The only cost to you is the time required to travel to and from the meeting and the time involved for the discussion.

9. Will your identity and statements remain confidential?
   Yes. No one outside of our group will know exactly what you said. We never use names when we review your comments. We will also ask you to complete a two-page questionnaire about your connection to the PGDP. Do not write your name on the questionnaire. That way your comments and identity will remain anonymous.

10. If you have questions, whom do I contact?

    If you have questions about the study you can ask them now or at any time during the meeting. You can also call Dr. Lindell Ormsbee, the principal investigator of this study at any time at 859-257-1299, or email Dr. Ormsbee at lormsbee@engr.uky.edu. You can also call the University of Kentucky Office of Research Integrity at 859-257-9428 or toll free at 1-866-400-9428.

Consent to Participate in a Focus Group Discussion of PGDP Future Use Vision

You are invited to take part in this study that will assist the local community to identify a vision for the future use of the Paducah Gaseous Diffusion Plant site. A Federal earmark facilitated by Senators McConnell and Bunning and Representative Whitfield supports the Study. The person in charge of this study is Dr. Lindell Ormsbee from the Kentucky Research Consortium for Energy and the Environment, located at the University of Kentucky. The other people on the team are Drs. Ted Grossardt and Chike Anyaegbunam, Ms. Anna Hoover and Mr. Mitchael Schwartz, all from the University of Kentucky.

You were selected to take part in this study because you are in some ways connected to the PGDP either because you live in Paducah, near the plant or work in the plant. You are one of about 90 people to participate from the communities in Paducah and nearby counties. The group discussion will take about two hours of your time.

By doing this study, we hope to learn what the Paducah community thinks should be done with the plant and surrounding areas when the plant is decommissioned, as well as the best means of achieving these objectives to the greater benefit of the community. The information you provide us today will help us to learn more about what the community thinks and wants for the plant and its surrounding areas and how best to achieve these wishes. We also want to find out what additional information you need about the process and the best means of getting that information to you. During this meeting, we will discuss the concerns and major issues that are important to your community in relation to PGDP, along with the best use of the plant in the future.

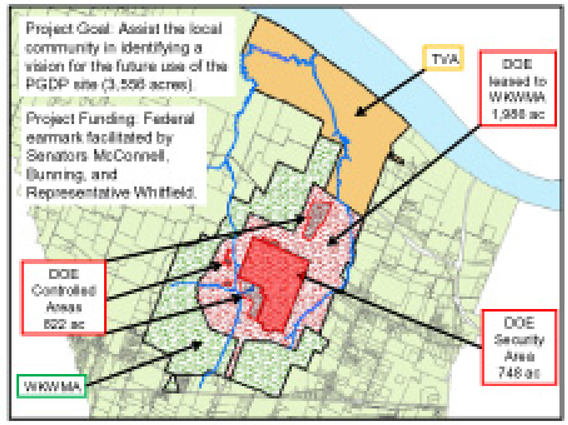
The discussion will be audio recorded so that the researchers can review all of the comments more thoroughly. This recording will be kept secure until information can be collected from it and then the recording will be destroyed. You are encouraged to voice your opinions; however, your participation in the discussion is voluntary. Your opinions are very valuable to us, but you are free to leave the discussion at any time. Your responses will be added to the responses of other participants for reporting purposes, and every effort will be made to protect your confidentiality. All the information you give us will be kept secure and will only be accessible to project personnel. Several faculty members at the University of Kentucky will listen to the recording of this discussion. Of course, the other individuals participating in today's focus group will know what was said and by whom during the session.

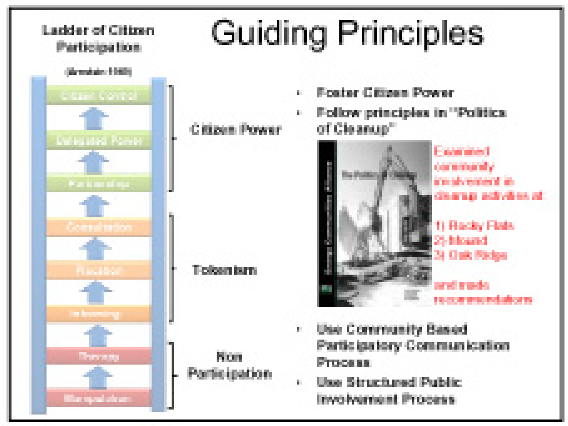
There are no known risks to you or your family if you participate in this study. By participating in this study, your views may affect the decisions about what should be done with the plant and its environs when current operations cease. By sharing your ideas and experience with us you will be part of a sample of about 90 community members from Paducah and surrounding counties who are working with the project team to ensure that the voice and opinions of all community segments will be taken into consideration when a decision is made about the future of the plant and its environs. You will not be paid for your participation although a meal will be provided. There are no costs to participate other than the two hours you will spend with others in the discussion.

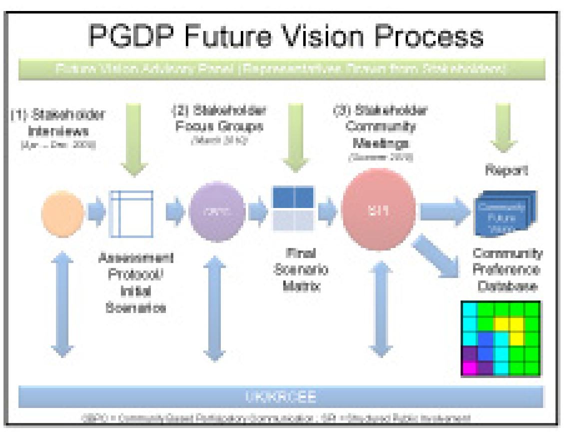
If you decide to take part in the group discussion, it should be because you really want to volunteer. You will not lose any benefits or rights that you would normally have if you choose not to volunteer. You can stop at any time during the study. If you do not want to be in the study, you may choose not to participate in the study.

If you have questions about the study, you may contact Dr. Lindell Ormsbee at 859-257-1299, or email lormsbee@engr.uky.edu. If you have any questions about your rights as a volunteer in this research, contact the staff in the Office of Research Integrity at the University of Kentucky at 859-257-9428 or toll free at 1-866-400-9428.

PGDP Future Vision Project:
Brief Project Description







FORM C: DEMOGRAPHIC SURVEY FOR PGDP FUTURE VISION FOCUS GROUP PARTICIPANTS

You are invited to take part in this study that will assist the local community to identify a vision for the future use of the Paducah Gaseous Diffusion Plant site. The information you provide us today is very crucial and will help us to learn more about what the community thinks and wants for the plant and its surrounding areas, as well as how best to achieve these wishes.

1) In what ways are you connected with PGDP? Check all that apply

Live in Paducah? ____

Live near the plant? ____

Work in the plant? ____

Have relatives who work/worked in the plant? ____

Have clients or customers who work in the plant? ____

Others (Describe) ____

2) Your age _________

3) Your sex
____ M
____ F

4) Ethnicity/Race?

__Hispanic or Latino

__White

__ Black or African American

__American Indian/Alaskan Native

__Asian

__Native Hawaiian or Other Pacific Islander

__ More than one race

__ Other

5) Occupation ____

Form D: Sample Scenario Preference Polling Questions (using keypads)

Please make brief one or two line comments after each item below.

1. Which scenario makes the most sense to you? Why?

____

____

____

2. Which scenario makes the least sense to you? Why?

____

____

____

3. Which parts of the scenarios would you support? Why?

____

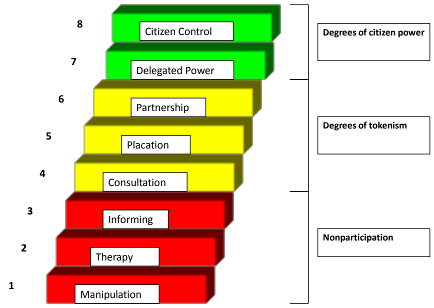
____

____

4. This fourth question is something we'll like you to discuss with us now and also take home and share with people in your community. Here is the question: *What would you and others in your community need to move forward on identifying the most optimal future use scenario for the plant site you feel should be implemented?*

FORM E (DRAFT)

The Arnstein Ladder: Degrees of Citizen Participation in Planning (Arnstein 1969)



COMMENTS

Where are we now?

1. Manipulation
2. Therapy
3. Informing
4. Consultation
5. Placation
6. Partnership
7. Delegated Power
8. Citizen Control

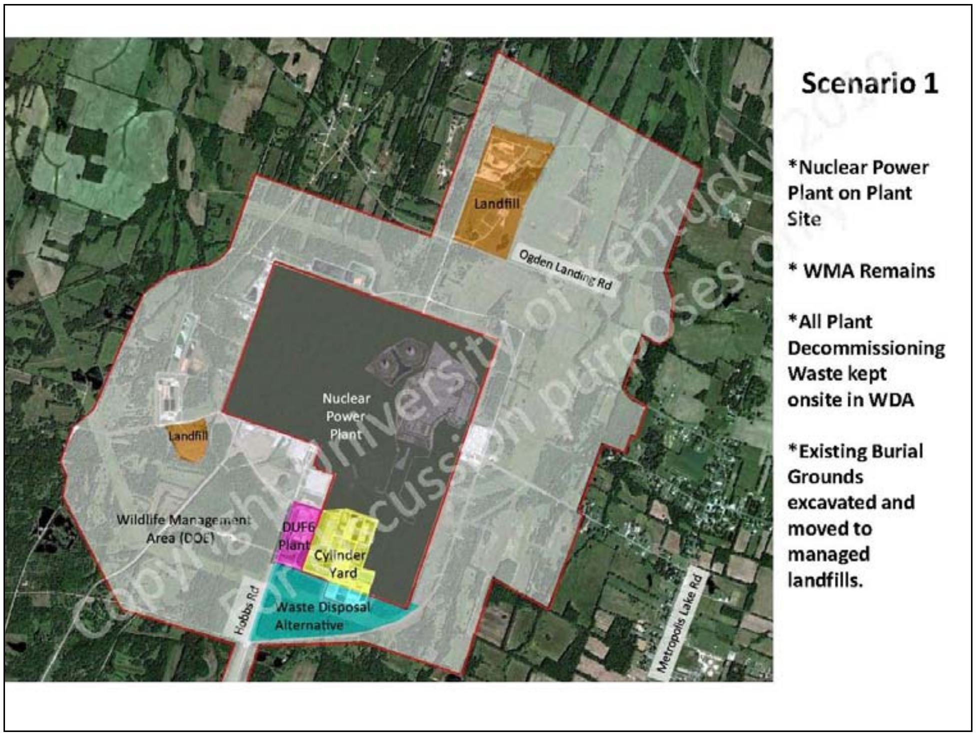
Where should we be?

1. Manipulation
2. Therapy
3. Informing
4. Consultation
5. Placation
6. Partnership
7. Delegated Power
8. Citizen Control

How Satisfied Are You With the Meeting Processes Used Here?

1. Very Unsatisfied
2. Unsatisfied
3. Somewhat Unsatisfied
4. Slightly Unsatisfied
5. Neutral
6. Slightly Satisfied
7. Somewhat Satisfied
8. Satisfied
9. Very Satisfied

APPENDIX L: FOCUS GROUP SCENARIOS



Scenario 1 from North

Scenario 1 from South

Scenario 2

*Nuclear Power Plant on Plant Site

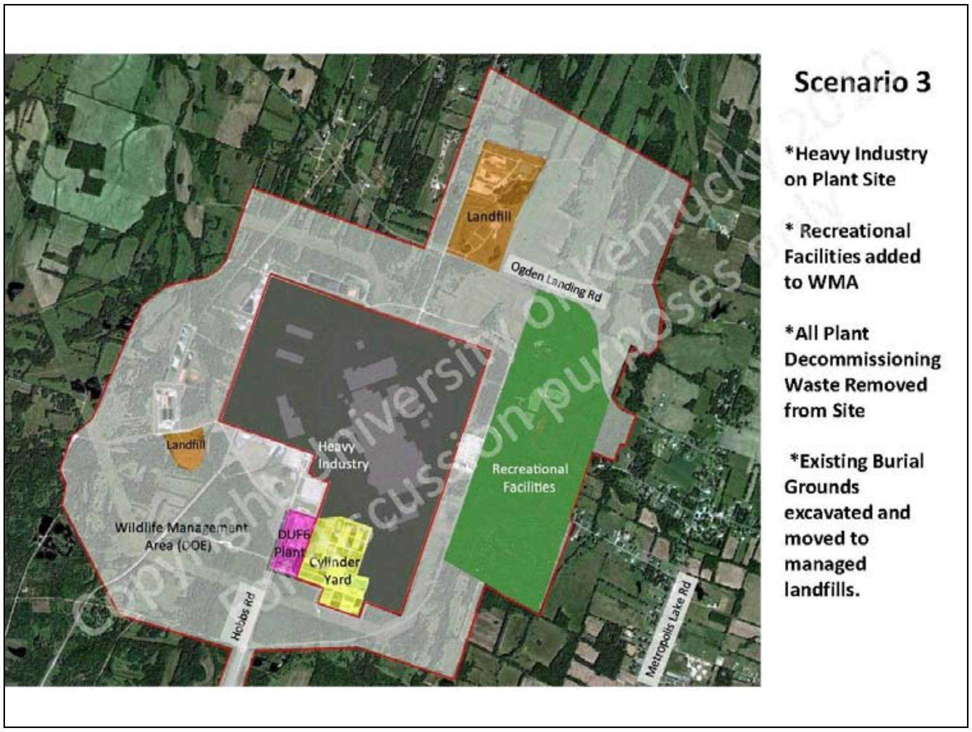
* WMA Remains

*Part of Plant Decommissioning Waste kept onsite in WDA

* Existing Burial Grounds sealed and left in place

Scenario 2 from North

Scenario 2 from South



Scenario 3 from North

Scenario 3 from South

Scenario 4

*Heavy Industry on Plant Site

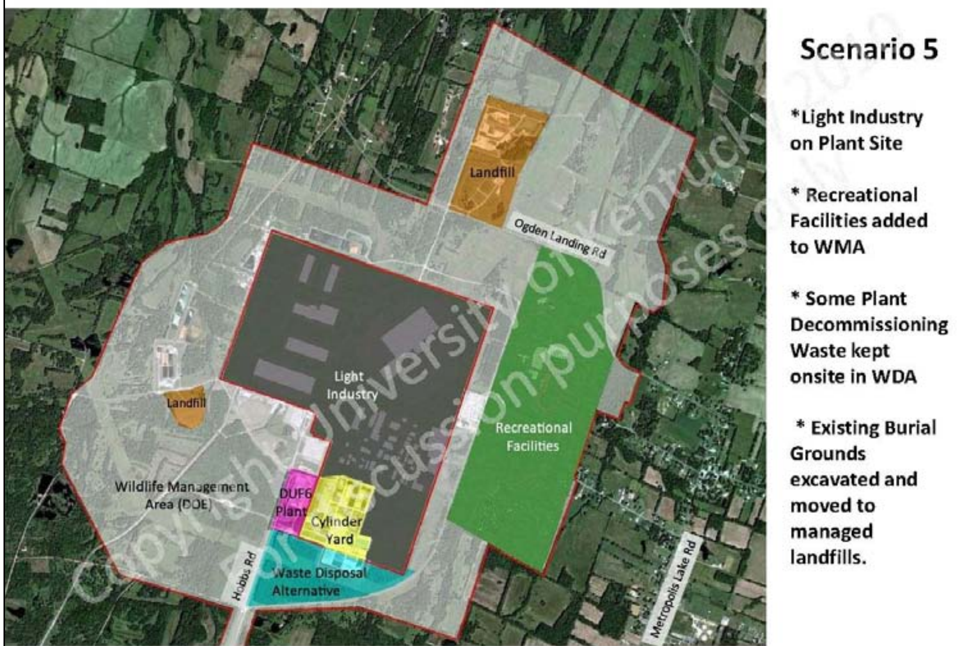
* WMA Remains

* All Plant Decommissioning Waste kept onsite in WDA

* Existing Burial Grounds sealed and left in place.

Scenario 4 from North

Scenario 4 from South



Scenario 5 from North

Scenario 5 from South

Scenario 6

*Light Industry on Plant Site

* WMA Remains

* All Plant Decommissioning Waste Removed from Site.

* Existing Burial Grounds sealed and left in place.

Scenario 6 from North

Scenario 6 from South

Scenario 7

*Recreational Facilities on Plant Site

* WMA Remains

* Some Plant Decommissioning Waste kept onsite in WDA

* Existing Burial Grounds sealed and left in place.

Scenario 7 from North

Scenario 7 from South

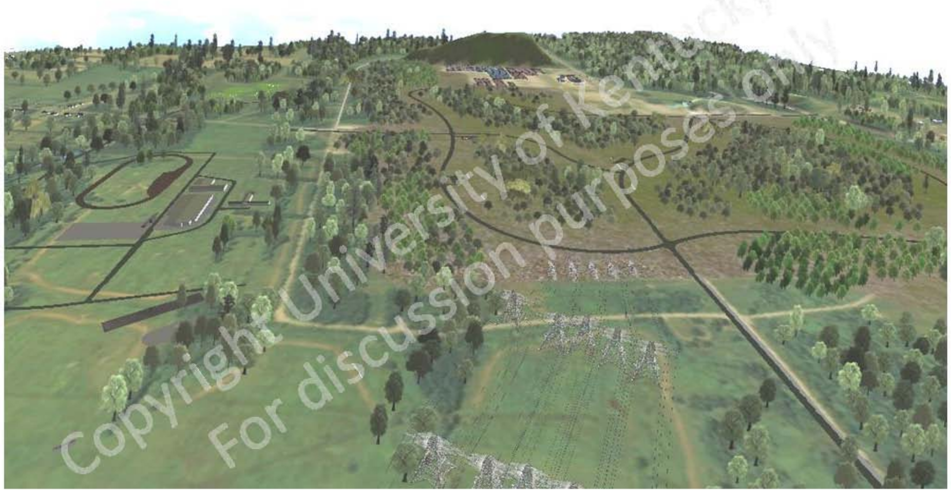
Scenario 8

*Recreational Facilities on Plant Site

* Recreational Facilities added to WMA

* All Plant Decommissioning Waste kept onsite in WDA

* Existing Burial Grounds excavated and moved to managed landfills.



Scenario 8 from North

Scenario 8 from South

Scenario 9

*Nature Preserve on Plant Site

* Recreational Facilities added to WMA

* All Plant Decommissioning Waste Removed from Site.

* Existing Burial Grounds sealed and left in place.

Scenario 9 from North

Scenario 9 from South

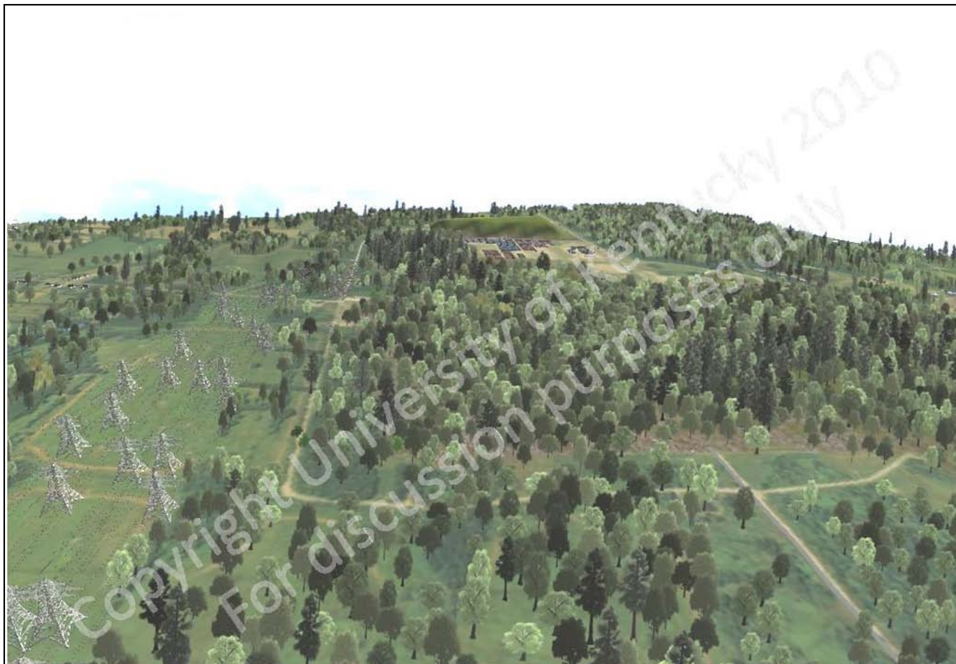
Scenario 10

*Nature Preserve on Plant Site

* WMA Remains

* Some Plant Decommissioning Waste kept onsite in WDA

* Existing Burial Grounds excavated and moved to managed landfills.



Scenario 10 from North

Scenario 10 from South

Scenario 11

*Plant Site sealed, fenced, access restricted

* WMA Remains

* All Plant Decommissioning Waste Removed from Site.

* Existing Burial Grounds excavated and moved to managed landfills.

Scenario 11 from North

Scenario 11 from South

Scenario 12

*Plant Site sealed, fenced, access restricted

* Recreational Facilities added to WMA

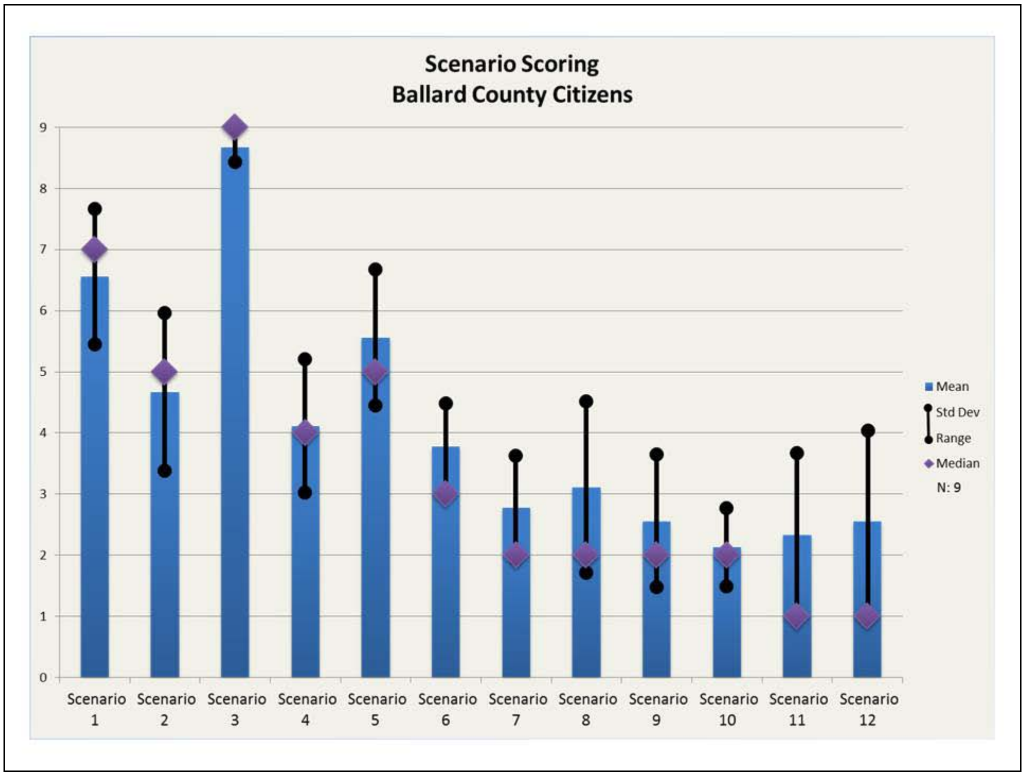
* All Plant Decommissioning Waste kept onsite in WDA

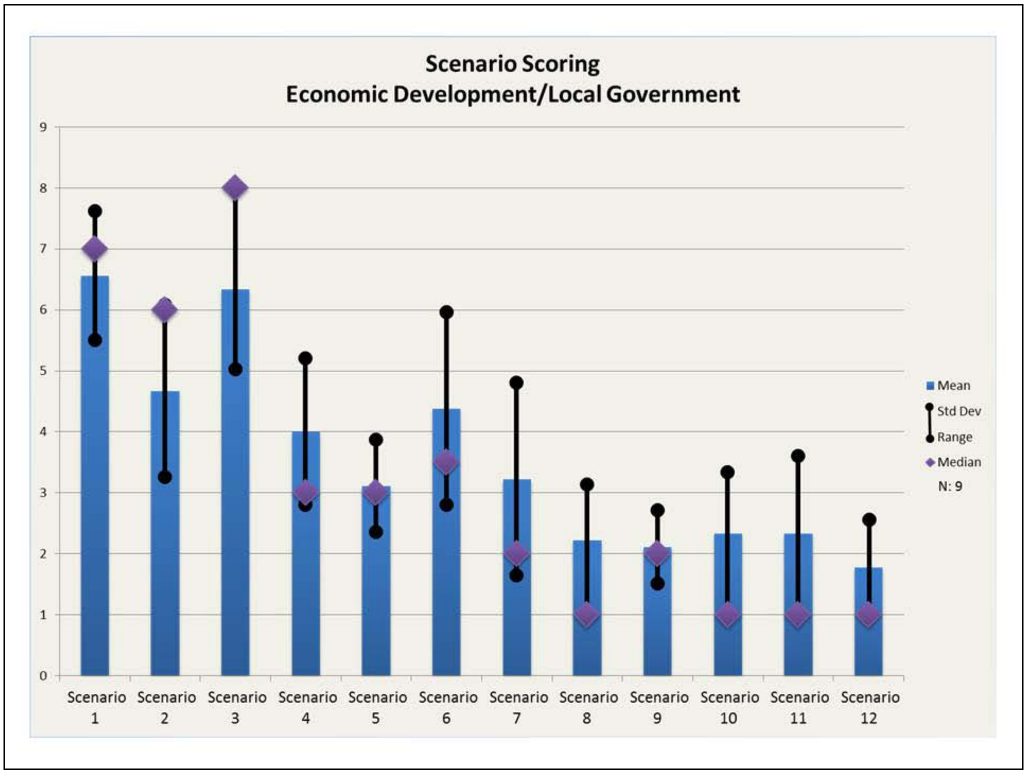
* Existing Burial Grounds sealed and left in place.

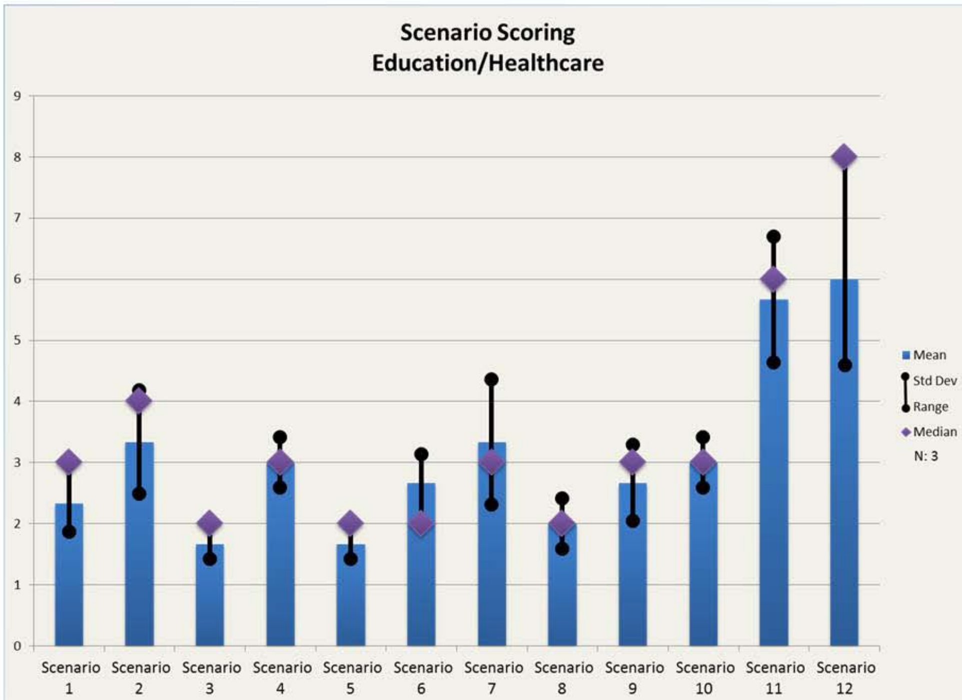
Scenario 12 from North

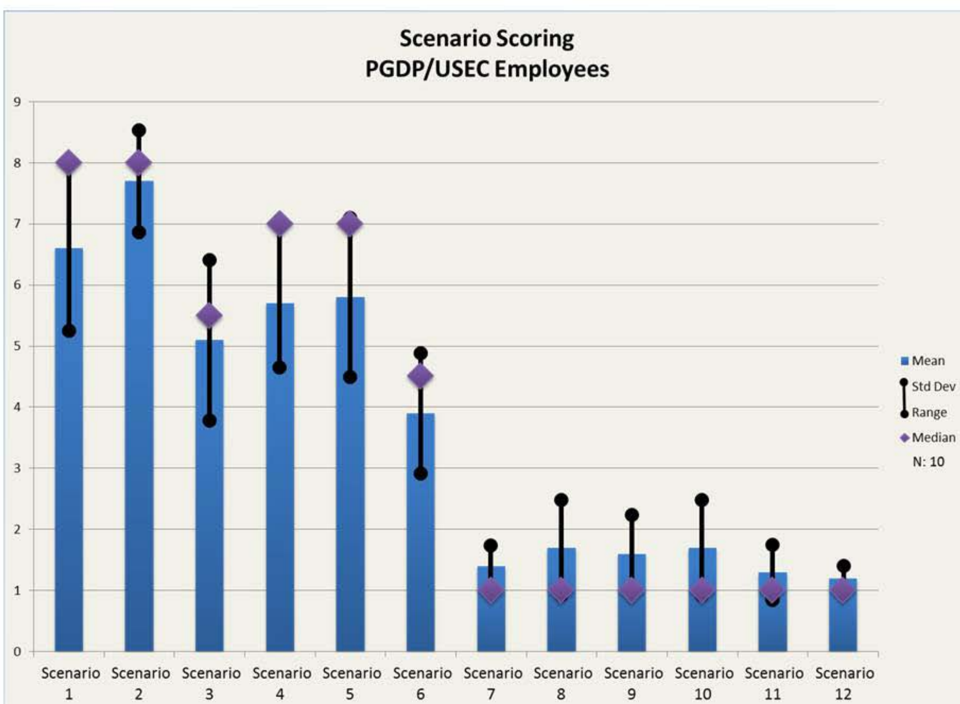
Scenario 12 from South

APPENDIX M: FOCUS GROUP SCENARIO SCORING (BY STAKEHOLDER CLUSTER)






Scenario Scoring
Education/Healthcare
0
1
2
3
4
5
6
7
8
9
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Scenario 7
Scenario 8
Scenario 9
Scenario 10
Scenario 11
Scenario 12
Mean
Std Dev
Range
Median
N: 3


Scenario Scoring
PGDP/USEC Employees
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3
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7
8
9
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
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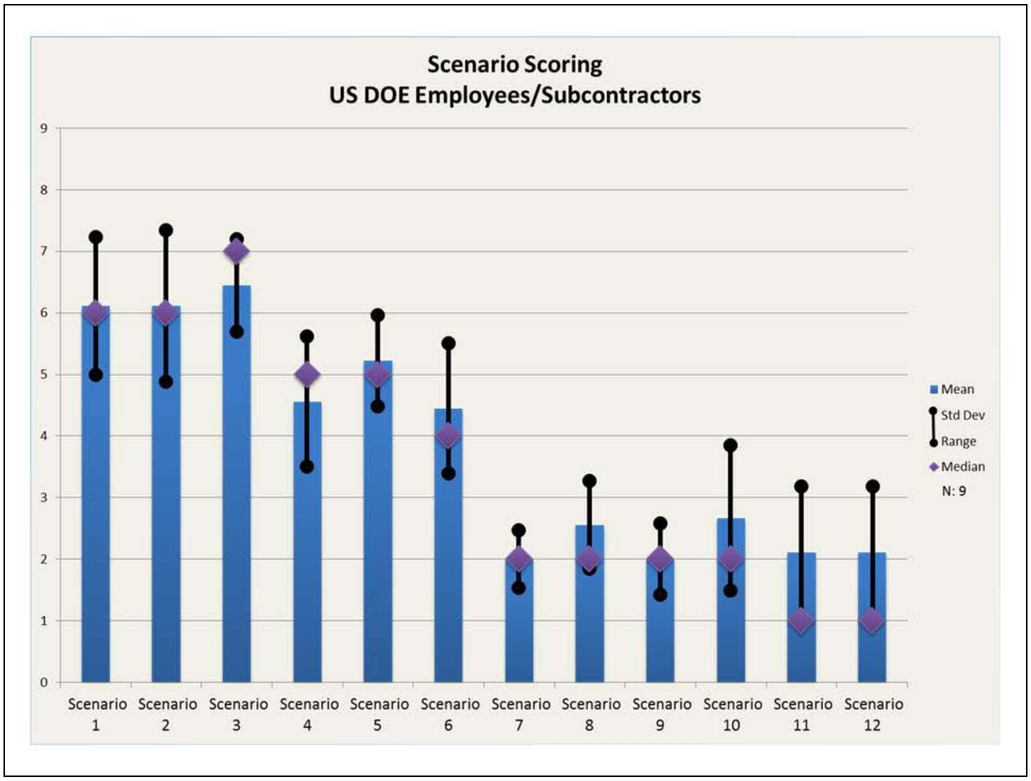
Scenario 7
Scenario 8
Scenario 9
Scenario 10
Scenario 11
Scenario 12
Mean
Std Dev
Range
Median
N: 10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1
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Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
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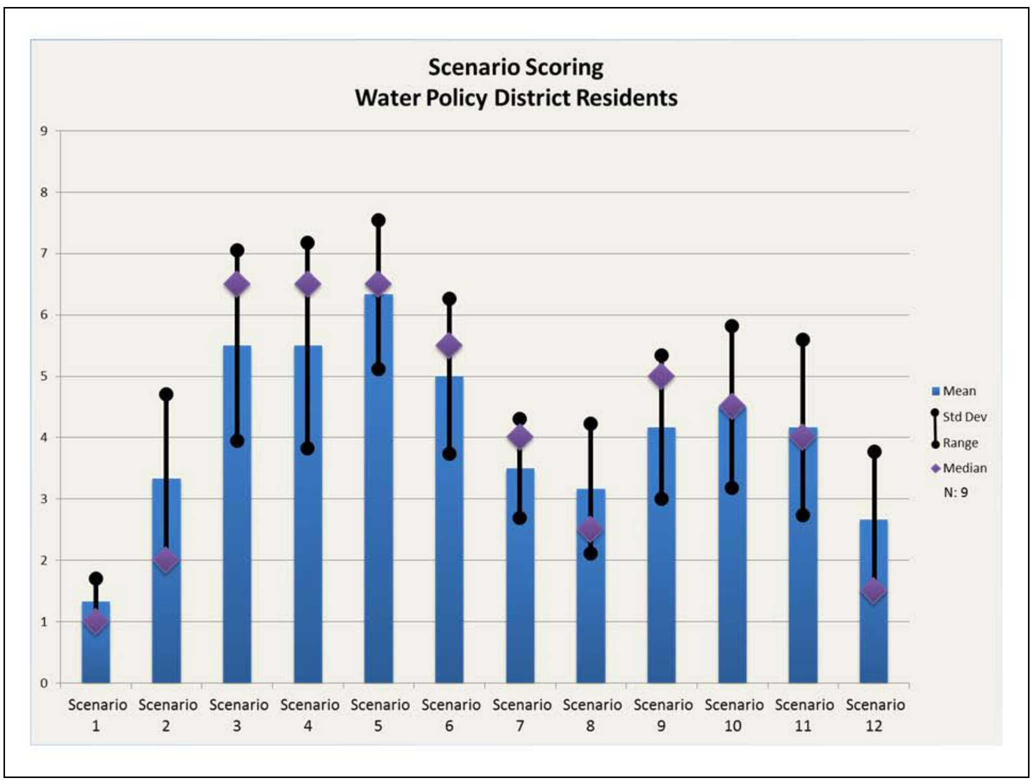
Scenario 8
Scenario 9
Scenario 10
Scenario 11
Scenario 12
Mean
Std Dev
Range
Median
N: 9


Scenario Scoring
Water Policy District Residents
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8
7
6
5
4
3
2
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0
Scenario 1
Scenario 2
Scenario 3
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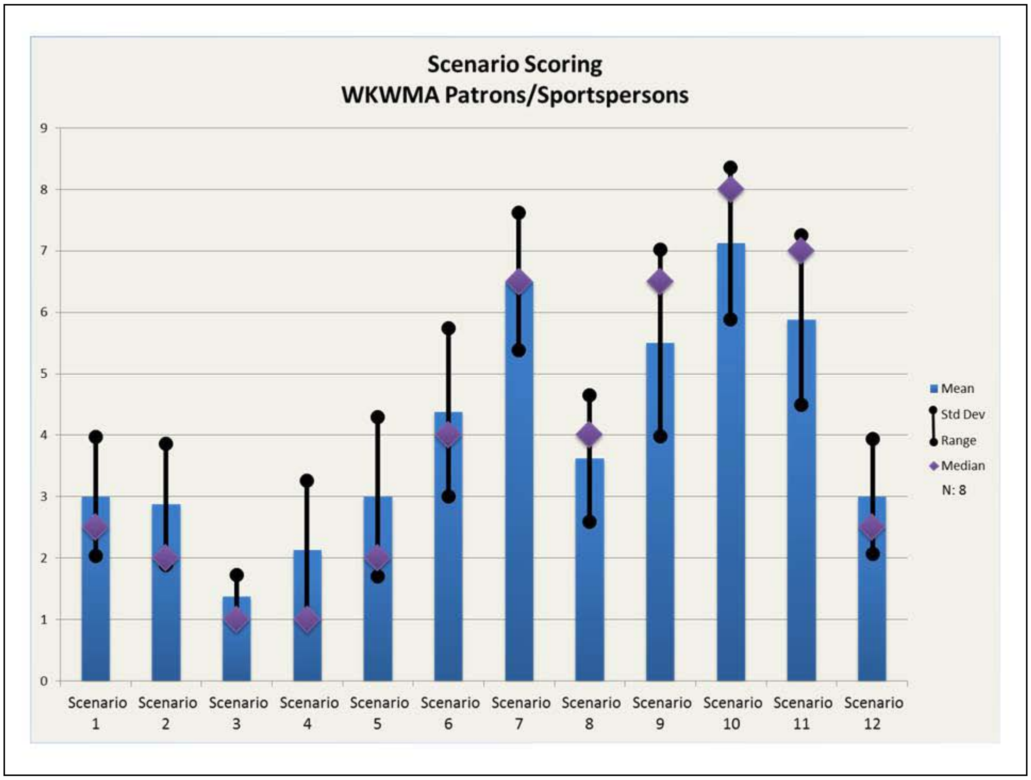
Std Dev
Range
Median
N: 9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Scenario 1
Scenario 2
Scenario 3
Scenario 4
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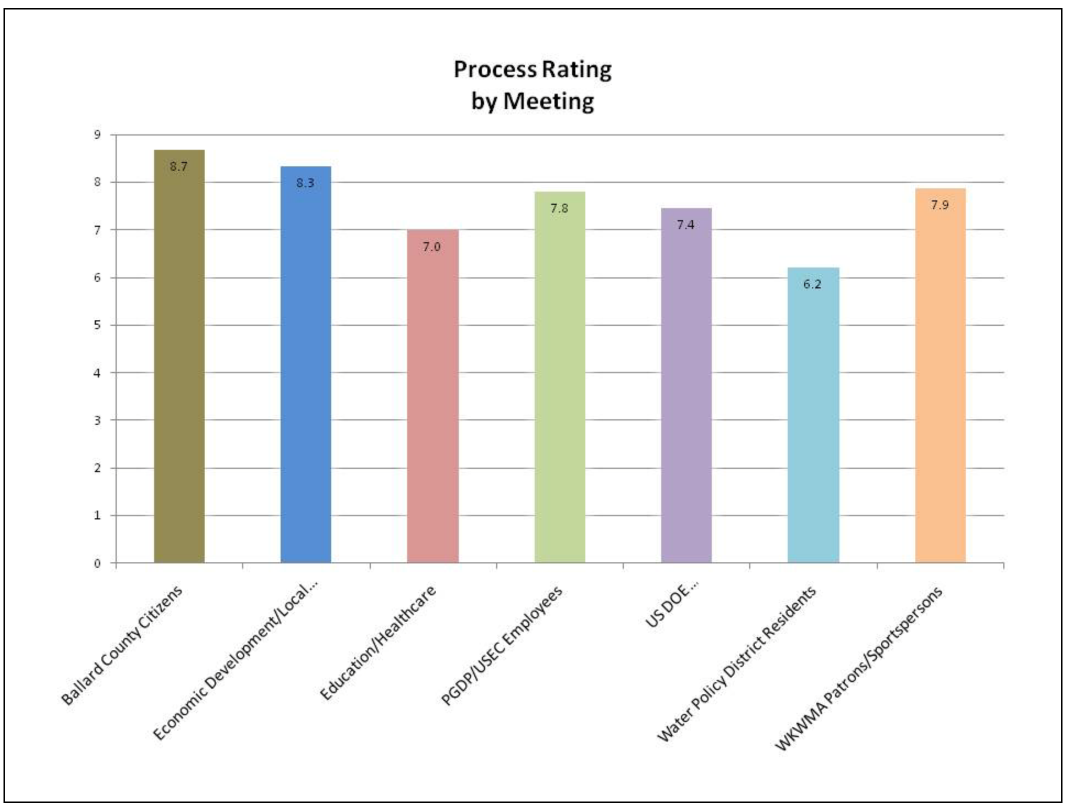
Scenario 9
Scenario 10
Scenario 11
Scenario 12
Mean
Std Dev
Range
Median
N: 8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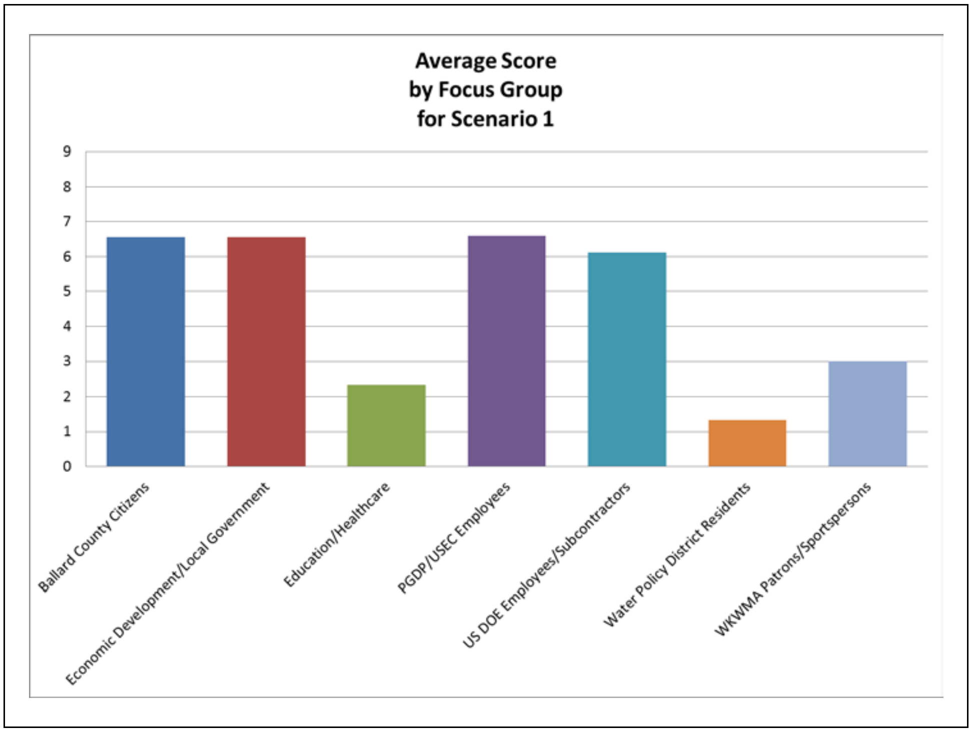
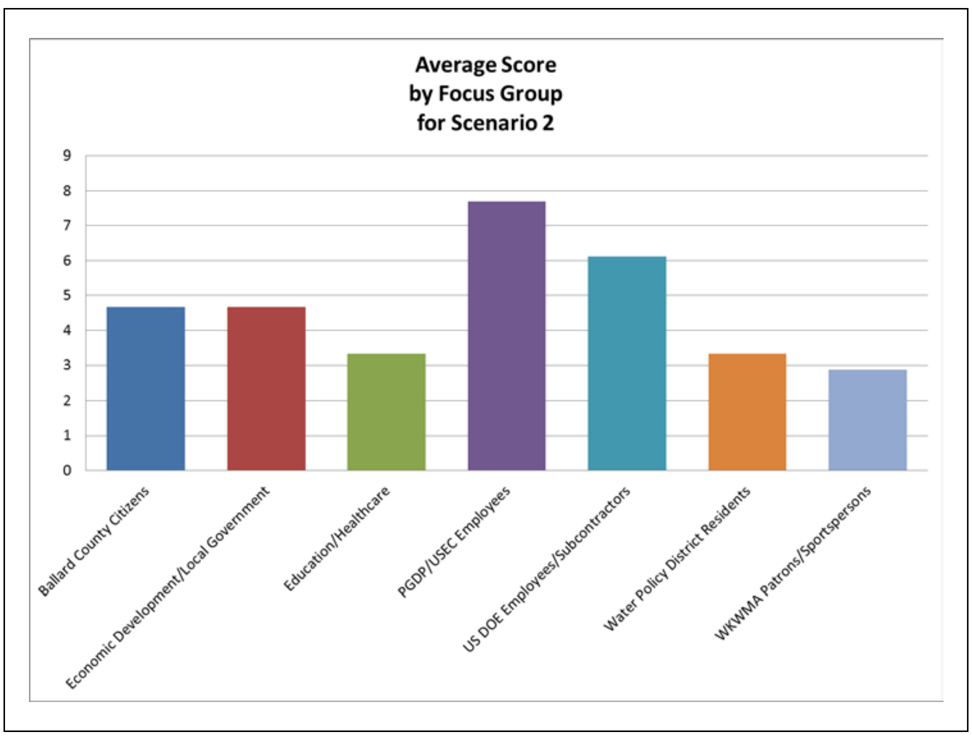
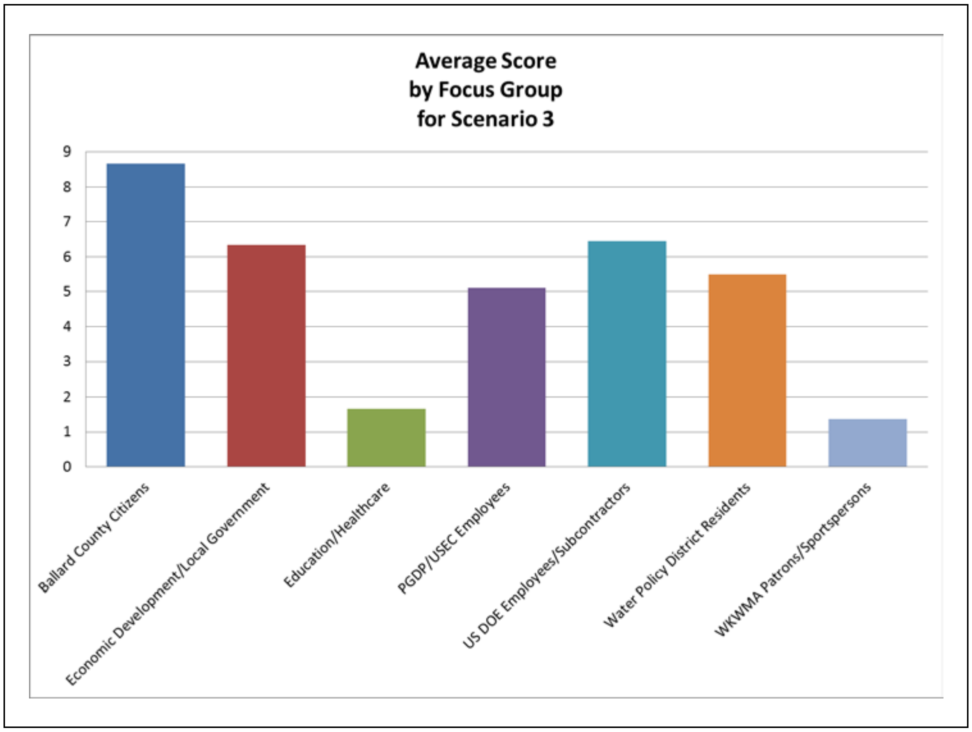
7.8
7.4
6.2
7.9
Ballard County Citizens
Economic Development/Local...
Education/Healthcare
PGDP/USEC Employees
US DOE...
Water Policy District Residents
WKWMA Patrons/Sportspersons

APPENDIX N: FOCUS GROUP SCENARIO SCORING (BY SCENARIO)



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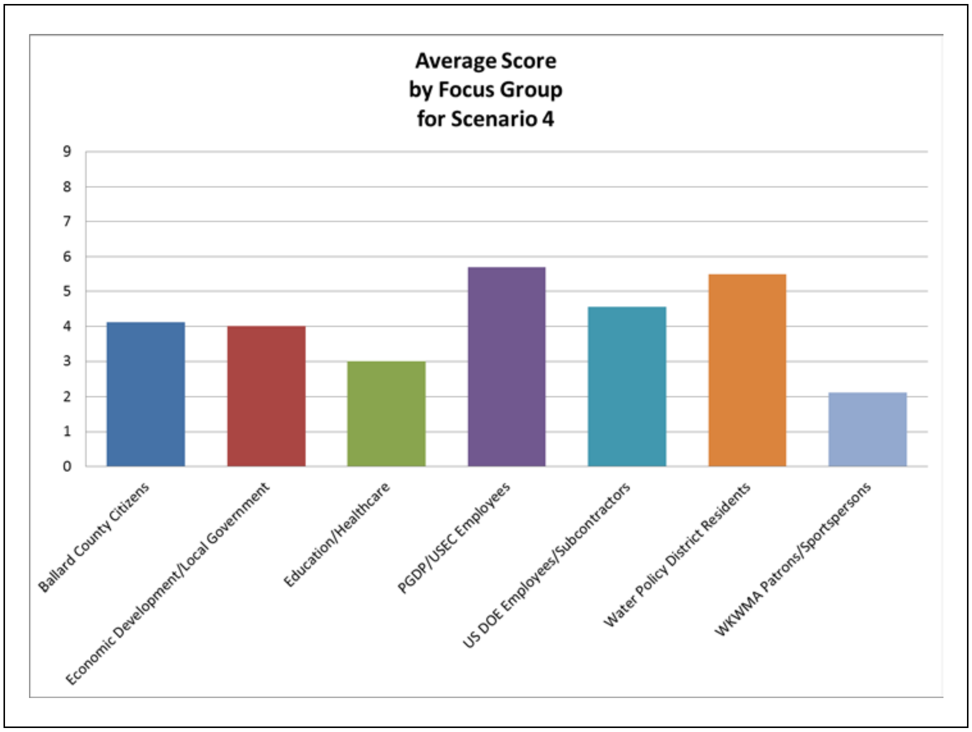
Education/Healthcare
PGDP/USEC Employees
US DOE Employees/Subcontractors
Water Policy District Residents
WKWMA Patrons/Sportspersons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by Focus Group
for Scenario 4
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4
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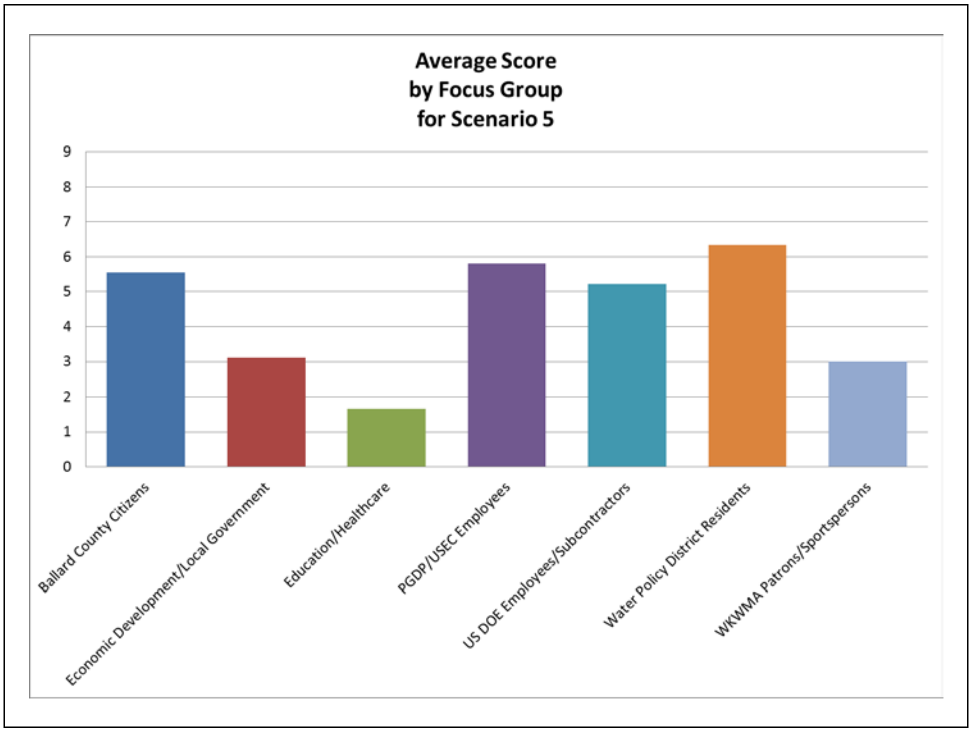
Economic Development/Local Government
Education/Healthcare
PGDP/USEC Employees
US DOE Employees/Subcontractors
Water Policy District Residents
WKWMA Patrons/Sportspersons


Average Score
by Focus Group
for Scenario 5
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2
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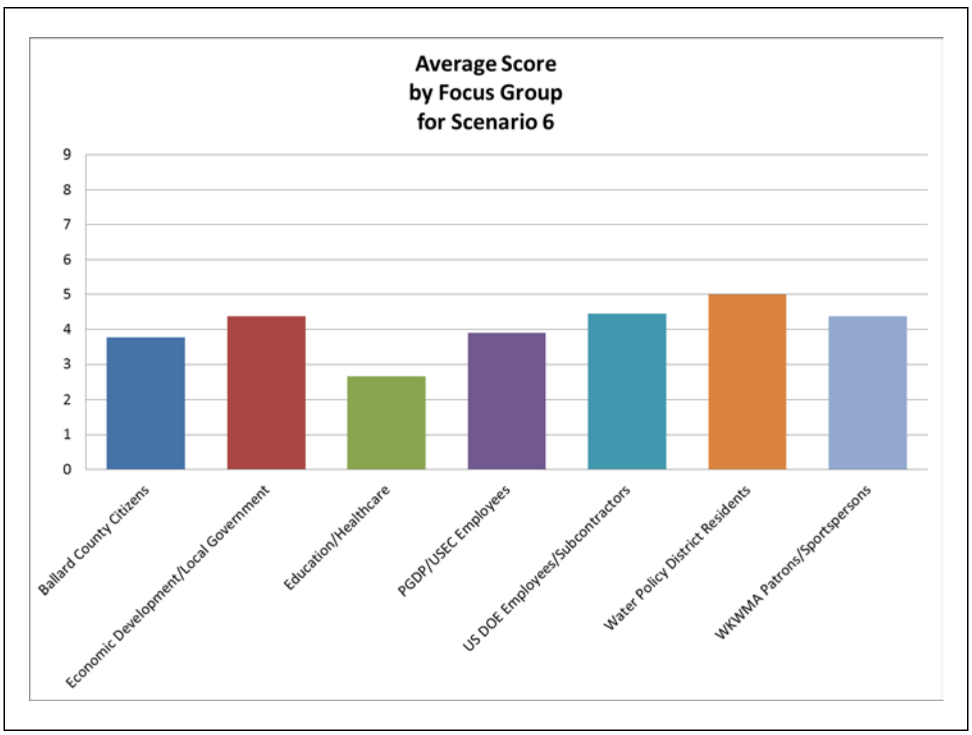
Ballard County Citizens
Economic Development/Local Government
Education/Healthcare
PGDP/USEC Employees
US DOE Employees/Subcontractors
Water Policy District Residents
WKWMA Patrons/Sportspersons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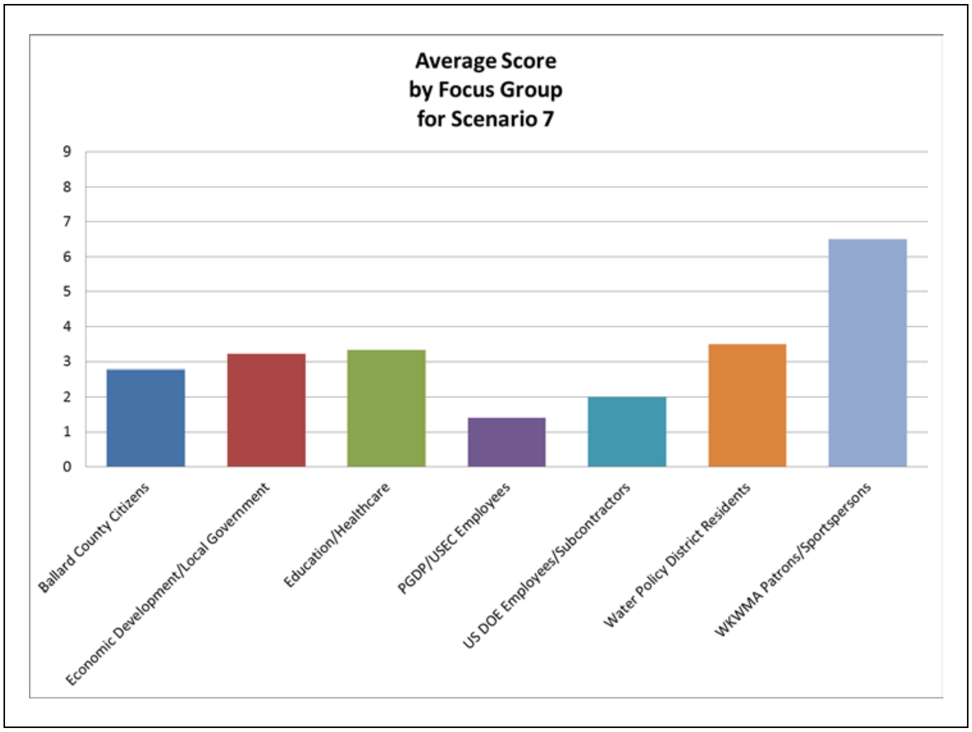
Education/Healthcare
PGDP/USEC Employees
US DOE Employees/Subcontractors
Water Policy District Residents
WKWMA Patrons/Sportspersons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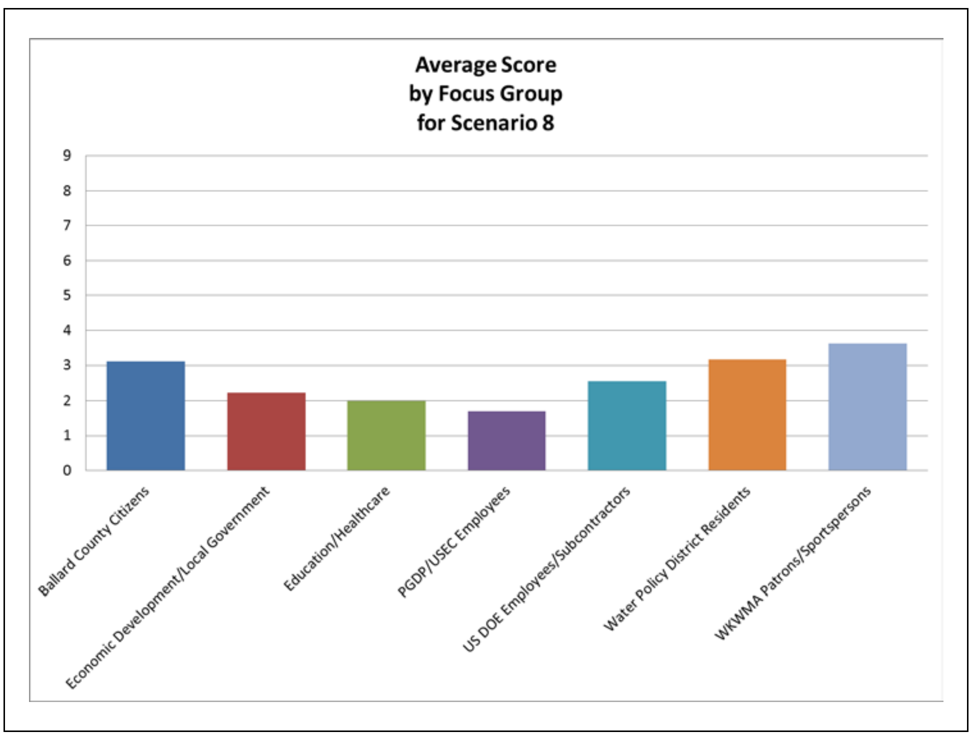
Education/Healthcare
PGDP/USEC Employees
US DOE Employees/Subcontractors
Water Policy District Residents
WKWMA Patrons/Sportspersons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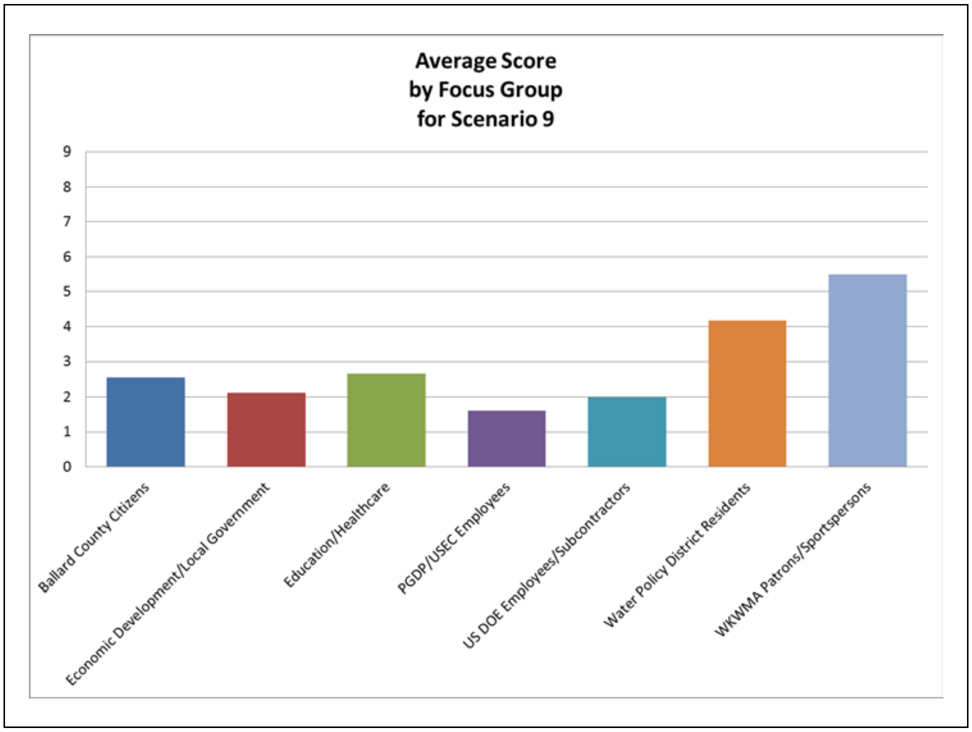
Economic Development/Local Government
Education/Healthcare
PGDP/USEC Employees
US DOE Employees/Subcontractors
Water Policy District Residents
WKWMA Patrons/Sportspersons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for Scenario 9
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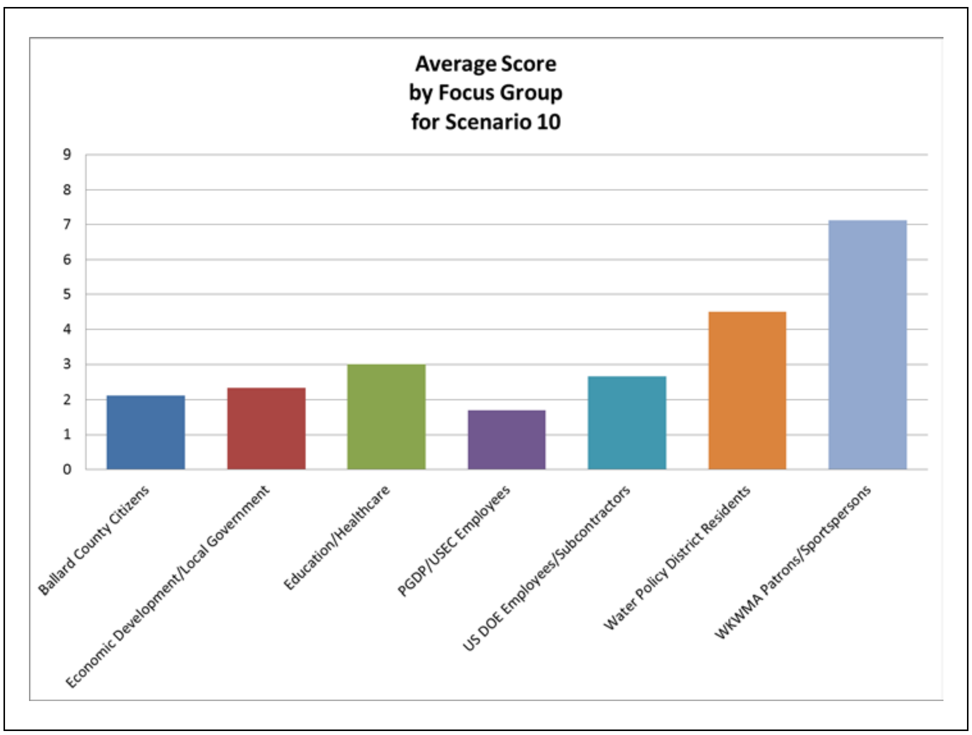
Education/Healthcare
PGDP/USEC Employees
US DOE Employees/Subcontractors
Water Policy District Residents
WKWMA Patrons/Sportspersons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by Focus Group
for Scenario 10
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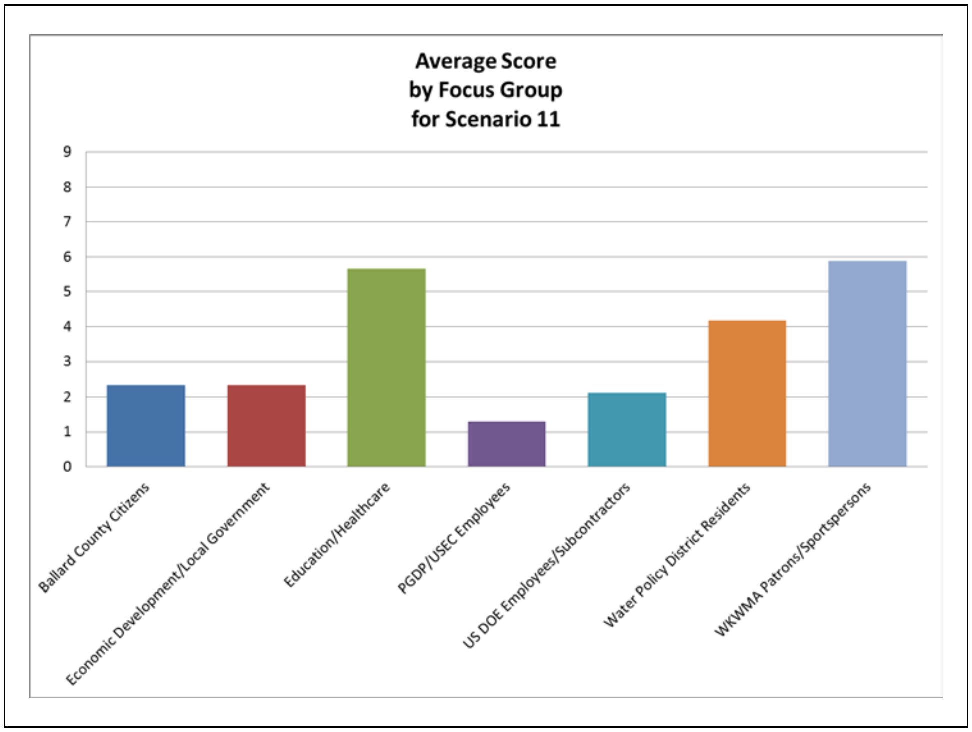
Education/Healthcare
PGDP/USEC Employees
US DOE Employees/Subcontractors
Water Policy District Residents
WKWMA Patrons/Sportspersons


Average Score
by Focus Group
for Scenario 11
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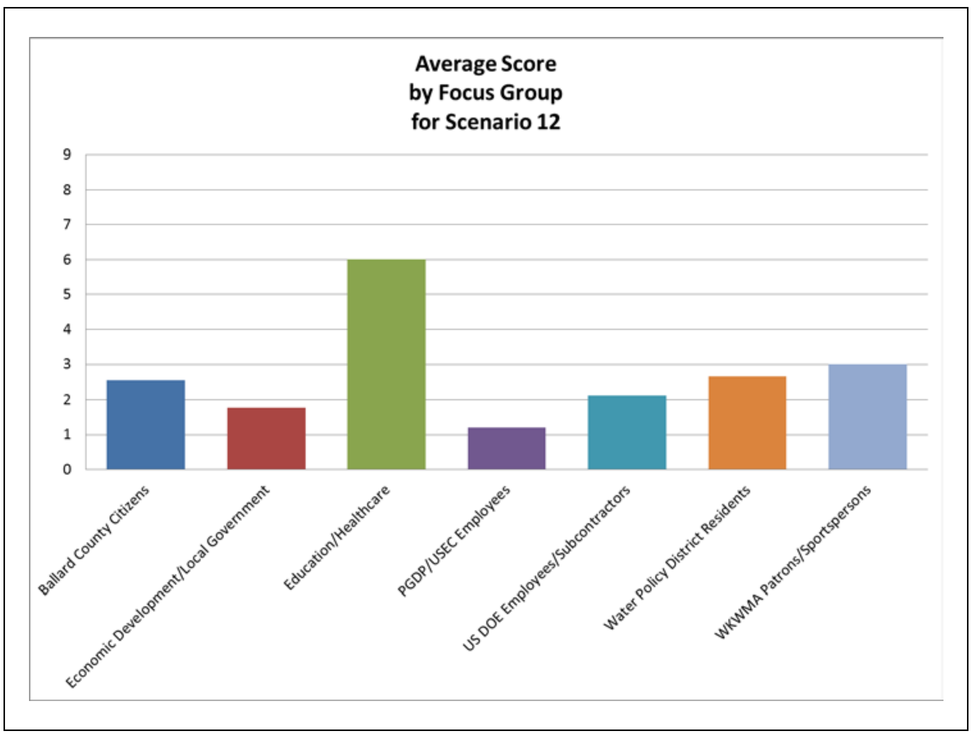
Economic Development/Local Government
Education/Healthcare
PGDP/USEC Employees
US DOE Employees/Subcontractors
Water Policy District Residents
WKWMA Patrons/Sportspersons


Average Score
by Focus Group
for Scenario 12
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Ballard County Citizens
Economic Development/Local Government
Education/Healthcare
PGDP/USEC Employees
US DOE Employees/Subcontractors
Water Policy District Residents
WKWMA Patrons/Sportspersons

APPENDIX O: PROMOTIONAL AND RECRUITMENT MATERIALS FOR PUBLIC INFORMATION AND SCENARIO MEETINGS

PUBLIC MEETINGS ADVERTISING SCHEDULE

Paducah Sun BBQ on the River Guide (Circulation: ~38,000)

- One quarter-page ad highlighting both informational and scenario meetings),

Paducah Sun (Circulation: ~25,000): Quarter-Page Ads

- Public Information Meetings
  - Monday, Oct. 4 (Section A)
  - Wednesday, Oct. 6 (Business section)
  - Friday, Oct. 8 (Weekender/Events section)
  - Sunday, October 10
  - Monday, October 11 (Section A)
- Scenario Meetings
  - Tuesday, Oct. 19 (Section A if possible)
  - Thursday, Oct. 21 (Business section)
  - Friday, Oct. 8 (Weekender/Events section)
  - Sunday, Oct. 24
  - Monday, October 25th (Section A if possible)

Advance Yeoman (Circulation: ~1400): Quarter-Page Ads

- Public Information Meetings
  - Week of October 3rd
- Scenario Meetings
  - Week of October 17

West Kentucky News (Circulation ~16,000): Quarter-Page Ads

- Public Information Meetings
  - Week of October 3rd
- Scenario Meetings
  - Week of October 17

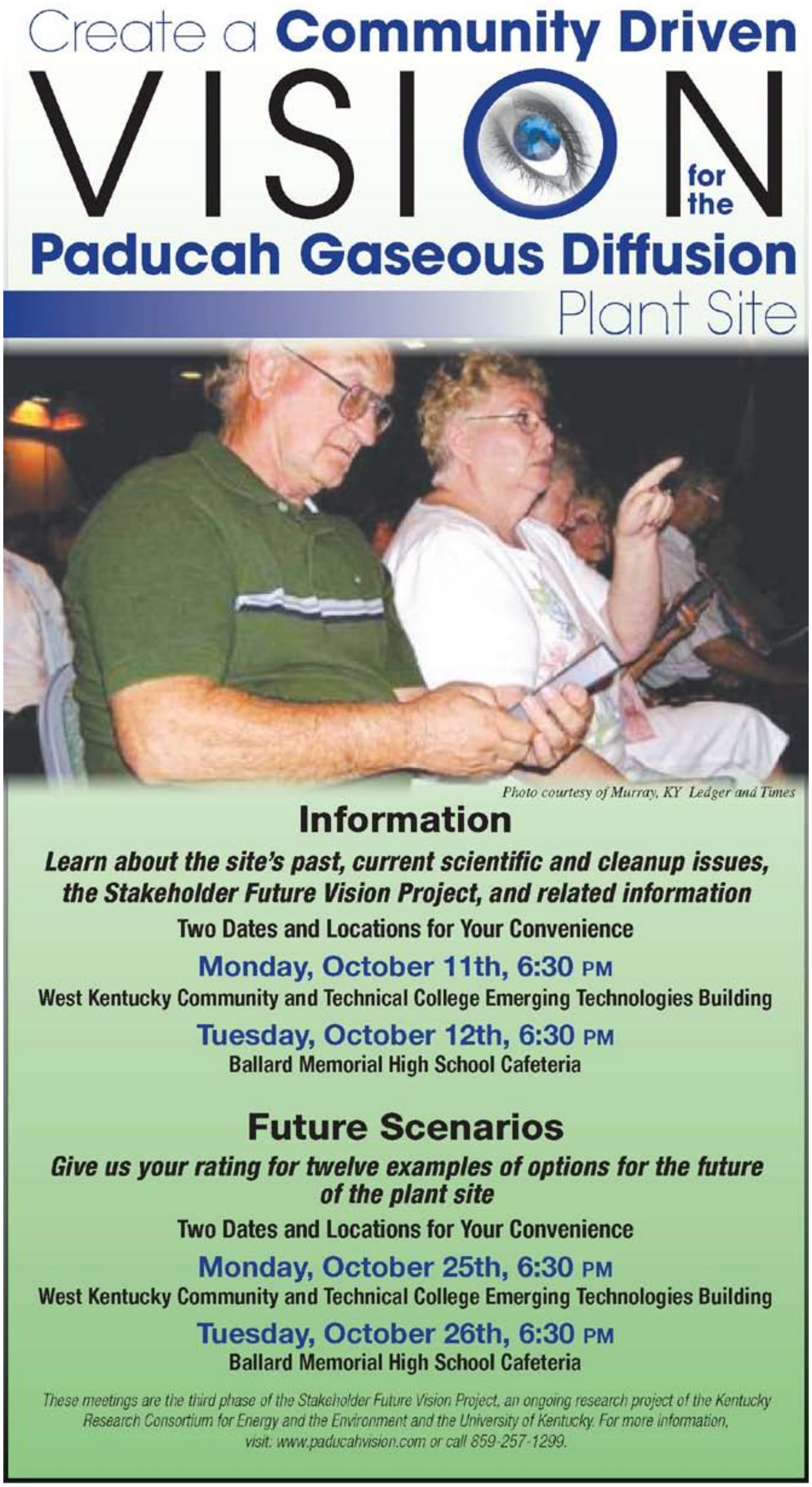
Ballard Weekly (Circulation: ~700): Half-Page Ads

- Public Information Meetings
  - Tuesday, October 5
- Scenario Meetings
  - Tuesday, October 19

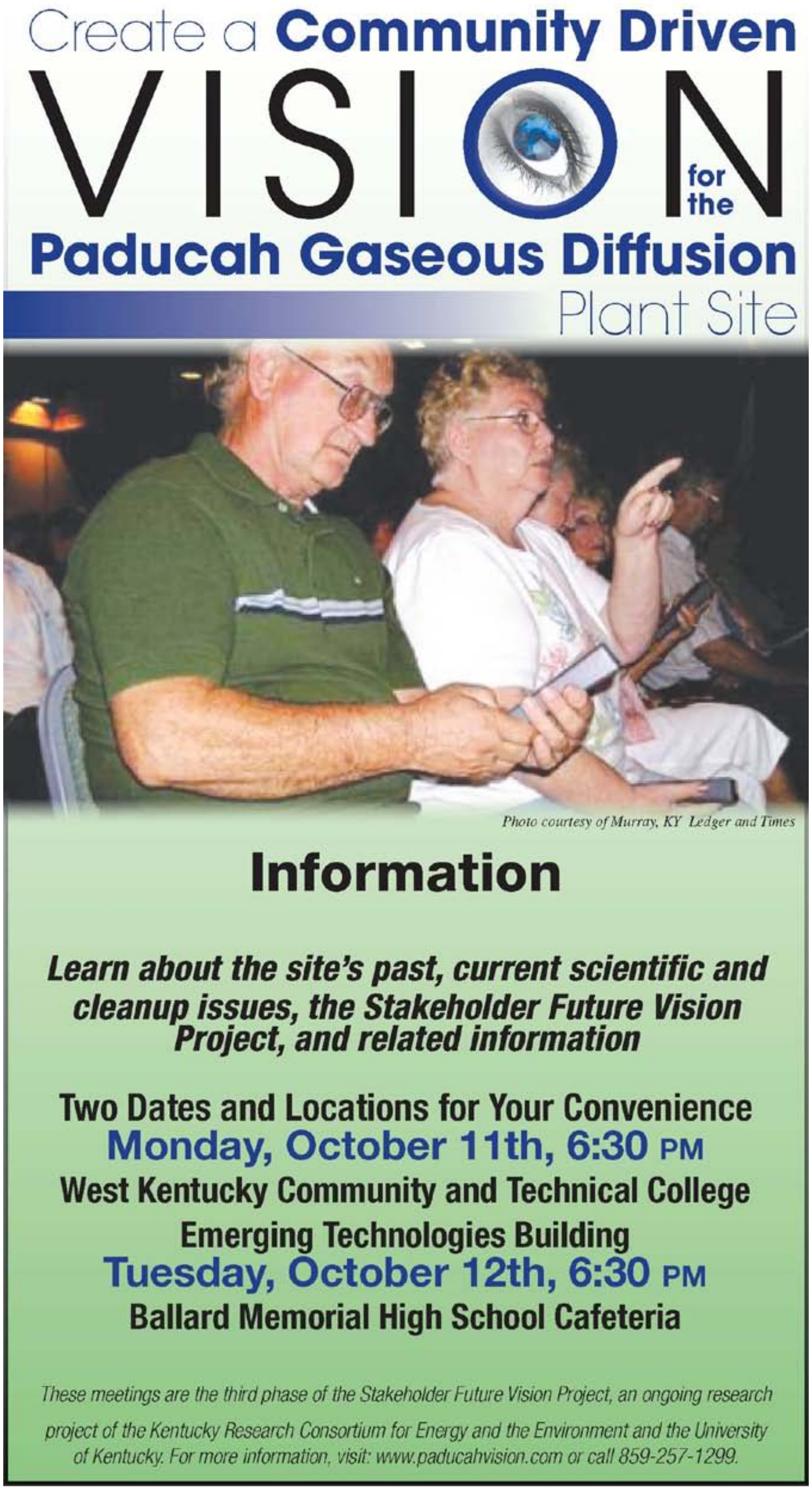
Meeting announcements and flyers were sent to 60-person stakeholder email list generated by the research team throughout the project. Announcements and flyers also were posted to iList Paducah, as well as to local radio and television websites. Press releases were sent to University of Kentucky Public Relations west Kentucky mailing list.

PUBLIC MEETINGS ADVERTISING COPY

BBQ on the River Tabloid Ad (Circulation ~38,000; ¼ page ad)



Paducah Sun, Advance Yeoman, West Kentucky News Public Information Meetings Ad
(Total circulation of all outlets: ~44,000; ¼ page ad)



Paducah Sun, Advance Yeoman, West Kentucky News Scenario Evaluation Meetings Ad
(Total circulation of all outlets: ~44,000; ¼ page ad)

Ballard Weekly Public Information and Scenario Scoring Meetings Ads
(Circulation of all outlets: ~700; ½ page ads)

Page Ten — The Ballard Weekly — October 6, 2010

Community News

Create a Community-Driven Vision for the Paducah Gaseous Diffusion Plant Site

Photo courtesy of Murray, KY Ledger and Times

Informational Meeting

Learn about the site's past, current scientific and cleanup issues, the Stakeholder Future Vision Project, and related information

Two Dates and Locations for your convenience

Monday, October 11th, 6:30 p.m.

West Kentucky Community and Technical College
Emerging Technologies Building

Tuesday, October 12th, 6:30 p.m.

Ballard Memorial High School Cafeteria

These meetings are the third phase of the Stakeholder Future Vision Project, an ongoing research project of the Kentucky Research Consortium for Energy and the Environment and the University of Kentucky. For more information, visit: www.paducahvision.com or call 859-257-1299.

Create a Community-Driven Vision for the Paducah Gaseous Diffusion Plant Site

Photo courtesy of Murray, KY Ledger and Times

Future Scenarios Meeting

Give us your rating for twelve examples of options for the future of the plant site.

Two Dates and Locations for your convenience

Monday, October 25th, 6:30 p.m.

West Kentucky Community and Technical College
Emerging Technologies Building

Tuesday, October 26th, 6:30 p.m.

Ballard Memorial High School Cafeteria

These meetings are the third phase of the Stakeholder Future Vision Project, an ongoing research project of the Kentucky Research Consortium for Energy and the Environment and the University of Kentucky. For more information, visit: www.paducahvision.com or call 859-257-1299.

Submit news and calendar items to: Phone:270.665.9335 · Fax:270.665-8013 · Email:weekly@bcky.net

PUBLIC MEETINGS FLYER

Create a Community-Driven Vision for the Paducah Gaseous Diffusion Plant Site

Photo courtesy of Murray, KY Ledger and Times

Information

Learn about the site's past, current scientific and cleanup issues, the Stakeholder Future Vision Project, and related information

Two Dates and Locations for Your Convenience

Monday, October 11th, 6:30pm
West Kentucky Community and Technical College Emerging Technology Building

Tuesday, October 12th, 6:30pm
Ballard Memorial High School Cafeteria

Future Scenarios

Give us your rating for twelve examples of options for the future of the plant site

Two Dates and Locations for Your Convenience

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West Kentucky Community and Technical College Emerging Technology Building

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Ballard Memorial High School Cafeteria

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PRESS RELEASE

UK UNIVERSITY OF KENTUCKY
Public Relations & Marketing

NEWS

www.uky.edu/PR

CONTACT: Anna Hoover, (859) 257-8637

FOR RELEASE

Public Meeting on Paducah Gaseous Diffusion Plant Planned

LEXINGTON, Ky. (Oct. 5, 2010) – Local citizens soon will have opportunities to contribute to a community-based future vision for the Paducah Gaseous Diffusion Plant in anticipation of its future decommissioning. In October, two sets of public meetings will be held in McCracken and Ballard Counties, with some sessions providing plant-related background information and others focusing on the evaluation of 12 hypothetical future land use options.

These meetings are the third phase of the Stakeholder Future Vision Project, an ongoing research project of the Kentucky Research Consortium for Energy and the Environment (KRCEE) and the University of Kentucky.

The first set of meetings will provide attendees with information about the past, present and future of the plant and its surroundings, as well as ongoing scientific and cleanup issues related to potential future land uses. The information will be presented interactively, and will include visuals and audience use of keypads. To encourage maximum community participation and for convenience of community members, two sessions are being offered. The first information session will be at 6:30 p.m. on Monday, Oct. 11, at the West Kentucky Community and Technical College (WKCTC) Emerging Technologies Building. The second session will be at 6:30 p.m. on Tuesday, Oct. 12, in the Ballard Memorial High School cafeteria.

The second set of meetings will allow community members to use anonymous keypads to register their opinions about 12 hypothetical future land use options. These options will be presented as 3-D graphic visualizations developed by the KRCEE team.

see blue.

An Equal Opportunity University

The 12 scenarios were created following dozens of interviews with local citizens, civic organizations, advocacy groups and representatives of local, state and federal government agencies. The options were selected to represent the broadest possible range of suggested future uses for the site and were further refined following input from eight focus groups around the area.

The first future scenario meeting will be held at 6:30 p.m. on Monday, Oct. 25, at the WKCTC Emerging Technologies Building. The second scenario meeting, which will follow the same agenda and evaluate the same future options, will be held at 6:30 p.m. on Tuesday, Oct. 26, in the Ballard Memorial High School cafeteria.

The results of the scenario evaluations will be included in a final report on the community's vision for the site. This report will be made available to the public and will be presented to the U.S. Department of Energy to inform decision-making related to the plant's future.

For additional information, visit http://www.paducahvision.com or call (859) 257-1299.

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We "see blue" at the University of Kentucky. We're home not only to powerhouse basketball and the best of intercollegiate athletics; we're also nationally ranked in more than 70 academic programs. We're charting an aggressive, exciting path toward becoming a Top 20 public research institution. "see blue." is a lot of things, but most of all it's about helping students realize their potential and harness the power of their dreams. For more about UK's efforts to become a Top 20 university and how we "see blue," visit www.uky.edu/OPBPA/business_plan.htm

APPENDIX P: PUBLIC INFORMATION PRESENTATION

The Past

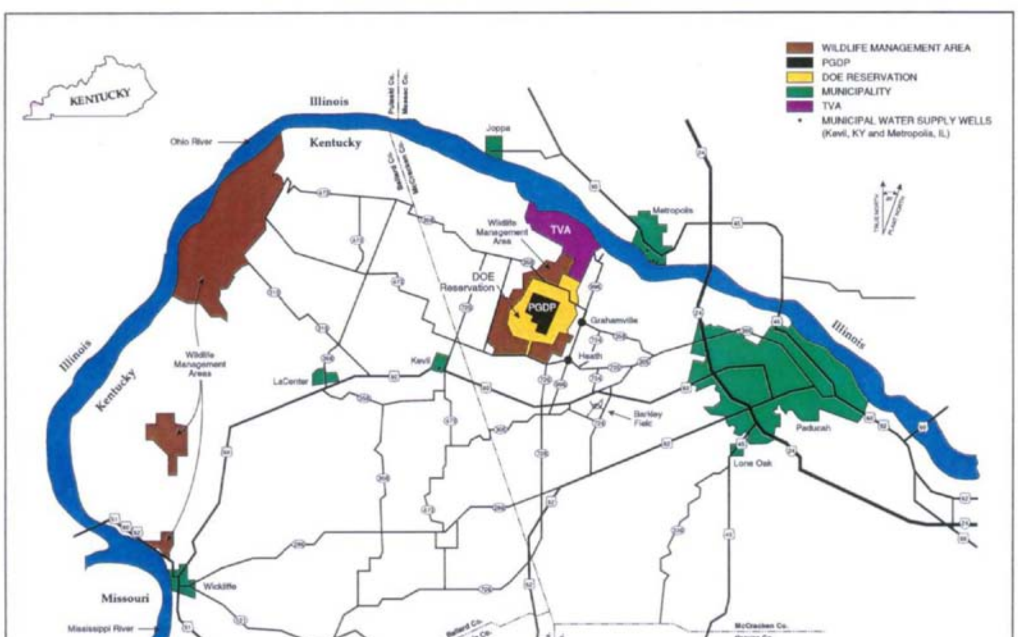
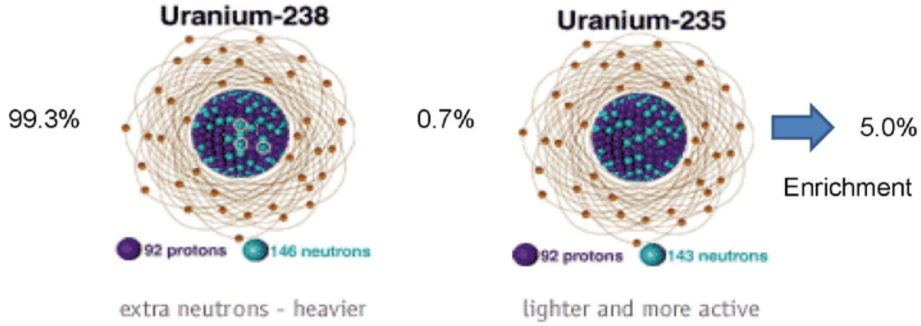
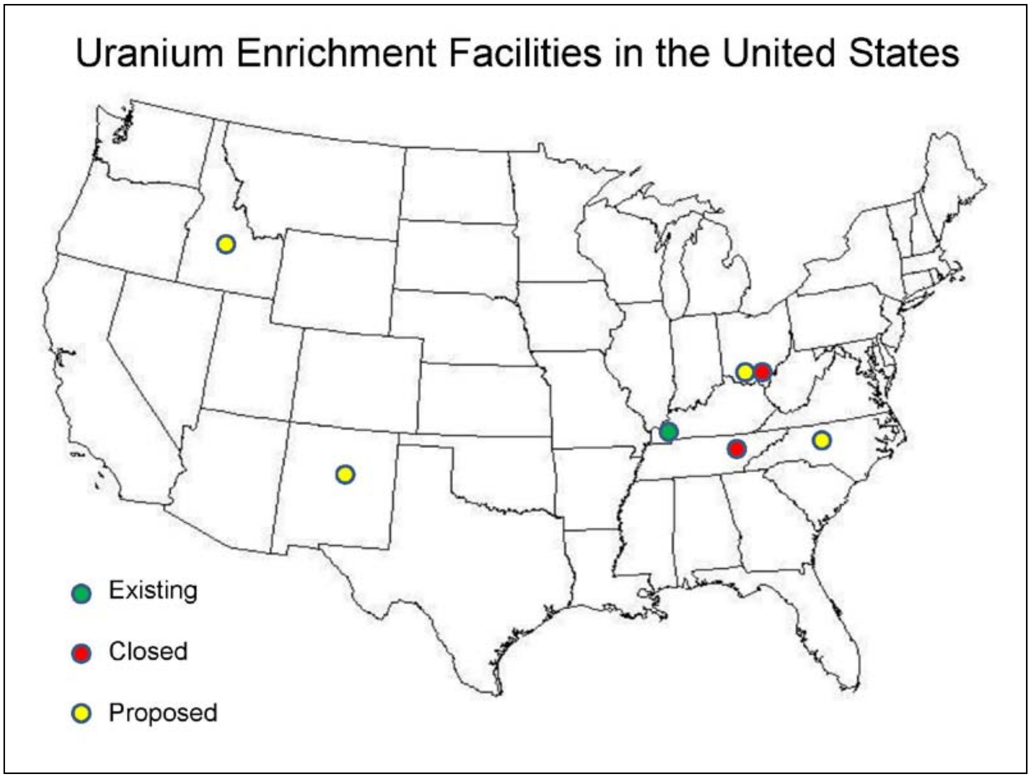


Figure 1-1.
PGDP VICINITY MAP
Paducah Gaseous Diffusion Plant
Paducah, Kentucky

Uranium

- Uranium is a naturally occurring element containing U-235 and U-238 isotopes (with a very small fraction of U-234). Only the U-235 isotope is fissionable.
- Uranium enrichment is the process of increasing the concentration of U-235 isotope in natural uranium and decreasing that of U-238 isotope. Enrichment is a critical step in transforming natural uranium into nuclear fuel to produce electricity.




Uranium Enrichment Facilities in the United States
Existing
Closed
Proposed

2. Before the PGDP was built in 1952, the property was used for what purpose?

1. State Park
2. State Forest
3. Department of Defense Munitions Facility
4. Amphibious Landing Craft Production Facility
5. German Prisoner of War Camp

2. Before the PGDP was built in 1952, the property was used for what purpose?

1. State Park
2. State Forest
3. Department of Defense Munitions Facility
4. Amphibious Landing Craft Production Facility
5. German Prisoner of War Camp

3. What event caused the PGDP to be placed on the Environmental Protection Agency's (EPA) Superfund National Priority List?

1. Technetium and TCE were discovered in private drinking wells northwest of the plant
2. PCBs were discovered in Little Bayou Creek
3. High levels of plutonium were discovered along Metropolis Lake Road
4. A significant number of dead fish were discovered in Big Bayou Lake
5. High levels of uranium were discovered along Metropolis Lake Road

3. What event caused the PGDP to be placed on the Environmental Protection Agency's (EPA) Superfund National Priority List?

1. Technetium and TCE were discovered in private drinking wells northwest of the plant
2. PCBs were discovered in Little Bayou Creek
3. High levels of plutonium were discovered along Metropolis Lake Road
4. A significant number of dead fish were discovered in Big Bayou Lake
5. High levels of uranium were discovered along Metropolis Lake Road

4. According to the US Agency for Toxic Substances and Disease Registry (ATSDR), which of the following events occurred at the PGDP?

1. During November 1960, a cylinder ruptured releasing at least 11,000 pounds of UF6 into the atmosphere
2. During December 1962, an explosion and fire released 5,000 pounds of UF6 into the atmosphere
3. Surface waters around the PGDP were contaminated with chemicals (e.g. PCBs, TCE) and radioactive materials as a result of process operations and past waste disposal activities.
4. Activities at the PGDP have contaminated surface soil and sediment.
5. All of the above

Reference: ATSDR – http://www.atsdr.cdc.gov/hac/pha/pha.asp?docid

4. According to the US Agency for Toxic Substances and Disease Registry (ATSDR), which of the following events occurred at the PGDP?

1. During November 1960, a cylinder ruptured releasing at least 11,000 pounds of UF6 into the atmosphere
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4. Activities at the PGDP have contaminated surface soil and sediment.
5. All of the above

Reference: ATSDR – http://www.atsdr.cdc.gov/hac/pha/pha.asp?docid

5. Past practices (from 1950 to mid-1980) at the PGDP resulted in the burial of over 400,000 cubic yards of waste into burial grounds that are currently undergoing remedial investigation. Which of the following types of contaminants in the waste are in the burial grounds?

1. Uranium and other metals
2. Trichloroethylene (TCE) – a metal degreaser
3. Polychlorinated biphenyls (PCBs) – used in electrical transformers
4. Asbestos
5. All of the above

Reference: DOE – Work Plan for the Burial Grounds Operable Unit Remedial Investigation/Feasibility Study at the Paducah Gaseous Diffusion Plant DOE/OR/07-2179&D2/R1

5. Past practices (from 1950 to mid-1980) at the PGDP resulted in the burial of over 400,000 cubic yards of waste into burial grounds that are currently undergoing remedial investigation. Which of the following types of contaminants in the waste are in the burial grounds?

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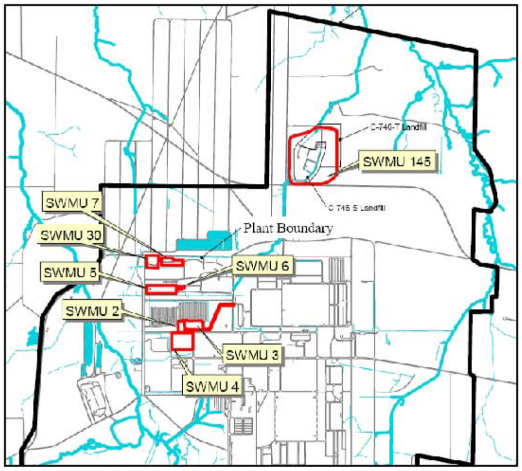
3. Polychlorinated biphenyls (PCBs) – used in electrical transformers
4. Asbestos
5. All of the above

Reference: DOE – Work Plan for the Burial Grounds Operable Unit Remedial Investigation/Feasibility Study at the Paducah Gaseous Diffusion Plant DOE/OR/07-2179&D2/R1

PGDP Burial Grounds



Names & Locations of Burial Grounds

SWMU = Solid Waste Management Unit

- SWMU 2 - C-749 Uranium Burial Ground
- SWMU 3 - C-404 Low-Level Radioactive Waste Burial Ground
- SWMU 4 - C-747 Contaminated Burial Yard and C-748-B Burial Area
- SWMU 5 - C-746-F Burial Yard
- SWMU 6 - C-747-B Burial Ground
- SWMUs 7 and 30 - C-747-A Burial Ground and Burn Area and the area beneath SWMU 12
- SWMU 13 – C-746-P/P1 Scrapyard buried metal
- SWMU 145 - Area P (residential/ inert borrow area) and old North-South Diversion Ditch (NSDD)

6. The PGDP currently uses the same amount of electricity as a city the size of:

1. Nashville
2. Lexington
3. Owensboro
4. Frankfort
5. Paducah

Reference: http://www.globalsecurity.org/wmd/facility/paducah-facts.htm

6. The PGDP currently uses the same amount of electricity as a city the size of:

1. Nashville
2. Lexington
3. Owensboro
4. Frankfort
5. Paducah

Reference: http://www.globalsecurity.org/wmd/facility/paducah-facts.htm


WELCOME
to the
ATOMIC CITY

The Present

Environmental Monitoring Stations at PGDP

1. Air and Radiation (55)
2. Surface Water (54)
3. Groundwater (81)
4. Soils and Sediment (13)
5. Biological (17)

Reference: DOE 2008 Annual Site Environmental Report

1. The West Kentucky Wildlife Management Area (WKWMA) encompasses 6,463 acres of land and is used for which of the following?

1. Deer and turkey hunting
2. Dog and field trials
3. Skeet shooting and archery events
4. Nature and fishing
5. All of the above

1. The West Kentucky Wildlife Management Area (WKWMA) encompasses 6,463 acres of land and is used for which of the following?

1. Deer and turkey hunting
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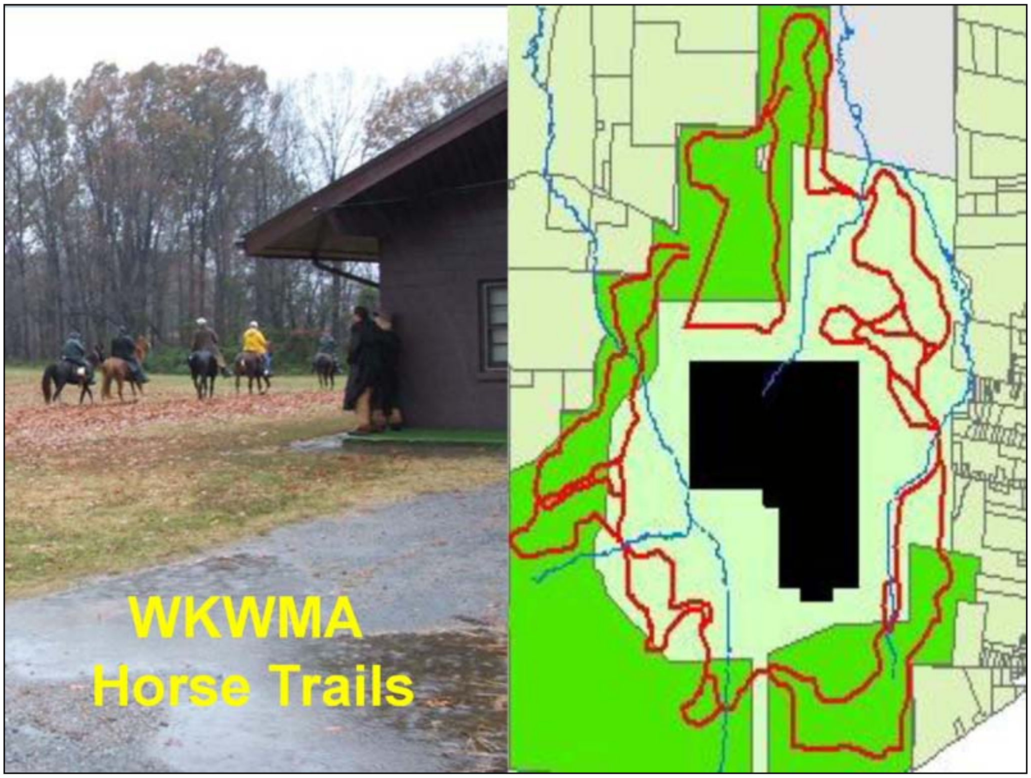

WKWMA
Horse Trails

2. The United State Enrichment Corporation (USEC), which operates the PGDP, employs approximately 1,200 works and has an annual payroll of what amount?

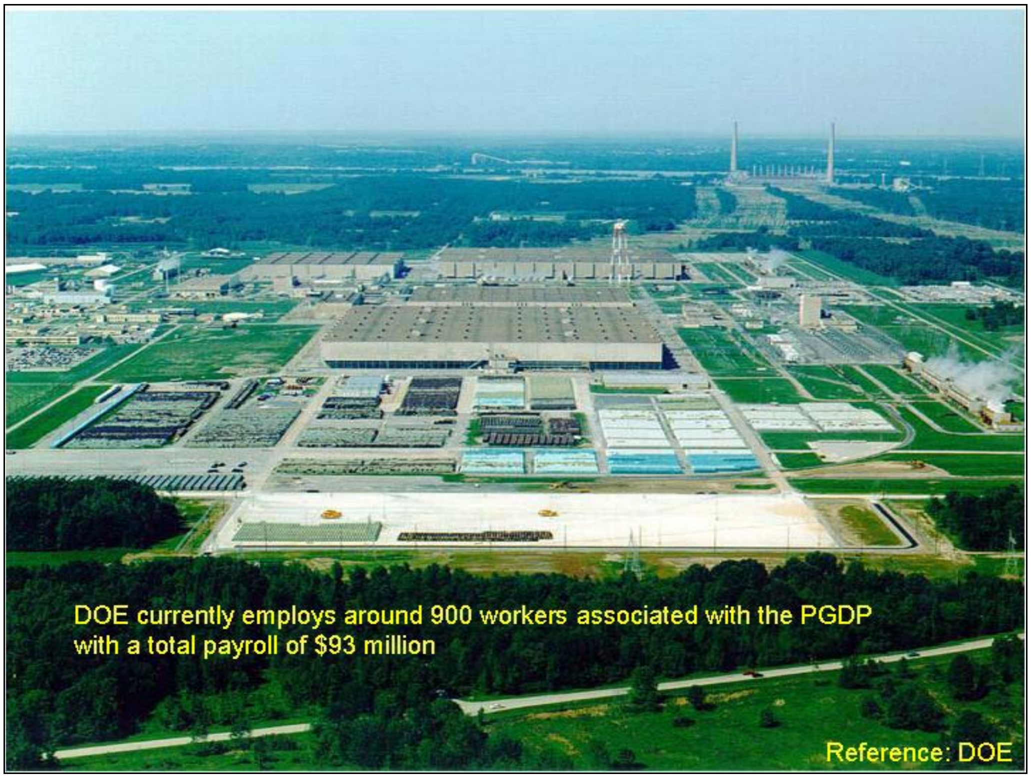
1. $10 million
2. $54 million
3. $93 million
4. $121 million
5. $210 million

Reference: USEC

2. The United State Enrichment Corporation (USEC), which operates the PGDP, employs approximately 1,200 works and has an annual payroll of what amount?

1. $10 million
2. $54 million
3. $93 million
4. $121 million
5. $210 million

Reference: USEC


DOE currently employs around 900 workers associated with the PGDP
with a total payroll of $93 million
Reference: DOE

3. The Depleted Uranium Hexafluoride (DUF6) facility which was recently built at the PGDP site to convert the DUF6 into Uranium oxide for disposal is expected to operate for how many years?

1. 5 years
2. 10 years
3. 15 years
4. 20 years
5. 25 years

Reference: Paducah Sun, May 2005

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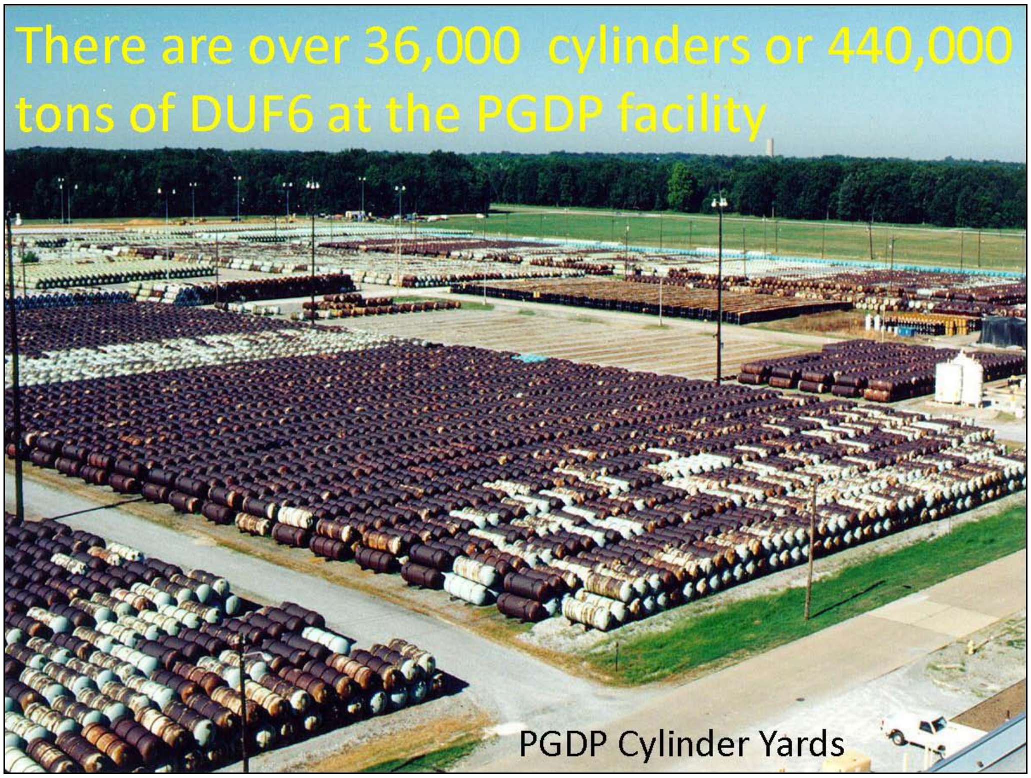
1. 5 years
2. 10 years
3. 15 years
4. 20 years
5. 25 years

Reference: Paducah Sun, May 2005


There are over 36,000 cylinders or 440,000 tons of DUF6 at the PGDP facility
PGDP Cylinder Yards


PGDP DUF6 Conversion Facility
Will employ approximately 150 workers

4. Approximately how many tons of contaminated nickel are stockpiled at the PGDP?

1. 1 ton
2. 170 tons
3. 1,300 tons
4. 5,600 tons
5. 9,700 tons

Reference: PUPAU

4. Approximately how many tons of contaminated nickel are stockpiled at the PGDP?

1. 1 ton
2. 170 tons
3. 1,300 tons
4. 5,600 tons
5. 9,700 tons

Reference: PUPAU

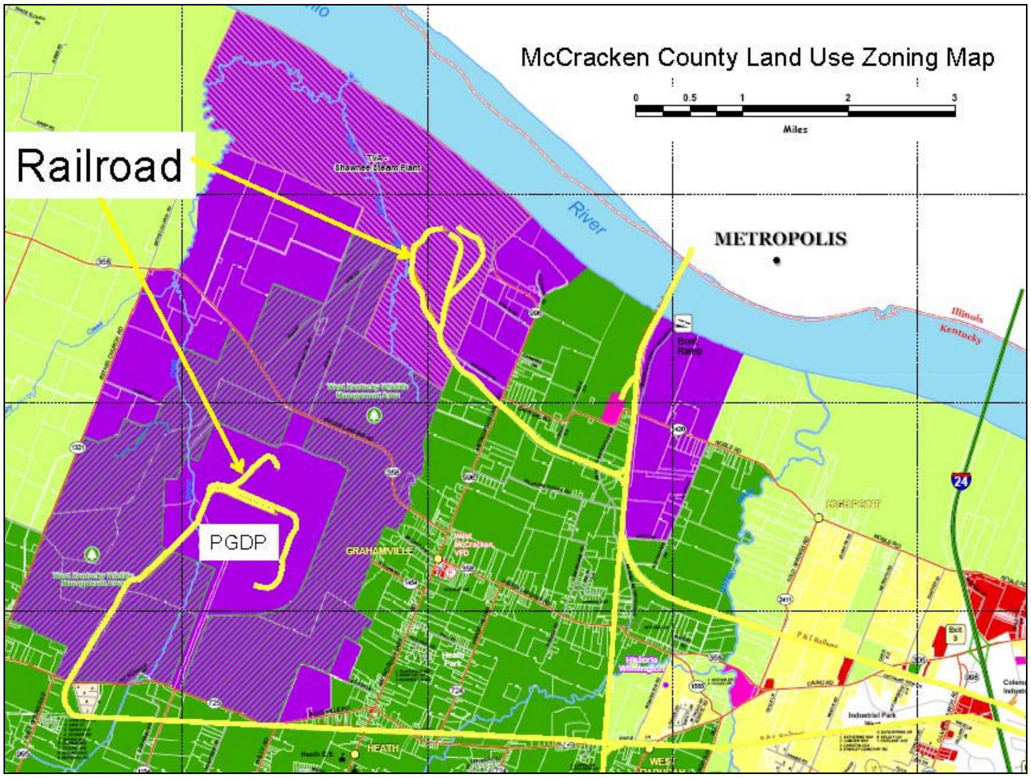

Contaminated Nickel Ingots

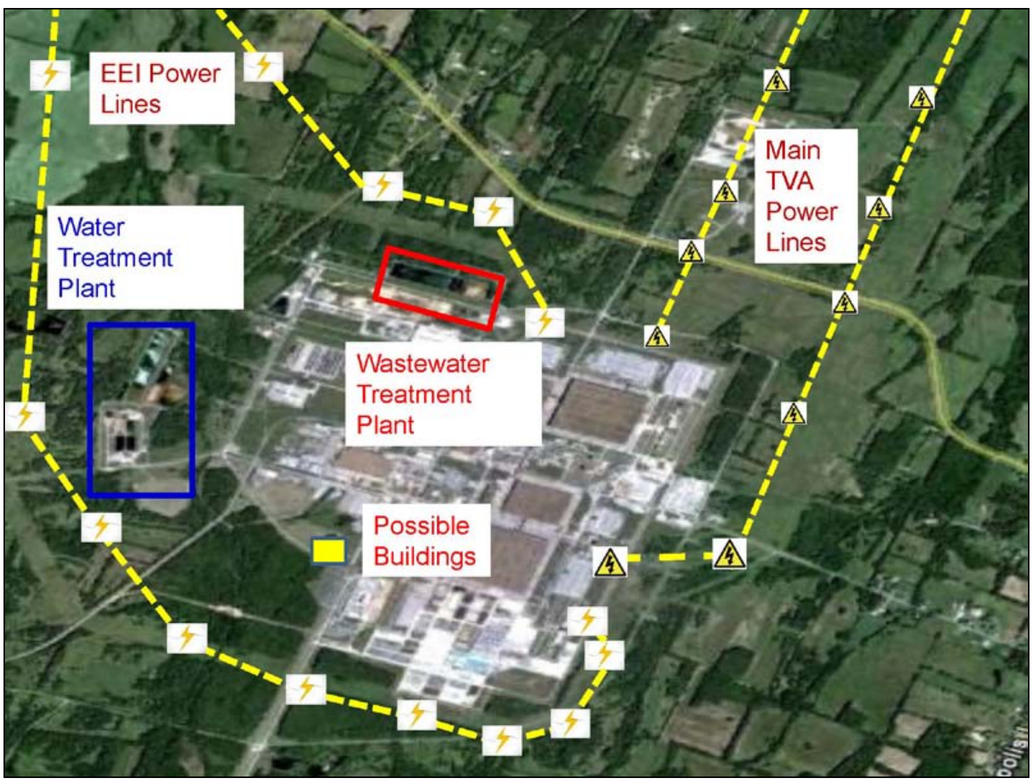
5. Which of the following type of infrastructure is not available at the PGDP?

1. Wastewater Treatment Plant
2. Water Treatment Plant
3. Railroad
4. Electric Grid
5. River Port

5. Which of the following type of infrastructure is not available at the PGDP?

1. Wastewater Treatment Plant
2. Water Treatment Plant
3. Railroad
4. Electric Grid
5. River Port


McCracken County Land Use Zoning Map
0 0.5 1 2 3
Miles
Railroad
METROPOLIS
PGDP
GRAHAMVILLE
River


EEI Power Lines
Main TVA Power Lines
Water Treatment Plant
Wastewater Treatment Plant
Possible Buildings

6. What type of environmental monitoring is currently conducted at the PGDP?

1. Air and radiation
2. Surface water
3. Groundwater
4. Soils and sediment
5. Biological
6. All of the Above

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1. Air and radiation
2. Surface water
3. Groundwater
4. Soils and sediment
5. Biological
6. All of the Above

Future

1. What future land use did the citizens of Rocky Flats, Colorado decide for their DOE facility?

1. Nuclear Power Plant
2. Reindustrialization
3. National Lab
4. National Park
5. National Wildlife Reserve

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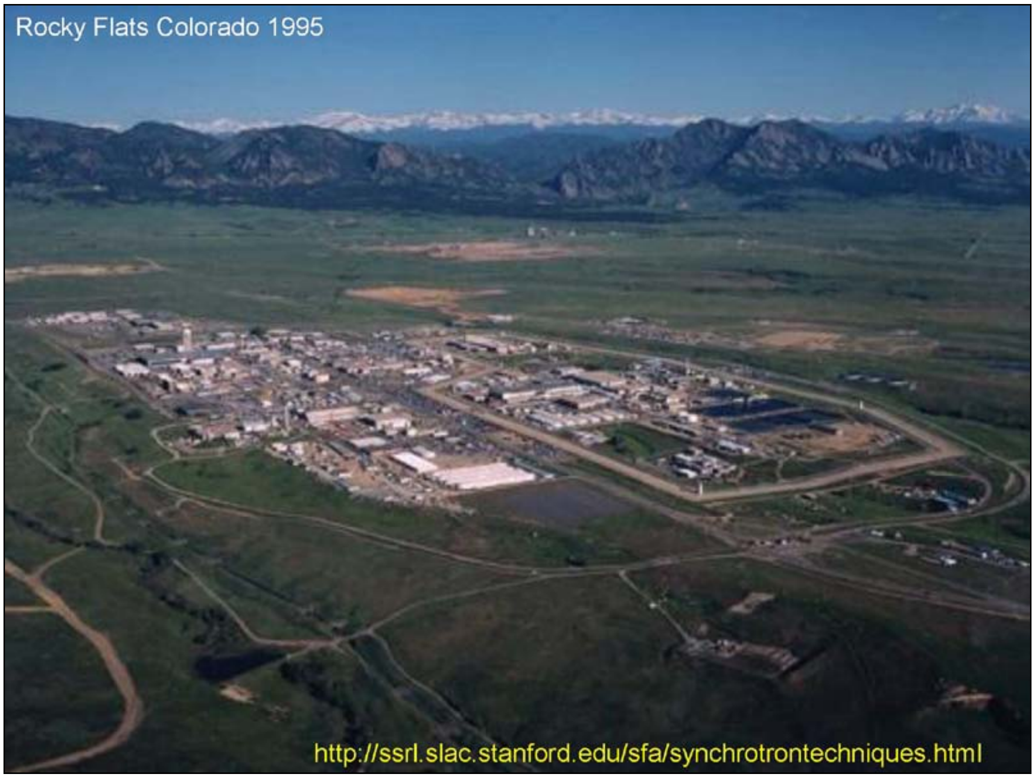
Rocky Flats Colorado 1995
http://ssrl.slac.stanford.edu/sfa/synchrotrontechniques.html


Rocky Flats Colorado 2005
http://ssrl.slac.stanford.edu/sfa/synchrotrontechniques.html

2. What future land use did the citizens of Mound, Ohio decide for their DOE facility?

1. State Fair Grounds
2. Reindustrialization
3. National Lab
4. National Park
5. National Wildlife Reserve

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1. State Fair Grounds
2. Reindustrialization
3. National Lab
4. National Park
5. National Wildlife Reserve


Mound, Ohio
Site
http://www.lm.doe.gov/mound/Sites.aspx


Mound, Ohio
Site
www.mound.com


Legend
Parcel - DOE
Parcel - MMCIC
River
Pond
Building Ownership
DOE
Leased
MMCIC
Road - paved
Railroad
N
Parcel 3
Parcel H
Parcel 6
Parcel 8
Parcel 7
Phase I A
Parcel D
Parcel 9
Phase I B
Phase I C
Parcel 4
Mound, Ohio
Site
MOUND ADVANCED TECHNOLOGY CENTER
http://www.lm.doe.gov/mound/Sites.aspx

3. Approximately 1,000 people are employed at the Wal-Mart Distribution Center in Hopkinsville, KY. What is the minimum starting salary for these workers?

1. $24,000
2. $26,000
3. $28,000
4. $30,000
5. $32,000

Reference: Wal-Mart

3. Approximately 1,000 people are employed at the Wal-Mart Distribution Center in Hopkinsville, KY. What is the minimum starting salary for these workers?

1. $24,000
2. $26,000
3. $28,000
4. $30,000
5. $32,000

Reference: Wal-Mart

The distribution center located in Hopkinsville, KY is approximately 1.2 million square feet.

4. The Duke Energy McGuire Nuclear Power Plant in North Carolina cost $2 billion (2007 USD) and produces 2,200 megawatts of electricity. The plant employs approximately 1,250 employees at an average salary of:

1. $40,000
2. $50,000
3. $60,000
4. $80,000
5. $100,000

Reference: Duke Energy

4. The Duke Energy McGuire Nuclear Power Plant in North Carolina cost $2 billion (2007 USD) and produces 2,200 megawatts of electricity. The plant employs approximately 1,250 employees at an average salary of:

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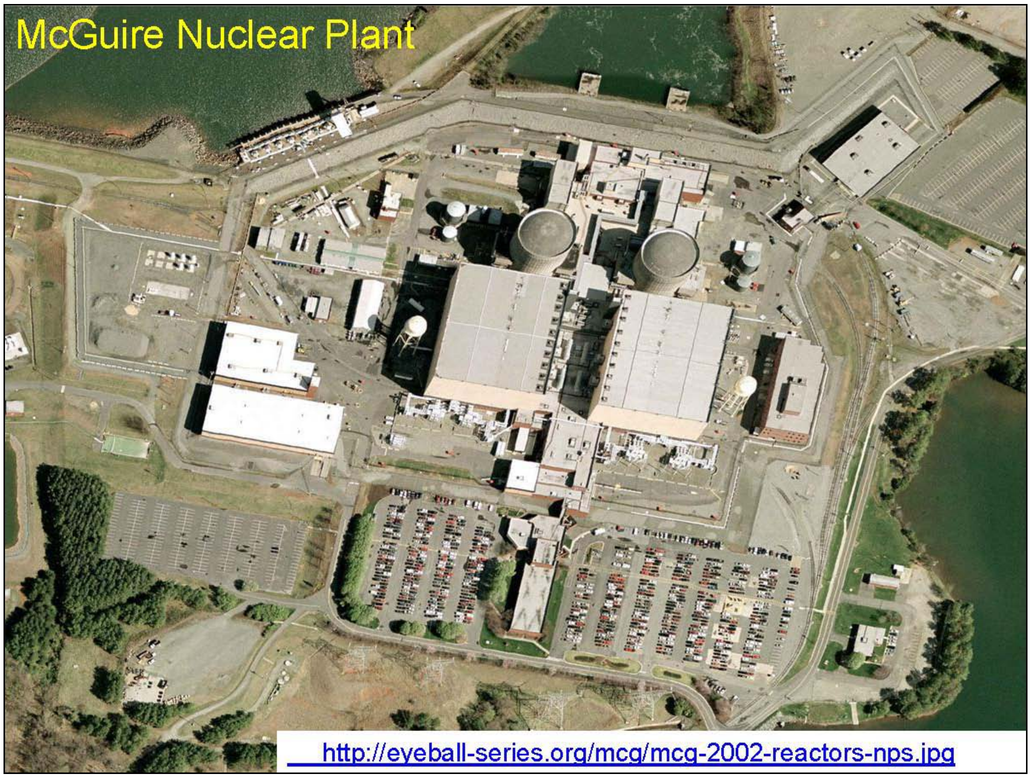
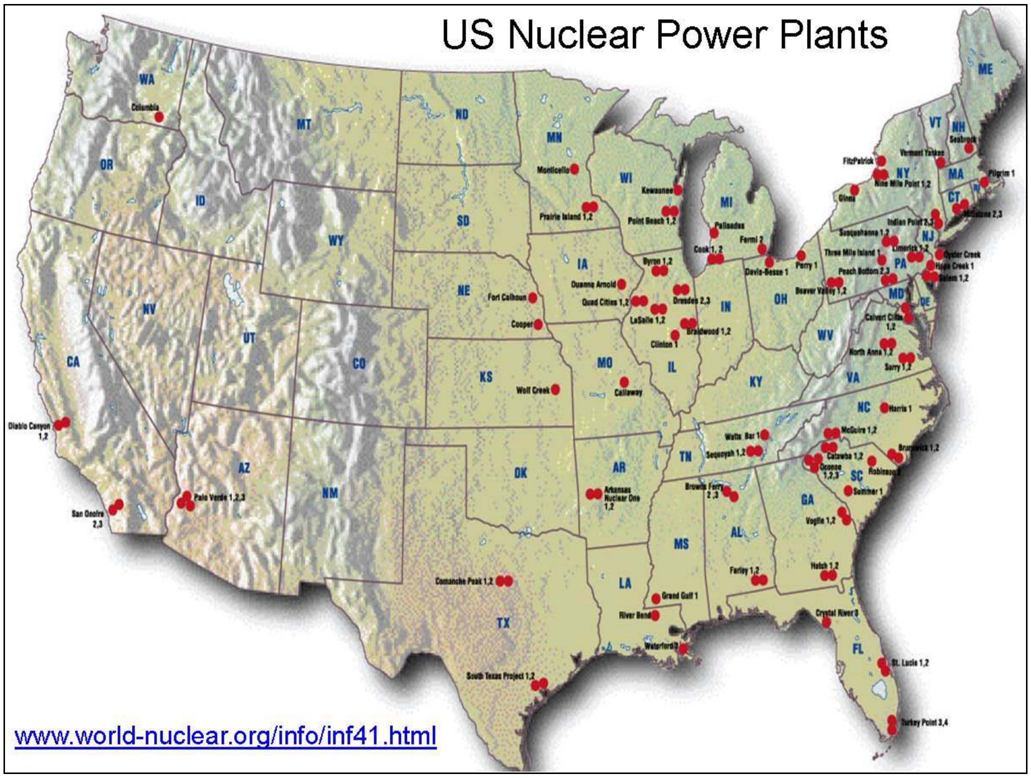
Reference: Duke Energy


McGuire Nuclear Plant
http://eyeball-series.org/mcg/mcg-2002-reactors-nps.jpg


McGuire Nuclear Plant
http://commons.wikimedia.org/wiki/File:McGuire_Nuclear_Power_Plant.jpg


US Nuclear Power Plants
www.world-nuclear.org/info/inf41.html
WA
OR
ID
MT
WY
ND
SD
NE
NV
UT
CO
CA
AZ
NM
KS
OK
TX
MN
IA
MO
AR
LA
WI
IL
MI
IN
OH
KY
TN
MS
AL
GA
FL
SC
NC
VA
WV
MD
DE
PA
NJ
NY
CT
MA
VT
NH
ME
Columbia
Diablo Canyon 1,2
San Onofre 2,3
Palo Verde 1,2,3
Fort Calhoun
Cooper
Wolf Creek
Comanche Peak 1,2
South Texas Project 1,2
Monticello
Prairie Island 1,2
Kewaunee
Point Beach 1,2
Palisades
Fermi 2
Cook 1, 2
Davis-Besse 1
Perry 1
Byron 1,2
Duanne Arnold
Quad Cities 1,2
Dresden 2,3
LaSalle 1,2
Braidwood 1,2
Clinton 1
Callaway
Arkansas Nuclear One 1,2
Grand Gulf 1
River Bend
Watts Bar 1
Sequoyah 1,2
Farley 1,2
Hatch 1,2
Vogtle 1,2
Catawba 1,2
McGuire 1,2
Oconee 1,2,3
Harris 1
North Anna 1,2
Surry 1,2
Calvert Cliffs 1,2
Beaver Valley 1,2
Peach Bottom 2,3
Three Mile Island 1
Susquehanna 1,2
Limerick 1,2
Oyster Creek
Hope Creek 1
Salem 1,2
Indian Point 2,3
Ginna
FitzPatrick
Nine Mile Point 1,2
Vermont Yankee
Seabrook
Pilgrim 1
St. Lucie 1,2
Turkey Point 3,4

5. Which of the following would have to happen before a nuclear power plant could be built at the PGDP?

1. Lifting the current statewide moratorium on nuclear plants
2. Nuclear Regulatory Commission (NRC) Design Certification
3. KY Public Service Commission (PSC) Certificate of Public Convenience and Necessity
4. Nuclear Regulatory Commission (NRC) Combined Construction and Operating License
5. All of the Above

Reference: KY Public Service Commission

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4. Nuclear Regulatory Commission (NRC) Combined Construction and Operating License
5. All of the Above

Reference: KY Public Service Commission

It takes a minimum of ten years to obtain a license for nuclear power production. Duke Energy currently is looking into the prospect of nuclear energy at the former Portsmouth Gaseous Diffusion Plant site.

6. Approximately 7,000 people work at the Toyota Auto Plant in Georgetown, KY. What is the average salary for these workers?

1. $30,000
2. $40,000
3. $50,000
4. $70,000
5. $80,000

Reference: Toyota

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3. $50,000
4. $70,000
5. $80,000

Reference: Toyota

Toyota Manufacturing Plant – Georgetown, KY

The Toyota Manufacturing Plant is approximately 7.5 million square feet

Science

1. What type of uranium enrichment process is used at the PGDP?

1. Laser
2. Centrifuge
3. Gaseous diffusion
4. Electromagnetic separation
5. Thermal diffusion

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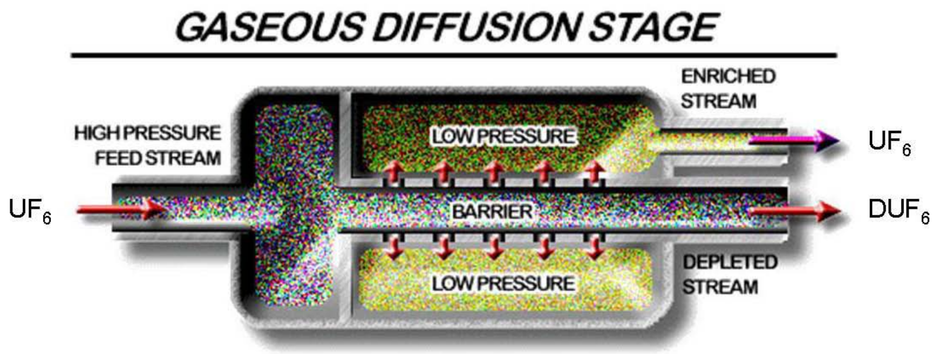

This process of uranium enrichment increases the concentration of U-235 from 0.7% up to 5.0%

http://www.usec.com/gaseousdiffusion.htm

PGDP has 1,760 enrichment stages

2. According to the Kentucky Geological Survey, the PGDP site is located in what earthquake (seismic) zone?

1. The Big Foot Lake Seismic Zone
2. The New Madrid Seismic Zone
3. The Wabash Valley Seismic Zone
4. In between the New Madrid and Wabash Valley Seismic Zones
5. In between the New Madrid and Big Foot Lake Seismic Zones

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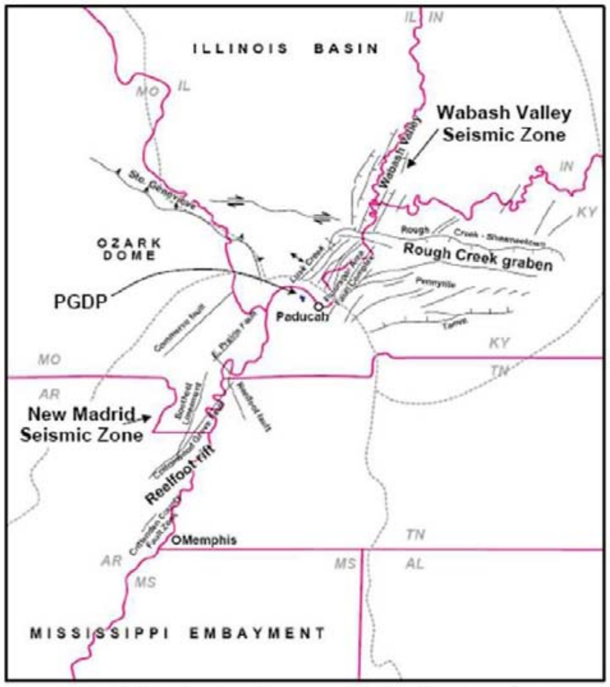
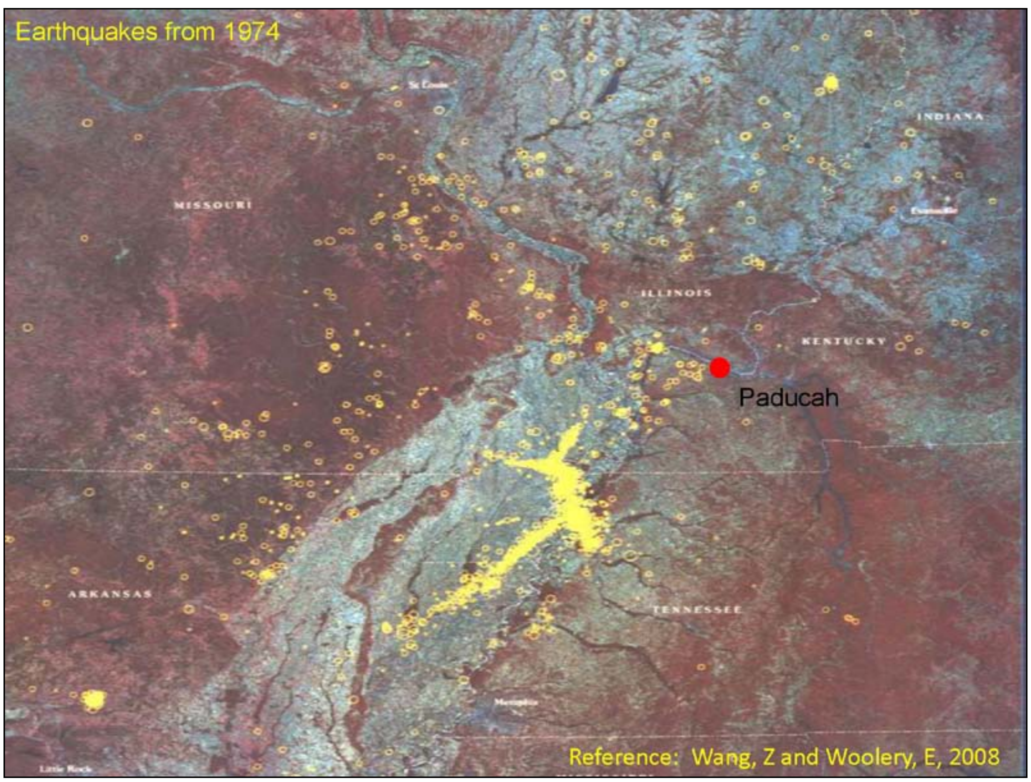


Kolata, D., Treworgy, J., Master, J., 1981. Structural framework of the Mississippi embayment of southern Illinois. Ill. St. Geol. Surv. Circ. 516, pp. 2 – 19.



3. Which of the following statements about Technetium 99 is true?

1. It is produced in nuclear reactors
2. It is an atomic element with atomic number 43 on the periodic table
3. Its name comes from the Greek word meaning artificial
4. It is radioactive and has a half-life of 211,000 years
5. All of the above

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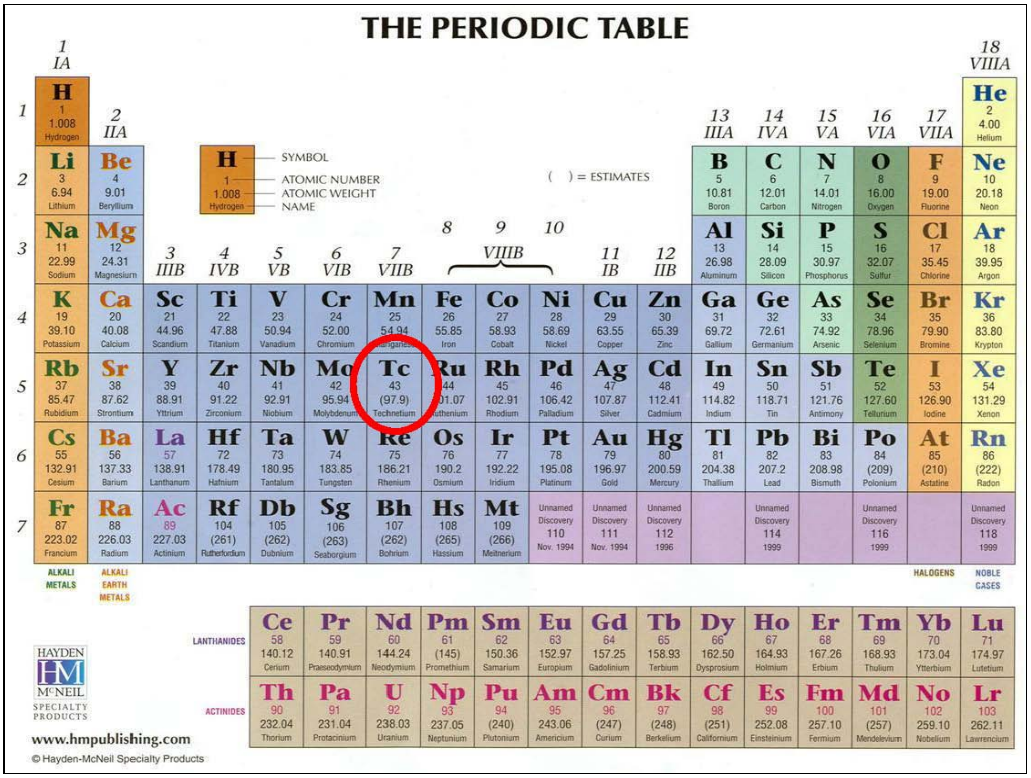
THE PERIODIC TABLE
SYMBOL
ATOMIC NUMBER
ATOMIC WEIGHT
NAME
( ) = ESTIMATES
1 IA
2 IIA
3 IIIB
4 IVB
5 VB
6 VIB
7 VIIB
8 9 10 VIIIB
11 IB
12 IIB
13 IIIA
14 IVA
15 VA
16 VIA
17 VIIA
18 VIIIA
H 1 1.008 Hydrogen
He 2 4.00 Helium
Li 3 6.94 Lithium
Be 4 9.01 Beryllium
B 5 10.81 Boron
C 6 12.01 Carbon
N 7 14.01 Nitrogen
O 8 16.00 Oxygen
F 9 19.00 Fluorine
Ne 10 20.18 Neon
Na 11 22.99 Sodium
Mg 12 24.31 Magnesium
Al 13 26.98 Aluminum
Si 14 28.09 Silicon
P 15 30.97 Phosphorus
S 16 32.07 Sulfur
Cl 17 35.45 Chlorine
Ar 18 39.95 Argon
K 19 39.10 Potassium
Ca 20 40.08 Calcium
Sc 21 44.96 Scandium
Ti 22 47.88 Titanium
V 23 50.94 Vanadium
Cr 24 52.00 Chromium
Mn 25 54.94
Fe 26 55.85 Iron
Co 27 58.93 Cobalt
Ni 28 58.69 Nickel
Cu 29 63.55 Copper
Zn 30 65.39 Zinc
Ga 31 69.72 Gallium
Ge 32 72.61 Germanium
As 33 74.92 Arsenic
Se 34 78.96 Selenium
Br 35 79.90 Bromine
Kr 36 83.80 Krypton
Rb 37 85.47 Rubidium
Sr 38 87.62 Strontium
Y 39 88.91 Yttrium
Zr 40 91.22 Zirconium
Nb 41 92.91 Niobium
Mo 42 95.94 Molybdenum
Tc 43 (97.9) Technetium
Rh 45 102.91 Rhodium
Pd 46 106.42 Palladium
Ag 47 107.87 Silver
Cd 48 112.41 Cadmium
In 49 114.82 Indium
Sn 50 118.71 Tin
Sb 51 121.76 Antimony
Te 52 127.60 Tellurium
I 53 126.90 Iodine
Xe 54 131.29 Xenon
Cs 55 132.91 Cesium
Ba 56 137.33 Barium
La 57 138.91 Lanthanum
Hf 72 178.49 Hafnium
Ta 73 180.95 Tantalum
W 74 183.85 Tungsten
75 186.21 Rhenium
Os 76 190.2 Osmium
Ir 77 192.22 Iridium
Pt 78 195.08 Platinum
Au 79 196.97 Gold
Hg 80 200.59 Mercury
Tl 81 204.38 Thallium
Pb 82 207.2 Lead
Bi 83 208.98 Bismuth
Po 84 (209) Polonium
At 85 (210) Astatine
Rn 86 (222) Radon
Fr 87 223.02 Francium
Ra 88 226.03 Radium
Ac 89 227.03 Actinium
Rf 104 (261) Rutherfordium
Db 105 (262) Dubnium
Sg 106 (263) Seaborgium
Bh 107 (262) Bohrium
Hs 108 (265) Hassium
Mt 109 (266) Meitnerium
Unnamed Discovery 110 Nov. 1994
Unnamed Discovery 111 Nov. 1994
Unnamed Discovery 112 1996
Unnamed Discovery 114 1999
Unnamed Discovery 116 1999
Unnamed Discovery 118 1999
ALKALI METALS
ALKALI EARTH METALS
HALOGENS
NOBLE GASES
LANTHANIDES
Ce 58 140.12 Cerium
Pr 59 140.91 Praseodymium
Nd 60 144.24 Neodymium
Pm 61 (145) Promethium
Sm 62 150.36 Samarium
Eu 63 152.97 Europium
Gd 64 157.25 Gadolinium
Tb 65 158.93 Terbium
Dy 66 162.50 Dysprosium
Ho 67 164.93 Holmium
Er 68 167.26 Erbium
Tm 69 168.93 Thulium
Yb 70 173.04 Ytterbium
Lu 71 174.97 Lutetium
ACTINIDES
Th 90 232.04 Thorium
Pa 91 231.04 Protacinium
U 92 238.03 Uranium
Np 93 237.05 Neptunium
Pu 94 (240) Plutonium
Am 95 243.06 Americium
Cm 96 (247) Curium
Bk 97 (248) Berkelium
Cf 98 (251) Californium
Es 99 252.08 Einsteinium
Fm 100 257.10 Fermium
Md 101 (257) Mendelevium
No 102 259.10 Nobelium
Lr 103 262.11 Lawrencium
HAYDEN McNEIL SPECIALTY PRODUCTS
www.hmpublishing.com
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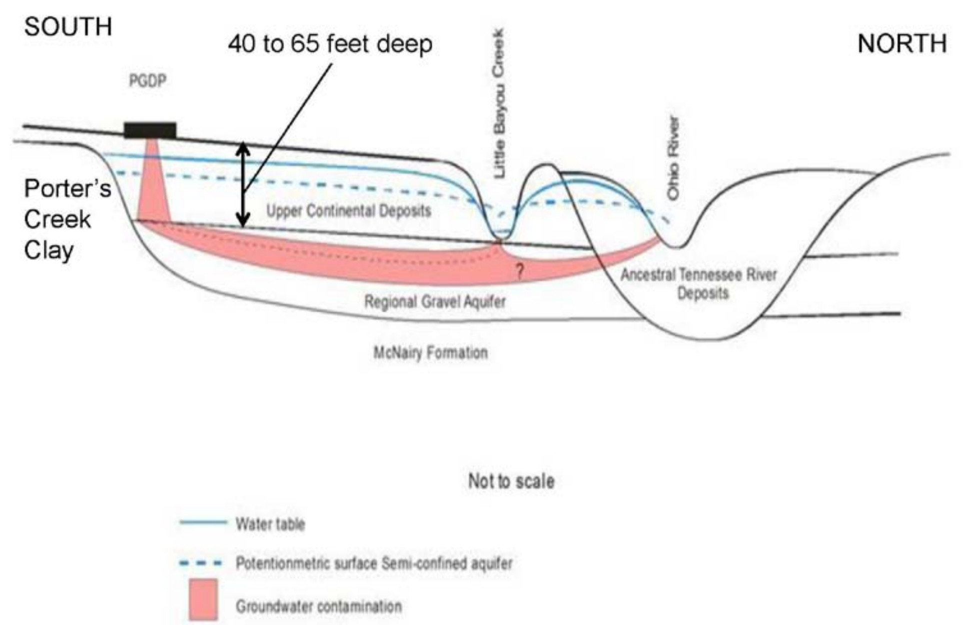
4. What keeps contaminated groundwater from moving south of the PGDP?

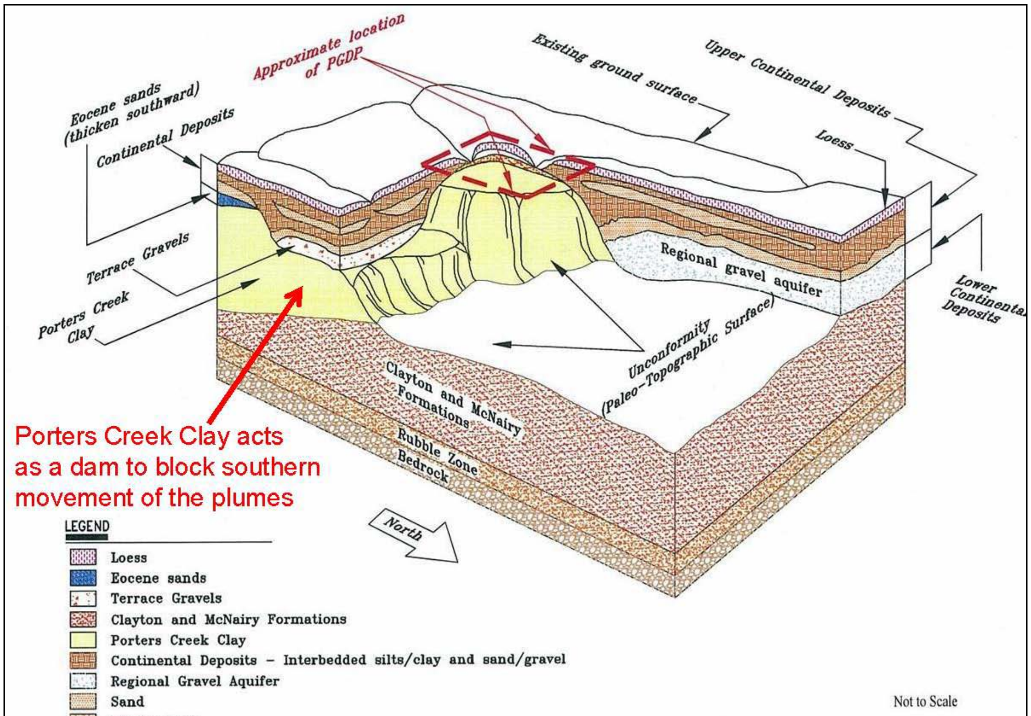
1. Nothing
2. DOE pump and Treat Facilities
3. Porters Creek Clay Geologic Formation
4. Large impervious area within the DOE property boundary
5. Forest

4. What keeps contaminated groundwater from moving south of the PGDP?

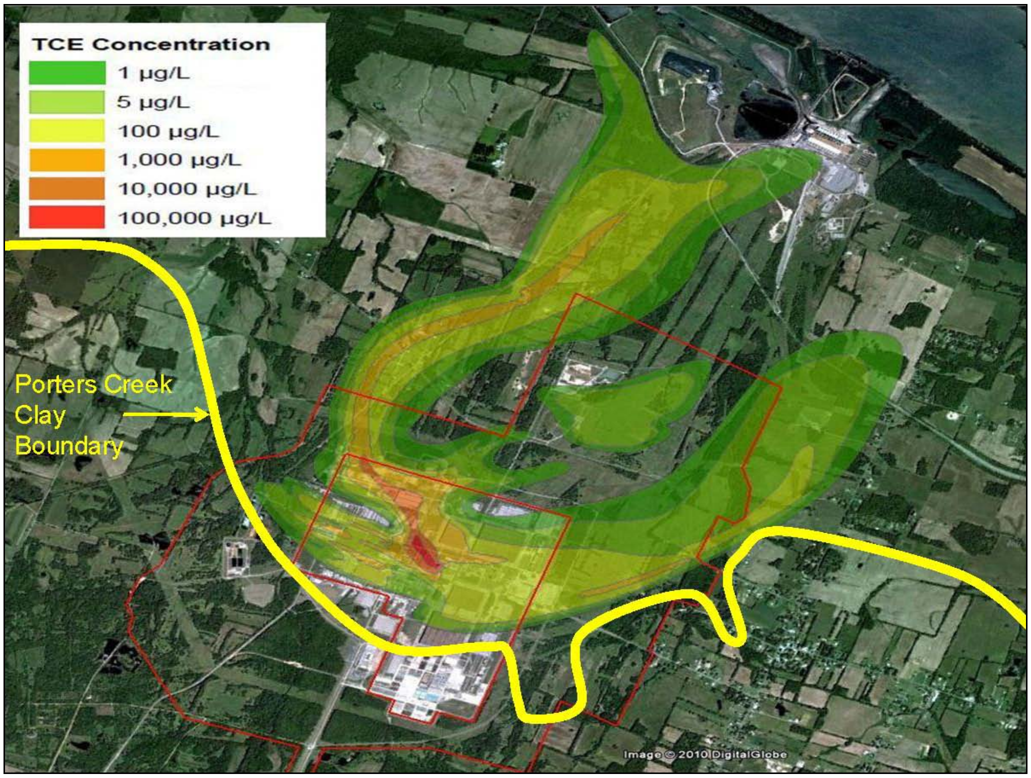
1. Nothing
2. DOE pump and Treat Facilities
3. Porters Creek Clay Geologic Formation
4. Large impervious area within the DOE property boundary
5. Forest

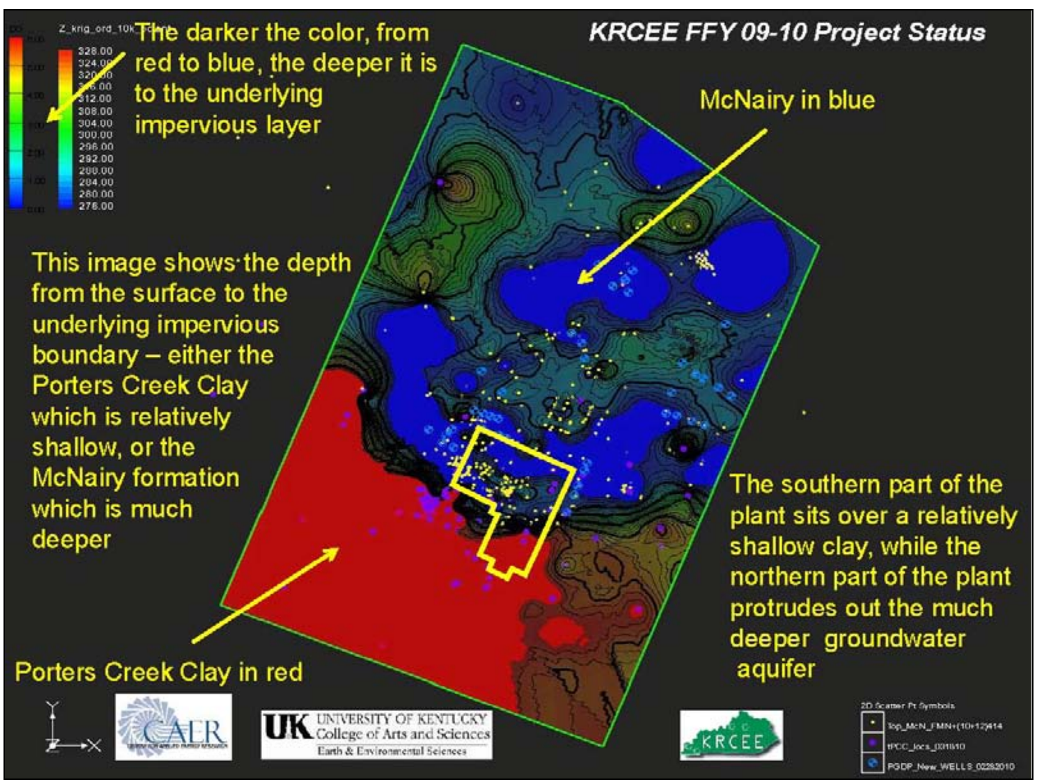


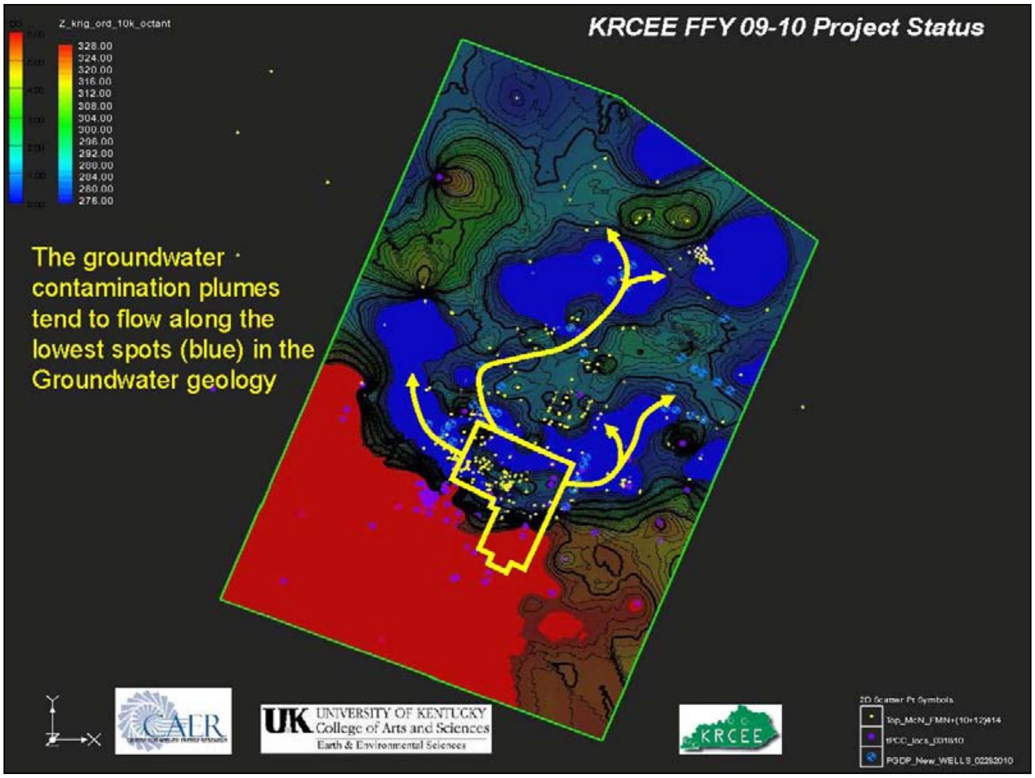
CROSS SECTION OF GEOLOGY AT THE PGDP SITE

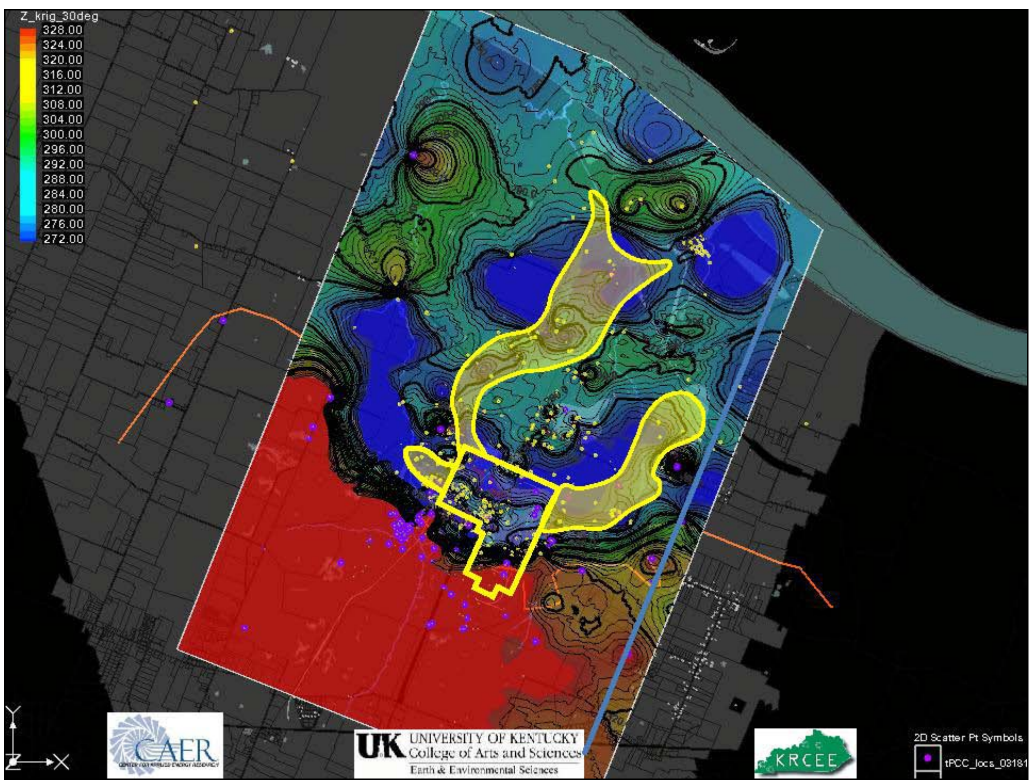


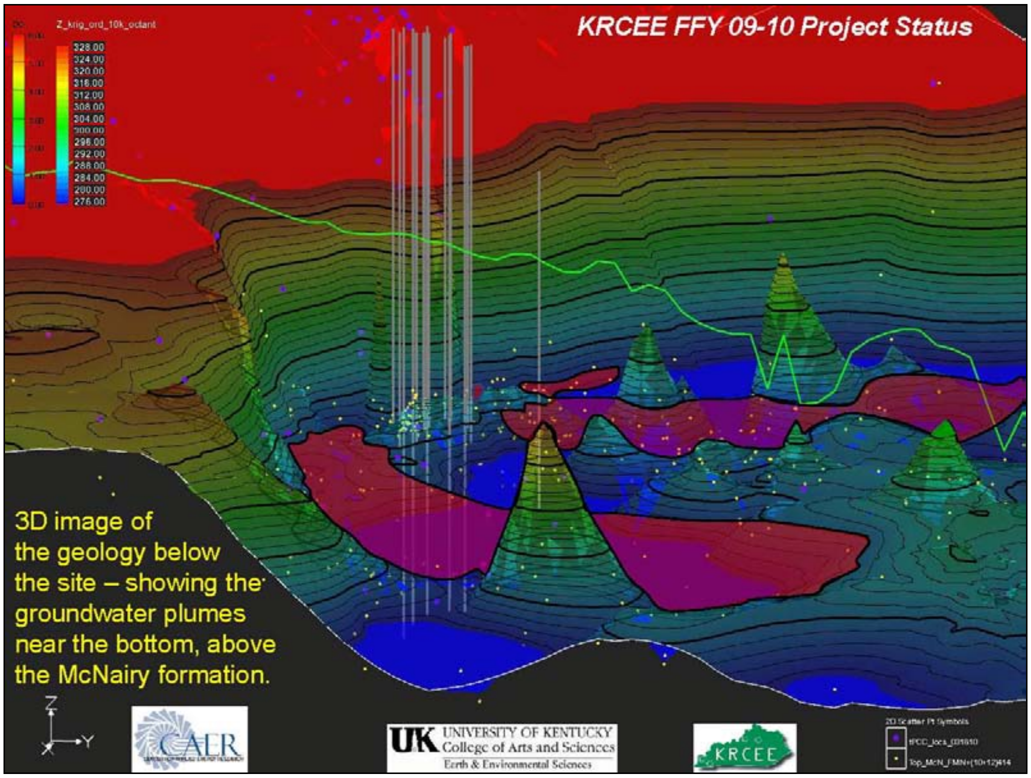
3-D IMAGE OF GEOLOGY AT THE PGDP SITE


TCE Concentration
1 µg/L
5 µg/L
100 µg/L
1,000 µg/L
10,000 µg/L
100,000 µg/L
Porters Creek Clay Boundary
Image © 2010 DigitalGlobe


KRCEE FFY 09-10 Project Status
The darker the color, from red to blue, the deeper it is to the underlying impervious layer
McNairy in blue
This image shows the depth from the surface to the underlying impervious boundary – either the Porters Creek Clay which is relatively shallow, or the McNairy formation which is much deeper
The southern part of the plant sits over a relatively shallow clay, while the northern part of the plant protrudes out the much deeper groundwater aquifer
Porters Creek Clay in red
UNIVERSITY OF KENTUCKY College of Arts and Sciences Earth & Environmental Sciences
KRCEE


KRCEE FFY 09-10 Project Status
Z_krig_ord_10k_octant
328.00
324.00
320.00
316.00
312.00
308.00
304.00
300.00
296.00
292.00
288.00
284.00
280.00
276.00
The groundwater contamination plumes tend to flow along the lowest spots (blue) in the Groundwater geology
UNIVERSITY OF KENTUCKY College of Arts and Sciences Earth & Environmental Sciences
KRCEE
2D Scatter Pt Symbols


Z_krig_30deg
328.00
324.00
320.00
316.00
312.00
308.00
304.00
300.00
296.00
292.00
288.00
284.00
280.00
276.00
272.00
UNIVERSITY OF KENTUCKY College of Arts and Sciences Earth & Environmental Sciences
KRCEE
2D Scatter Pt Symbols


KRCEE FFY 09-10 Project Status
3D image of
the geology below
the site – showing the
groundwater plumes
near the bottom, above
the McNairy formation.
UK UNIVERSITY OF KENTUCKY
College of Arts and Sciences
Earth & Environmental Sciences
KRCEE
CAER

5. According to the National Renewable Energy Lab, areas with annual average wind speeds around 6.5m/s and greater at 80-m height are generally considered to have suitable resources for wind development. The average such wind speeds around the PGDP are?

1. 2 to 3 m/s
2. 3 to 4 m/s
3. 5 to 5.5 m/s
4. 6 to 7 m/s
5. 8 to 9 m/s

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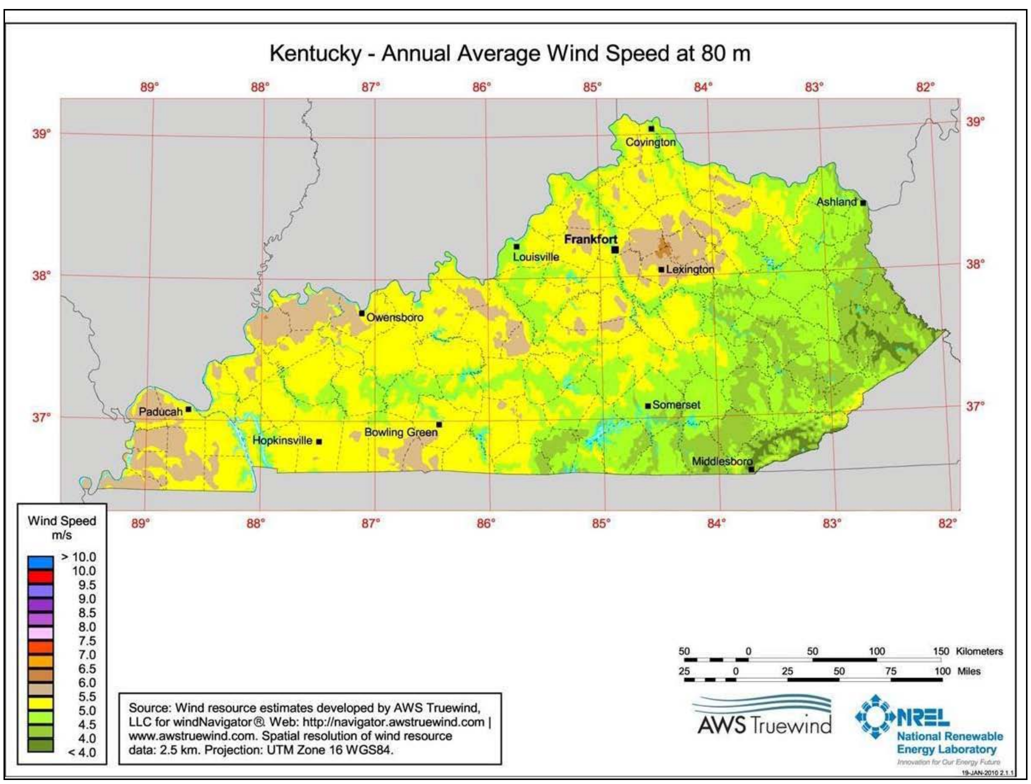
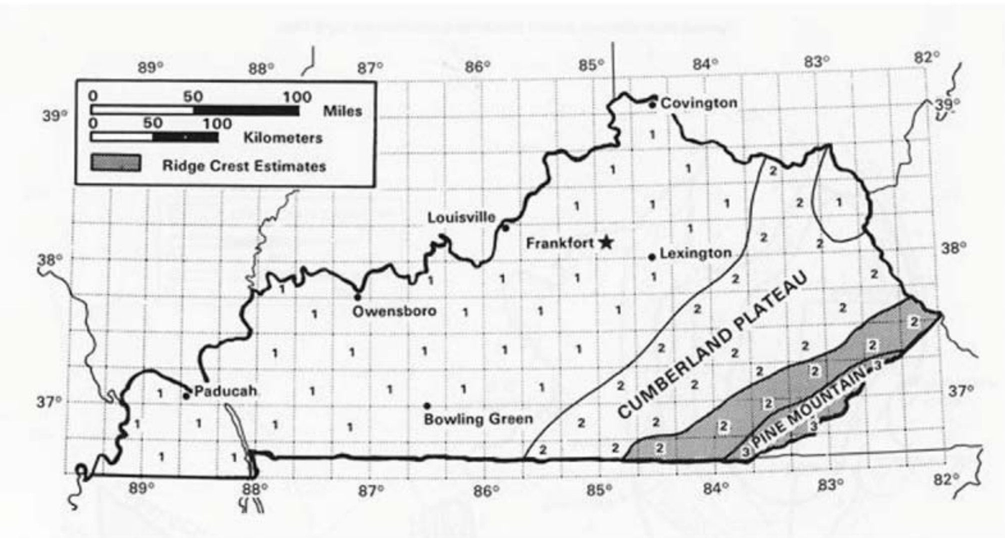

Kentucky - Annual Average Wind Speed at 80 m
89°
88°
87°
86°
85°
84°
83°
82°
39°
38°
37°
Covington
Ashland
Frankfort
Louisville
Lexington
Owensboro
Paducah
Somerset
Hopkinsville
Bowling Green
Middlesboro
Wind Speed
m/s
> 10.0
10.0
9.5
9.0
8.5
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
< 4.0
Source: Wind resource estimates developed by AWS Truewind, LLC for windNavigator®. Web: http://navigator.awstruewind.com | www.awstruewind.com. Spatial resolution of wind resource data: 2.5 km. Projection: UTM Zone 16 WGS84.
50 0 50 100 150 Kilometers
25 0 25 50 75 100 Miles
AWS Truewind
NREL
National Renewable Energy Laboratory
Innovation for Our Energy Future
19-JAN-2010 2.1.1

Kentucky Annual Average Wind Power: Minimum Wind Class Required = 3



http://rredc.nrel.gov/wind/pubs/atlas/maps/chap3/3-29m.html

6. According to the Commonwealth of Kentucky Alternative Energy Facilities Site Bank, the PGDP site is best suited for which type of alternative energy plant?

1. Nuclear
2. Solar
3. Biomass
4. Clean coal
5. Other

NREL (http://www.nrel.gov/solar/news/2010/888.html),
NASA Atmospheric Science Data Center (http://eosweb.larc.nasa.gov/sse/)

6. According to the Commonwealth of Kentucky Alternative Energy Facilities Site Bank, the PGDP site is best suited for which type of alternative energy plant?

1. Nuclear (70%)
2. Solar (59%)
3. Biomass (83%)
4. Clean coal (79%)
5. Other

Source: kysitebank.com


COMMONWEALTH AGRI-ENERGY ETHANOL PLANT, HOPKINSVILLE ROAD
20 MILLION GALLON/YEAR – EMPLOYEES 30 EMPLOYEES

Cleanup

1. EPA regulations require Superfund sites to be cleaned up to such a level that the risk of cancer from exposure to any residual contaminants is equivalent to the risk of dying from which of the following?

1. Living two months with a cigarette smoker
2. Traveling 300 miles by car
3. Flying 1000 miles by jet
4. Traveling 6 miles by canoe
5. Any of the Above

Reference: Wilson R (1979) Analyzing the Daily Risks of Life, Technology Review; 81(4):41-46

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3. Flying 1000 miles by jet
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5. Any of the Above

Reference: Wilson R (1979) Analyzing the Daily Risks of Life, Technology Review; 81(4):41-46

2. Past practices at the PGDP resulted in the spilling of two contaminants: Trichloroethylene (TCE) and Technetium 99 (Tc99) into the groundwater. As of 2000, how much groundwater has been contaminated? Enough to fill.....

1. 1,000 Olympic size swimming pools
2. 5,000 Olympic size swimming pools
3. 10,000 Olympic size swimming pools
4. 16,000 Olympic size swimming pools
5. 20,000 Olympic size swimming pools

Reference: General Accounting Office {April 29, 2000: GAO/RCED-00-96}

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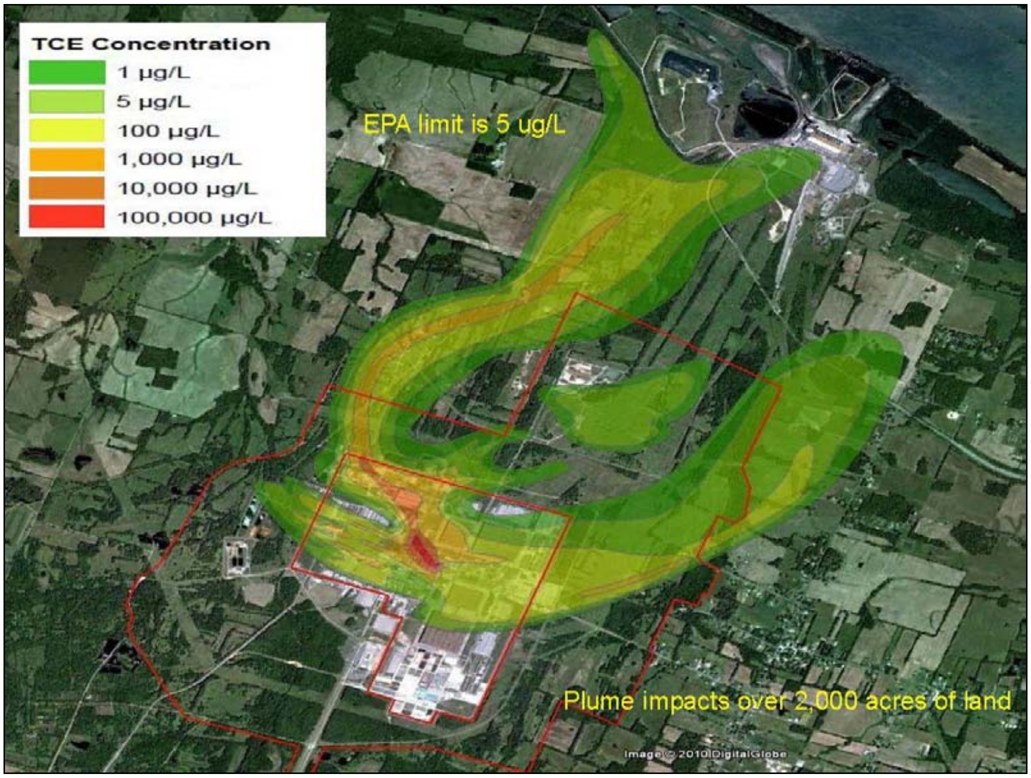
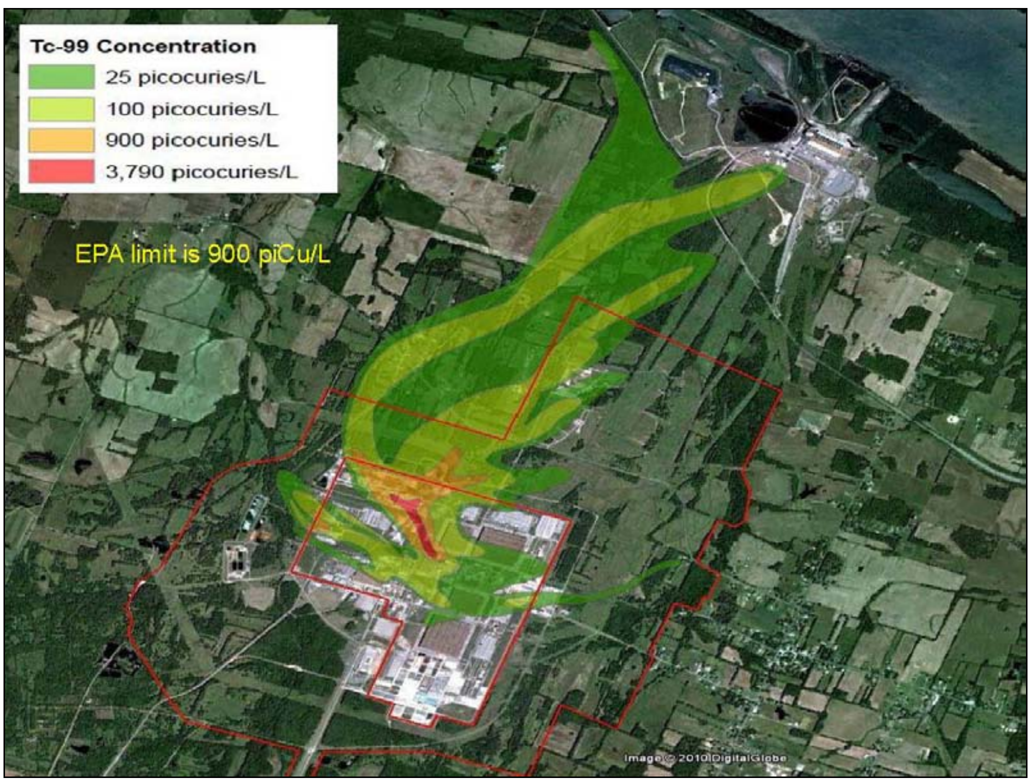
5. 20,000 Olympic size swimming pools

Reference: General Accounting Office {April 29, 2000: GAO/RCED-00-96}


TCE Concentration
1 µg/L
5 µg/L
100 µg/L
1,000 µg/L
10,000 µg/L
100,000 µg/L
EPA limit is 5 ug/L
Plume impacts over 2,000 acres of land
Image © 2010 DigitalGlobe


Tc-99 Concentration
25 picocuries/L
100 picocuries/L
900 picocuries/L
3,790 picocuries/L
EPA limit is 900 piCu/L
Image © 2010 DigitalGlobe

3. If all the residual sources of TCE in soils and groundwater inside the PGDP facility were removed, approximately how long would it take for the TCE concentration in the groundwater plume outside of the plant to drop below what EPA deems an acceptable contamination level?

1. 5 years
2. 10 years
3. 15 years
4. 30 years
5. Over 100 years

Reference: KRCEE – Property Acquisition Study for Areas near the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, April 2007

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Reference: KRCEE – Property Acquisition Study for Areas near the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, April 2007

4. Non-hazardous waste from ongoing operations and cleanup at the PGDP are currently being placed where?

1. Disposed on DOE property in a landfill
2. Dumped in the Ohio River
3. Shipped to another location out of state
4. Stored in the Paducah Landfill
5. There are no non-hazardous wastes

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5. There are no non-hazardous wastes


PGDP Landfills
U
S
T
C404
K

5. The total estimated waste volume from the demolition of the PGDP existing facilities could fill how many football fields a yard deep?

1. 100
2. 500
3. 675
4. 1,000
5. 1,500

Reference: 3,596,000 cubic yards from DOE CERCLA Waste Disposal Alternatives RI/FS Workplan

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6. Approximately how much would it cost to ship all the PGDP waste off-site, compared to burying the waste in an on-site landfill?

1. Twice as much
2. Three times as much
3. The same
4. One half as much
5. One third as much

Reference: DOE, based on shipping 2,640,000 cubic yards at $1.1 billion

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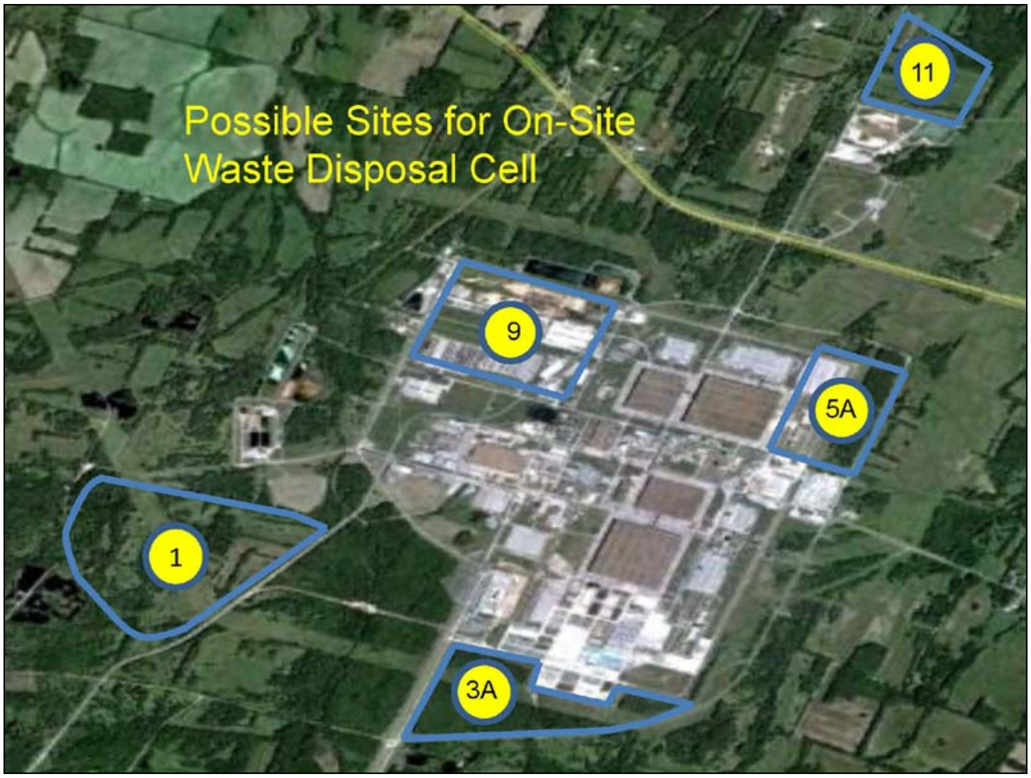
Possible Sites for On-Site
Waste Disposal Cell
11
9
5A
1
3A

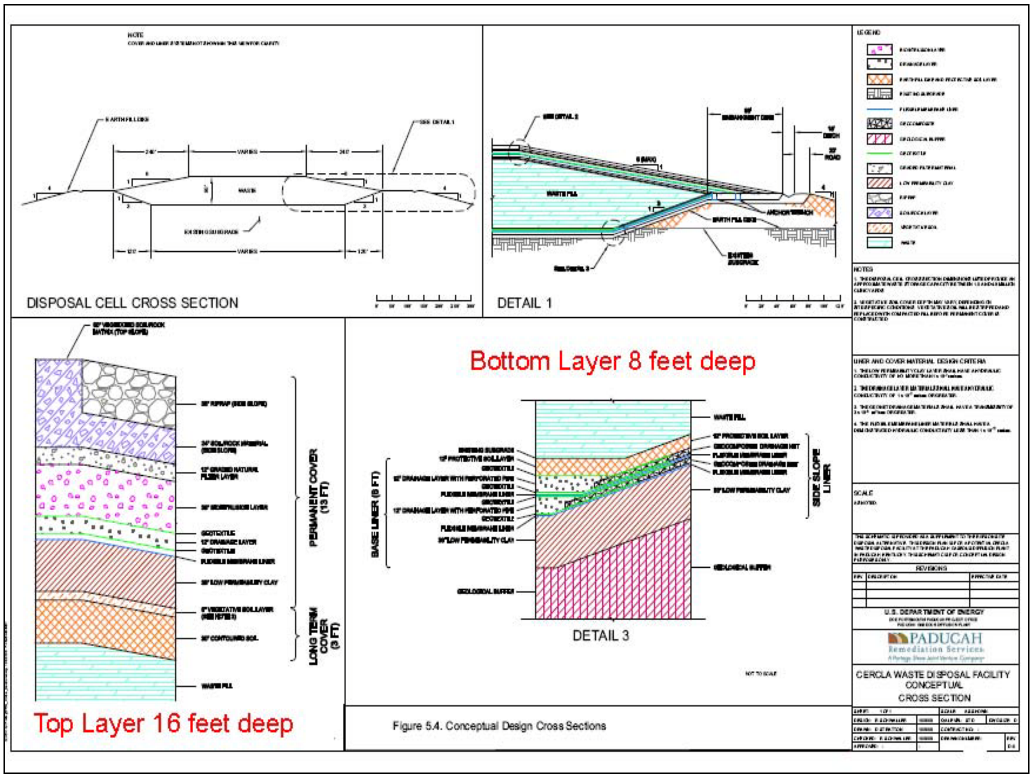

Figure 5.4. Conceptual Design Cross Sections

7. According to the Kentucky Division of Waste Management, after the PGDP site is cleaned up, what regulatory steps would be triggered if additional contamination were discovered off-site?

1. A new site investigation would be mandated by EPA
2. Any new property owners would be responsible
3. The site would be closed
4. The site would be placed back on the NPL Superfund list
5. Nothing

Reference: Kentucky Division of Waste Management

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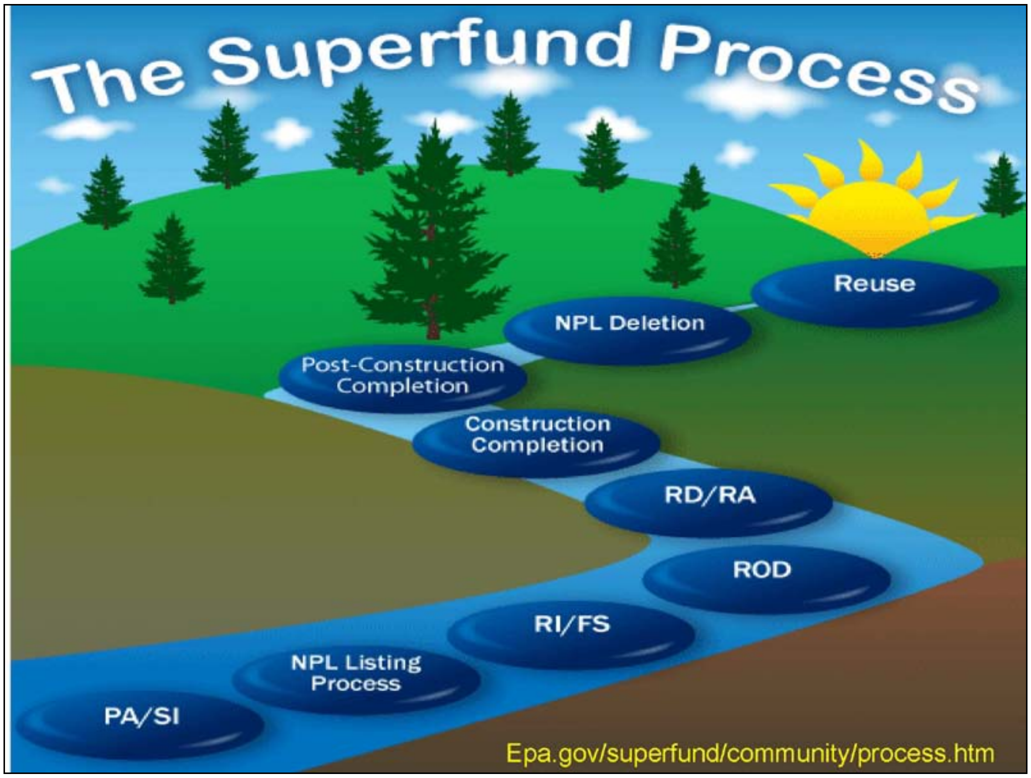

The Superfund Process
Reuse
NPL Deletion
Post-Construction
Completion
Construction
Completion
RD/RA
ROD
RI/FS
NPL Listing
Process
PA/SI
Epa.gov/superfund/community/process.htm

APPENDIX Q: SUMMARY OF PROJECT FACTORS

It is useful to understand the distinctive nature of every public infrastructure project. Borrowing from the literature and their experience, the KRCEE research team has determined that several different factors can be used to qualitatively distinguish projects (Panel on Public Participation in Environmental Assessment and Decision Making, 2008; Bieirle and Cayford, 2002). A proper consideration of these factors is useful in thinking about public participation in the larger sense and helps situate the PGDP project. The major facets of any project are summarized in Table 8.1 and discussed in the following sections.

Table Q.1 List of Project Facets

Time Frame
Spatial Extent
Complexity of the Problem
Process Product
Project of Uncertainty
Breadth and Depth of Public Impact
Different Perspectives, Capabilities, and Power Levels
Public Level of Trust of Agencies
Agency Culture, Approach and Regulator/Administrative Environment

Q.1 TIME FRAME

Q.1.1 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. Given that the timing of the PGDP decommissioning is uncertain, participants' preferences are somewhat more speculative. However, in an effort to address this challenge, the hypothetical future scenarios created for this project were composed and presented at a level of generality and in a progressive fashion (e.g. low intensity land use to high intensity land use), so as to allow participants the most practical method for discovering and relaying their preferences.

As for the stability of participant preferences over time, the team's work in other contexts has shown that, when input is drawn from a larger proportion of the community, later evaluations (6 months to one year later) of alternatives will be quite consistent with the earlier sets of preferences. Thus, increasing the number of people participating in the process will help to ensure preference stability over time. The team is making extensive efforts to broaden the opportunities for input from community members, for this (and other) reason(s). This preference stability is not reliable, of course, if, over this extended time frame, significant new facts emerge which would reasonably be weighed by those expressing their preferences about future scenarios.

Q.1.1.1 Need For Long –Term Monitoring Of Processes And Outcomes

A corollary of the problem of increasing unreliability over time is the need to consider monitoring strategies. Any current planning will need to include a method to specify decision-making in the years beyond those implicated in the future scenarios. 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 the PGDP has existed. Thus, current preferences are most applicable to the near term, and longer term monitoring and management will be a concern of the public.

This is a significant consideration and opportunity for US DOE, as research by Fischer (2000) and others has shown that the public is willing to accept more risk when they have a stronger hand in the decision-making processes to deal with that risk. In the case of PGDP, many of the future vision preferences expressed by the participants include judgments about their acceptance of various levels of risk. These judgments might be altered if a more explicit and clearer role is defined for the public for the long term management of the site.

Q.1.2 Spatial Extent

Q.1.2.1 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. In the immediate vicinity of the plant is the largest TCE contamination plume in the world, which defines a certain district of people with contaminated water wells (the "Water Policy District"), 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. Consequently, different affected constituencies were reached through strategic meeting locations, or, in the case of the wildlife management area users, meeting timings that coincided with events that drew users from a multi-state area.

Q.1.2.2 Arranging Agency Involvement Across Political And Administrative Boundaries

This problem of scale also is relevant from the side of the sponsoring agency(s), as it increases the likelihood that agencies with overlapping spatial responsibilities will be affected and thus implicated. While one agency (i.e. 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 project team has been engaged with each of these entities to ascertain the possible implications, to them, of different future scenarios for PGDP. For example, while TVA operates the power plants that provide the electricity to the current PGDP facility, TVA has no particular objection to the possibility of the site being converted to another power plant in close proximity to theirs. Their user base is defined as the area south of the Ohio River, while a new power plant could help supply energy further north on the grid.

Q.1.3 Complexity of Problem

Q.1.3.1 Dealing with many possible outcomes

Overall project complexity, in terms of the number of possible variable 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 own 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, legacy waste issues, and future waste uses (including decommissioning and destruction of structures) are each limited to only three possible general outcomes, the complex of total possible scenarios approaches 81! Adding one more factor (for example, three options for the overall treatment of groundwater pollution) would expand the number of distinct future scenarios to 81x x 3 = 243, and so on. This quickly exceeds the capacity of most public processes.

Q.1.3.2 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, limiting 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 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.

The team explored the interactions of alternative land use/clean up combinations at some length with the extensive focus group process. At the end of that phase, we were satisfied that the most important conditional cleanup considerations about future land use were those involving surface contamination and the handling and disposal of surface materials and contaminants. This is because the physical location and arrangement of these materials has the most potential to impinge on different anticipated land uses. Conversely, while the treatment and attenuation of the contaminated water plumes is important, the choices among different treatment strategies appear to have less implication for near-term land use decisions. As a consequence, this factor was not included in the development of the final scenario state matrix.

Q.1.4 Type of Final Product from Process

Q.1.4.1 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.

Q.1.4.2 Information Gathering/Preference Measuring/Values Measuring

Projects that require information regarding public preferences or values to inform professional or agency decisions generally require less intensity of interaction. In such situations, 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 project sponsor 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 seems to characterize the past history of public engagement. In the current project, 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 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.

The research team recruited participants for both the Step Three Community Informational Meetings and the Step Four Scenario Evaluation Meetings through multiple channels (see Appendix O). An extensive advertising campaign was conducted in local and regional newspapers with a combined circulation of more than 43,000 individuals. In addition, an advertisement was placed on the second page of the *BBQ on the River* regional festival tabloid, which has a circulation of 38,000. Meeting announcements and flyers were sent to the entire project stakeholder email list of approximately sixty individuals, with a request that recipients forward the information to their own contacts in the area. Announcements and flyers also were posted in local online bulletin boards, including iList Paducah and local radio and television websites. University of Kentucky Public Relations sent press releases and media alerts to its entire west Kentucky mailing list.

Q.1.5 Project Uncertainties

Q.1.5.1 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 classic 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).

Q.1.5.2 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.

Q.1.5.3 Collective Monitoring

Similarly, there are many existing and potential sources and types of environmental monitoring that can be implemented in any given project to help 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 the PGDP, extensive monitoring efforts already are conducted by US DOE and its contractors. What is not clear is the extent to which the monitoring output is available to, or has credence with, the general public, or specific portions of the public.

Q.1.6 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 it's emphasis on distributional justice for race or income-defined groups. In the practical world of projects, there are of course a wide array of possible 'groups' that may be impacted in different ways by a particular project.

Q.1.6.1 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 clear potential impacts from a change at the 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.

Part of the team's strategy to address this is to have open public meetings so that anyone may self-select to participate in the preference expressions, without needing to have been pre-qualified by the project team. Further, because the SPI process provides equal voice to all participants, no adjudication is made by the project team as to the legitimacy or relative importance of any given participant's interest.

Q.1.6.2 Understanding How Each Group Is Impacted

The way that different groups are impacted by 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 extent 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.

Given the long history of the plant in the community, the research team is not prepared to make judgments about differential weights and legitimacies of different participants' opinions regarding future uses of the site. For example, the passage of time implies, among other things, that the particular set of participants involved in the current preference-gathering process inevitably will change in ways no one can anticipate. For this reason, the team decided not to attempt to gather particular identity group information during the public meeting phase of the project, even though it is easily done using the A.R.S. To do so could raise the concern that some opinions would be given greater credence than others, which could erode the confidence of the participants in the overall project process.

Q.1.7 Different Perspectives, Capabilities, and Power Levels in 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.

Q.1.7.1 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 iteration or feedback, errors in measuring or understanding the preferences that people are trying to communicate can proliferate throughout the project.

In the latter phases of the focus group process, and especially in the public meeting phase, the team's use of A.R.S. as part of the S.P.I. process helped to ensure that everyone in the room provided equal value input. The keypad systems have been shown to be easy to understand and use by all educational and age levels, and because of the anonymity and simultaneous nature of the data collection, help guard against intimidation and undue influence by those who consider themselves opinion leaders.

Q.1.7.2 Solutions With Long Term Weaknesses

Lack of understanding of substantial issues or values can then 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, as well.

To address the reality of information shortages, the team deployed a round of information meetings prior to the scenario scoring process. These meetings were designed to inform both the team and the public about information gaps relevant to making judgments about the future vision for PGDP. At the actual scenario scoring meetings, the team provided the best possible, and clearest quality, visual representations possible, with explanations of each aspect of each scenario, to help address possible information shortages in the public realm.

Q.1.8 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 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 the PGDP. For whatever reason or reasons, the level of confidence in the US DOE regarding the PGDP is very low. This particular situation is not for the team to remedy; however, it contributes to an unwillingness by the public to engage in the process. Extensive outreach has been conducted to encourage participation by the public, and the results have been modest. Nonetheless, those who do participate in the public meetings have a high opinion of the process. It is the team's hope that this positive experience will encourage others to invest their time in the process, as well.

Q.1.9 Agency Culture, Approach, and Regulatory/Administrative Environment

In a review of US DOE SSABs, Bradbury pointed out that if there was insufficient engagement or commitment by DOE officials to the recommendations of the boards, members would become apathetic, cynical, and stop participating (Bradbury 1999, p. iii). Such as been the past experience of some members of the PGDP CAB. This fundamental observation is a challenge for governmental 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 open-ended commitments to decisions fashioned 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 dynamic can 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 (see Figure 6.1).

The research team's prior work indicates that the Arnstein Ladder can be a useful heuristic for understanding the perceptions and the aspirations of both the 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, as well as 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 8.2). 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 their own preferences. It also reveals that professionals have a higher opinion of how well they deliver public involvement than the public does.

Q.2 A FRAMEWORK FOR FAIRNESS AND JUSTICE: STRUCTURED PUBLIC INVOLVEMENT

The complexity of the PGDP future vision 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 relate to 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 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 Rawles.

Q.2.1 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 implication, for 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), this concept holds implications for the general public. The considerable levels of risk and uncertainty associated with a situation such as the PGDP may yield risk-minimizing preferences 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 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 myriad ways, ranging from a means of livelihood for some to a threat to life itself 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 the 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 that 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.

APPENDIX R: VISUALIZATION THEORY

Several methodological issues are associated with visual scenario evaluation by large groups. Table R.1 shows properties of visual evaluation methods. There are conflicting goals for visual evaluation. The need for a high volume and quality of input data from a large number of participants must be balanced against the cost and time involved in acquiring this data. The need for a large number of samples must be balanced against logistical and feasibility considerations for each meeting. The desirability of interval or ratio numerical quality inputs for statistical and numerical analysis must be balanced against the seamless functioning of human perception and cognition systems. These factors must all be taken into account during process design and selection of visual method.

Many of the problems encountered with large-scale group visual evaluation are associated with the reality of hosting large public meetings. A key constraint in real public processes is the useful time available. The authors have hosted over one hundred public meetings dealing with infrastructure issues and 90 minutes appears to be an upper bound for this evaluation. Less than 60 minutes is preferable. Experience shows that between twelve and twenty-five visualizations can be evaluated effectively during this timeframe, depending on whether these are still images, or animations requiring run times prior to evaluation. The extent of post-scoring, focused verbal evaluation of specific visualizations and their properties also must be considered in the time budget.

Table R.1 Properties of visual evaluation methods

Visual assessment method	**Philosophy**	**Advantages**	**Disadvantages**
Traditional visual assessment	Composite	Intuitive, rapid evaluation	Unstructured, very limited analytic capacity
Visual Preference Survey (VPS®)	Elemental	Rapid scoring	Marginal discrimination unreliable
		Intuitive	No analytic method
			Not open for public inspection
Exhaustive pair-wise comparison	Composite	Explicit elemental scoring	Too data-hungry
		Reliable marginal preference discrimination	Far from intuitive
			Potential for inconsistency (i.e. preference intransitivity)

R.1 Traditional Visual Assessment

Traditional visual assessment consists of showing a small number of images to respondents and eliciting unstructured verbal feedback, or ordinal rankings of one scenario versus another. This method is inexpensive and easy to implement. It often is employed by consultants and designers for large group evaluations of design proposals. However, despite its convenience, it is a data-poor way to evaluate preference. It leaves unanswered the questions of whether, and how, specific design elements are influencing public valuations, and in which combinations, and it does not address the problem of preference intransitivity.

R.2 Visual Preference Survey

The Visual Preference Survey, or VPS®, (Nelessen 1994) is widely used by architects, designers and public involvement practitioners for visual evaluation of structures and built environments. It consists of rapid evaluation of images on an integer Likert scale and is quick and intuitive. However, the interpretation of the data, and the way in which elements interact with one another, is left to the minds of the survey designers. No database is generated, and third-party analytic inspection of community values in relation to the design elements is not possible. The success of this system depends strongly on the participating group's trust of the individuals administering and interpreting the survey, and of the designers' understandings of how people react to composite scenarios.

R.3 Exhaustive Pairwise Image Comparison

Marginal discrimination is most effectively maintained by performing exhaustive pairwise image comparison (e.g. Zube et al. 1982, Whitmore, Cook and Steiner 1995). The function that describes the necessary number of comparisons is given by the *Combination Equation*:

$$ {}_{n}C_{r} = \frac{n!}{r!(n-r)!} $$

Despite the quality of the analysis, this evaluation method is not viable when a realistic number of design elements exists. This is because, even with few design properties, hundreds of potential combinations, *C*, exist. Environmental behavior or environmental design research of this type is often conducted with captive subjects, such as students or advisory panel members, or with small numbers of paid attendees solicited for an experiment (e.g. Whitmore, Cook and Steiner 1995, Stamps 1998). However, the expectations of large numbers of citizens attending open public meetings cannot be met in this way.

If exhaustive evaluation is not possible, but feedback on elements and their interactions is desired, it follows that the visual evaluation decision support system needs to be able to convert the information from a smaller sample set into a function that will predict outputs for all possible input combinations, i.e. it will estimate stakeholder preference for scenarios that may not yet have been modeled or tested, if such scenarios can be defined from feasible combinations of the input parameters. Conceptually, this is a desirable evaluation feature because it eliminates the need to score all possible combinations of inputs. It also provides more analytic information than traditional visual assessment or the Visual Preference Survey. However, standard statistical methods cannot generate useful properties with such small sample sizes and limited coverage of the state space.

R.4 Casewise Visual Evaluation (CaVE)

For several decades, fuzzy set approaches have been used effectively to model analogous complex nonlinear systems under conditions of sparse data and high uncertainty (e.g. Zadeh 1965, Ridgley and Ruitenbeek 1999). Members of the research team have designed a fuzzy-set based system modeling approach for visual evaluation called Casewise Visual Evaluation, or CAVE (Bailey et al. 2001). The aim of CAVE is to map the output, y, i.e. mean stakeholder preference for the scenario, to the known inputs x_1, x_2, $x_3 \ldots x_n$, which in this case are the planning, design and management parameters that define the properties of each visualized scenario. A relatively small set of sample evaluations can be used to generate a community knowledge base covering all potential configurations. The software *FuzzyKnowledgeBuilder* is used to build the community knowledge base. A series of neural network algorithms are employed to build outputs around the known points. The functions are compiled and saved as a multidimensional mapping function that relates the output to all of the inputs across the entire range of every input parameter. Once verified and built, the community knowledge base exists as a multi-dimensional inputs-output model that can be interrogated by the design team across this full range of all input parameters. The community knowledge base now functions as a decision support system. The research team and project managers can inspect this knowledge base, examining the sensitivity of stakeholder preferences with respect to various input parameters. It also allows for trade-off analyses, or constrained optimizations, to be performed in cases where the community knowledge base must interoperate with other factors, e.g. cost, areas of the design envelope that are not feasible for constructability reasons, etc.

Various tools exist to facilitate the inspection of the community knowledge base. A knowledge slicer allows a 3D graphical output to be presented. For example, for a problem with 4 inputs, two of the inputs can be fixed at constant values while the values of the remaining two input variables (x_1, x_2) are presented across their entire ranges, and the output (z) is mapped to a surface. Figure X.1 shows a sample output for a general landuse analysis where the two input variables represent land density and building height.

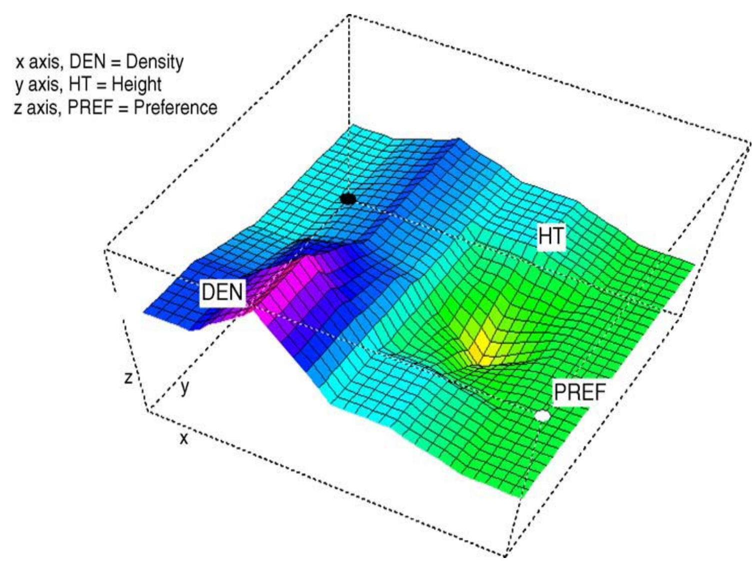


Figure X.1 Example Visualization Graph

Exhaustive inspection of a range of these surfaces allows the team to interpret likely public response to changes in one input parameter, with all other inputs held constant. By working sequentially through each input, high spots or plateau, i.e. combinations that the community values highly, can be identified. Also "sinkholes" or undesirable areas in the planning and design envelope, can be identified. The outputs are categorical, corresponding to numerical ranges for each parameter. The principle behind fuzzy logic application is the trading of false precision for greater accuracy between broader categories of output. For example, this means that, unlike a multivariate statistically-based analysis, discrimination based on numerical outputs within a given output class is not reliable. However, the discrimination between categories is robust. Normally, five categories or more are used to map output ranges. It must be borne in mind that this method is not directly comparable to standard statistical approaches to visual decomposition because statistical methods cannot function at all with such limited data input.

R.5 Similarities and differences of PGDP with respect to previous CAVE applications

Dynamic visual evaluation using CAVE has previously demonstrated high performance for design support in large-scale planning and infrastructure applications such as noise wall design (Bailey et al. 2006), context-sensitive large bridge design (Bailey et al. 2007), community-driven visioning for transit-oriented development (Bailey et al. 2007), and integrated transportation and land use planning (Blandford et al. 2008).

Several dimensions of the PDGP future state visioning problem are similar to these previous cases. For example, the complexity of presenting attributes of utility and disamenity in the same visualization is similar to the TOD case. These divergent valuations are captured implicitly in the "suitability" criterion, and the reasons for a high standard deviation are disaggregated using verbal feedback, if prompted by participants during the discussion phase.

Another similarity is the time horizon over which the valuations are elicited. The values of the future state are intended to be more than those pertaining to an instantaneous snapshot at the instant of plan approval. For the long-term viability of the final PGDP future state, when a management plan is developed using the future state visioning process as input, certain commitments are envisaged which could include land use controls, development planning, access controls, site management programs and so on. Likewise, investment in the built environment of TOD entailed sunk or unrecoverable costs and the fixed capital. When participants evaluate the visualizations using the "suitability" criterion, they are not only evaluating visual amenity, they are "bundling" other valuations into their score, including perceived risk, environmental impacts, economic impacts and other factors. The team does not seek to make explicit which factors could, or should, be included. Respondents self-evaluate the meaning of "suitability."

However, there are notable differences compared with previous applications. Risk levels of attributes such as the dissolved solvent plume, and the site uses, are not comparable (Freeman and Godsil 1994). In the case of the PGDP, these are much more significant than other cases, and recent studies by team members have demonstrated that, to some extent, they are unknown in spatial extent, duration and intensity (Chandramouli, Ormsbee and Kopp 2007). Although the community benefits can be apprehended clearly in the form of the utility of different land uses for the decommissioned plant, the risks cannot be so easily defined and delineated.

The actual extent of the physical plant itself is not enormous, but the area impacted by the PGDP future use is considerably larger than the plant. The impacted area extends over several counties, across the Ohio River to Illinois, and it includes tens of thousands of citizens and residents, as well as businesses, organizations, recreational land users and other groups from outside the immediate area. The geographic scale at which the visualizations are engineered and presented takes this factor into consideration.

Also, the historical development legacy of the plant and its impact on community valuations of future uses extend over a wider area and affect more stakeholders than in the land-use planning case. The plant has a significant history spanning over five decades, and the complexity of stakeholder relationships with the plant runs a gamut from acceptance to intolerance. The process described here is designed to depolarize citizen valuations and decouple them from one another, as well as to attach meaningful quantitative valuations to all feasible future scenarios and allow for reliable and defensible value comparisons. In these ways, the SPI process using CaVE is structured similarly to those used on the previous large infrastructure cases.

APPENDIX S: DESCRIPTION OF SCENARIO CONSTRUCTION PROCESS

In order to represent the scenarios in context the team used two visualization techniques: planimetric (2D) maps and three dimensional (3D) representations. Planimetric visualizations incorporate imagery and/or cadastral information combined with built objects, including transportation networks and building footprints, as seen from the air. The components of 3D visualizations in a rural setting for decision support purposes are terrain, built environment, and vegetation.

The extent of the area required for representation needed to be large enough to establish familiarity for both locals and non-locals, while remaining manageable for a laptop to handle the processor intensive graphics requirements. An area nearly 2km square was chosen for the visualizations as this included the closest roads surrounding the plant site accessible by the general public.

Planimetric maps were created using Google Earth Pro. Satellite and aerial imagery of the existing area was combined with imagery of existing sites with land uses and coverage similar to the parameters of the scenario matrix. Imagery was exported from Google Earth Pro to be cropped, blended and reshaped in Photoshop to align with existing US DOE boundaries. Built object footprints and boundaries were hand digitized to match GIS data.

The 3D visualizations required data from multiple sources. Terrain data was generated from US DOE 2-meter resolution elevation data of the plant site, combined with the statewide digital elevation model (DEM) from kygeonet.ky.gov, which has a resolution of 10 meters for the surrounding areas. Two-foot resolution orthophoto imagery from kygeonet.ky.gov was draped over the terrain data. Built environment items, including transportation networks, building and structure footprints, power transmission lines, and non-security fencing, were created from US DOE GIS data. Vegetation and general land use coverage were generated from the Southeast USGS Gap Analysis landcover dataset.

Built objects specific to the scenario land uses were created in Google Sketchup and imported into CityScape. Inspiration for building form, and layout was taken from existing structures. The heavy industry scenario demonstrates the potential land use of a large auto manufacturer. The site closely resembles the Louisville, KY Ford Truck plant. The nuclear power plant was constructed from schematics in an industry brochure from AREVA. The on-site recreation scenario combines attributes of the Bernheim Arboretum and Research Forest near Clermont, KY and the Fernald Preserve Visitors Center near Harrison, OH. Design of the waste disposal alternative was taken from Figure 5.4 from the 2010 US DOE report "Work Plan for CERCLA Waste Disposal Alternatives Evaluation Remedial Investigation/Feasibility Study at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky."

PixelActive's CityScape was chosen as the software package to create the virtual 3D representations. CityScape had some or all of the necessary features of multiple visualization software products combined in one efficient platform. The software can import vector data and parse attribute information from GIS files. This enables the designer to create rudimentary procedural rules for the creation of objects such as roads, structures, vegetation and traffic without the requirement of hand digitizing every component. CityScape has heads-up, real-time rendering that permits dynamic, interactive editing with immediate visual feedback. The software has extensive terrain manipulation tools which accommodate synchronous updates of affected assets (roads, structures, and vegetation). In other words, if a large hole is created in the ground a road will follow the contours while following default cut and fill standards. This feature was essential as the size, shape, and location of the waste disposal alternative (landfill) was unknown to the project team before creation of the visualizations. CityScape was intended for a planning tool while efficiently creating worlds readily rendered in several gaming engines. Because of this, it has the ability to import and export in several 3D formats.

Before the GIS data could be imported, the data needed to be in standardized coordinate system and matching projection to allow correct parsing of the locational information. Much of the US DOE data was in a proprietary "plant" or "site" coordinate system requiring geoprocessing and reprojection to establish an offset for reconciliation with the single-state plane coordinate system standardized by the Kentucky Office of Geographic Information. The actual process is summarized in Table X3.1.

Table S.1. Coordinate Conversion Protocol

1. Obtain the *.wld file for the site
2. Copy the file to the same directory as the dxf or dwg file
3. Rename the wld file to match the dxf or dwg file
    a. Copy / Paste / Rename the wld file for each file you have to convert
4. Open ArcMap and start a new map document
5. Add the files to be converted
6. In ArcMap
    a. View
    b. Data Frame Properties
    c. Coordinate System tab
7. Select
    a. Projected Coordinate Systems
    b. State Plane
    c. NAD 1983 (feet)
    d. NAD 1983 StatePlane Kentucky South FIPS 1602 (feet)
8. Click Apply and OK
9. Right-click each layer in the table of contents (iteratively, not simultaneously)
    1. Data
    2. Export Data
10. For "Use the same coordinate system as" select "the data frame"
11. Select a destination and filename
12. Click OK

The virtual world created in CityScape was exported to a format that could be interpreted by the Unity3D gaming engine. The Unity3D gaming engine was used to create still shots, animations, and fly-through videos of the scenarios. Unity3D also has the ability to create an online game. The game could be viewed through a web browser with the Unity3D Web Player add-on installed. This would allow the end user to interact with the scenarios in a four dimensional space similar to World of Worldcraft.

APPENDIX T: PUBLIC SCENARIOS MEETING PRESENTATION (WITH SCENARIOS)

PGDP Future Vision Project

KRCEE

UK

Kentucky Water Research Institute

www.paducahvision.com

Why We Are Here

- Future PGDP Plant Closing Anticipated
  - Loss of existing jobs
  - Cleanup questions
- Entire Region Affected
- Many Possible Future Uses for Site
- Our Job: Gather Your Preferences for a Future Vision
- Our Method: Show and Discuss a Wide Range of Hypothetical Futures and Then Solicit Your Rating for Each One
- Compile your Preferences in a report for the community and DOE

Origin and Use of the Scenarios

- The land uses and cleanup options contained in these scenarios arose from conversations with people from across the community, with very different histories and relationships with the plant. They represent a very broad range of possible outcomes, and so each may be strongly favored by some and strongly opposed by others.
- Thank you for taking the time to help us with this important work.

What We Will Do Tonight

- Discuss land uses and cleanup options
- Show and discuss twelve hypothetical scenarios
- When you are ready, you will rate them with keypads
- Discuss your ratings
- You tell us how we did tonight
- You get to go home! (or stay and talk)
- Time goal: 2 hours or less
- Bonus Round! Talk about specific land uses in more detail and have you rate those

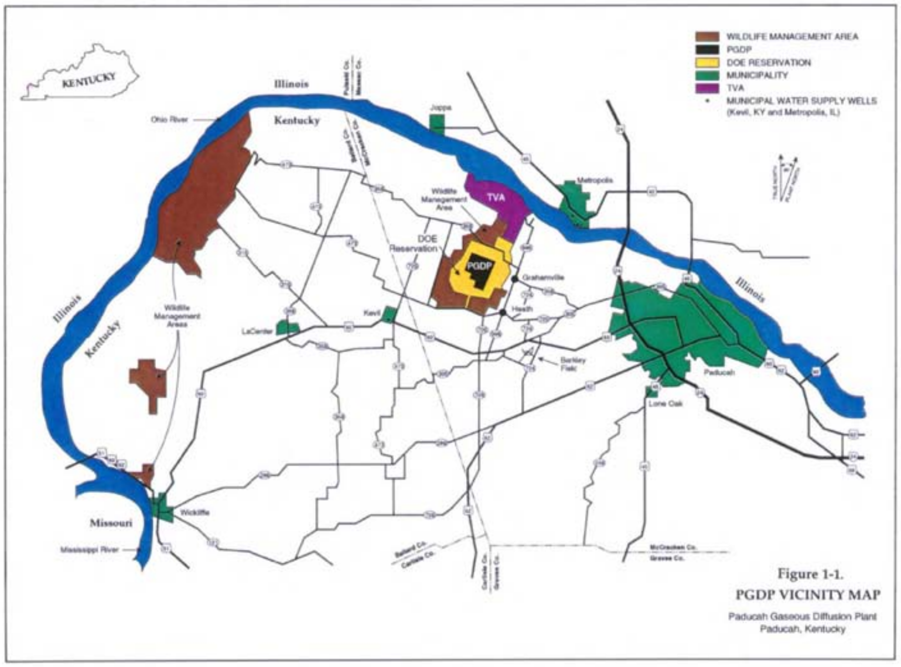


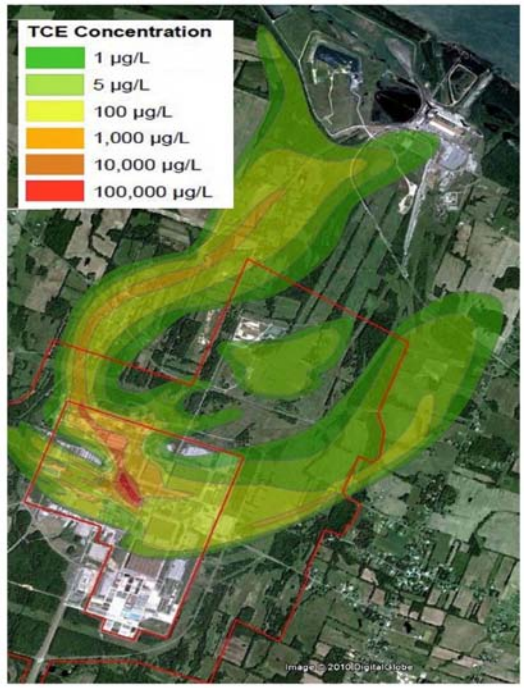
Figure 1-1.
PGDP VICINITY MAP
Paducah Gaseous Diffusion Plant
Paducah, Kentucky

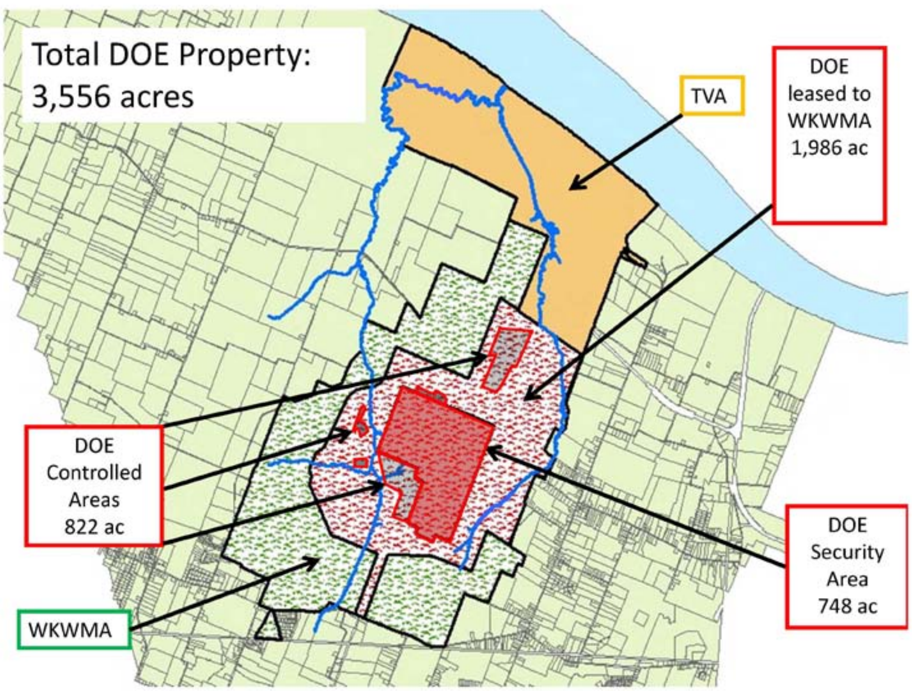
Environmental Impacts

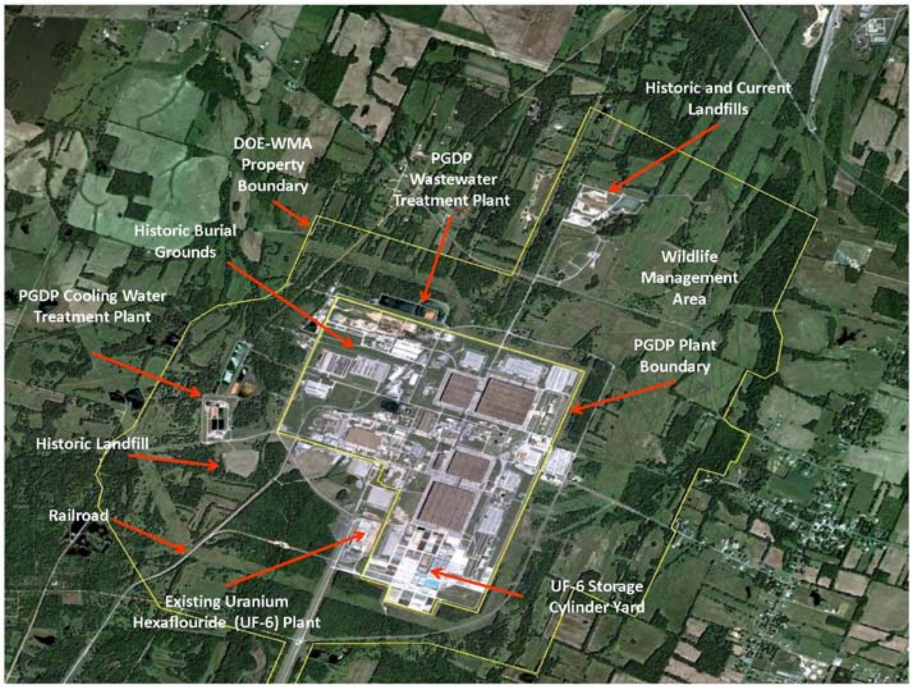
- Groundwater Plumes
  - TCE
  - Tc99
- Burial Grounds
- Contaminated Soils and Sediments
  - Radioactive Metals
  - Heavy Metals
  - PCBs

Environmental Cleanup

- Controlled by federal laws (e .g. CERCLA, RCRA)
- Managed by DOE
- Oversight by USEPA, KYEEC and KYCFHS







Breakdown of Scenarios Options

1. Land Uses for the Actual PGDP Plant Site:
   – 750 acres
2. Land Uses for the PGDP property currently part of the surrounding Wildlife Management Area
   – 2,000 acres
3. Disposal Options for the "Burial Grounds"
4. Disposal Options for the Plant Decommissioning Wastes
5. Disposal Options utilizing existing landfills

PGDP Plant Site Land Use Options

1. Nuclear Industry (eg. Power, Recycling)
2. Heavy Industry (eg. Steel, Auto, Coal Gas/Liquid Plant)
3. Light Industry (eg. Distribution Center, Data Server Farm)
4. Passive Recreation (State Park)
5. Expanded Wildlife Management Area
6. Permanent Site Closure

PGDP Wildlife Management Area Land Use Options

1. Structured Recreation (Fairgrounds, Soccer Fields)
2. Expanded Wildlife Management Area

Burial Grounds Options

1. Excavate Part

2. Excavate All

Burial Ground Contents

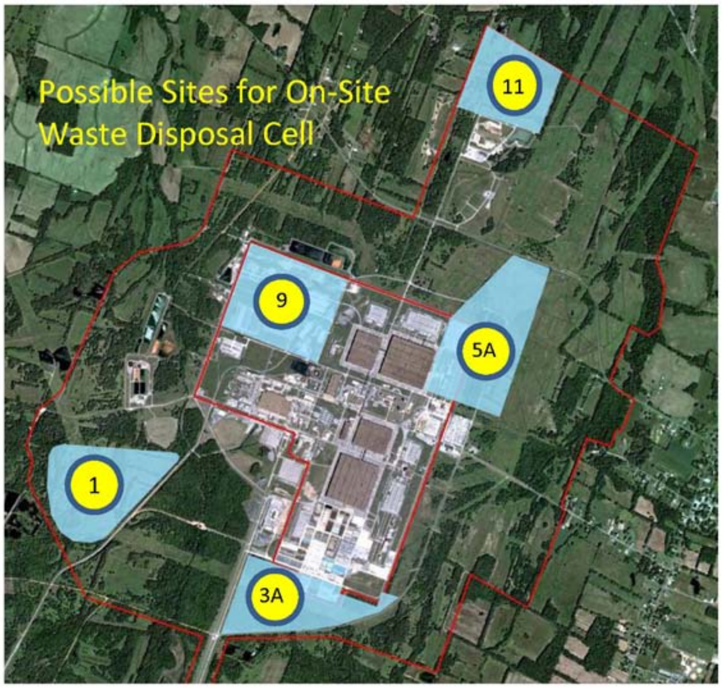
1. Uranium
2. TCE
3. Tc-99
4. Contaminated metals
5. Demolition debris
6. Heavy metals
7. Asbestos
8. Arsenic
9. Trash
10. Oils
11. etc.

Plant Decommissioning Waste Disposal Options

1. All Plant Decommissioning Waste Removed from Site

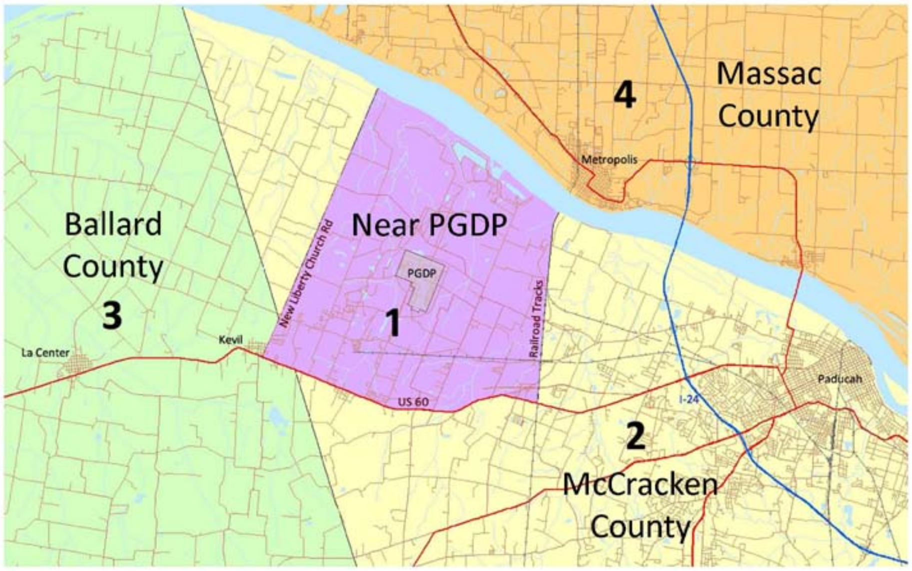
2. Part of Plant Decommissioning Waste kept onsite in WDA and part placed in DOE managed Landfill

3. All Plant Decommissioning Waste kept onsite in WDA



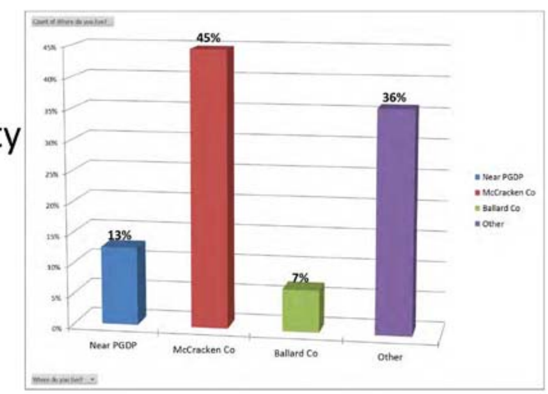
RF Keypad System

Where do you live?



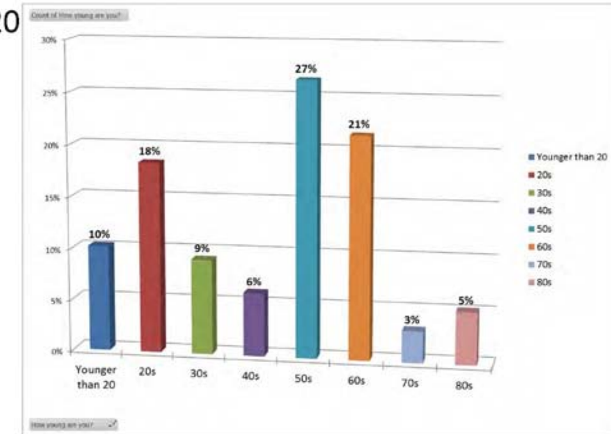
Where do you live?

1. Near PGDP
2. McCracken County
3. Ballard County
4. Massac County
5. Other



How young are you?

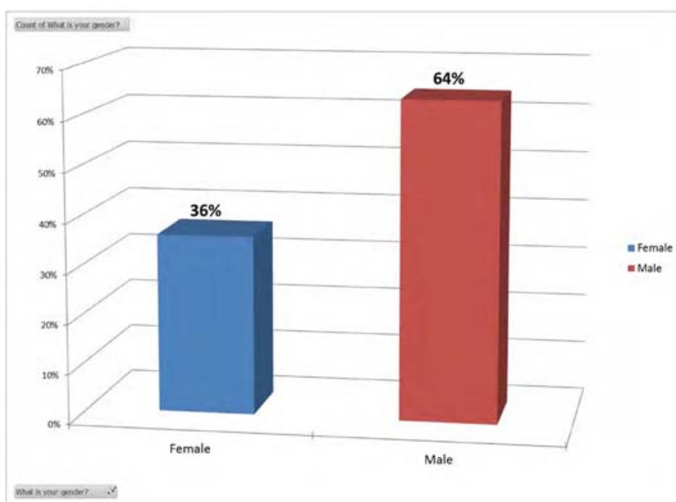
1. Younger than 20
2. 20 - 29
3. 30 - 39
4. 40 - 49
5. 50 - 59
6. 60 - 69
7. 70 - 79
8. 80 - 89
9. 90 or older



Mean = 43

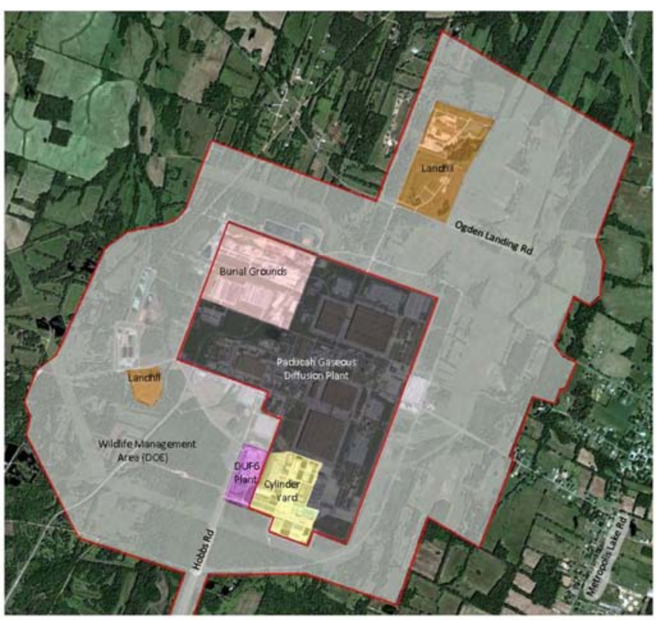
What is your gender?

1. Female
2. Male



PGDP Views

1. Panorama from Metropolis Lake Road
2. Plant site from southern boundary
3. Over Hobbs Road from south
4. From northwest overlooking burial grounds



Current:

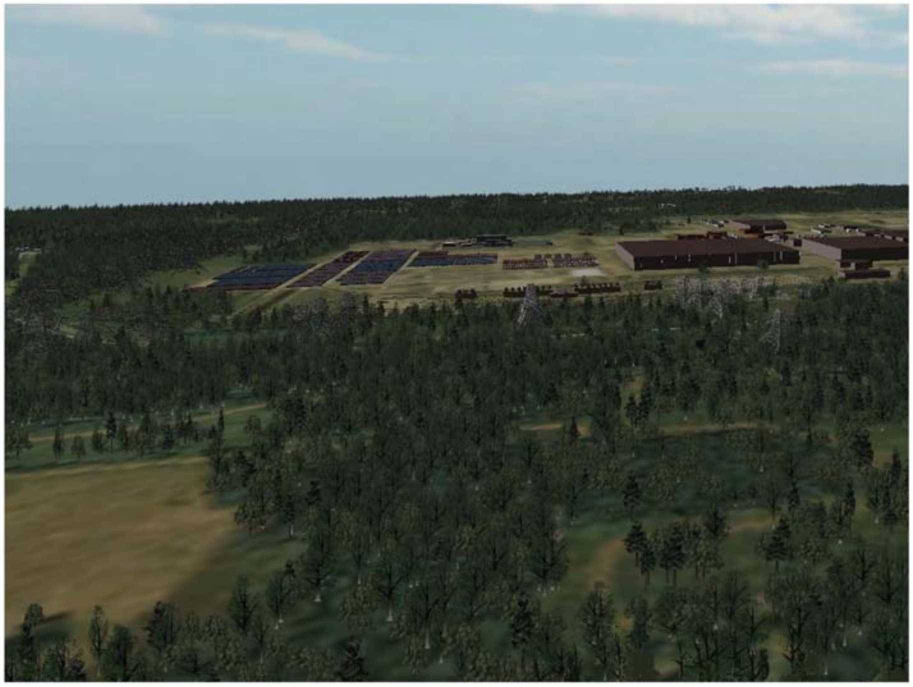
*DUF6 Flouride Extraction Plant

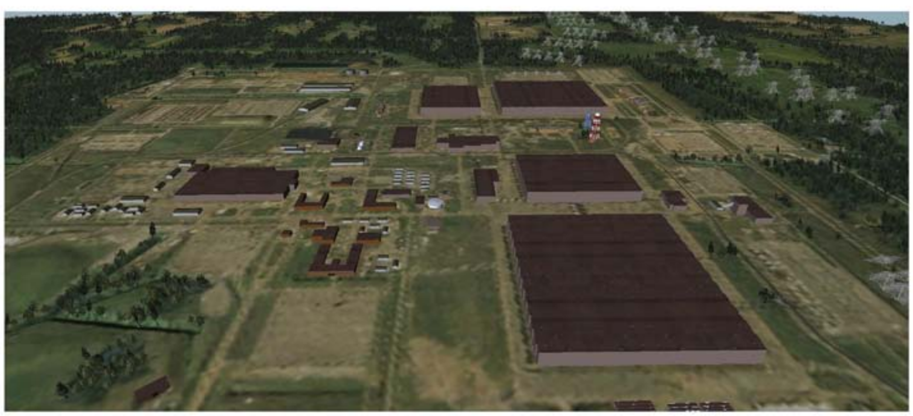
*Cylinder Yard

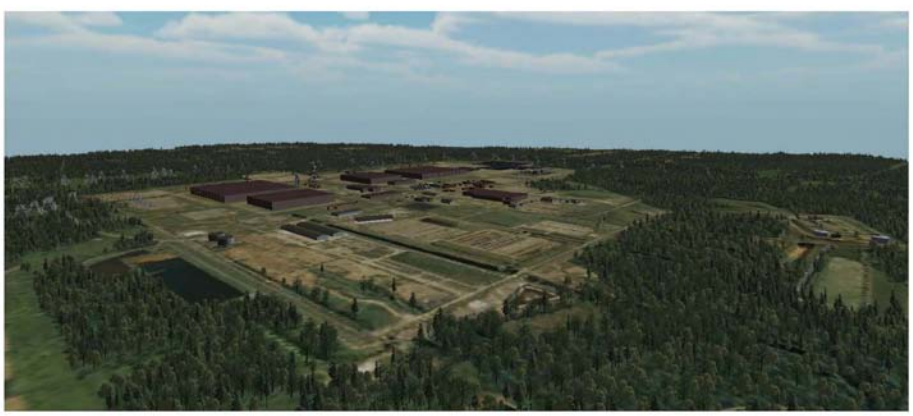
*Plant Site surrounded by WMA

*Burial Ground Area - site of older buried waste of many kinds

*Designed Landfills – site of newer buried wastes







Scenario 12

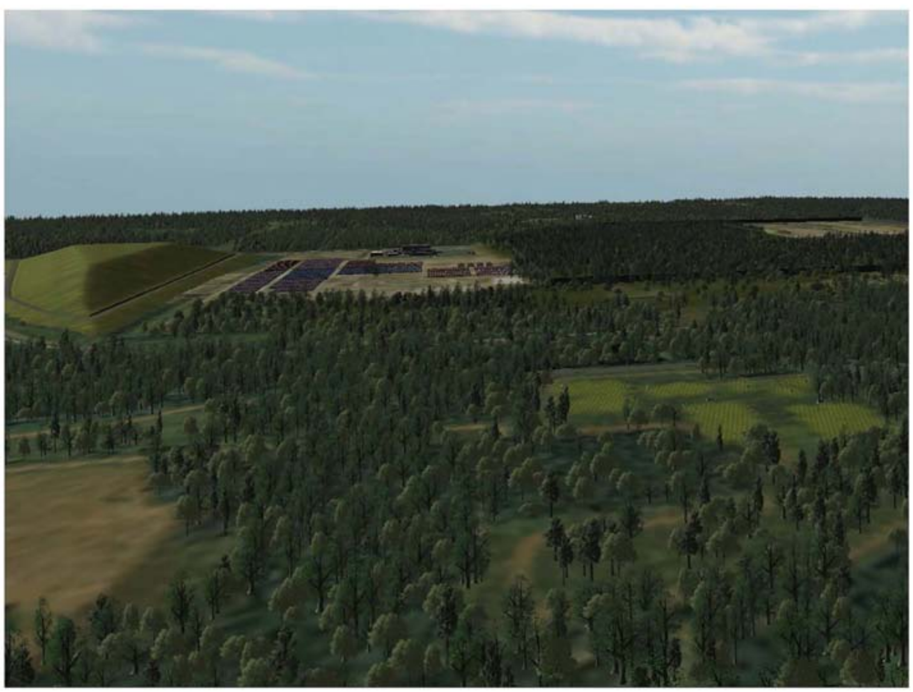
*Plant Site sealed, fenced, access restricted

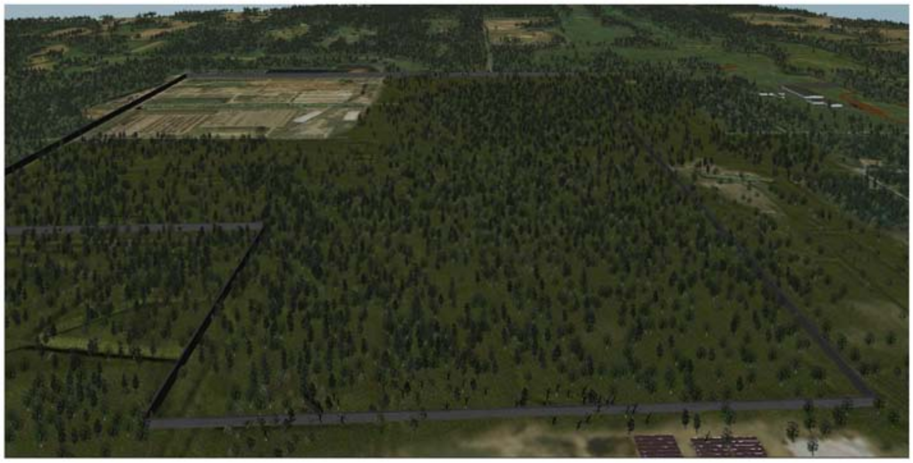
* Active Recreational Facilities added to PGDP WMA

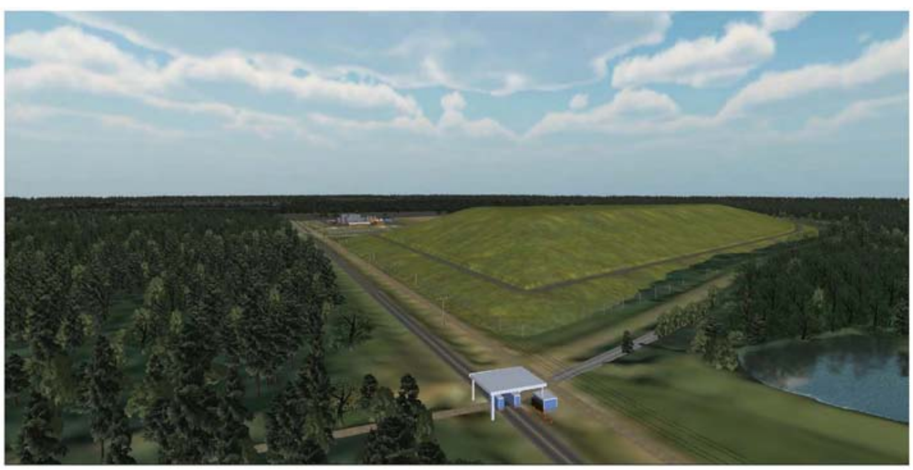
NOTE: Rec facilities shown in the same location for consistency. Actual location can vary!

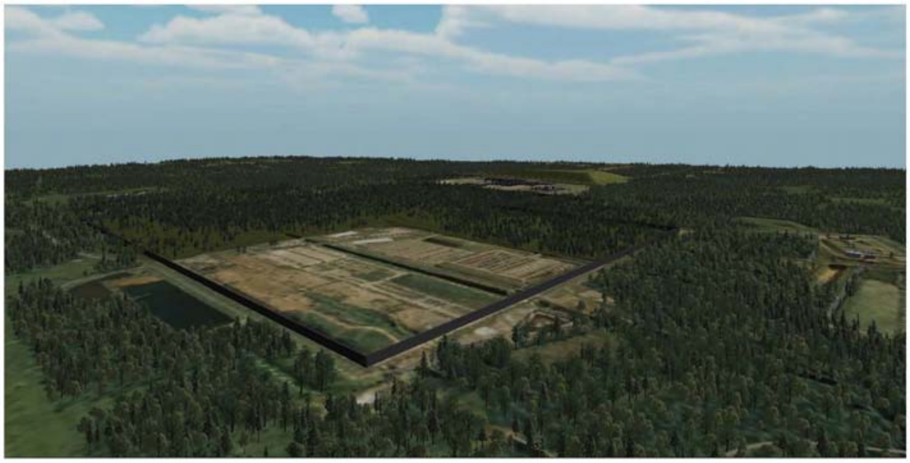
* All Plant Decommissioning Waste kept onsite in WDA

* Some existing Burial Grounds sealed and left in place, the rest put in WDA.









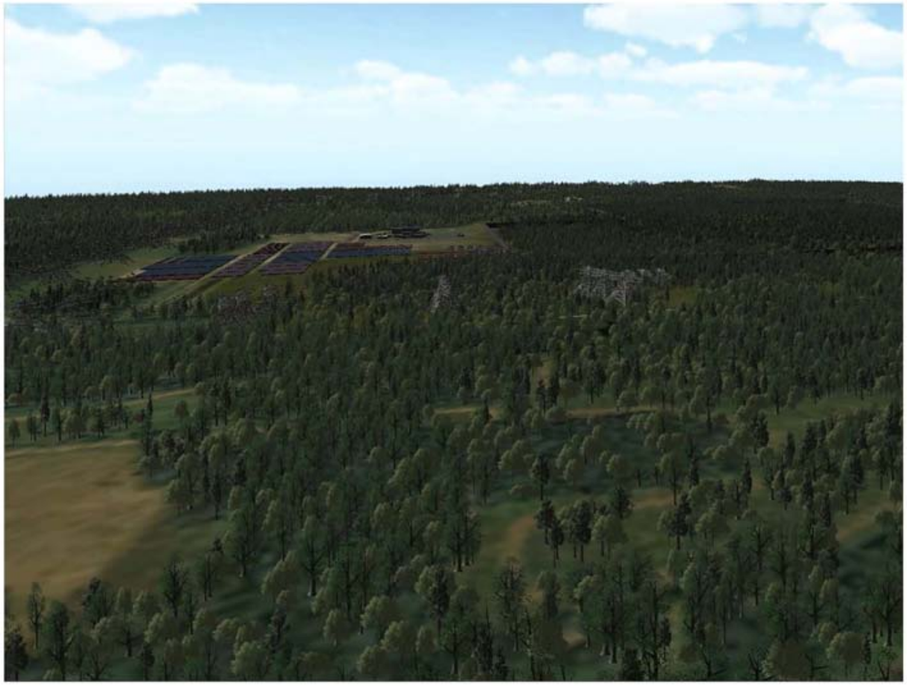
Scenario 11

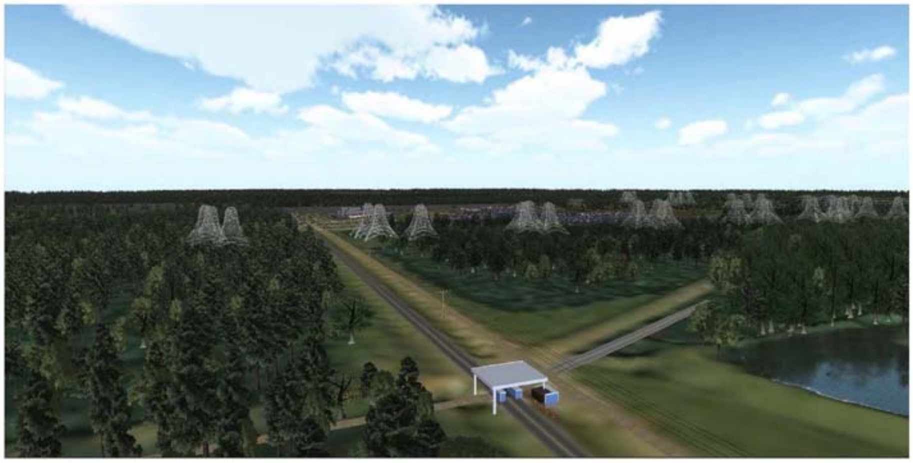
*Plant Site sealed, fenced, access restricted

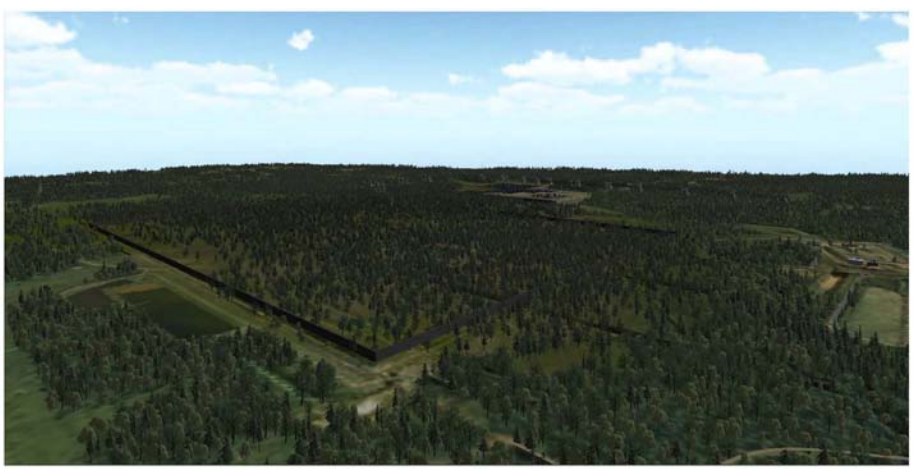
* PGDP WMA Remains

* All Plant Decommissioning Waste Removed from Site.

* All existing Burial Grounds excavated and shipped off-site.







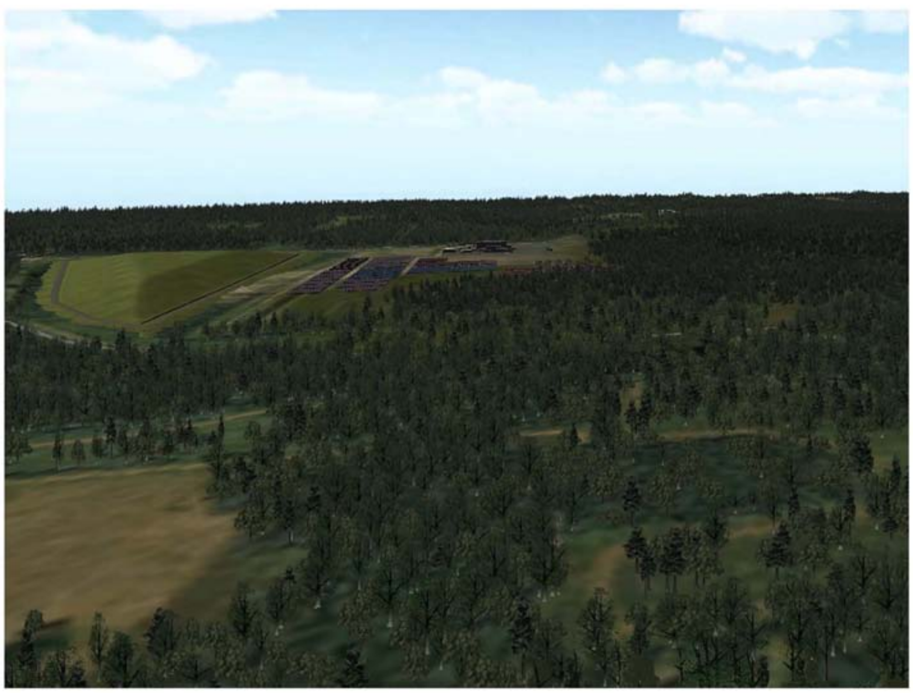
Scenario 10

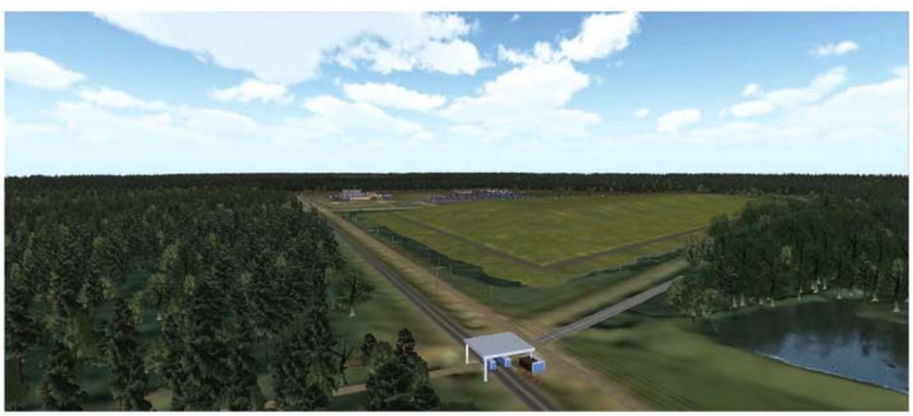
*Expanded Wildlife Management on Plant Site

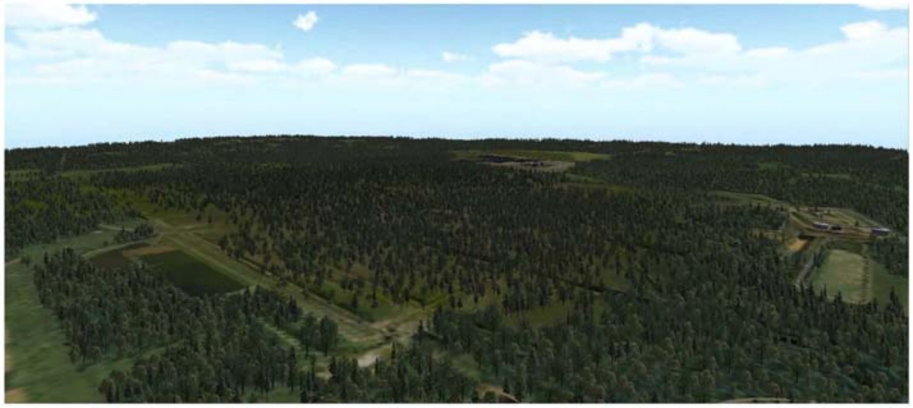
* PGDP WMA Remains

* Part of Plant Decommissioning Waste kept onsite in WDA and part placed in DOE managed landfill

* All existing Burial Grounds excavated - some placed in WDA and the rest shipped off-site.







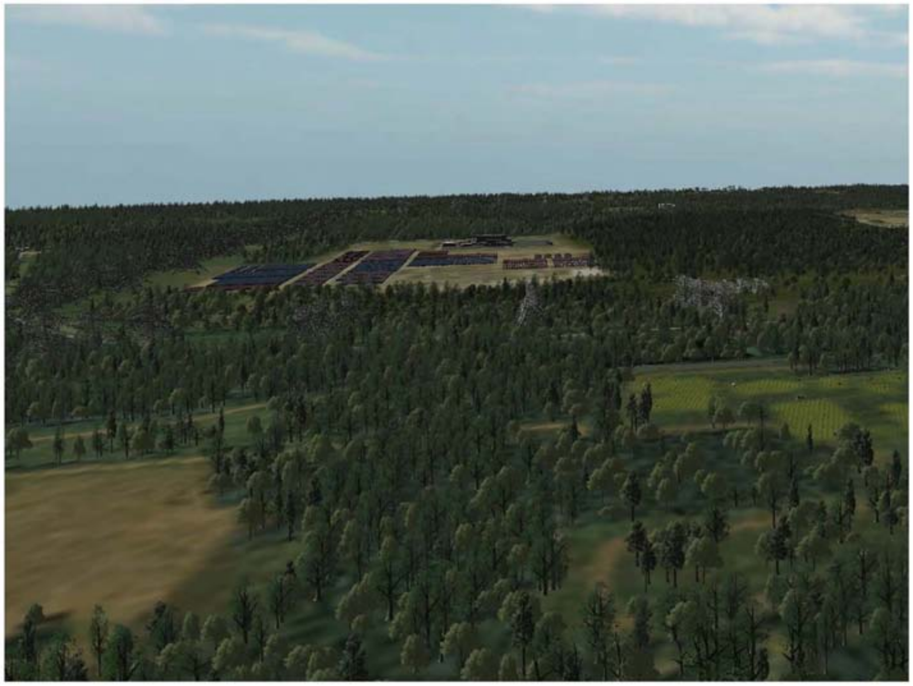
Scenario 9

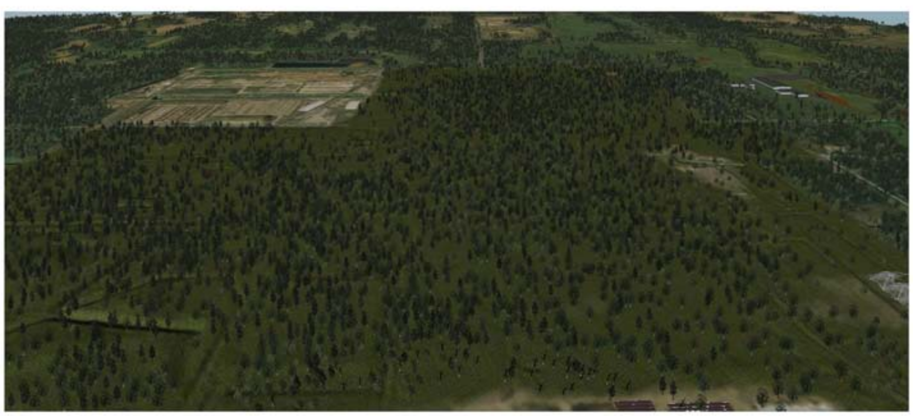
*Expanded Wildlife Management on Plant Site

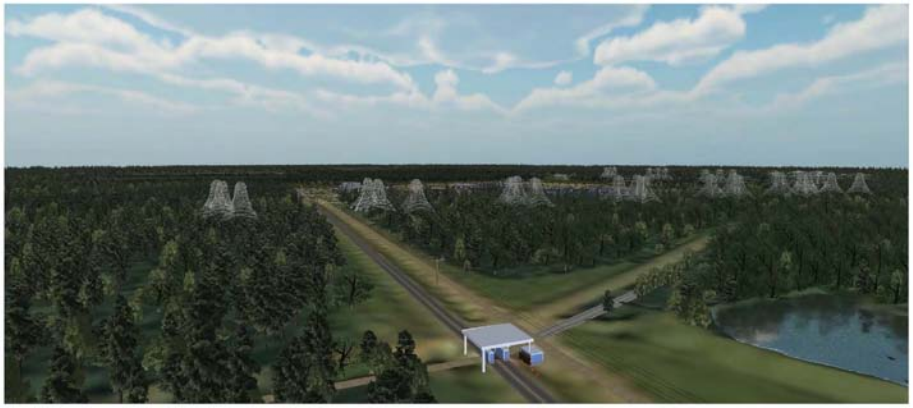
* Recreational Facilities added to PGDP WMA

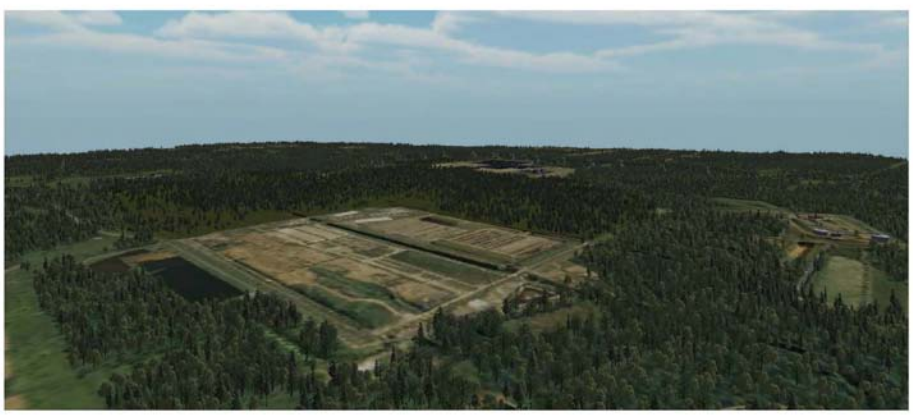
* All Plant Decommissioning Waste Removed from Site.

* Some existing Burial Grounds sealed and left in place, the rest excavated and shipped off-site.









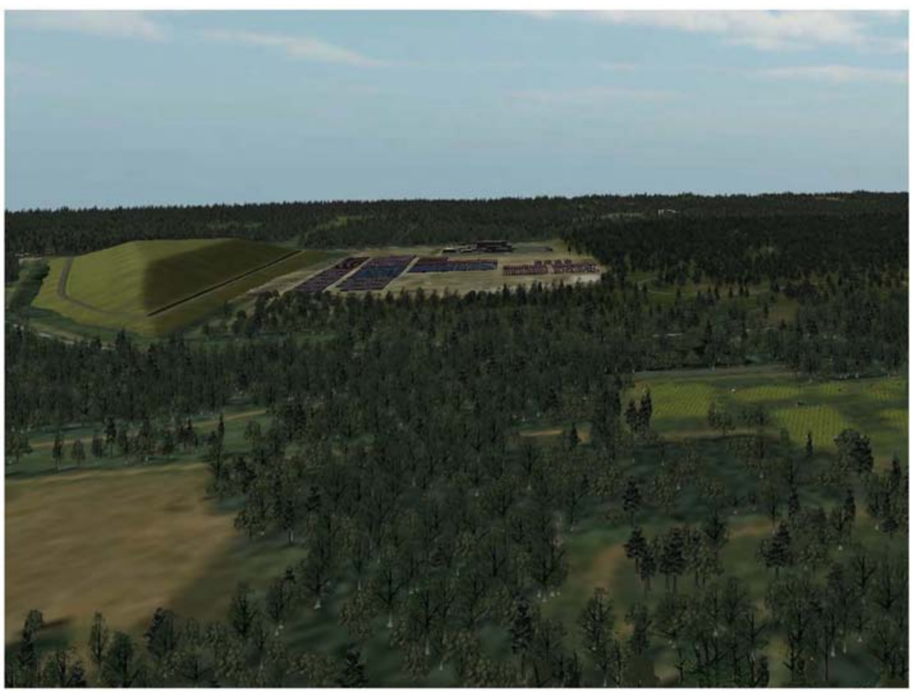
Scenario 8

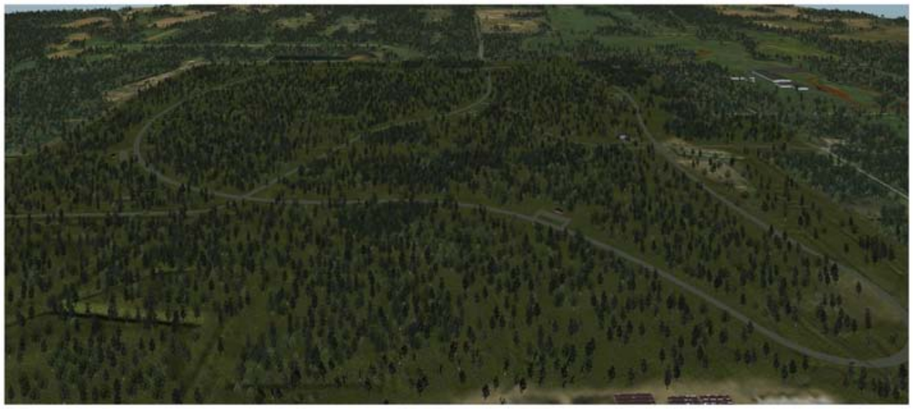
* Passive Recreational Facilities on Plant Site

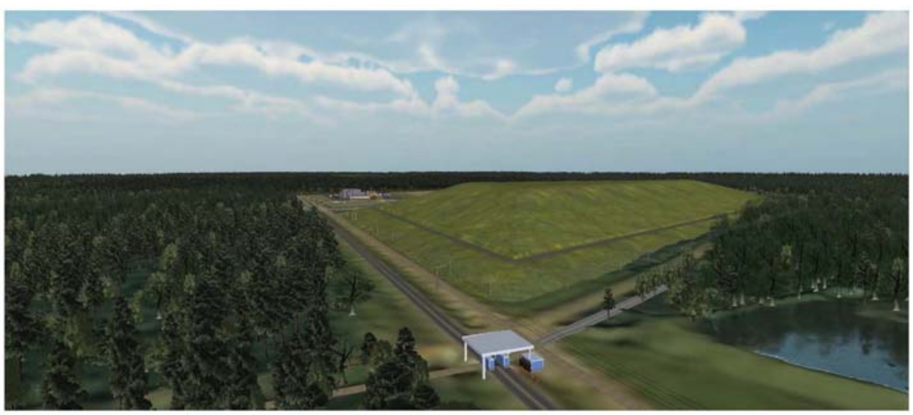
* Active Recreational Facilities added to PGDP WMA

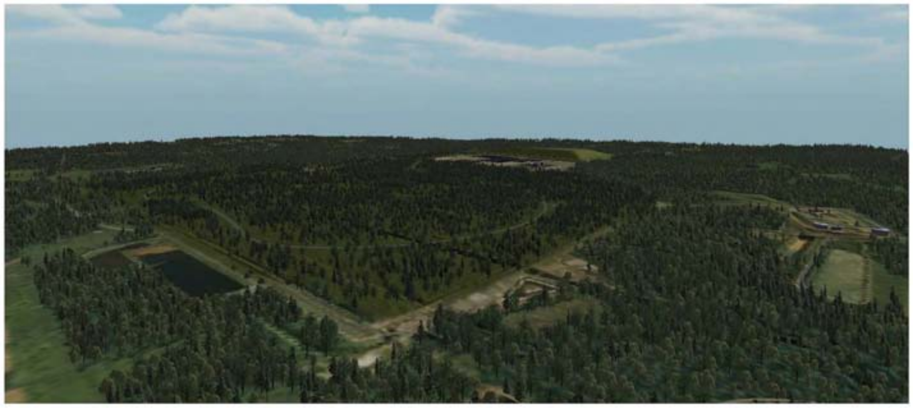
* All Plant Decommissioning Waste kept onsite in WDA

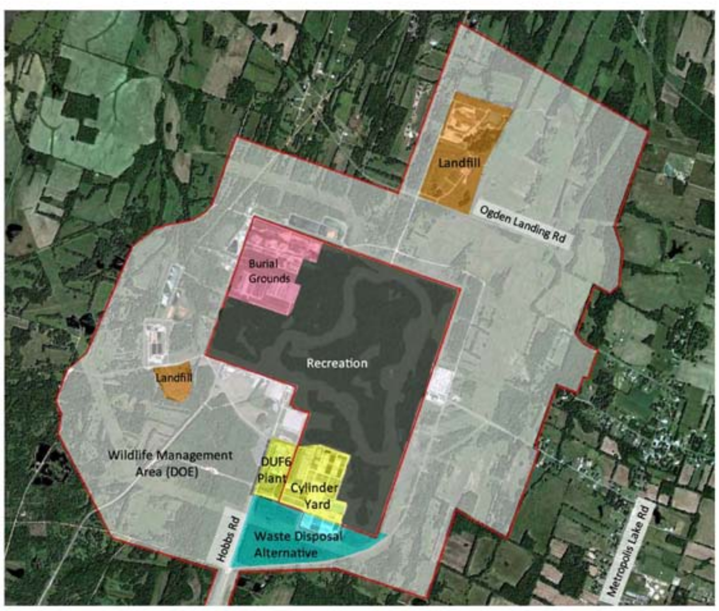
* All Existing Burial Grounds excavated, some placed in the WDA and the rest shipped off-site.











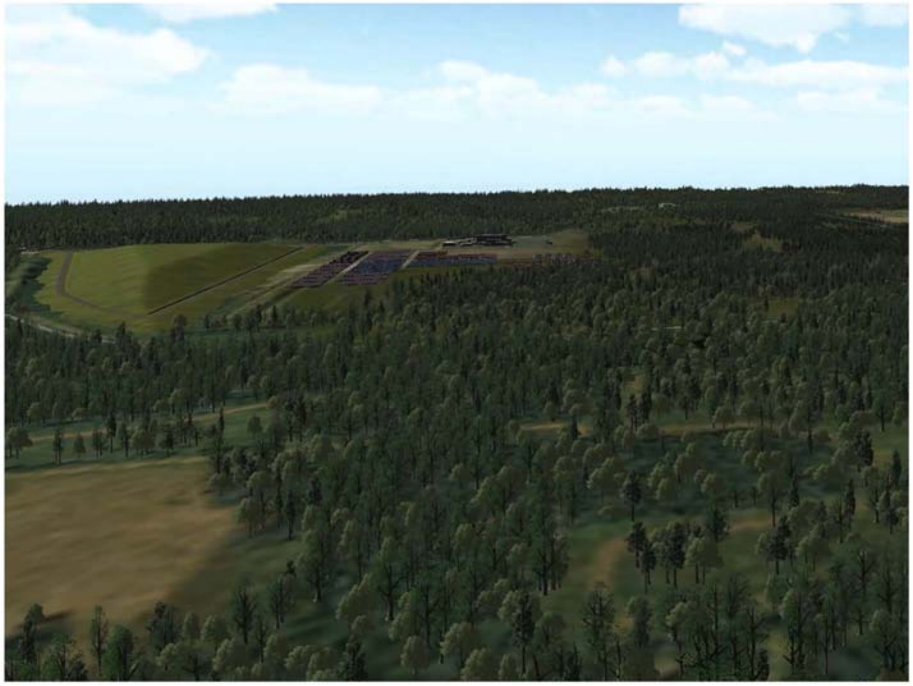
Scenario 7

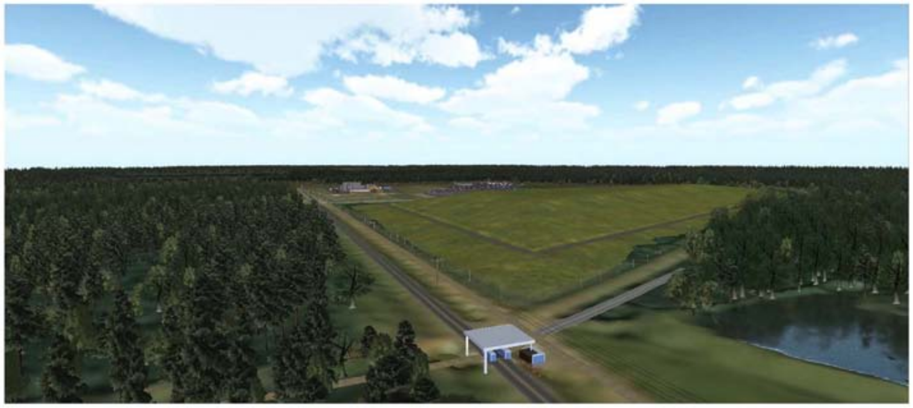
*Passive Recreational Facilities on Plant Site

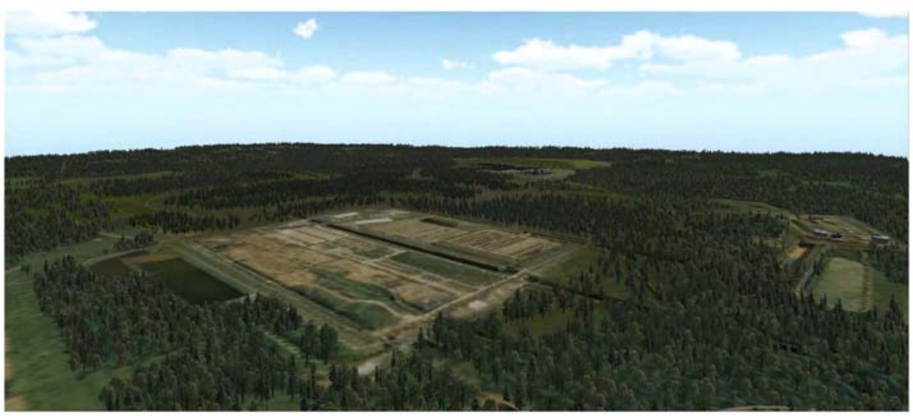
* PGDP WMA Remains

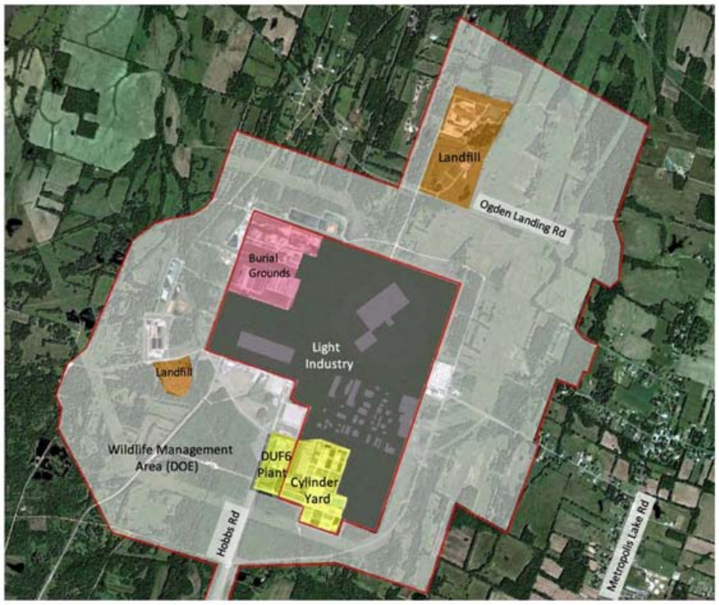
*Part of Plant Decommissioning Waste kept onsite in WDA and part placed in DOE managed Landfill

* Some existing Burial Grounds sealed and left in place, the rest put in WDA.









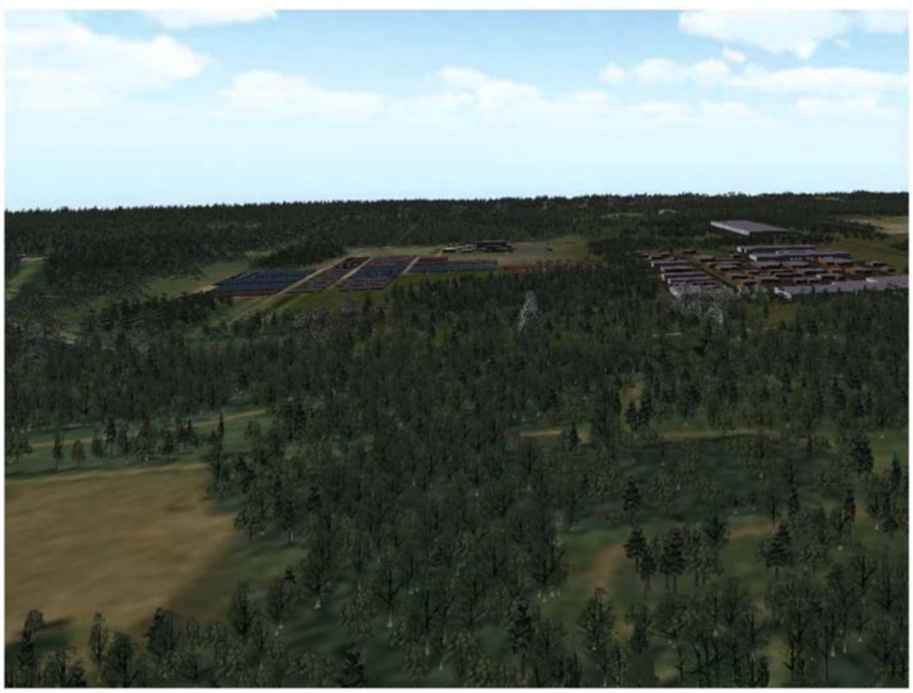
Scenario 6

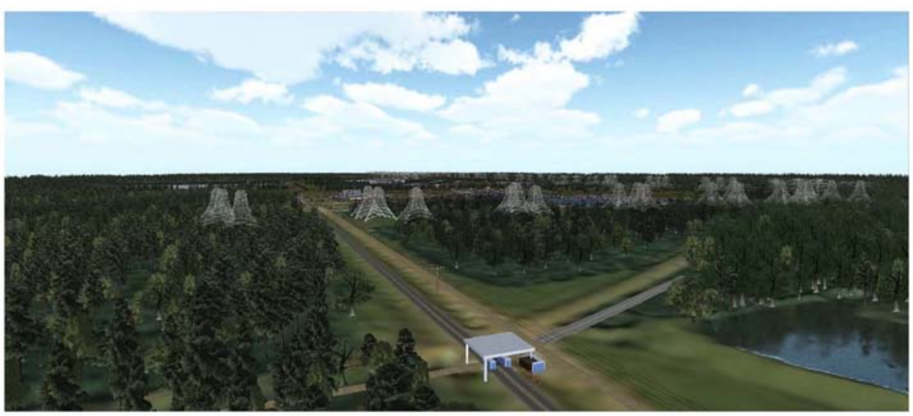
*Light Industry on Plant Site

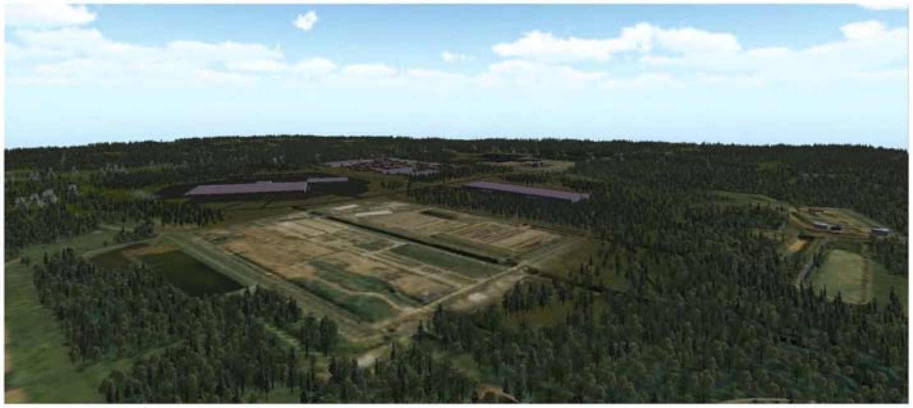
* PGDP WMA Remains

* All Plant Decommissioning Waste Removed from Site.

* Some existing Burial Grounds sealed and left in place, the rest are excavated and shipped off-site







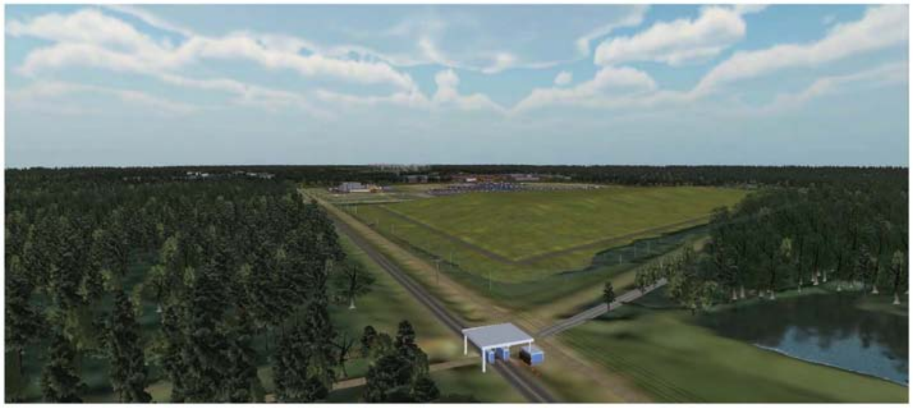
Scenario 5

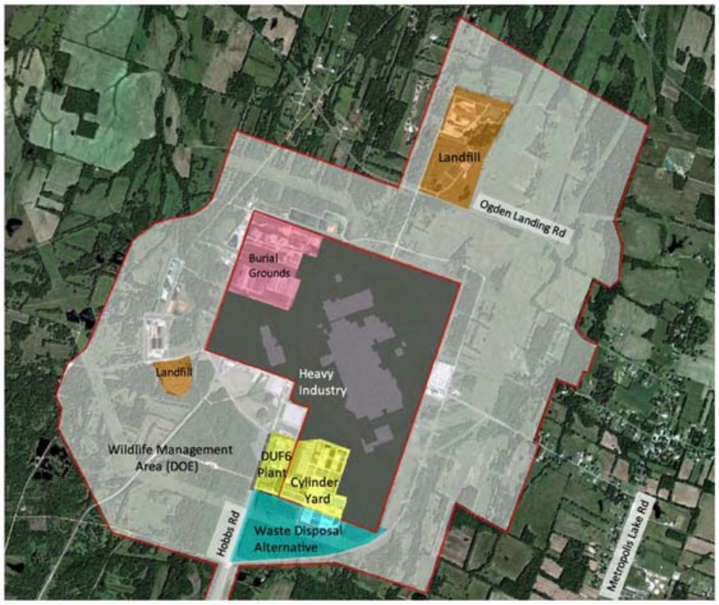
*Light Industry on Plant Site

* Active Recreational Facilities added to PGDP WMA

* Part of Plant Decommissioning Waste kept onsite in WDA and part placed in managed Landfill

* All Existing Burial Grounds excavated, some placed in the WDA and the rest shipped off-site.





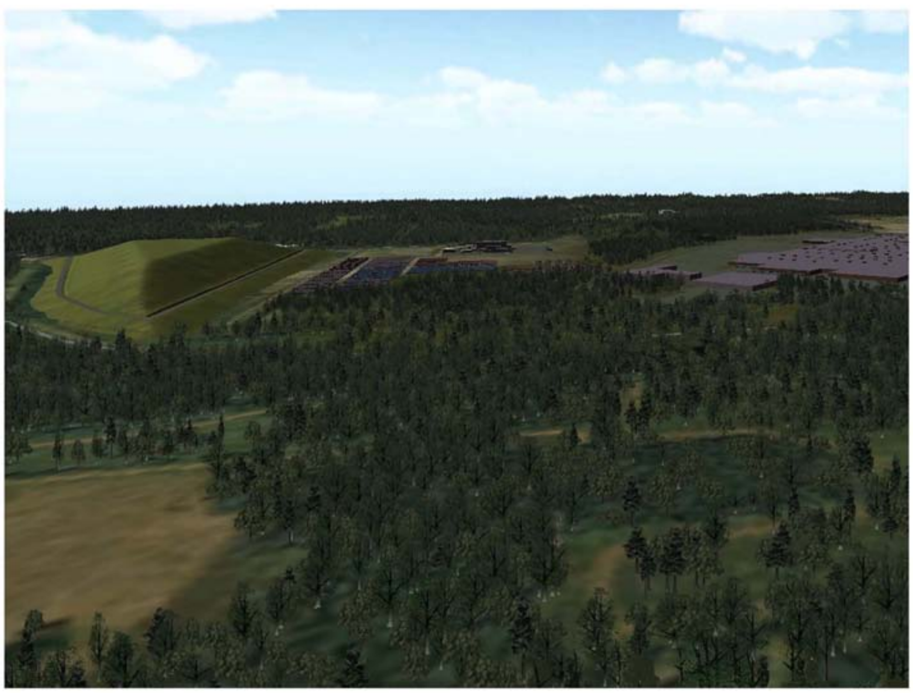
Scenario 4

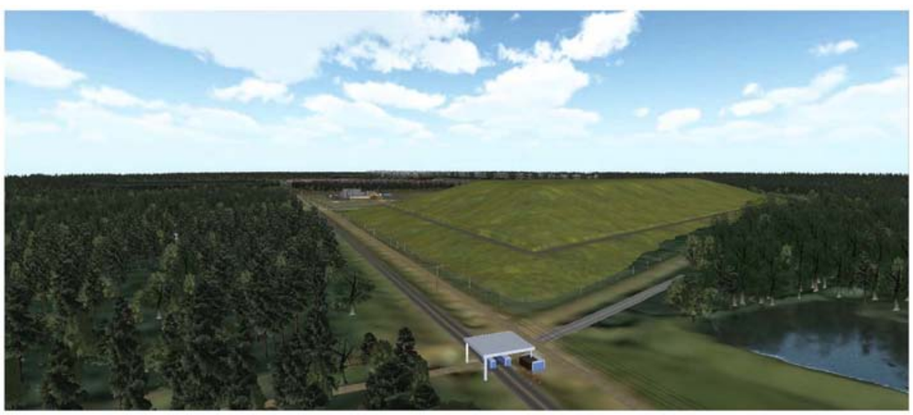
*Heavy Industry on Plant Site

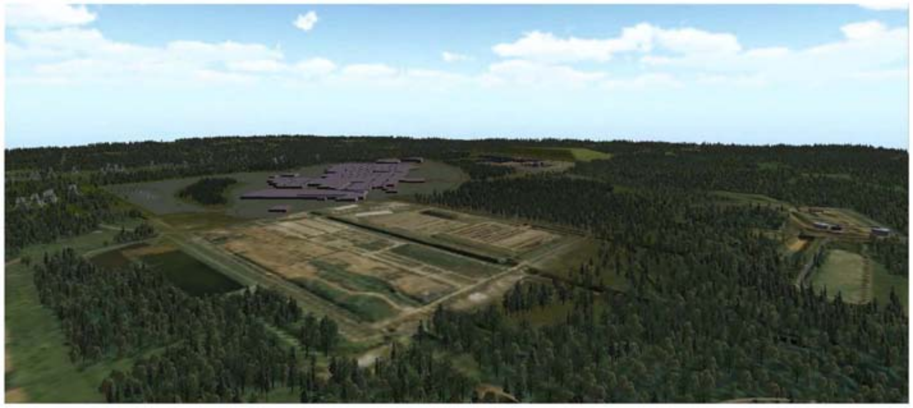
* PGDP WMA Remains

* All Plant Decommissioning Waste kept onsite in WDA

* Some existing Burial Grounds sealed and left in place, the rest excavated placed in WDA.







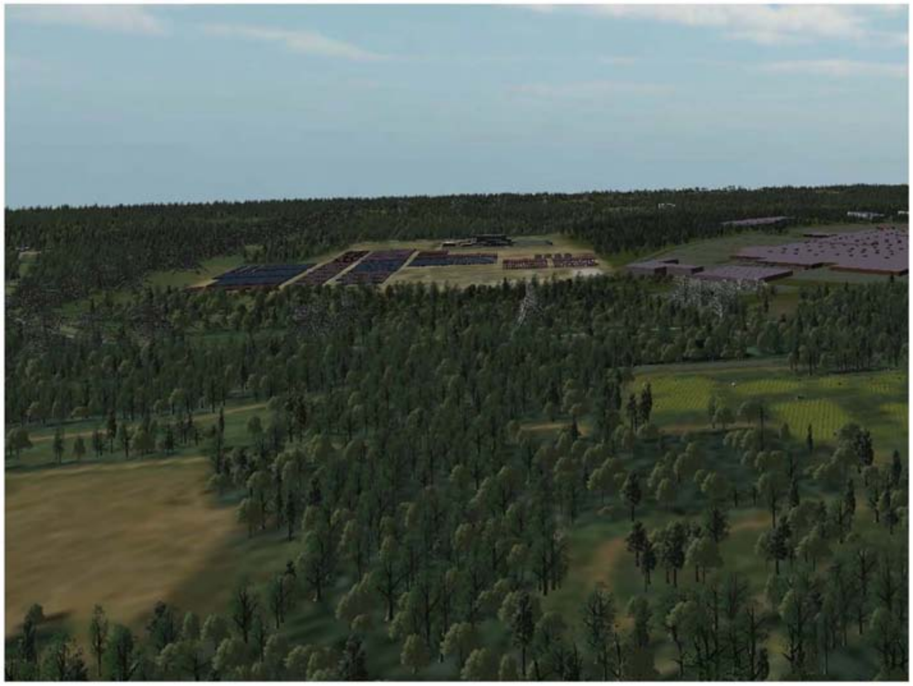
Scenario 3

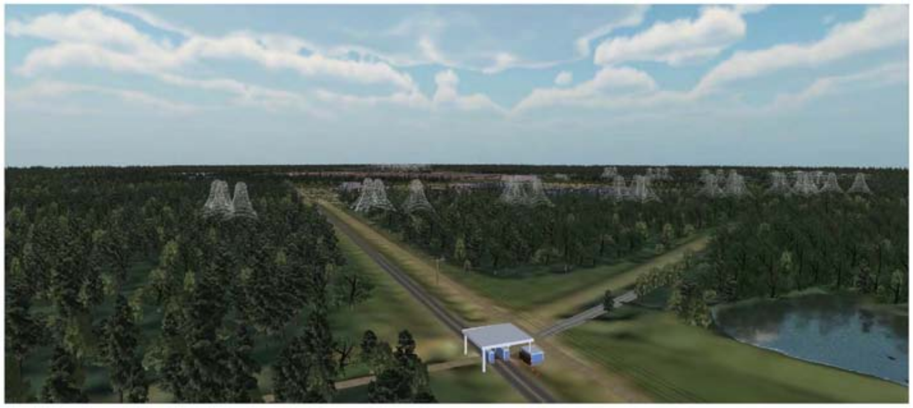
*Heavy Industry on Plant Site

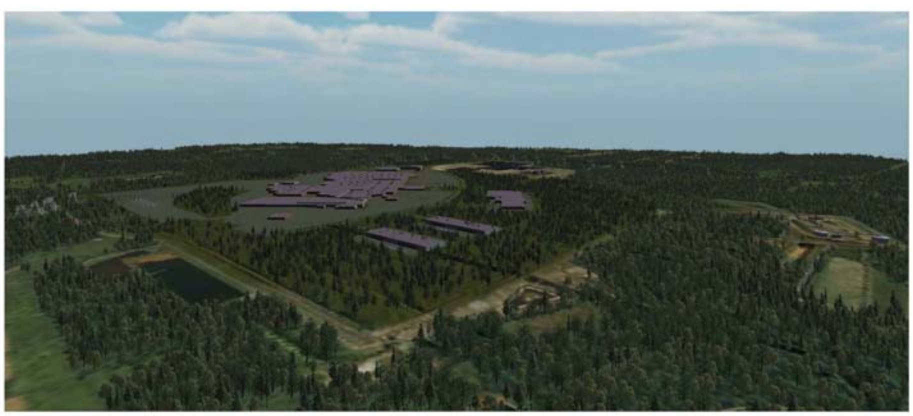
* Active Recreational Facilities added to PGDP WMA

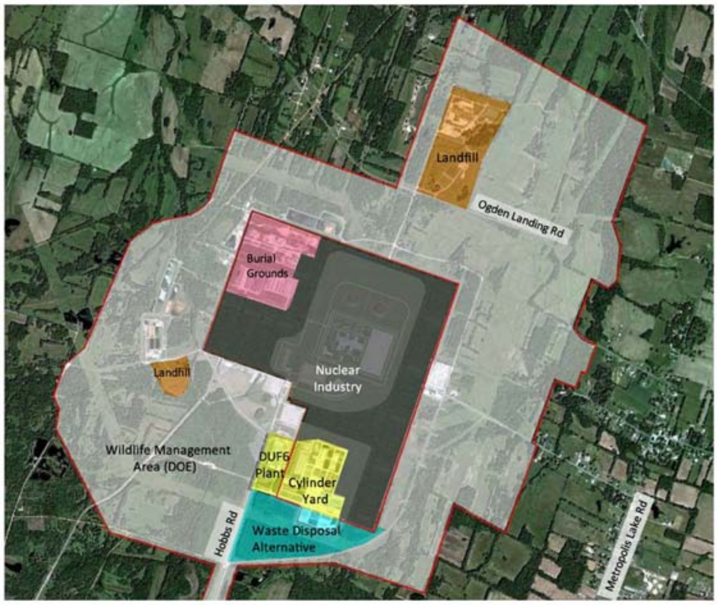
*All Plant Decommissioning Waste Removed from Site

*All Existing Burial Grounds excavated and shipped off-site.









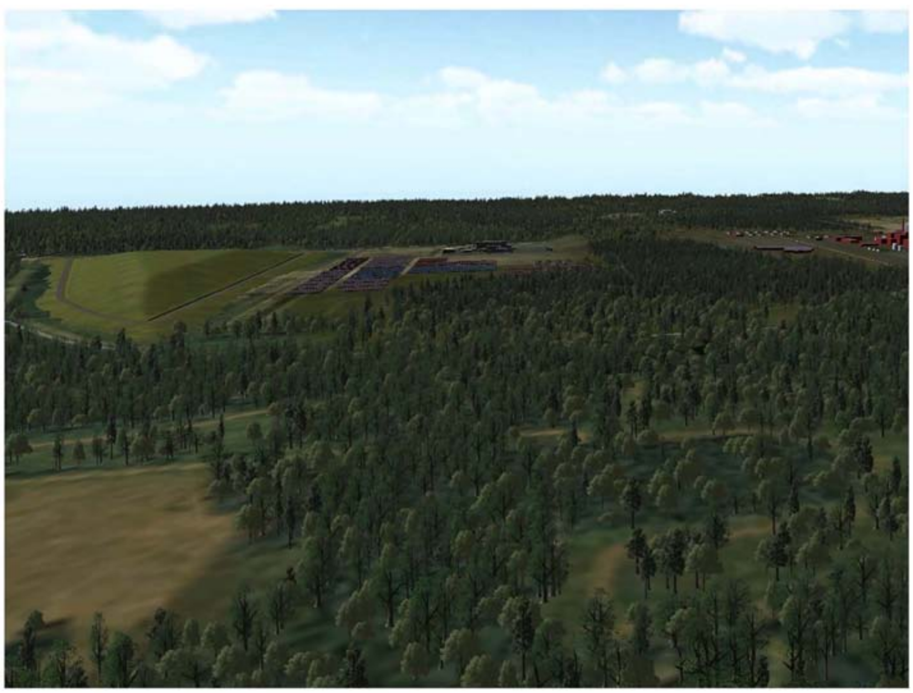
Scenario 2

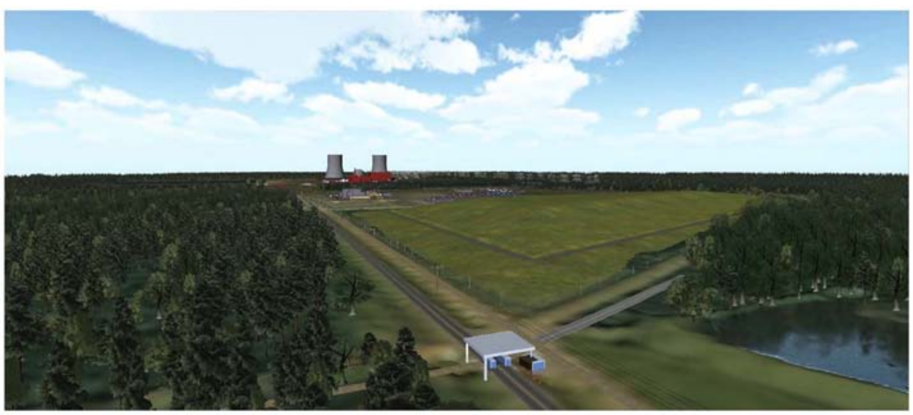
*Nuclear Industry on Plant Site

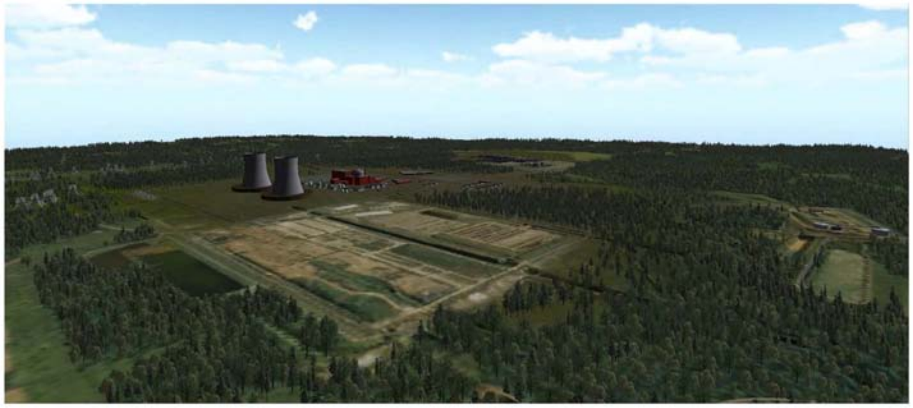
* PGDP WMA Remains

* Part of Plant Decommissioning Waste kept onsite in WDA and part placed in DOE managed Landfill

* Some existing Burial Grounds sealed and left in place, the rest excavated placed in WDA.







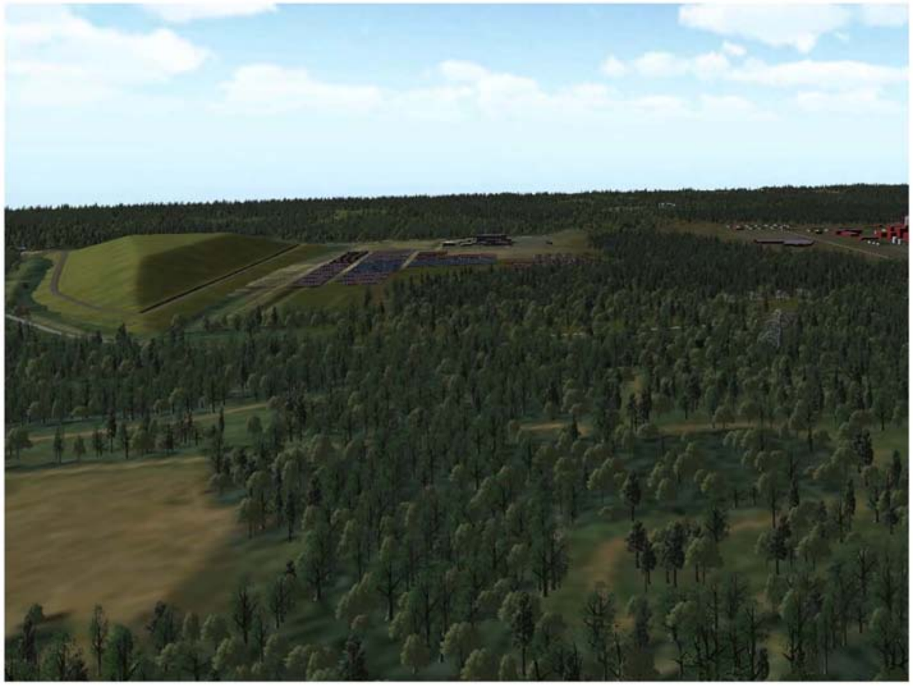
Scenario 1

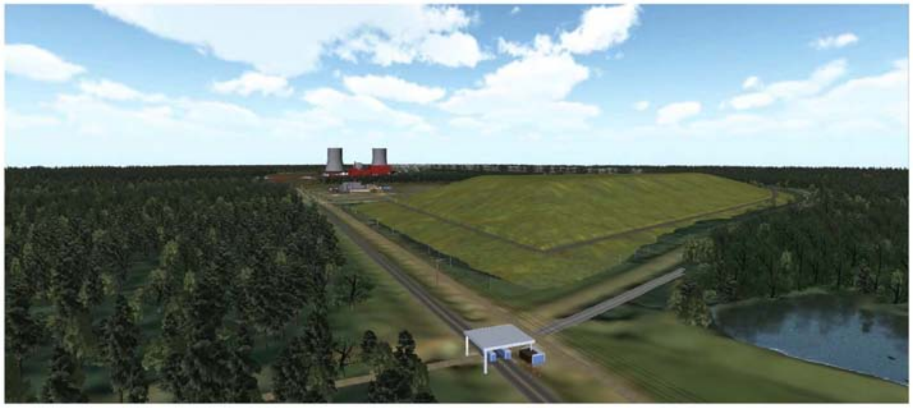
*Nuclear Industry on Plant Site

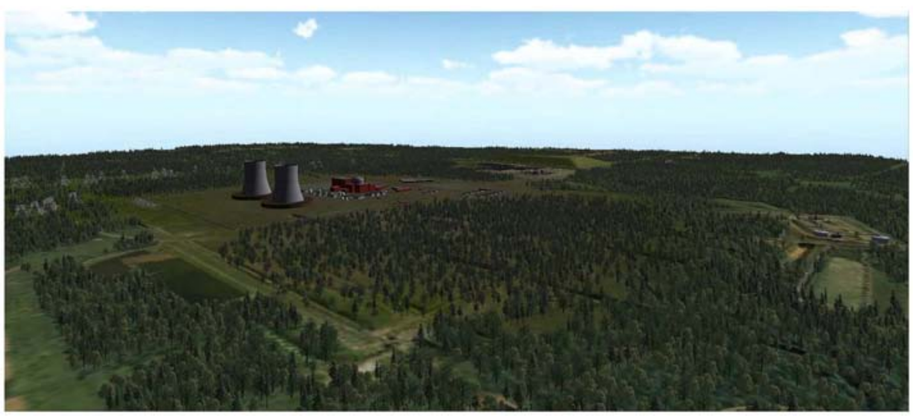
* PGDP WMA Remains

*All Plant Decommissioning Waste kept onsite in WDA

* All Existing Burial Grounds excavated, some placed in the WDA and the rest shipped off-site.

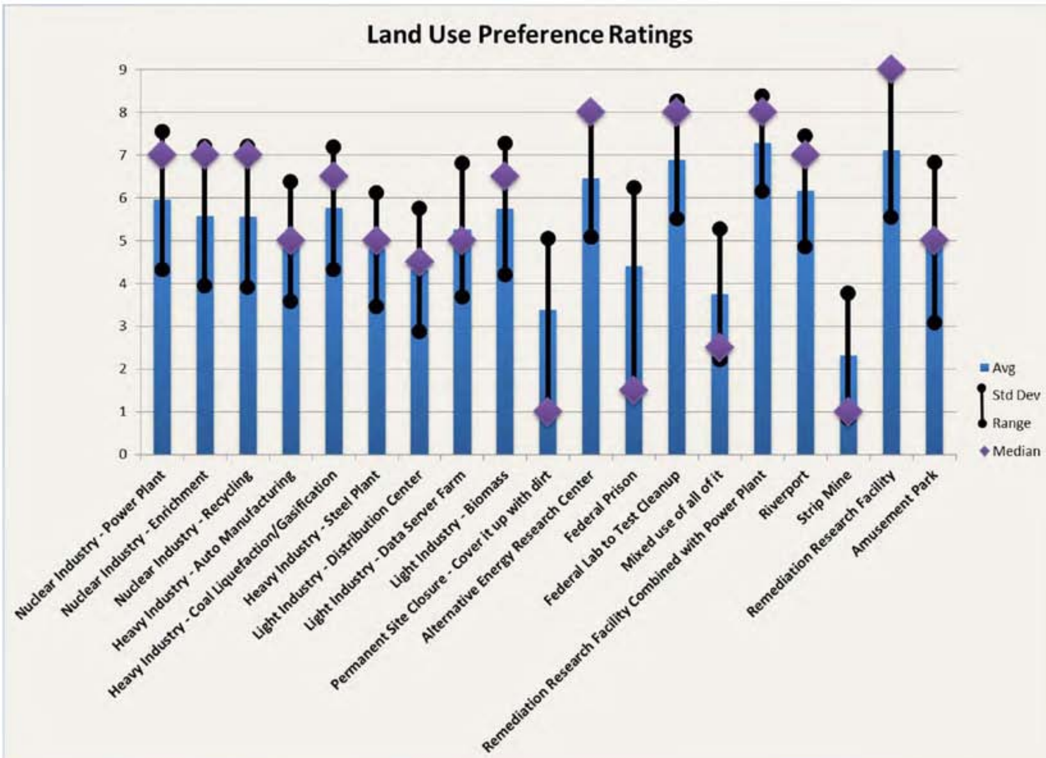






Score these scenarios

APPENDIX U: PUBLIC SCENARIOS MEETINGS AGGREGATE RESULTS



Scenario 12

*Plant Site sealed, fenced, access restricted

* Active Recreational Facilities added to PGDP WMA

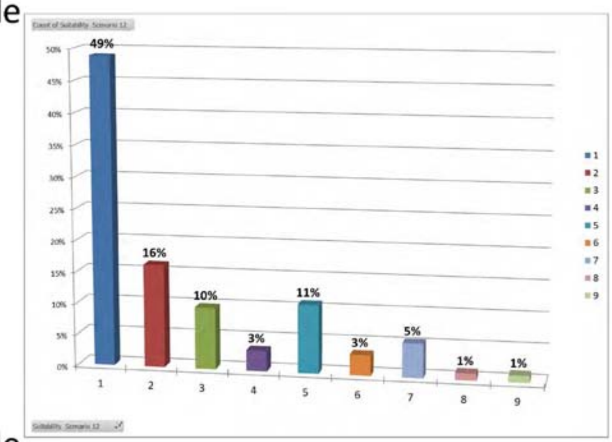
NOTE: Rec facilities shown in the same location for consistency. Actual location can vary!

* All Plant Decommissioning Waste kept onsite in WDA

* Some existing Burial Grounds sealed and left in place, the rest put in WDA.

Suitability Scenario 12

1. Least suitable
2. ...
3. ...
4. ...
5. ...
6. ...
7. ...
8. ...
9. Most suitable



StdDev = 2.05

Mean = 2.54

Scenario 11

*Plant Site sealed, fenced, access restricted

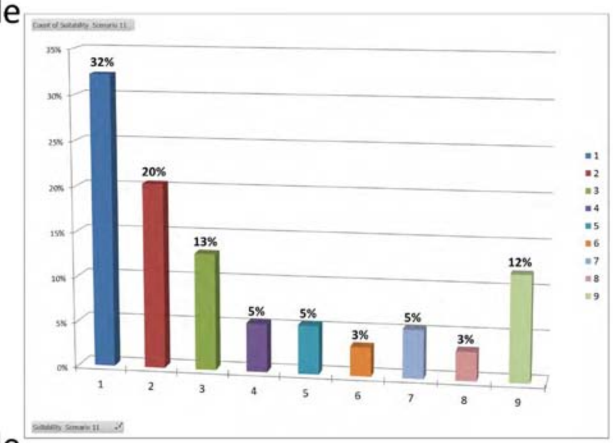
* PGDP WMA Remains

* All Plant Decommissioning Waste Removed from Site.

* All existing Burial Grounds excavated and shipped off-site.

Suitability Scenario 11

1. Least suitable
2. ...
3. ...
4. ...
5. ...
6. ...
7. ...
8. ...
9. Most suitable



StdDev = 2.78

Mean = 3.49

Scenario 10

*Expanded Wildlife Management on Plant Site

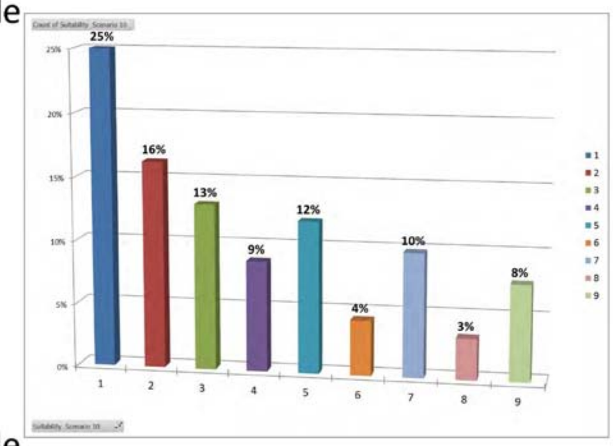
* PGDP WMA Remains

* Part of Plant Decommissioning Waste kept onsite in WDA and part placed in DOE managed landfill

* All existing Burial Grounds excavated - some placed in WDA and the rest shipped off-site.

Suitability
Scenario 10

1. Least suitable
2. ...
3. ...
4. ...
5. ...
6. ...
7. ...
8. ...
9. Most suitable



StdDev = 2.57

Mean = 3.80

Scenario 9

*Expanded Wildlife Management on Plant Site

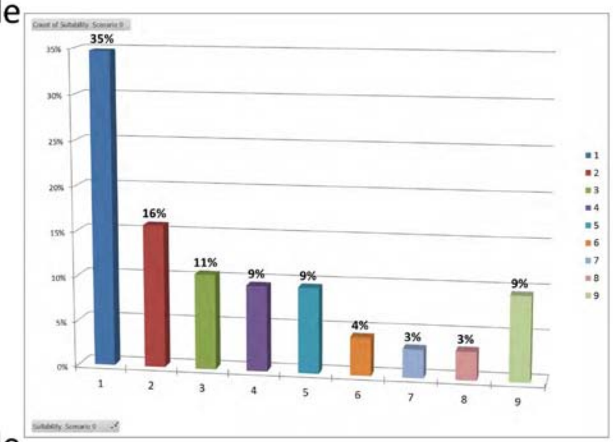
* Recreational Facilities added to PGDP WMA

* All Plant Decommissioning Waste Removed from Site.

* Some existing Burial Grounds sealed and left in place, the rest excavated and shipped off-site.

Suitability
Scenario 9

1. Least suitable
2. ...
3. ...
4. ...
5. ...
6. ...
7. ...
8. ...
9. Most suitable



StdDev = 2.63

Mean = 3.41

Scenario 8

* Passive Recreational Facilities on Plant Site

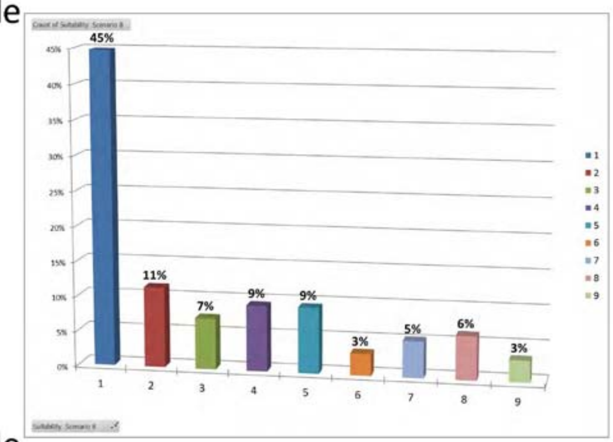
* Active Recreational Facilities added to PGDP WMA

* All Plant Decommissioning Waste kept onsite in WDA

* All Existing Burial Grounds excavated, some placed in the WDA and the rest shipped off-site.

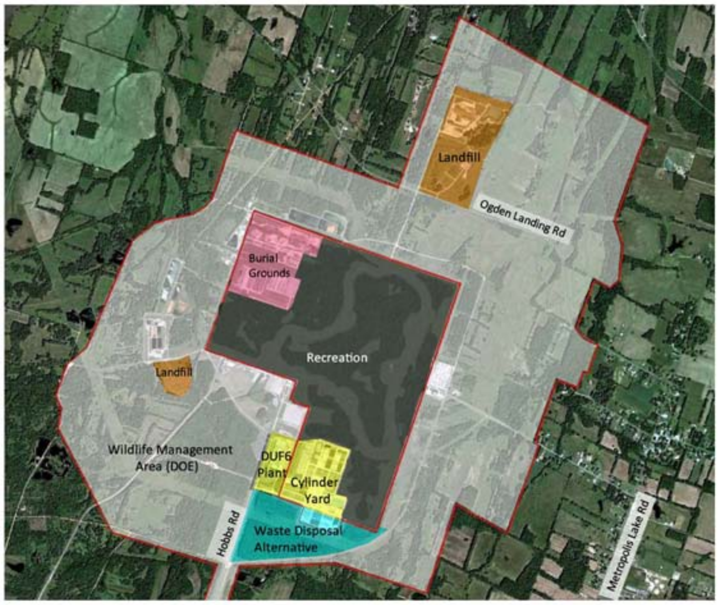
Suitability Scenario 8

1. Least suitable
2. ...
3. ...
4. ...
5. ...
6. ...
7. ...
8. ...
9. Most suitable



StdDev = 2.48

Mean = 3.07



Scenario 7

*Passive Recreational Facilities on Plant Site

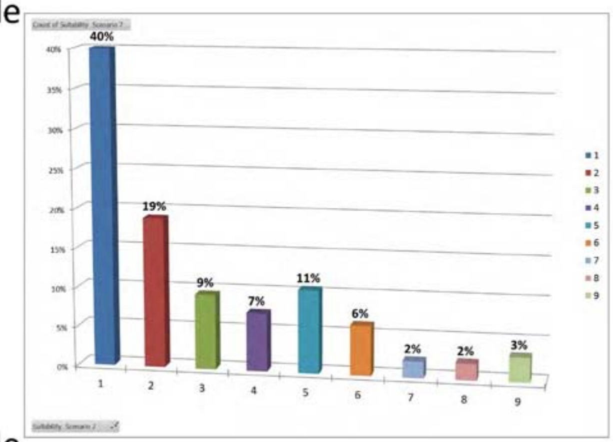
* PGDP WMA Remains

*Part of Plant Decommissioning Waste kept onsite in WDA and part placed in DOE managed Landfill

* Some existing Burial Grounds sealed and left in place, the rest put in WDA.

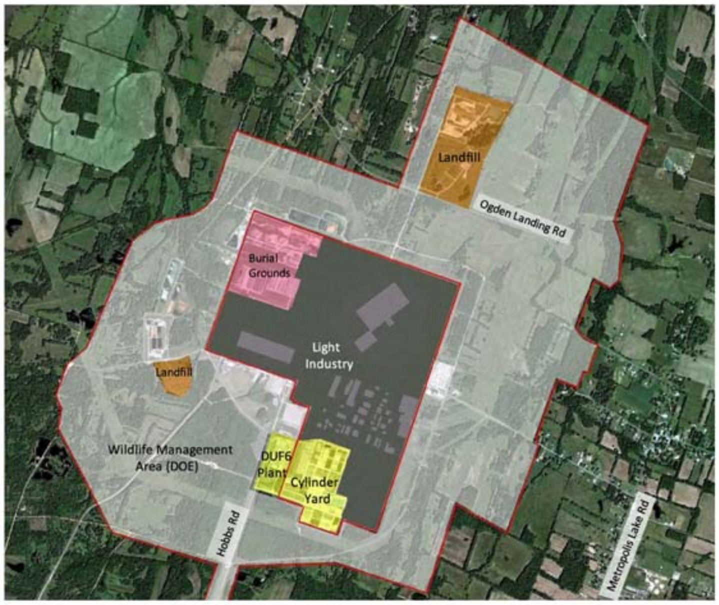
Suitability Scenario 7

1. Least suitable
2. ...
3. ...
4. ...
5. ...
6. ...
7. ...
8. ...
9. Most suitable



StdDev = 2.20

Mean = 2.86



Scenario 6

*Light Industry on Plant Site

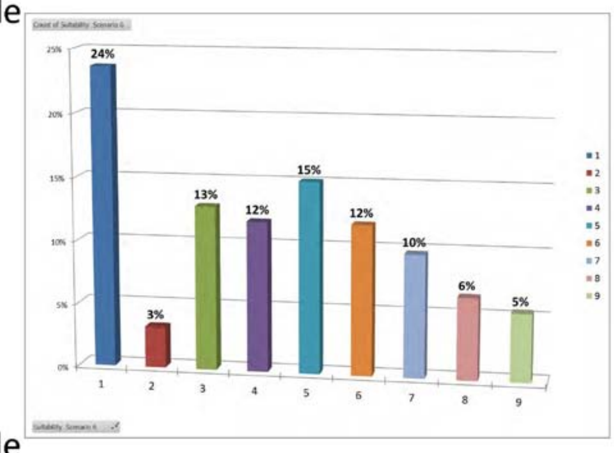
* PGDP WMA Remains

* All Plant Decommissioning Waste Removed from Site.

* Some existing Burial Grounds sealed and left in place, the rest are excavated and shipped off-site

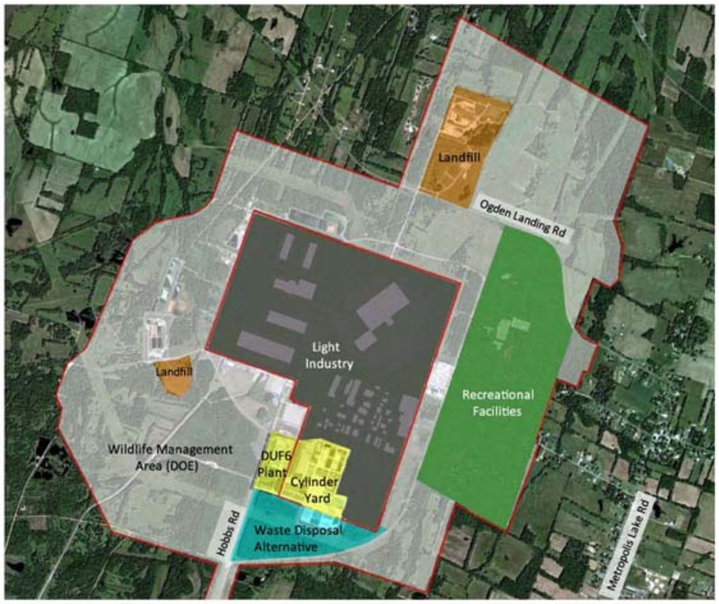
Suitability Scenario 6

1. Least suitable
2. ...
3. ...
4. ...
5. ...
6. ...
7. ...
8. ...
9. Most suitable



StdDev = 2.48

Mean = 4.30



Scenario 5

*Light Industry on Plant Site

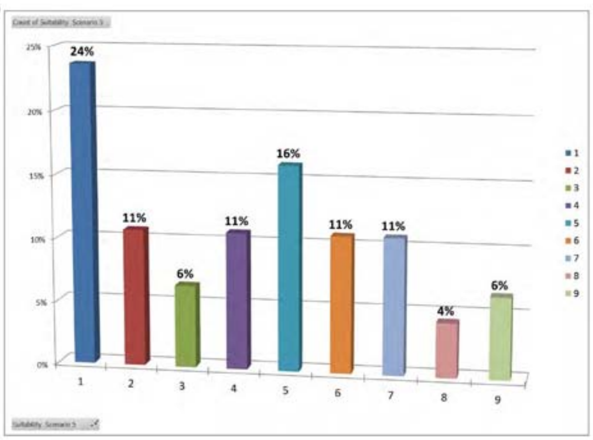
* Active Recreational Facilities added to PGDP WMA

* Part of Plant Decommissioning Waste kept onsite in WDA and part placed in managed Landfill

* All Existing Burial Grounds excavated, some placed in the WDA and the rest shipped off-site.

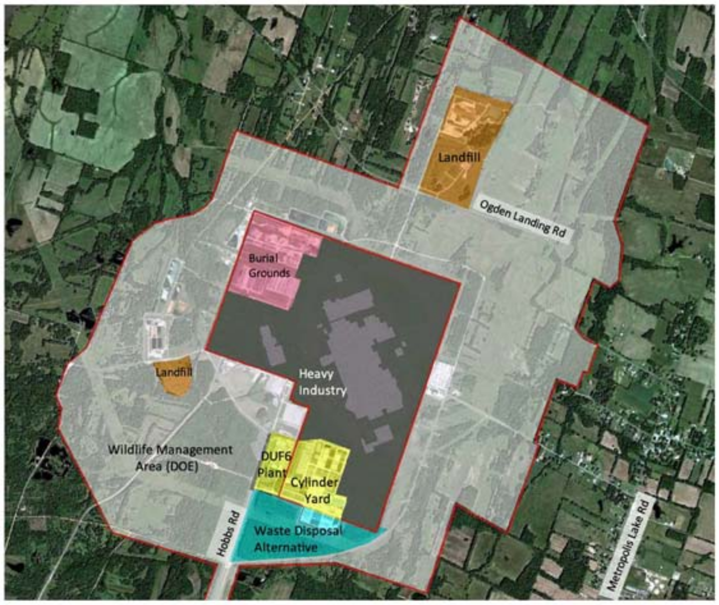
Suitability Scenario 5

1. Least suitable
2. ...
3. ...
4. ...
5. ...
6. ...
7. ...
8. ...
9. Most suitable



StdDev = 2.54

Mean = 4.20



Scenario 4

*Heavy Industry on Plant Site

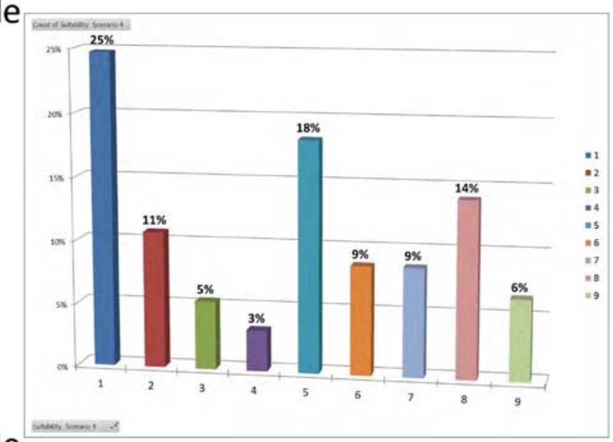
* PGDP WMA Remains

* All Plant Decommissioning Waste kept onsite in WDA

* Some existing Burial Grounds sealed and left in place, the rest excavated placed in WDA.

Suitability Scenario 4

1. Least suitable
2. ...
3. ...
4. ...
5. ...
6. ...
7. ...
8. ...
9. Most suitable



StdDev = 2.76

Mean = 4.48

Scenario 3

***Heavy Industry on Plant Site**

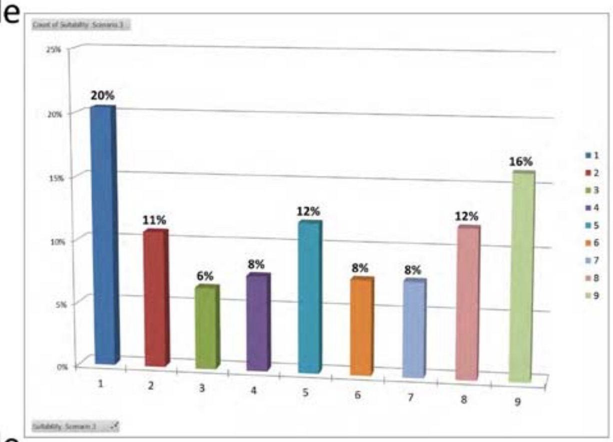
*** Active Recreational Facilities added to PGDP WMA**

***All Plant Decommissioning Waste Removed from Site**

***All Existing Burial Grounds excavated and shipped off-site.**

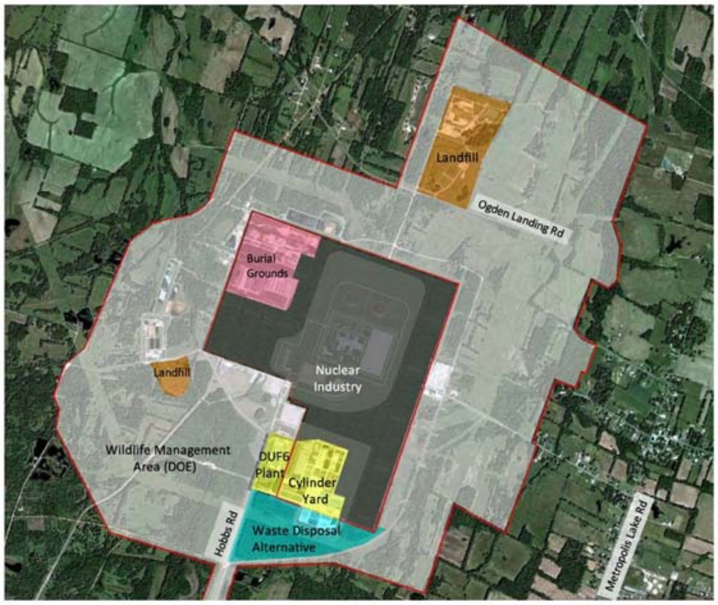
Suitability Scenario 3

1. Least suitable
2. ...
3. ...
4. ...
5. ...
6. ...
7. ...
8. ...
9. Most suitable



StdDev = 2.93

Mean = 4.88



Scenario 2

*Nuclear Industry on Plant Site

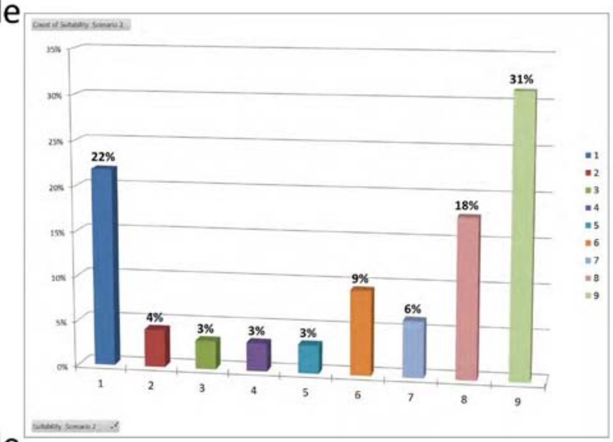
* PGDP WMA Remains

* Part of Plant Decommissioning Waste kept onsite in WDA and part placed in DOE managed Landfill

* Some existing Burial Grounds sealed and left in place, the rest excavated placed in WDA.

Suitability Scenario 2

1. Least suitable
2. ...
3. ...
4. ...
5. ...
6. ...
7. ...
8. ...
9. Most suitable



StdDev = 3.19

Mean = 5.91

Scenario 1

*Nuclear Industry on Plant Site

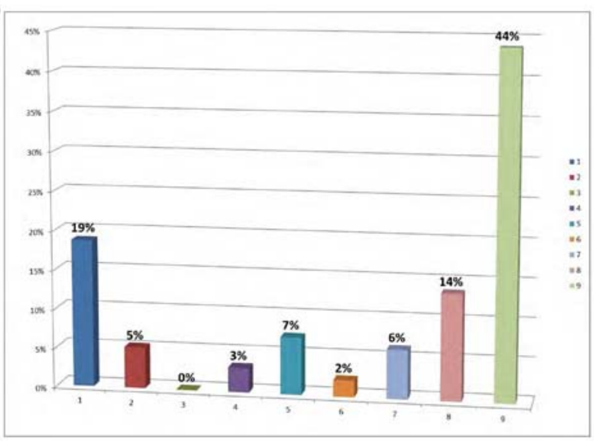
* PGDP WMA Remains

*All Plant Decommissioning Waste kept onsite in WDA

* All Existing Burial Grounds excavated, some placed in the WDA and the rest shipped off-site.

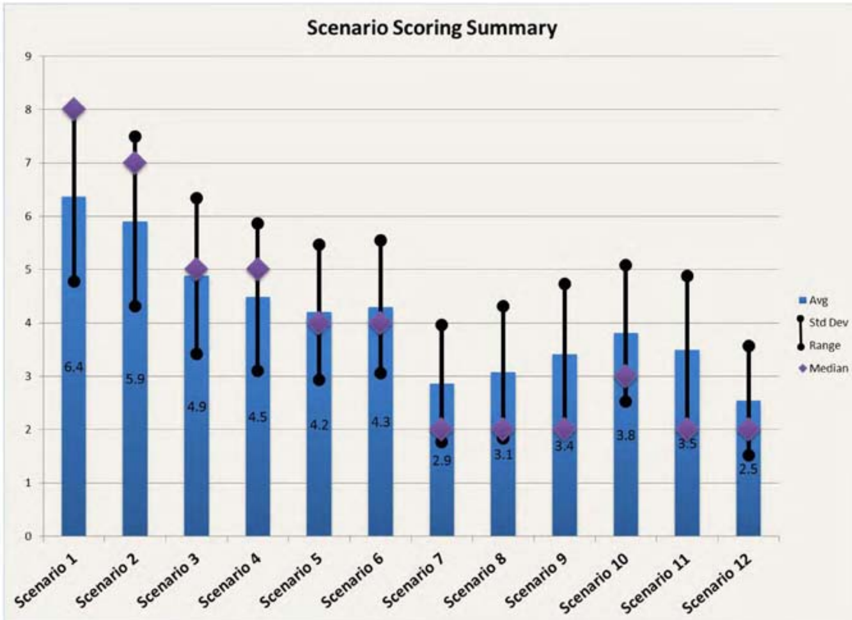
Suitability Scenario 1

1. Least suitable
2. ...
3. ...
4. ...
5. ...
6. ...
7. ...
8. ...
9. Most suitable



StdDev = 3.18

Mean = 6.36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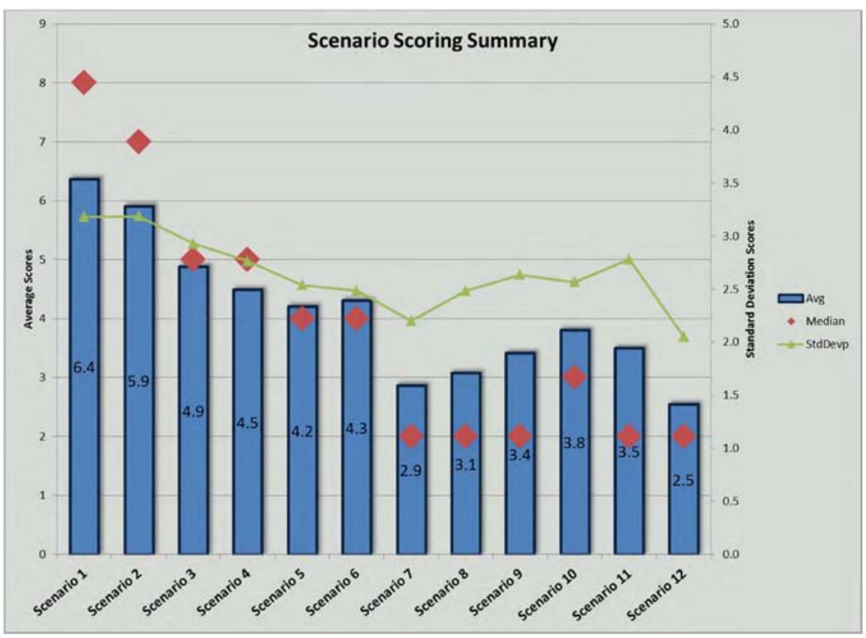
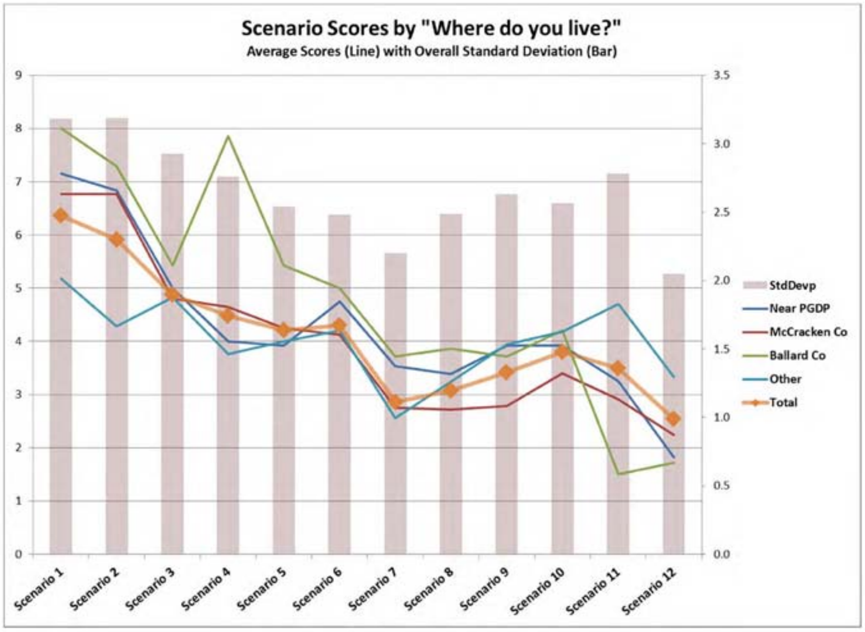
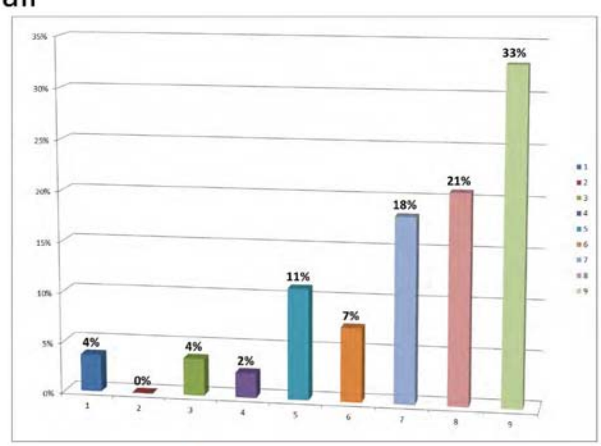
Avg
Std Dev
Range
Median
6.4
5.9
4.9
4.5
4.2
4.3
2.9
3.1
3.4
3.8
3.5
2.5
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Scenario 7
Scenario 8
Scenario 9
Scenario 10
Scenario 11
Scenario 12


Scenario Scoring Summary
Average Scores
Standard Deviation Scores
Avg
Median
StdDevp
6.4
5.9
4.9
4.5
4.2
4.3
2.9
3.1
3.4
3.8
3.5
2.5
Scenario 1
Scenario 2
Scenario 3
Scenario 4
Scenario 5
Scenario 6
Scenario 7
Scenario 8
Scenario 9
Scenario 10
Scenario 11
Scenario 12



Please rate your satisfaction with tonight's process?

1. Not satisfied at all
2. …
3. …
4. …
5. …
6. …
7. …
8. …
9. Extremely satisfied



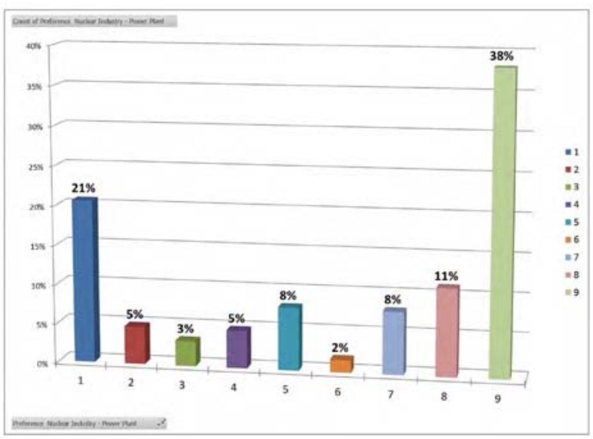
Mean = 7.13

Bonus Round!

- Talk about specific land uses in more detail
- Have you rate those

Preference
Nuclear Industry - Power Plant

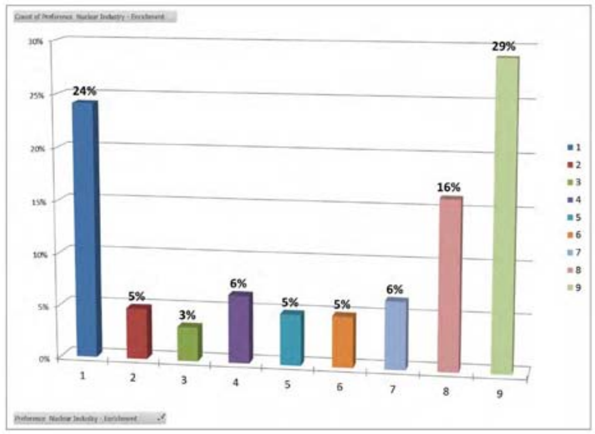
1. Lowest
2. ...
3. ...
4. ...
5. ...
6. ...
7. ...
8. ...
9. Highest



StdDev = 3.23 **Mean = 5.95**

Preference
Nuclear Industry - Enrichment

1. Lowest
2. ...
3. ...
4. ...
5. ...
6. ...
7. ...
8. ...
9. Highest

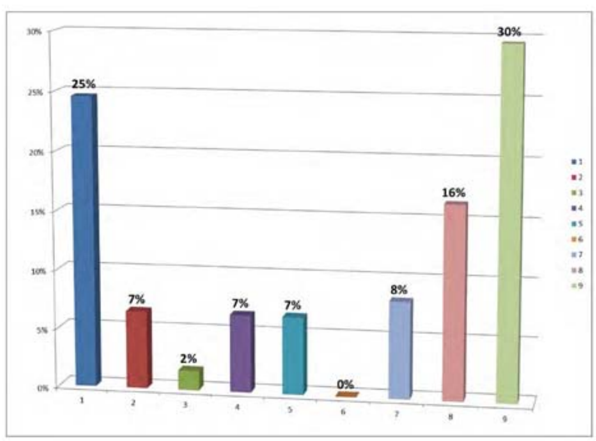


StdDev = 3.25

Mean = 5.58

Preference
Nuclear Industry - Recycling

1. Lowest
2. ...
3. ...
4. ...
5. ...
6. ...
7. ...
8. ...
9. Highest

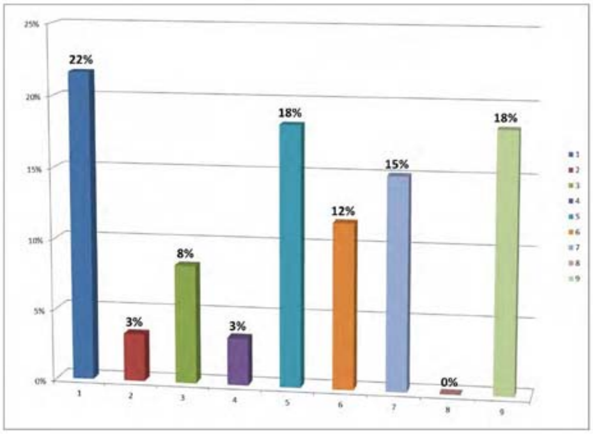


StdDev = 3.30

Mean = 5.56

Preference
Heavy Industry - Auto Manufacturing

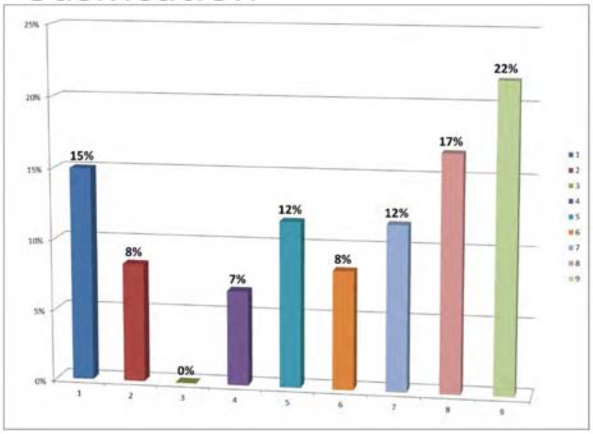
1. Lowest
2. ...
3. ...
4. ...
5. ...
6. ...
7. ...
8. ...
9. Highest



StdDev = 2.79 **Mean = 4.98**

Preference
Heavy Industry - Coal Liquefaction / Gasification

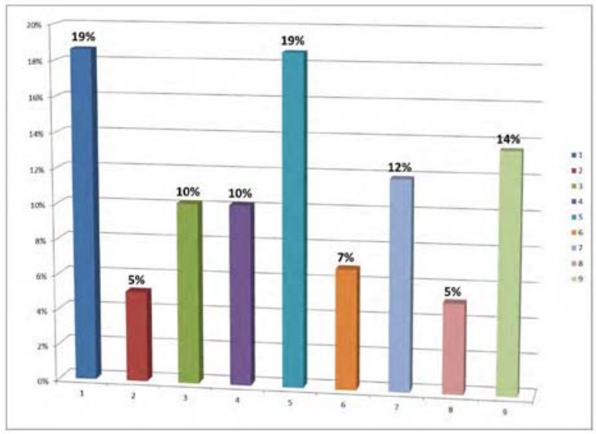
1. Lowest
2. ...
3. ...
4. ...
5. ...
6. ...
7. ...
8. ...
9. Highest



StdDev = 2.85 **Mean = 5.77**

Preference
Heavy Industry - Steel Plant

1. Lowest
2. ...
3. ...
4. ...
5. ...
6. ...
7. ...
8. ...
9. Highest

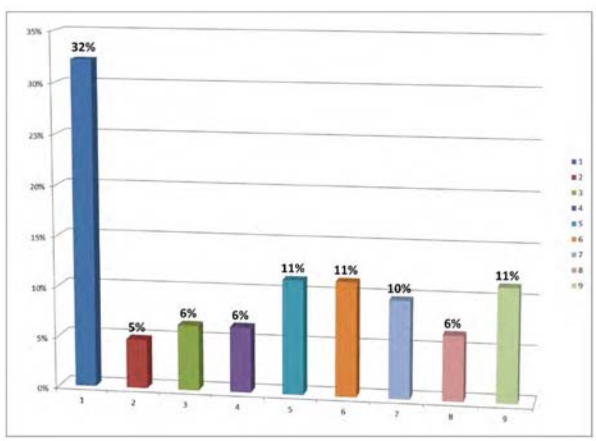


StdDev = 2.66

Mean = 4.80

Preference
Light Industry - Distribution Center

1. Lowest
2. ...
3. ...
4. ...
5. ...
6. ...
7. ...
8. ...
9. Highest

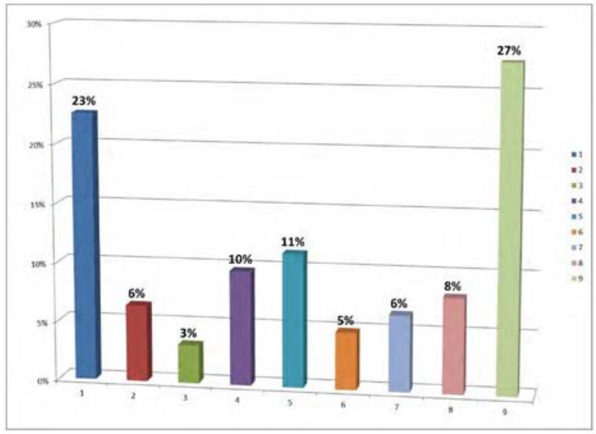


StdDev = 2.89

Mean = 4.32

Preference
Light Industry - Data Server Farm

1. Lowest
2. ...
3. ...
4. ...
5. ...
6. ...
7. ...
8. ...
9. Highest

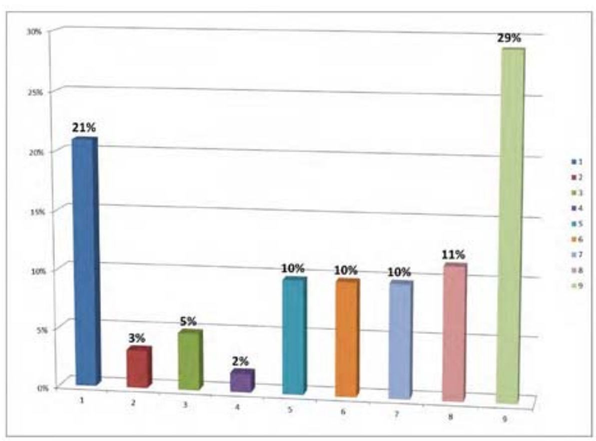


StdDev = 3.13

Mean = 5.26

Preference
Light Industry - Biomass

1. Lowest
2. ...
3. ...
4. ...
5. ...
6. ...
7. ...
8. ...
9. Highest

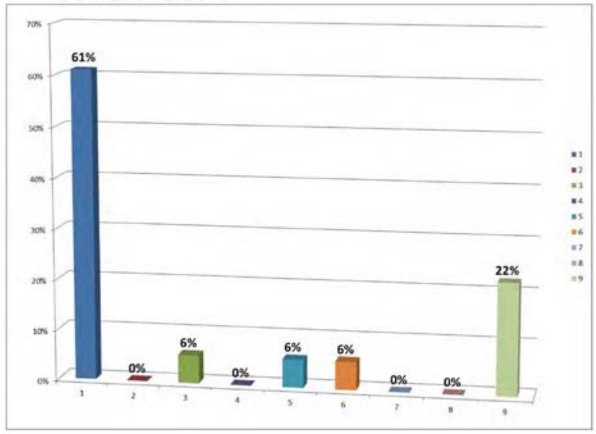


StdDev = 3.07

Mean = 5.74

Preference
Permanent Site Closure - Cover it up with dirt

1. Lowest
2. ...
3. ...
4. ...
5. ...
6. ...
7. ...
8. ...
9. Highest

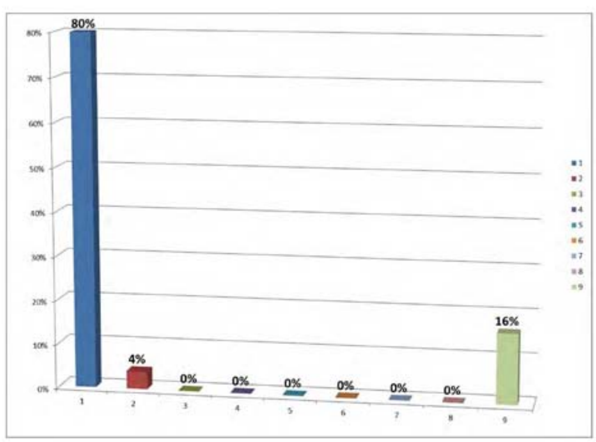


StdDev = 3.32

Mean = 3.39

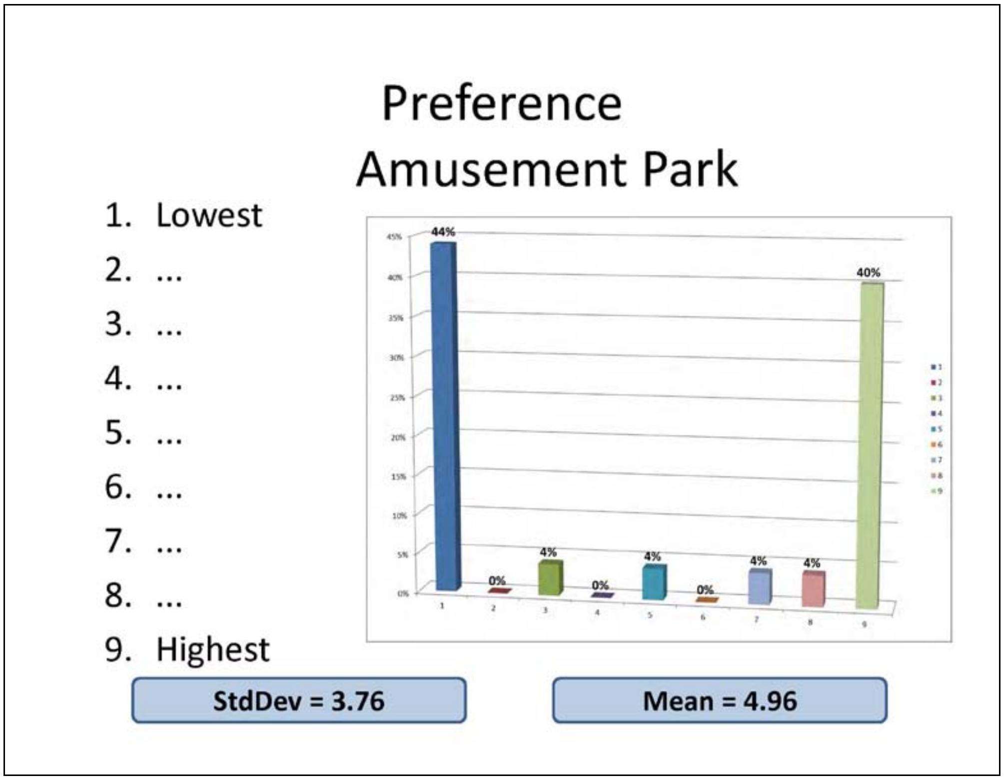
Preference
Strip Mine

1. Lowest
2. ...
3. ...
4. ...
5. ...
6. ...
7. ...
8. ...
9. Highest



StdDev = 2.92

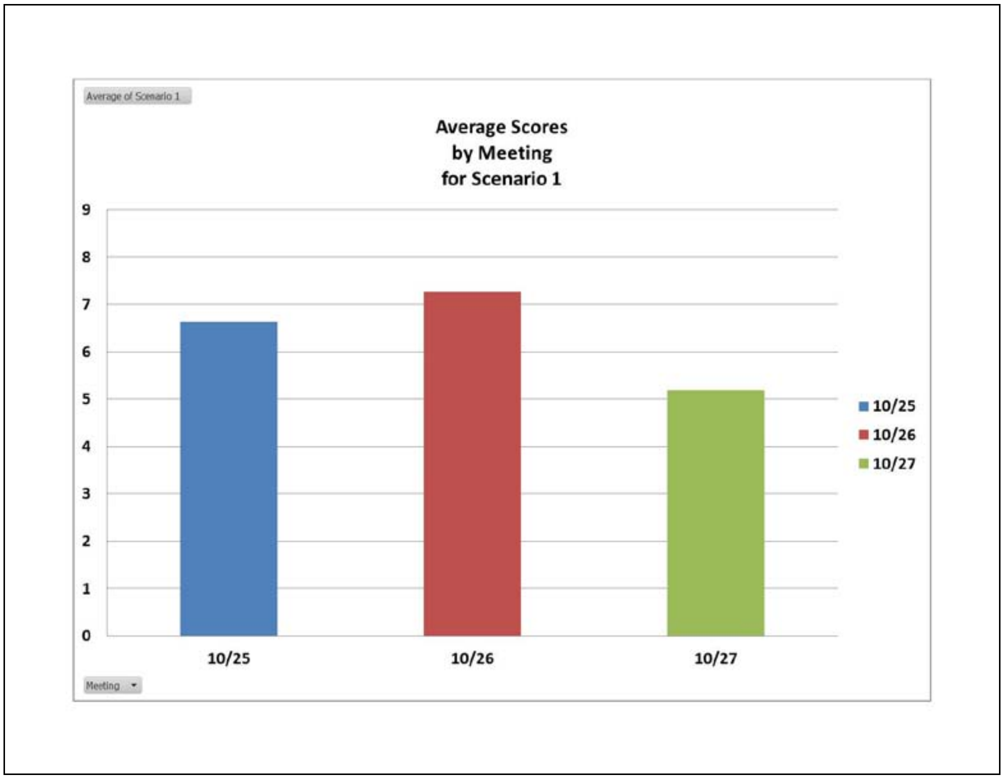
Mean = 2.32

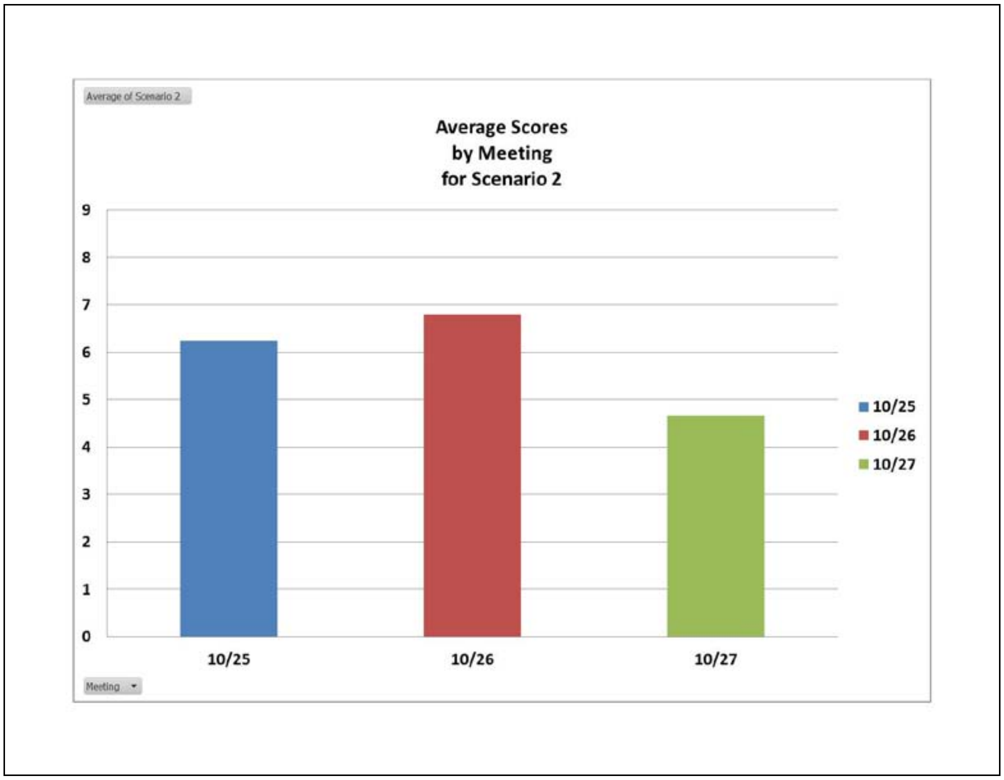

Preference
Amusement Park
1. Lowest
2. ...
3. ...
4. ...
5. ...
6. ...
7. ...
8. ...
9. Highest
44%
0%
4%
0%
4%
0%
4%
4%
40%
StdDev = 3.76
Mean = 4.96

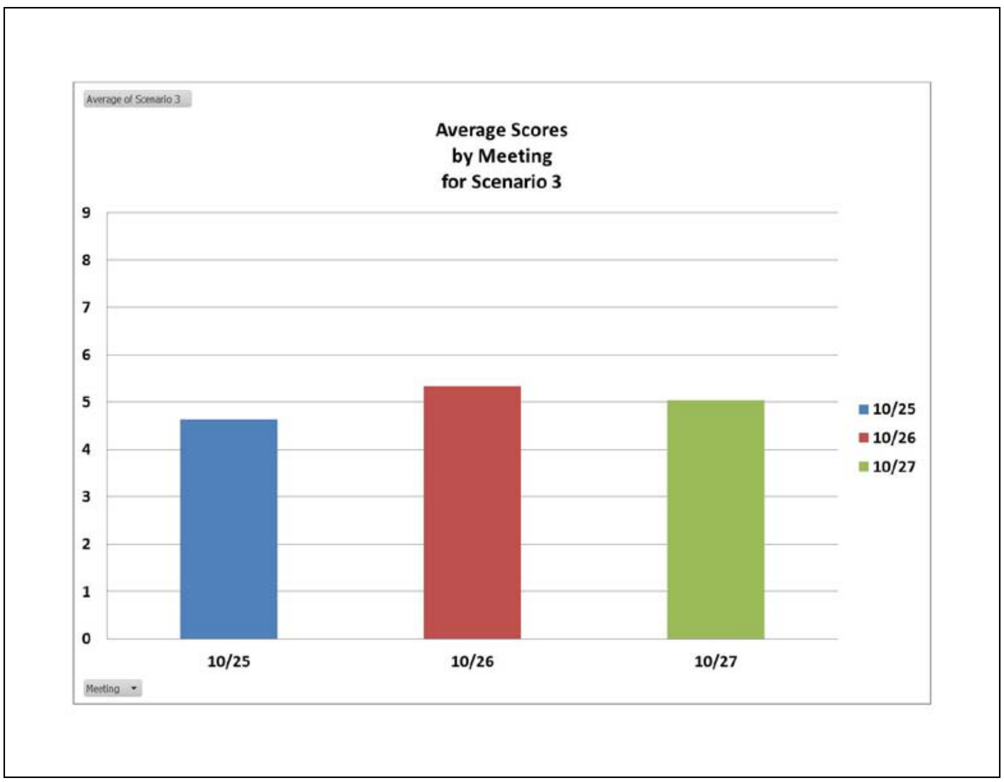
APPENDIX V: PUBLIC SCENARIOS MEETINGS RESULTS BY MEETING

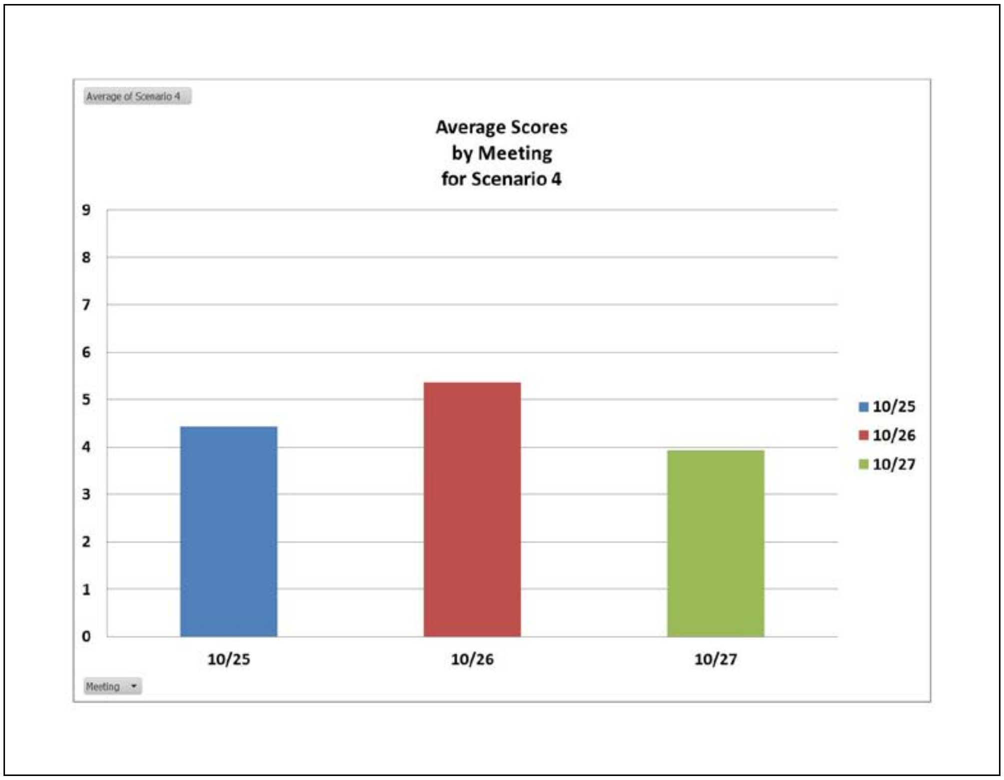
Key

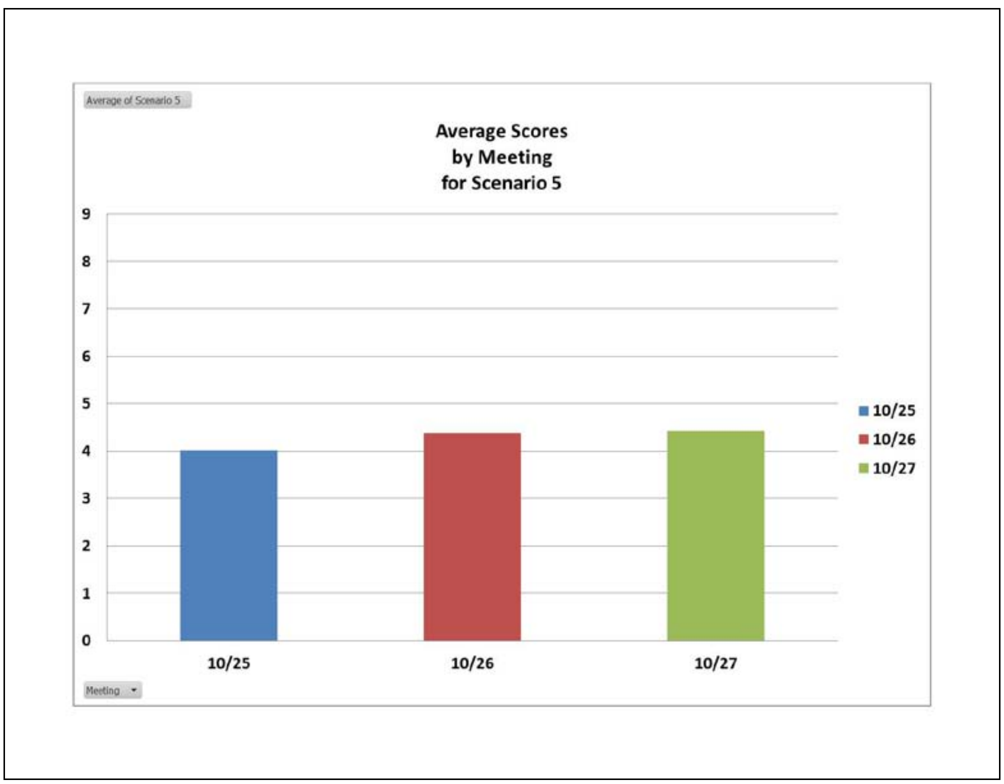
10/25: McCracken County Meeting at West Kentucky Community & Technical College
10/26: Ballard County Meeting at Ballard County High School
10/27: Students Meeting at West Kentucky Community & Technical College Classroom

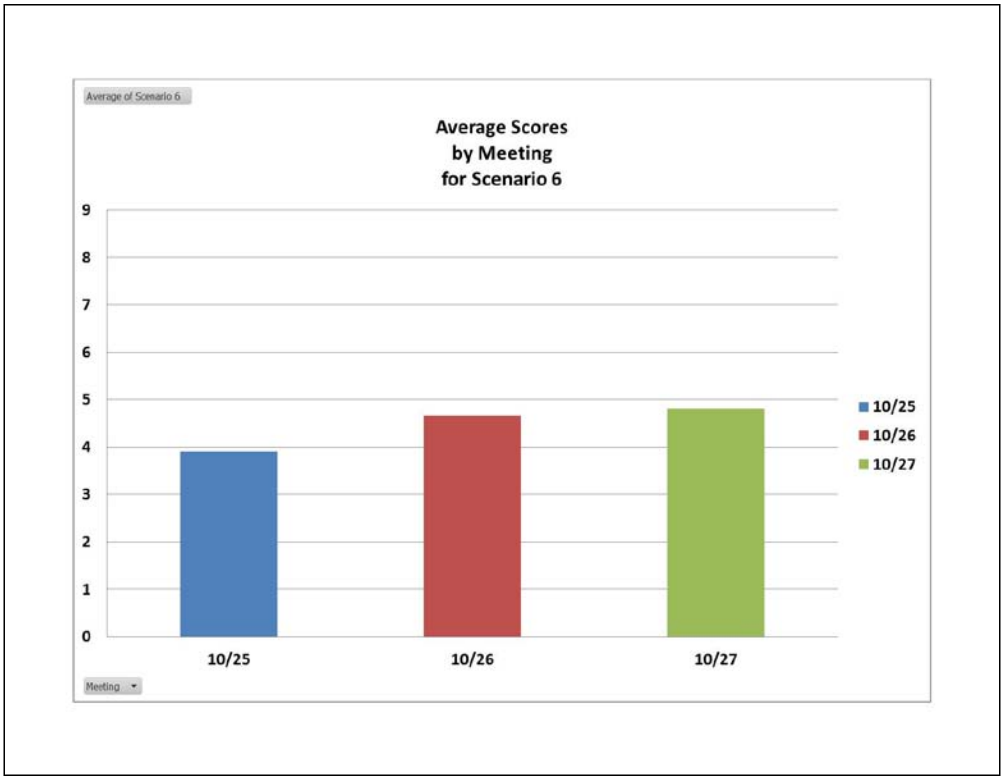


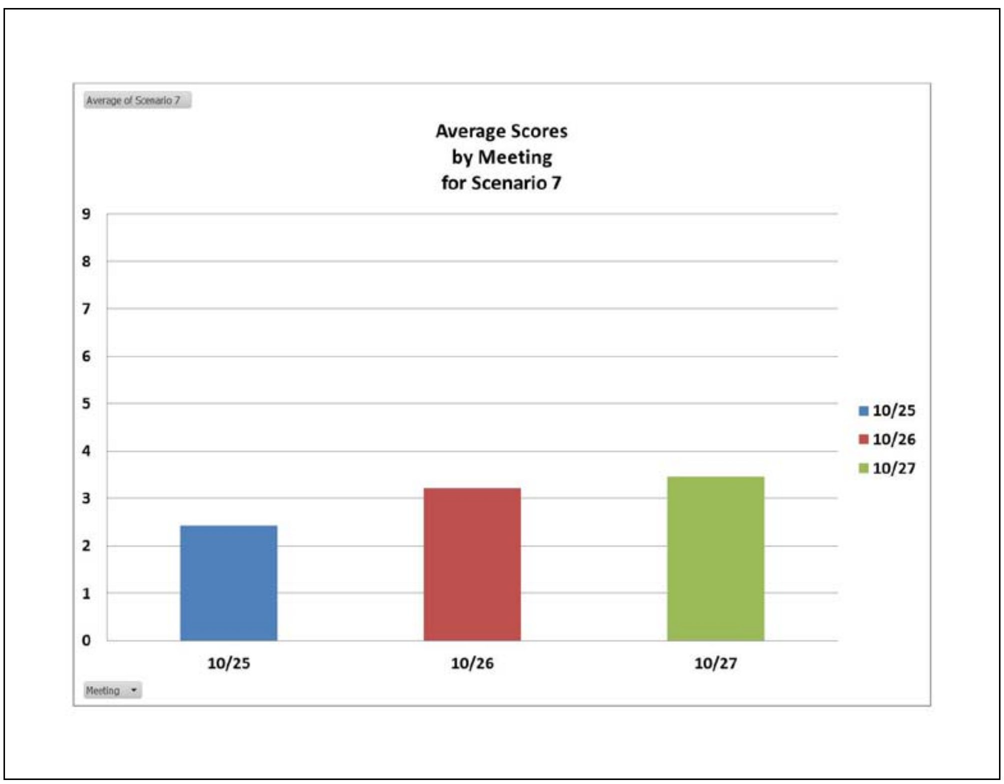

Average of Scenario 2
Average Scores
by Meeting
for Scenario 2
9
8
7
6
5
4
3
2
1
0
10/25
10/26
10/27
10/25
10/26
10/27
Meeting

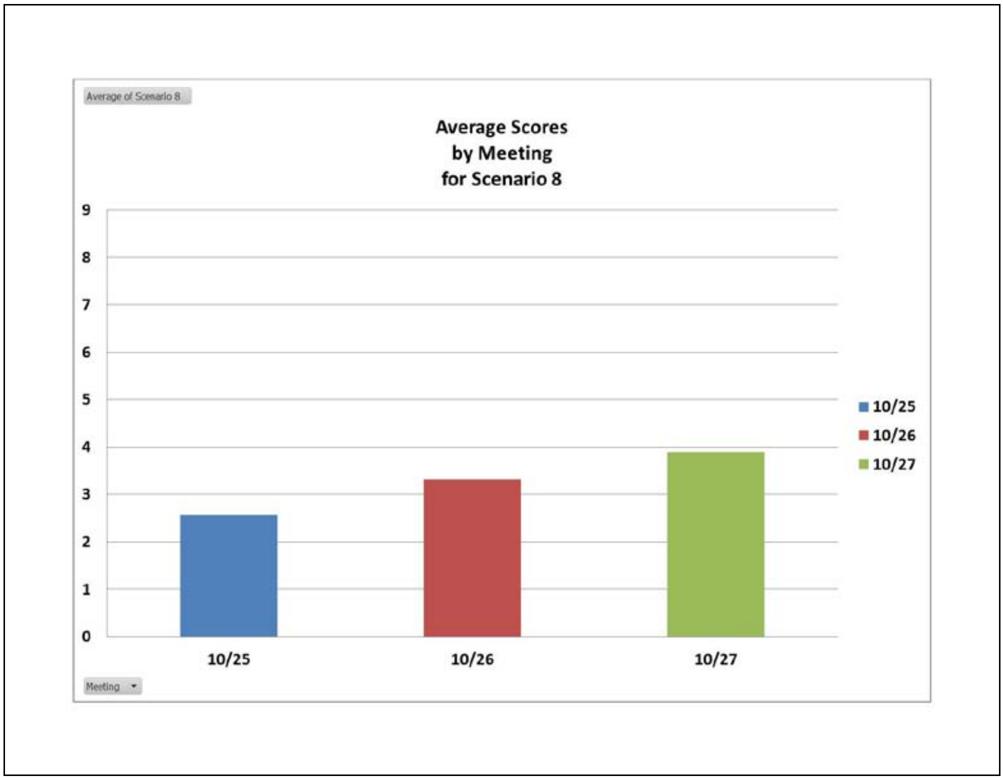

Average of Scenario 3
Average Scores
by Meeting
for Scenario 3
9
8
7
6
5
4
3
2
1
0
10/25
10/26
10/27
10/25
10/26
10/27
Meeting

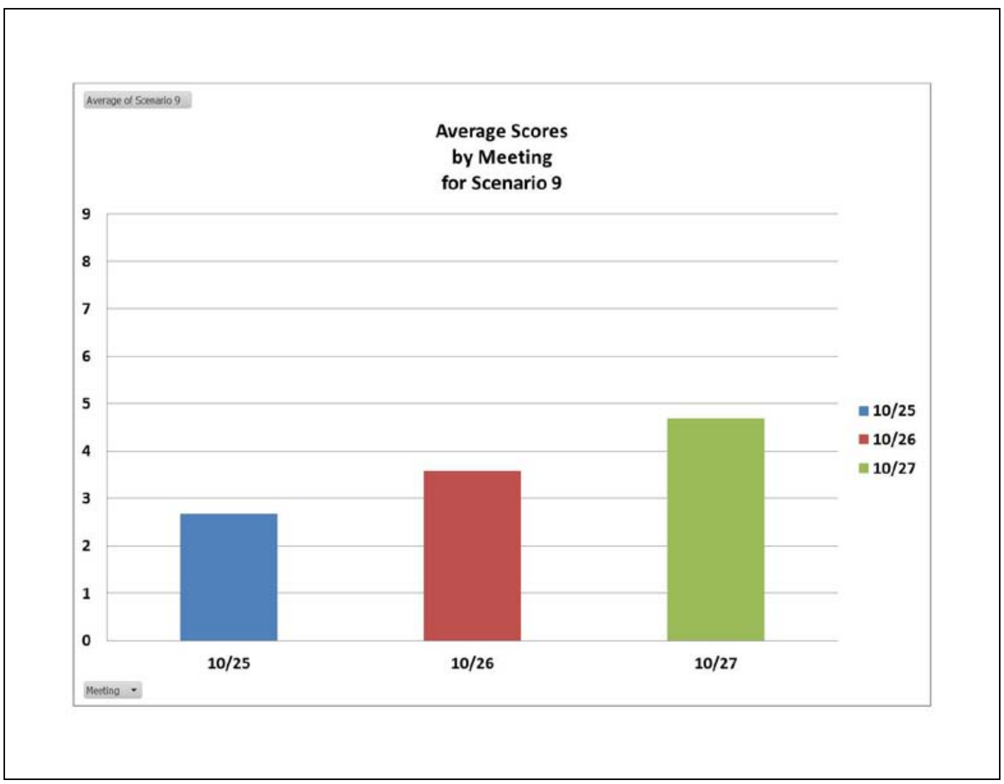

Average of Scenario 4
Average Scores
by Meeting
for Scenario 4
9
8
7
6
5
4
3
2
1
0
10/25
10/26
10/27
10/25
10/26
10/27
Meeting

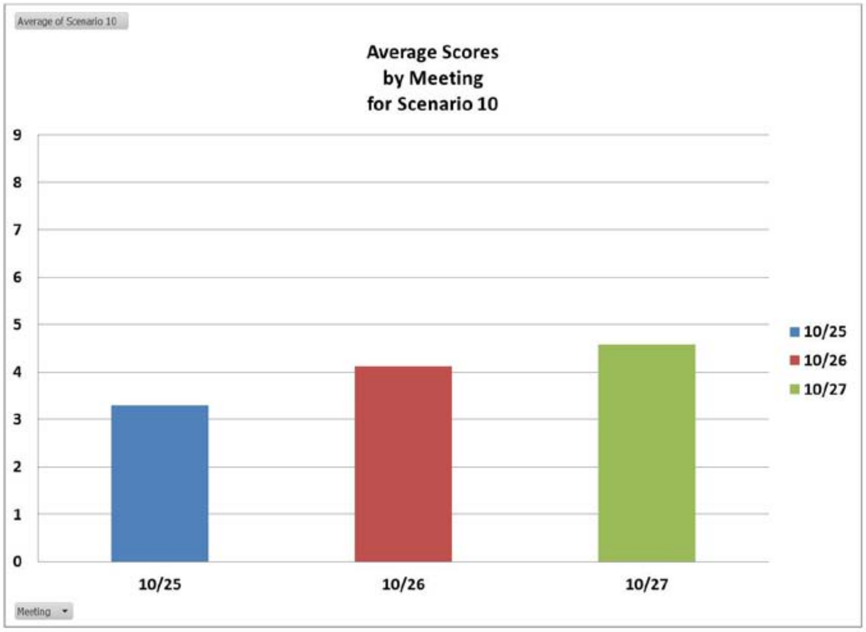

Average of Scenario 5
Average Scores
by Meeting
for Scenario 5
9
8
7
6
5
4
3
2
1
0
10/25
10/26
10/27
10/25
10/26
10/27
Meeting

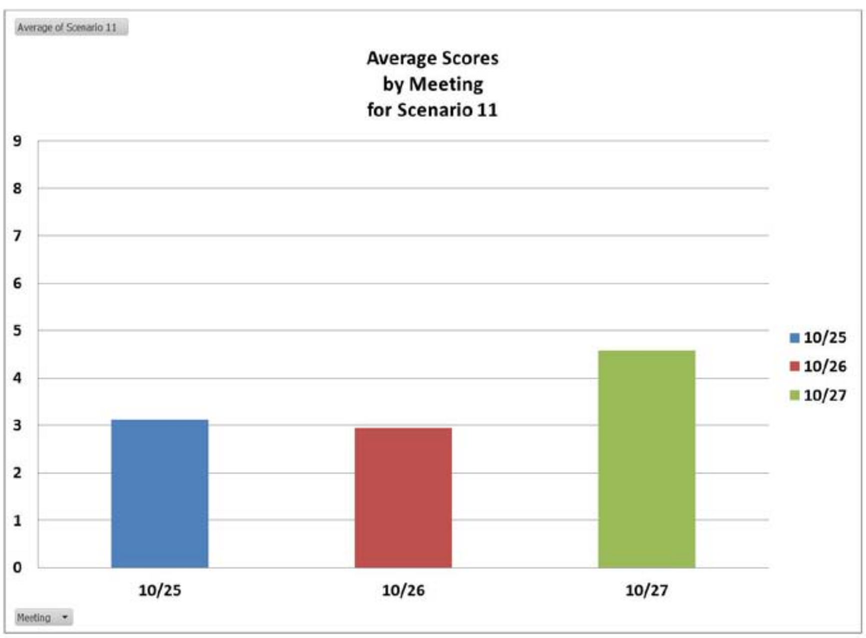

Average of Scenario 6
Average Scores
by Meeting
for Scenario 6
9
8
7
6
5
4
3
2
1
0
10/25
10/26
10/27
10/25
10/26
10/27
Meeting

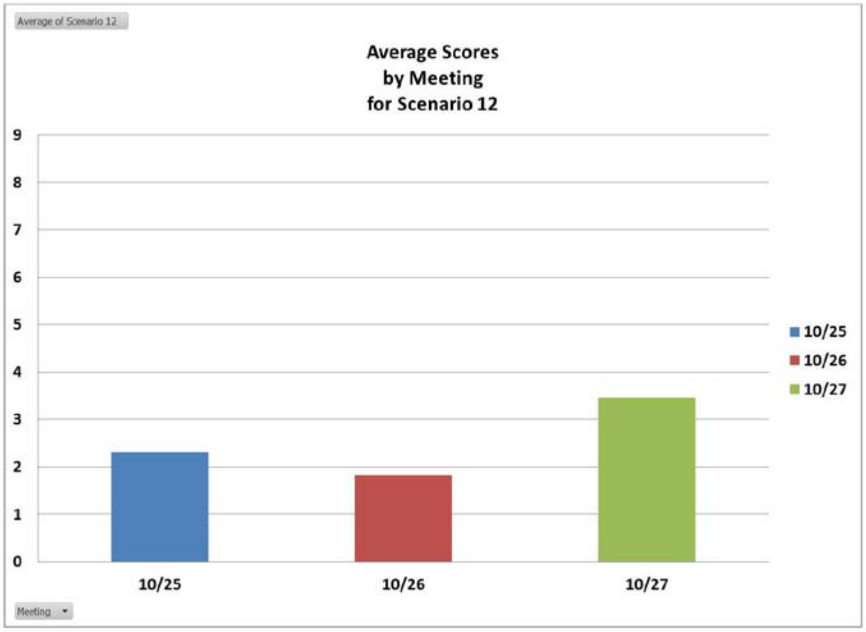

Average of Scenario 7
Average Scores
by Meeting
for Scenario 7
9
8
7
6
5
4
3
2
1
0
10/25
10/26
10/27
10/25
10/26
10/27
Meeting

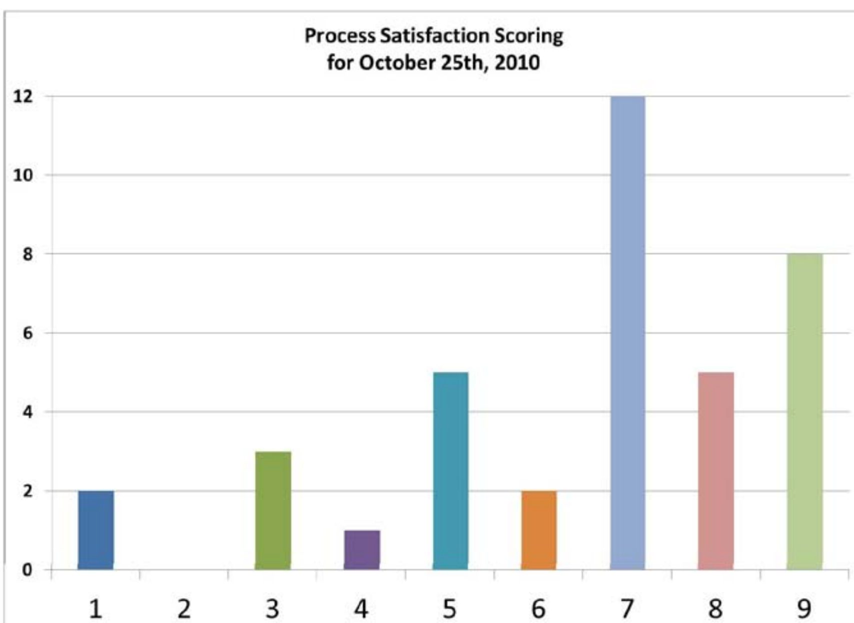

Average of Scenario 8
Average Scores
by Meeting
for Scenario 8
9
8
7
6
5
4
3
2
1
0
10/25
10/26
10/27
10/25
10/26
10/27
Meeting

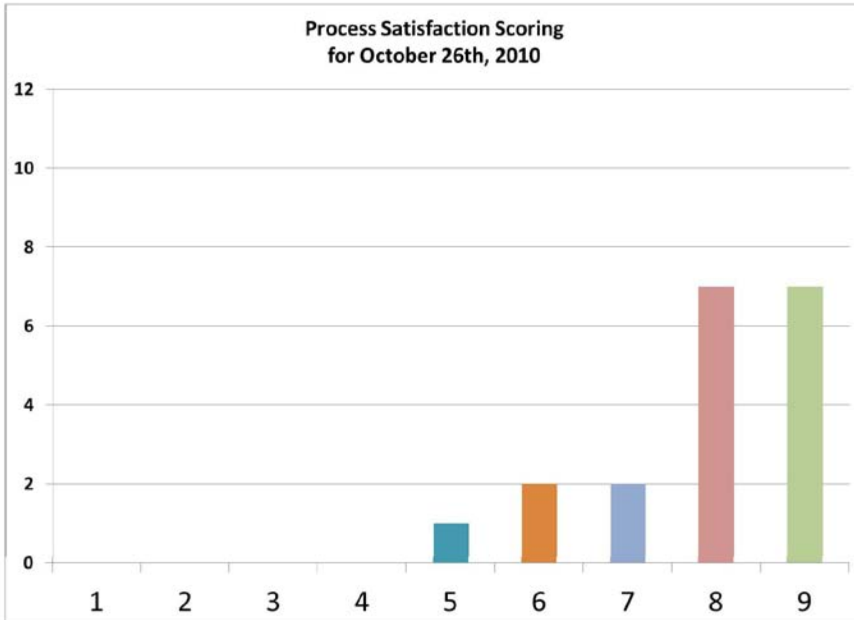

Average of Scenario 9
Average Scores
by Meeting
for Scenario 9
9
8
7
6
5
4
3
2
1
0
10/25
10/26
10/27
10/25
10/26
10/27
Meeting

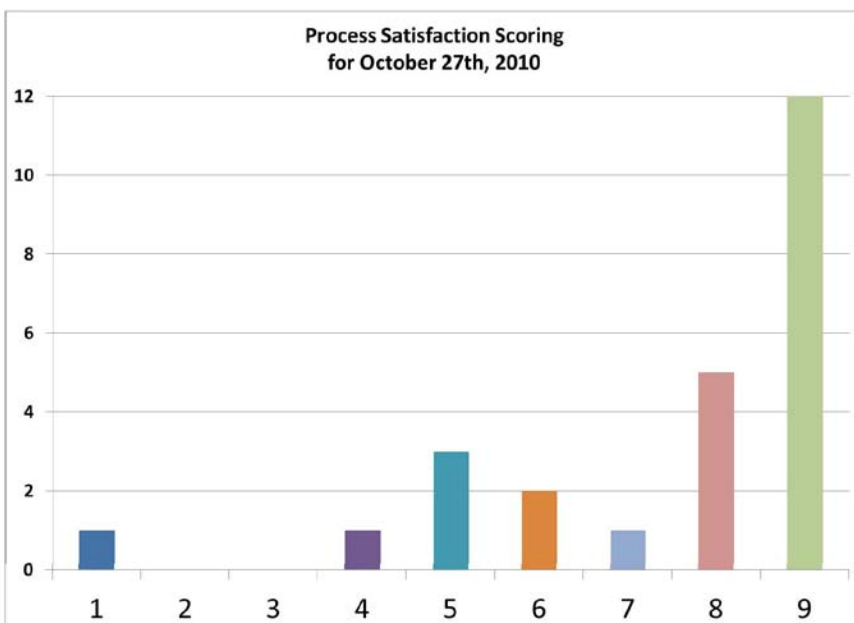

Average of Scenario 10
Average Scores
by Meeting
for Scenario 10
9
8
7
6
5
4
3
2
1
0
10/25
10/26
10/27
10/25
10/26
10/27
Meeting

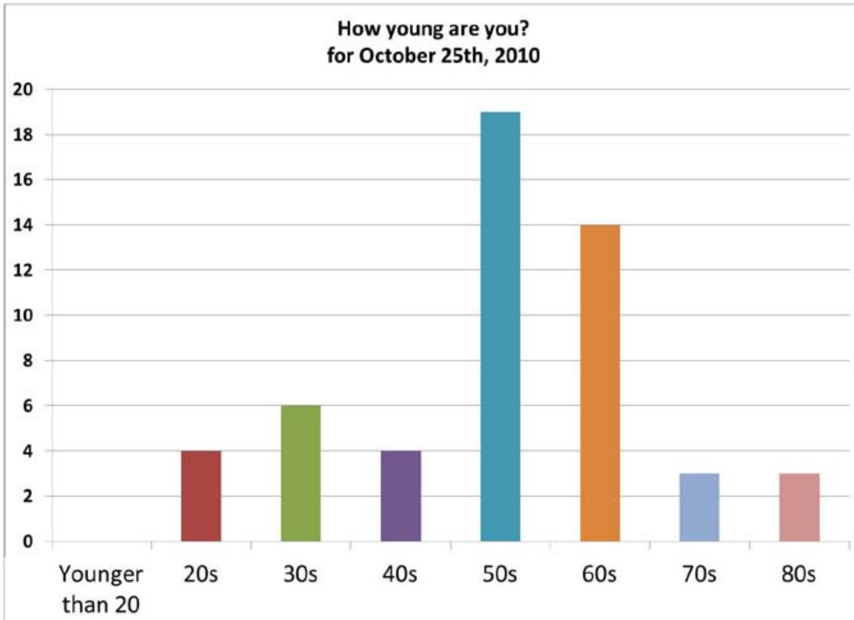

Average of Scenario 11
Average Scores
by Meeting
for Scenario 11
9
8
7
6
5
4
3
2
1
0
10/25
10/26
10/27
10/25
10/26
10/27
Meeting

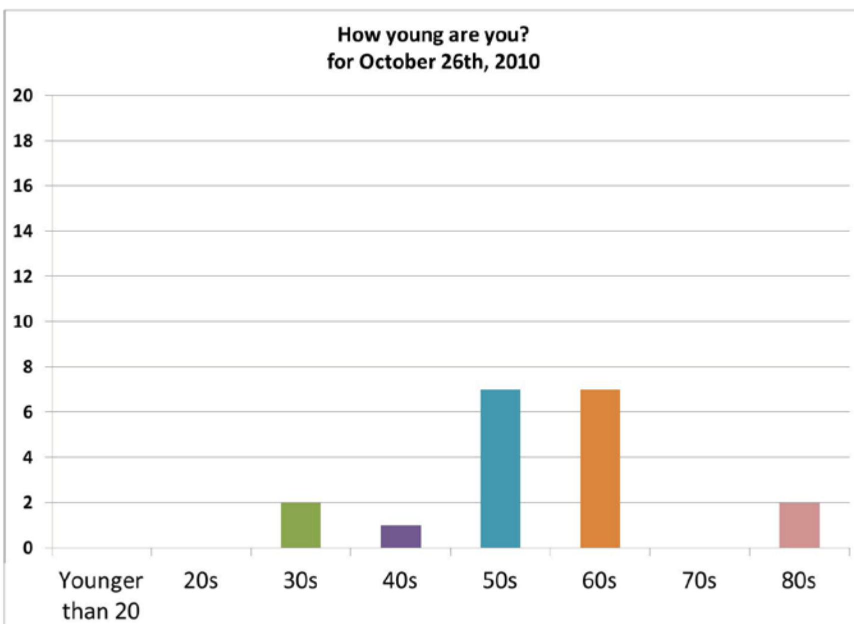

Average of Scenario 12
Average Scores
by Meeting
for Scenario 12
9
8
7
6
5
4
3
2
1
0
10/25
10/26
10/27
10/25
10/26
10/27
Meeting

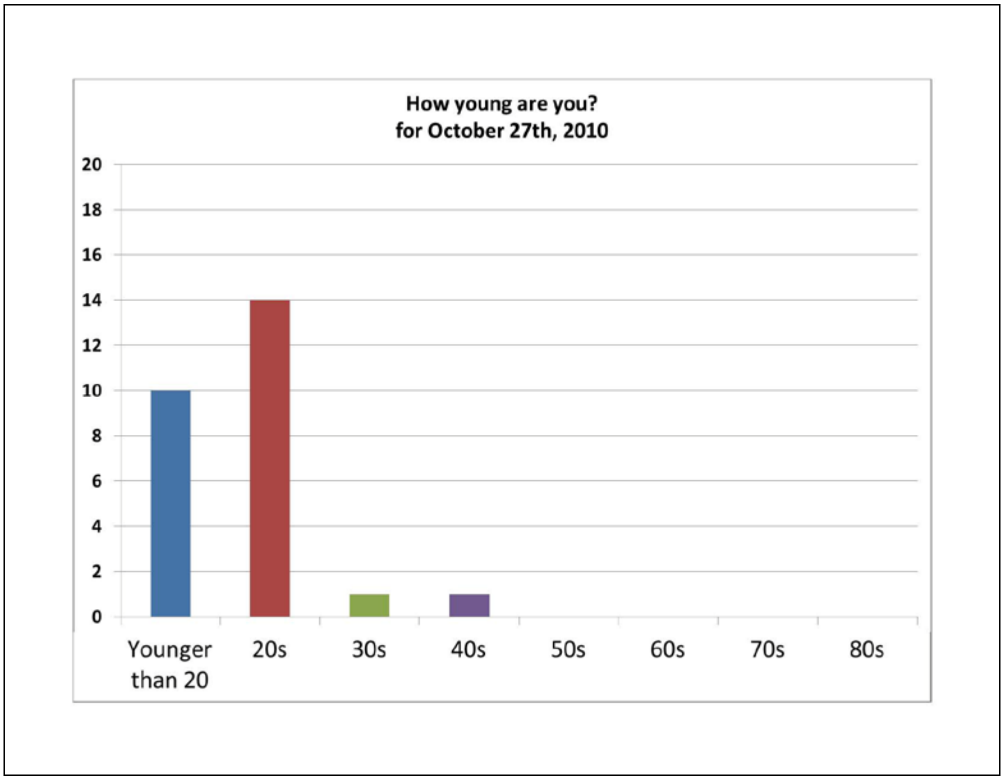

Process Satisfaction Scoring
for October 25th, 2010
12
10
8
6
4
2
0
1
2
3
4
5
6
7
8
9

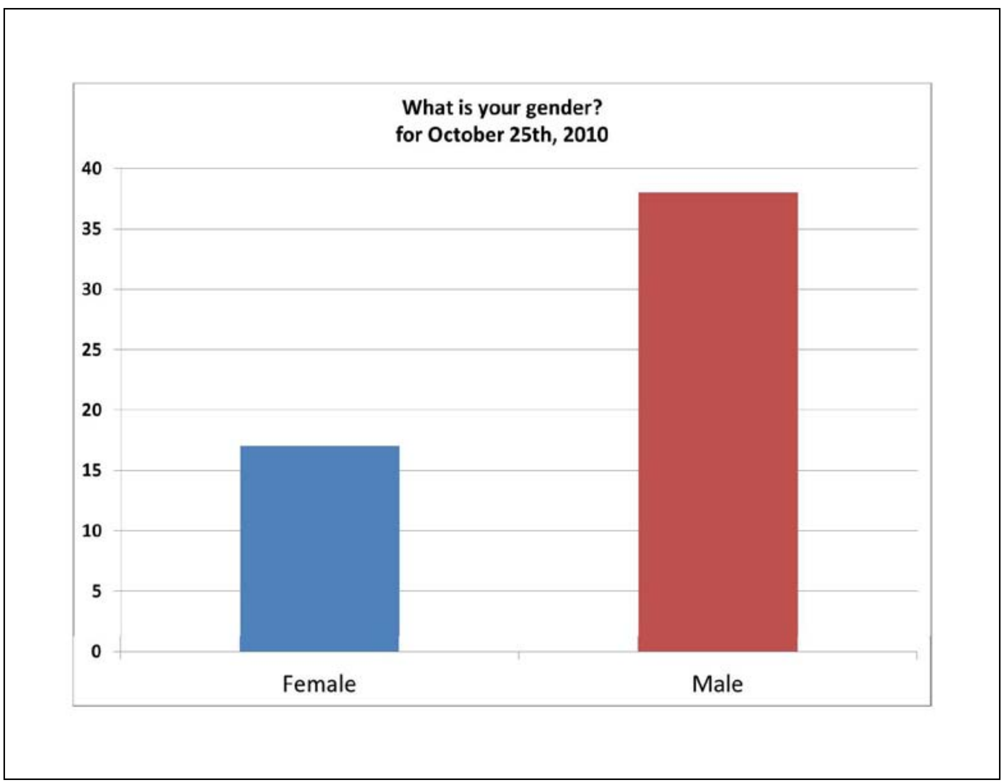

Process Satisfaction Scoring
for October 26th, 2010
12
10
8
6
4
2
0
1
2
3
4
5
6
7
8
9

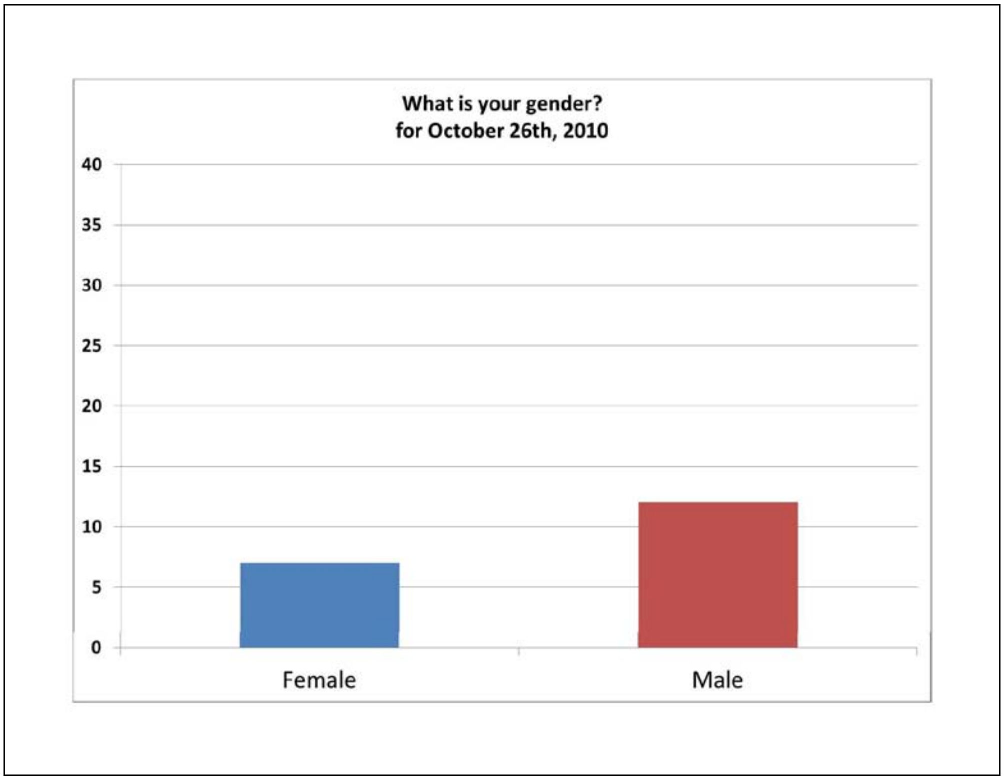

Process Satisfaction Scoring
for October 27th, 2010
12
10
8
6
4
2
0
1
2
3
4
5
6
7
8
9

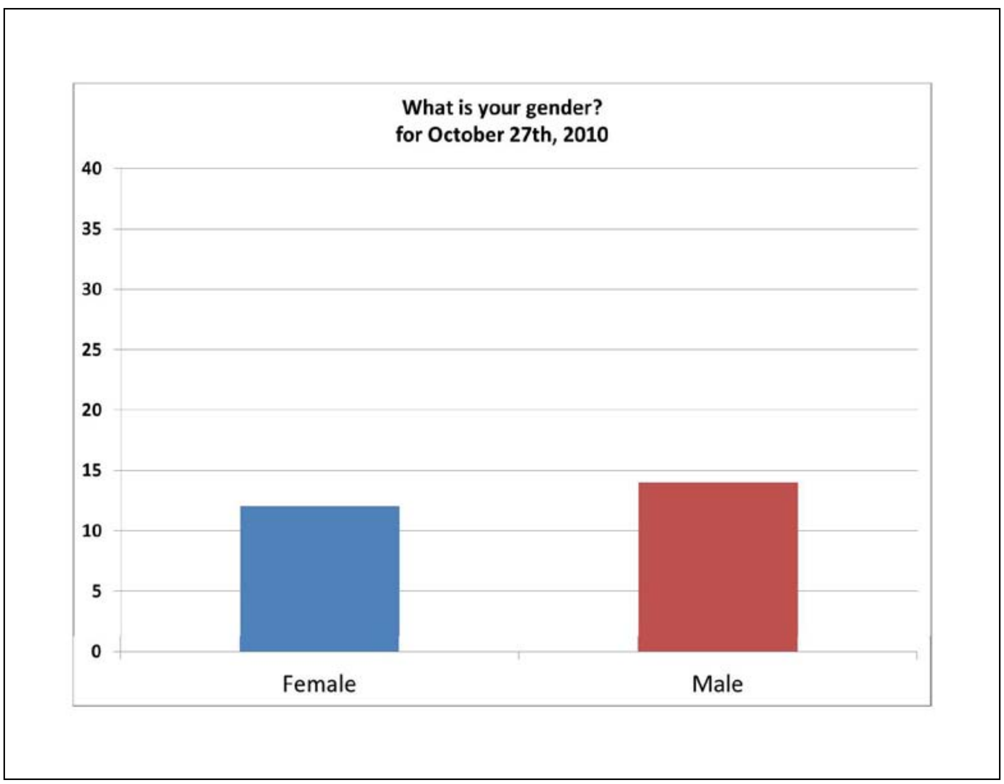

How young are you?
for October 25th, 2010
20
18
16
14
12
10
8
6
4
2
0
Younger than 20
20s
30s
40s
50s
60s
70s
80s

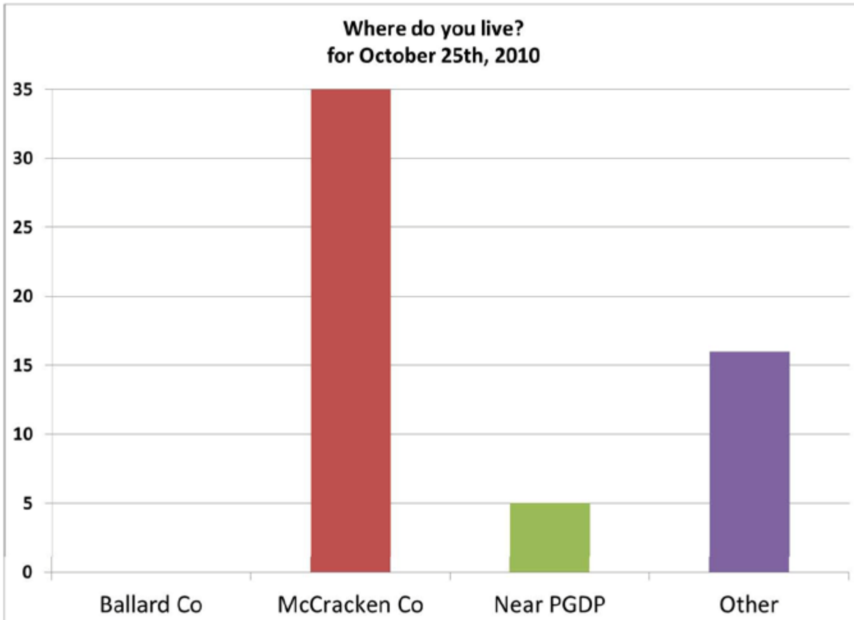

How young are you?
for October 26th, 2010
20
18
16
14
12
10
8
6
4
2
0
Younger than 20
20s
30s
40s
50s
60s
70s
80s

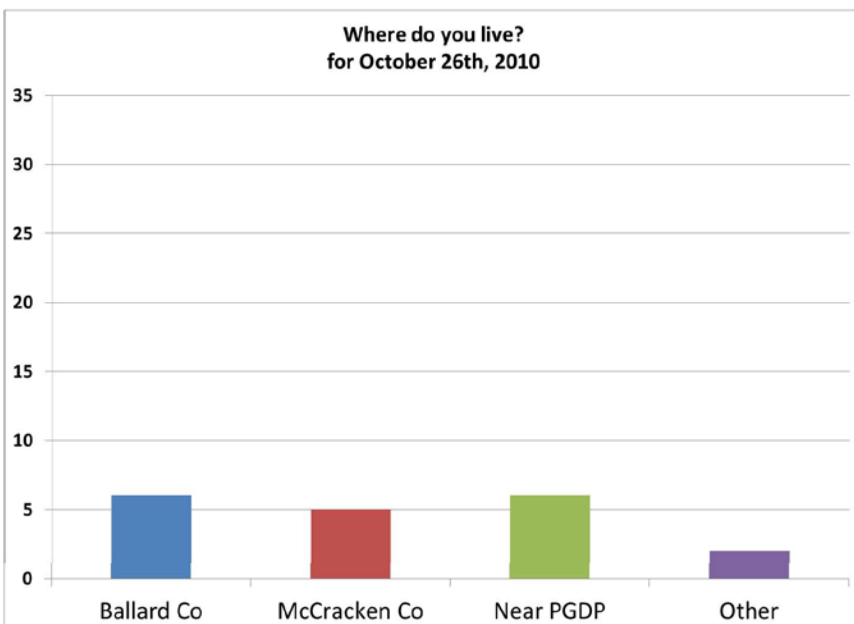

How young are you?
for October 27th, 2010
20
18
16
14
12
10
8
6
4
2
0
Younger than 20
20s
30s
40s
50s
60s
70s
80s

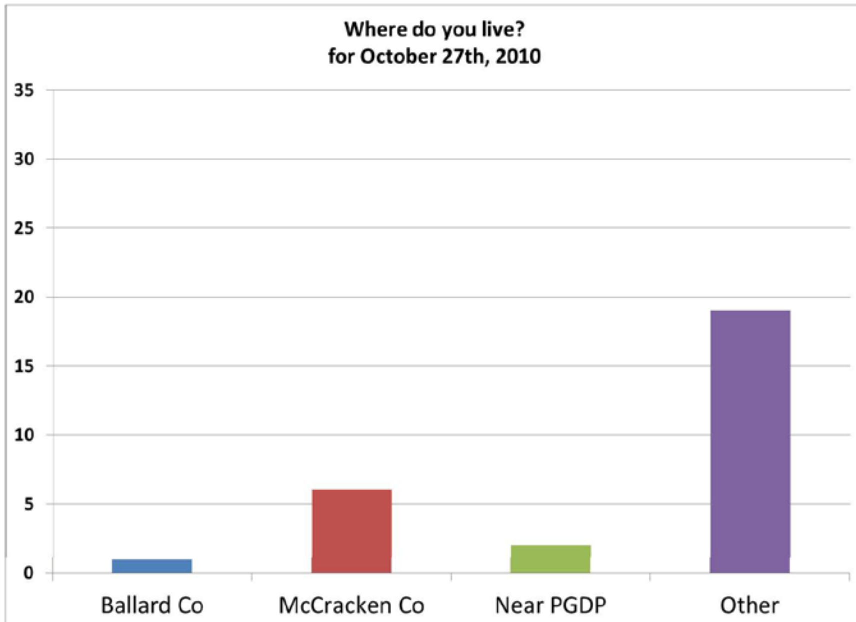

What is your gender?
for October 25th, 2010
40
35
30
25
20
15
10
5
0
Female
Male


What is your gender?
for October 26th, 2010
40
35
30
25
20
15
10
5
0
Female
Male


What is your gender?
for October 27th, 2010
40
35
30
25
20
15
10
5
0
Female
Male


Where do you live?
for October 25th, 2010
35
30
25
20
15
10
5
0
Ballard Co
McCracken Co
Near PGDP
Other


Where do you live?
for October 26th, 2010
35
30
25
20
15
10
5
0
Ballard Co
McCracken Co
Near PGDP
Other


Where do you live?
for October 27th, 2010
35
30
25
20
15
10
5
0
Ballard Co
McCracken Co
Near PGDP
Other

APPENDIX W: PRESS COVERAGE OF PUBLIC INFORMATION AND SCENARIO MEETINGS

WPSD-TV, 10/11/2010 (page 1 of 2)

WPSD Local 6 - News, Sports, Weather - Paducah KY Paducah, Kentucky

Print this article

Researchers take light-hearted approach to plant's future

Originally printed at http://www.wpsdlocal6.com/news/local/Researchers-take-light-hearted-approach-to-gaseous-diffusion-plants-future-104748609.html

By Reporter - Jason Hibbs
By Photojournalist - Eric Ziglin
October 11, 2010

PADUCAH - University of Kentucky researchers said they want members of the community to learn about the Paducah Gaseous Diffusion Plant and have fun at the same time.

So they tried to lighten it up a bit by inviting members of the community to come out and participate in a game.

All the questions and discussion were about the plant and the site's future when the Department of Energy shuts it down.

UK researchers said they want the public to have an impact on the future of the site and the only way they can do that is to speak out

The property is well over 3,000 acres and scientists said it has lots of potential.

But to understand what can be done at the site, they said people need to understand some things about the chemicals that were made and contamination.

Many people seemed to enjoy the discussion but some former plant employees said the topic is anything but fun and games. They said the contamination levels in the area may be higher than many realize.

The researchers said they've conducted surveys for about a year now and there are many misconceptions about the plant and it's future.

They said that's all the more reason for people to come to the meetings.

The next meeting will be held Oct. 12 at the Ballard Memorial High School cafeteria. The meeting starts at 6:30 p.m.

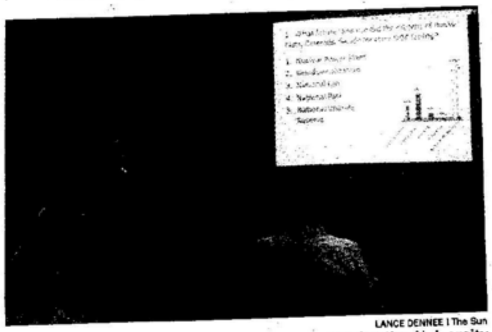
Members of the community will get an opportunity to look at the different ideas for the plant site and vote for their favorite.

Those meetings will be held on Oct. 25 and 26.

The first meeting will be held at the West Kentucky Community and Technical College Emerging Technology Building at 6:30 p.m.

The second is set for Ballard Memorial High School, also at 6:30 p.m.

Paducah Sun, 10/12/2010



LANCE DENNEE | The Sun

Ted Grossardt, research program manager for the University of Kentucky, explains results of a survey on land usage for the Paducah Gaseous Diffusion Plant at West Kentucky Community & Technical College in Paducah on Monday.

Researchers discuss fate of Paducah atomic plant

BY MICHAEL DE LOS REYES

mdelosreyes@paducahsun.com

After Monday night's 90-minute public meeting at West Kentucky Community & Technical College about the anticipated decommissioning of the Paducah Gaseous Diffusion Plant, most people were interested on reusing the property. About 50 people attended the meeting.

The plant is about 15 miles west of Paducah and sits on about 3,400 acres of land owned by the U.S. Department of Energy, according to the DOE website.

Operations at the plant contaminated soil and water both at the plant and the surrounding areas, the website said.

"I've started thinking about what can be done with the land," said Nancy Huff, 62, of Paducah who attended the meeting. Huff, who has a master's degree in environmental management, moved back to Paducah last year after living in Nashville for 15 years.

Huff said she will go online to investigate the challenges and hurdles to using the PGDP's land.

She was disappointed that the meeting's speakers never discussed in great detail all the possible uses for the land.

Ted Grossardt, a University of Kentucky research program manager, said, "There's too much information to present in a single night."

Grossardt and Lindell Ormsbee, another UK researcher, said Monday night's meeting was meant to get people thinking about future land uses, provide the problems with clearing DOE property and offer a website (paducahvision.com) holding about 16 years of research information about DOE land.

During the meeting, the researchers outlined some possibilities for the decontaminated land:

■ A Hopkinsville Wal-Mart distri-

Please see **PLANT** | 5A

CONTINUED FROM 1A

bution center, the researchers said, hired 1,000 people and pays them \$32,000 annually. The PGDP acreage is comparable to the distribution center's acreage.

■ Toyota in Georgetown pays 7,000 employees an average salary of \$70,000, they said.

■ A nuclear plant, on a similar footprint in North Carolina, pays about \$80,000 to its employees, Grossardt and Ormsbee said during the meeting.

"Using the area for a biomass (alternative energy plant) would be more feasible," Ormsbee said.

The problem would be razing the plant's buildings and disposing the contaminated soil and water on and around the area.

The researchers said about 2,000 acres was contaminated with radioactive Technetium-99 and toxic Trichloroethylene, which were part of the plant's daily operations.

It would cost about \$500 million to bury the razed buildings and contaminated soil and water, the researchers said, or about \$1 billion to ship those items out of state.

A second informational meeting is set for 6:30 tonight in the Ballard Memorial High School cafeteria, the researchers said.

They said they would return to WKCTC on Oct. 25 to present 12 possible land use options for the public's consideration.

Contact Michael de los Reyes, a Paducah Sun staff writer, at 270-575-8652.

Paducah Sun 10/26/10

Meeting yields opinions and votes on plant site

BY ADAM SHULL
ashull@paducahsun.com

The obvious lessons learned from the 50-plus community members at Monday's meeting concerning future uses for the Paducah Gaseous Diffusion Plant site:

■ The most popular plans include recruiting industry to operate again at the site.

■ That most prefer removing harmful waste from existing burial sites, rather than leave it there.

■ A lot of questions still remain before most feel comfortable deciding what they want to be done.

The meeting's less obvious result, at least initially, was that mostly one kind of community member showed up: plant workers and those with jobs directly affected by the goings-on.

"I had a man turn around and ask me; 'How long did you work in the plant? I've never seen you before.'" said Nancy Duff, a former analyst for AT&T living in Paducah.

"I told him I'm just an interested citizen."

In a meeting where proposed future uses included soccer fields, hiking trails and fencing the entire area off to the public, Duff said more folks from every part of the community should learn the information.

Duff attended the first informational session Oct. 11 at West Kentucky Community & Technical College's Emerging Technology Building, where University of Kentucky researchers presented information about the plant and why changes were taking place.

Monday's meeting in the same building was to propose 12 specific scenarios, and hear feedback, for changes to the 3,556 acres sitting about 15 miles west of Paducah. The same presentation is set for 6:30 tonight in Ballard County *(see box)*.

The U.S. Department of Energy owns the land where operations at

Please see **PLANT** | 3A

ADAM SHULL / The Sun

Jim Key of Paducah, vice president of United Steelworkers Local 550, casts a test vote during a meeting at the West Kentucky Community & Technical College's Emerging Technology Building on Monday. The meeting proposed changes to the Paducah Gaseous Diffusion Plant site.

PLANT: Scenarios for the land include recreational facilities, state park

CONTINUED FROM 1A

the uranium enriching plant contaminated soil and water both at and around the plant.

Ted Grossardt, a UK research program manager, led the presentation outlining the scenarios, which he said are available at paducahvision.com.

Scenarios for the land also include:

■ Recreational facilities such as fairgrounds and soccer fields.

■ Large swatches of land for hunting and other wildlife uses.

■ Making the area a state park.

Attendees voted anonymously and electronically with a digital keypad on each scenario and results appeared on four screens throughout the conference room. Folks voted by entering a number 1 through 10 gauging their preference for each scenario. Graphics and photos complemented each scenario.

Before voting, about an hour and a half's worth of discussion took place with some of the more pressing questions concerning how or if waste would be buried on site and who will be responsible for the land and any issues there years from now. Grossardt said it will cost $500 million to sufficiently bury the buildings and contaminated soil and water. It will cost $1 billion to ship those radioactive items somewhere else.

Grossardt reminded the crowd that the votes and preferences shown in Monday's meeting, as well as those collected tonight in Ballard County, aren't the end of what will be a long planning process for the land.

Whatever happens to the area is something most will want to be in on, Grossardt said, because whatever changes take place, they'll be replacing an area that provides 1,200 jobs that average more than $100,000 in salary per year.

Contact Adam Shull, a Paducah Sun staff writer, at 270-575-8653.

Next meeting

[illegible]

The Paducah Sun 10/26 continued

Paducah Sun, 10/31/2010 (carried over to next page)

Editorial

POTENTIAL

Power-producing facility best use for plant site

EDITOR'S NOTE: Today's editorial was penned by Paducah Sun Editor and Publisher Jim Paxton.

Meetings were held in McCracken and Ballard counties last week to gather public input on an oft-asked question: What would be the best future use of the Paducah Gaseous Diffusion Plant site when, inevitably, the plant shuts down?

The uranium enrichment plant, with its 1950s technology, has been on a death watch for two decades now, as enrichment domestically and internationally migrates to more-efficient centrifuge technology. Consequently, trying to divine future uses for the plant site is not a recent process. The Paducah Area Community Reuse Organization (PACRO) has in recent years put considerable study and effort into this process.

It stands to reason that if that amount of power can be wheeled into the PGDP on the existing grid, it can just as easily be transmitted out.

Last week's meetings represent a more recent iteration, conducted by the U.S. Department of Energy and spearheaded by University of Kentucky researchers. Attendees were presented with 12 redevelopment scenarios (you can view them at www.paducahvision.com) ranging from a nuclear power plant to mixed-used development of recreational facilities and nature preserves.

A majority of those attending the Oct. 11 meeting in Paducah favored finding a new industrial use for the site, and we agree such would be in the enlightened best interest of our community.

The PGDP, which at one time employed 2,000 people in what were on average some of the highest-paying jobs in Kentucky, still employs about 900 people here, still in top-paying jobs. Another less-talked-about concern is what the future is for TVA's Shawnee Fossil Plant in west McCracken County, which has been the PGDP's power supplier for much of the past half-century. The TVA plant, which provides high-paying jobs for more than 300 employees, is among the oldest of TVA's 11 coal-fired facilities, dating back to 1951. This summer TVA announced it is shuttering 59 coal-fired units, including one of the 10 at Shawnee, as it moves more to nuclear, natural gas and even biomass power production.

TVA has not suggested it has its eye on further downsizing or closing its McCracken County plant in the future, but suffice it to say current trends merit concern.

All of that to say this: It strikes us that in looking to the future for the PGDP site and jobs in McCracken County, we need to focus on the greatest asset of the site. And in material terms, that asset may be the enormous power-transmission infrastructure that exists between the PGDP and the power plants that currently supply it, as well as the Tennessee Valley and beyond.

It has been known for generations that at peak production the PGDP consumes enormous power, enough to run a city like Nashville. One analysis we recently read said that at the PGDP's average 2009 load (at a time when the plant had become more energy efficient than a generation ago) the plant consumed enough power in one year to power the entire state of New York for one month.

It stands to reason that if that amount of power can be wheeled into the PGDP on the existing grid, it can just as easily be transmitted out, and we suspect there may not be any other existing industrial site in the United States with that potential already in place.

Thus it strikes us that the best possible use of the site is as a major power-producing campus. Reasonable people can differ as to whether the power generation source should be nuclear, coal, gas, solar, or maybe some combination of those. But clearly, there's an extremely valuable asset here that we need to agree upon, leverage and quickly move forward to re-develop.

We cannot imagine any enterprise in the future that could provide better jobs and greater economic security for McCracken County than to become a major energy producer for the nation, and we believe we have the foundation here and now to make that possible.

APPENDIX X: PROJECT PRESENTATION TO THE PGDP CITIZEN'S ADVISORY BOARD

FEBRUARY 17, 2011

PGDP Future Vision Project

KRCEE

UK

www.uky.edu/krcee/project23.html

1

Presentation Outline

- Project objectives/study team
- Process and methods
  - listening tour and outcomes
  - focus groups: methods & scenario scoring
  - public information meetings
  - public scenario meetings: methods & results
- Results analysis
- Data limitations
- Project accomplishments
- General land use findings
- General public engagement findings
- Recommendations

2

Project Objectives

- Provide scoping/facilitation/document support for activities related to developing a publicly acceptable PGDP End State Vision for the PGDP based on "Politics of Cleanup" approaches.
- Develop and integrate public, stakeholder, regulatory, & technical community visions thru meetings and development of a "PGDP End-State Vision Document".
- Integrate activities of public, stakeholder, regulatory, & technical personnel.
- Provide technical support to foster understanding of technical issues related to development and finalization of "PGDP End-State Vision Document".

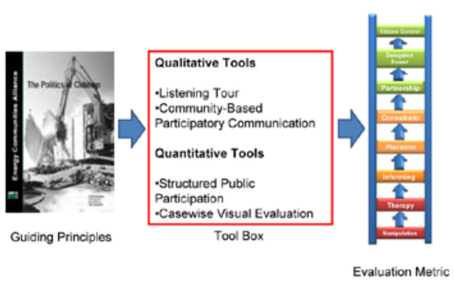
3

Project Team

- DOE Technical Liaison
  - Rich Bonczek (DOE)
- UK Technical Liaison
  - Steve Hampson (University of Kentucky)
- Project Manager
  - Dr. Lindell Ormsbee (University of Kentucky)
- Community-Based Participatory Communication
  - Dr. Chike Anyaegbunam (University of Kentucky)
- Structured Public Involvement
  - Dr. Ted Grossardt (University of Kentucky)
- Casewise Evaluation
  - Dr. Keiron Bailey (University of Arizona)
- Scenario Visualization
  - John Ripy, Ben Blandford (University of Kentucky)
- Facilitation/Logistics/Technical Support
  - Anna Hoover, Mitchael Schwartz, Jason Martin, Chas Hartman

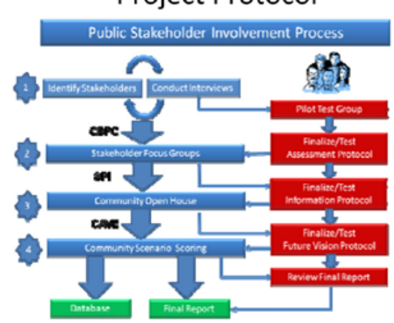
4

Process Components



5

Project Protocol



6

STEP ONE: Background Research and Listening Tour

April 13, 2009 – August 5, 2009

Goals

- Identify Critical Issues
- Discover Previously-Identified Scenarios
- Distinguish Stakeholder Clusters

Background Resources

- 1995 Oak Ridge Study
- DOE RBES
- KRCEE Land Study
- ATSDR Study
- CAB Minutes
- Newspaper Archives
- 2008, 2009 DOE Public Meetings

Listening Tour

- KRCEE-Identified Stakeholders
- *Snowball Sampling*
- Stakeholder-Identified Stakeholders

STEP TWO: Community-Based Participatory Communication Focus Groups

August 5, 2009 – May 5, 2010

Goals

- Solicit community values
- Discuss perceptions about the plant's future
- Identify information gaps and credible sources

Small Group Discussions

- Blind scenario selection
- Identify scenario-related key issues/data needs
- Present scenario/discussion results to re-assembled group

Assembled Group

- Community values discussion
- Scenario critiques
- Information gap identification
- Credible sources

Value Exercises

- Appealing characteristics of the local community
  - Sense of community/community spirit
  - Heritage/tradition/family/"roots"
  - Friendliness
  - Outdoor recreation
  - Rural lifestyle with proximity to urban areas
  - Scenic beauty
  - Safety
  - Cultural/arts opportunities
- Characteristics of the ideal city
  - Jobs and economic opportunities
  - Clean environment
  - Safety
  - Kid-friendly
  - Scenic beauty
  - Education
  - Affordability

Values were used to evaluate hypothetical future visions (i.e. scenarios)

Values → Visions

Future Vision Scenarios

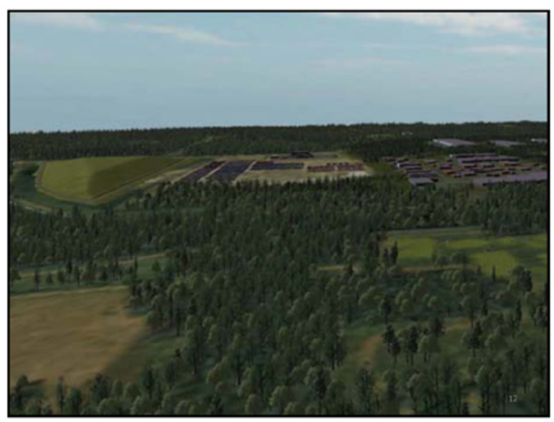
S#	PGDP Landuse						WMA Land Use		Future Waste Ship Off Site:			Legacy Waste Excavate:	
	NE	HI	LI	AR	PR	IC	Addl Rec	Exist	None	Part	All	All	Part
1	x							x	x			x	
2	x							x		x			x
3		x					x				x	x	
4		x						x	x				x
5			x				x			x		x	
6			x					x			x		x
7				x				x		x			x
8				x			x		x			x	
9					x		x				x		x
10					x			x		x		x	
11						x		x			x	x	
12						x	x		x				x

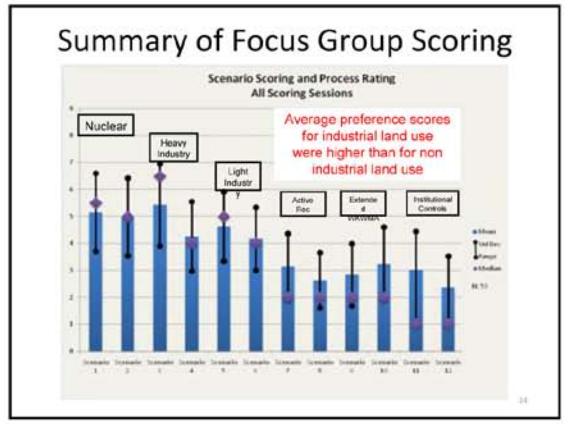
Industrial Land uses (scenarios 1–6)

Non Industrial Land uses (scenarios 7–12)

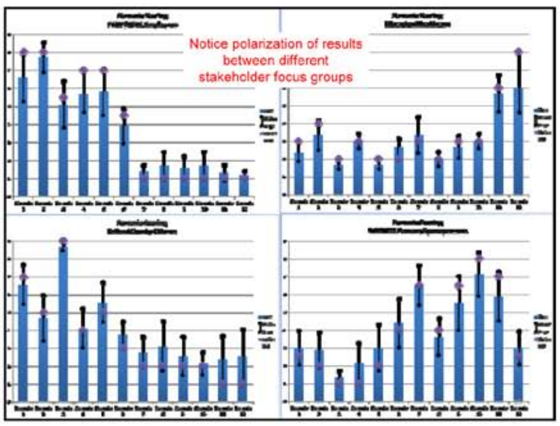
Scenario 5

- *Light Industry on Plant Site
- * Active Recreational Facilities added to PGDP WMA
- * Part of Plant Decommissioning Waste kept onsite in WDA and part placed in managed Landfill
- * All Existing Burial Grounds excavated, some placed in the WDA and the rest shipped off-site.

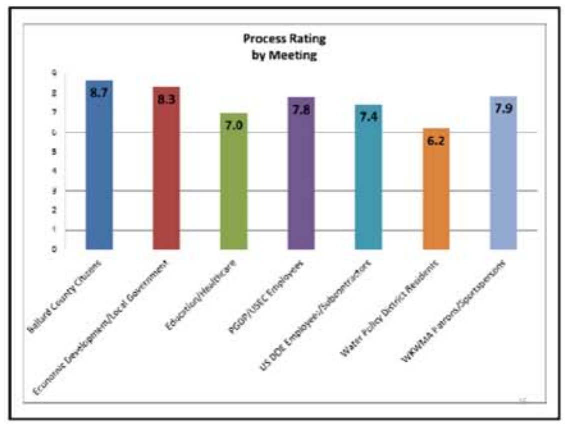




Summary of Focus Group Scoring
Scenario Scoring and Process Rating
All Scoring Sessions
Nuclear
Heavy Industry
Light Industr y
Average preference scores for industrial land use were higher than for non industrial land use
Active Rec
Institutional Controls

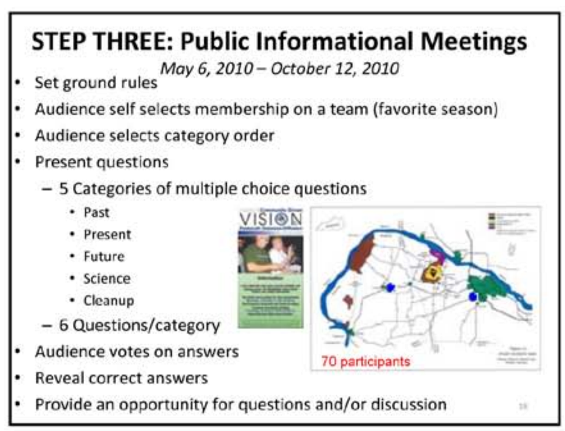


Notice polarization of results between different stakeholder focus groups



Process Rating
by Meeting
8.7
8.3
7.0
7.8
7.4
6.2
7.9
Ballard County Citizens
Economic Development/Local Government
Education/Healthcare
PGDP/USEC Employees
US DOE Employees/Subcontractors
Water Policy District Residents
WKWMA Patrons/Sportspersons

paducahvision.com
Paducah's Future Vision
Welcome
The Project
The Past
The Present
The Future
Science
Cleanup
FAQ
Welcome
Project History
View here
Welcome to the Atomic City



STEP THREE: Public Informational Meetings
May 6, 2010 – October 12, 2010
Set ground rules
Audience self selects membership on a team (favorite season)
Audience selects category order
Present questions
– 5 Categories of multiple choice questions
Past
Present
Future
Science
Cleanup
– 6 Questions/category
Audience votes on answers
Reveal correct answers
Provide an opportunity for questions and/or discussion
VISION
70 participants

STEP FOUR: Public Scenario Scoring Meetings

October 25, 2010 – October 27, 2010

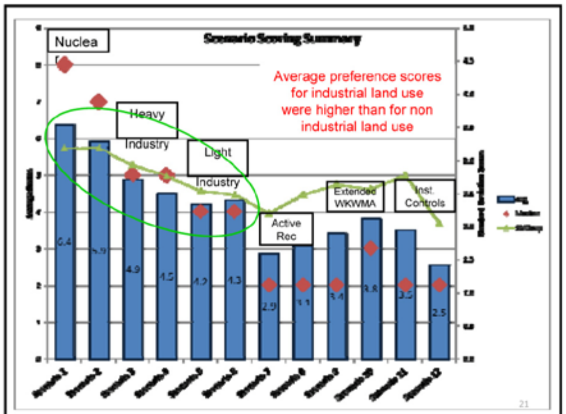
- Set ground rules
- Present each of the 12 scenarios
- Field questions about scenarios
- Vote on each scenario
- Solicit additional scenarios from audience
- Vote on audience-generated scenarios
- Evaluate the process

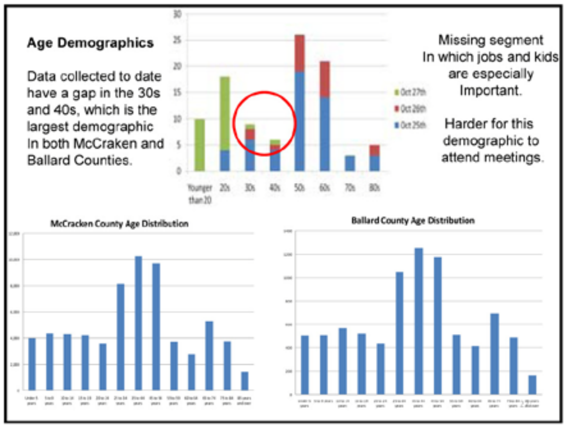
Future Vision Scenarios

S#	PGDP Landuse						WMA Land Use		Future Waste Ship Off Site:			Legacy Waste Excavate:	
	NE	HI	LI	AR	PR	IC	Addl Rec	Exist	None	Part	All	All	Part
1	x							x	x			x	
2	x							x		x			x
3		x					x				x	x	
4		x						x	x				x
5			x				x			x		x	
6			x					x			x		x
7				x				x		x			x
8				x			x		x			x	
9					x		x				x		x
10					x			x		x		x	
11						x		x			x	x	
12						x	x		x				x

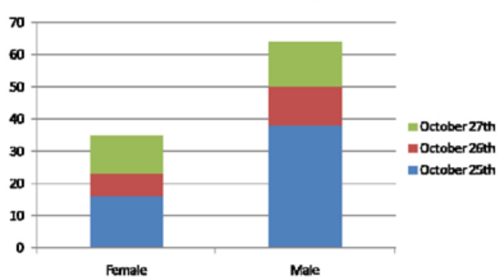
Industrial Land uses (scenarios 1–6)

Non Industrial Land uses (scenarios 7–12)

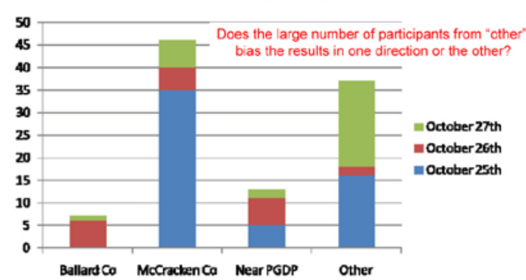


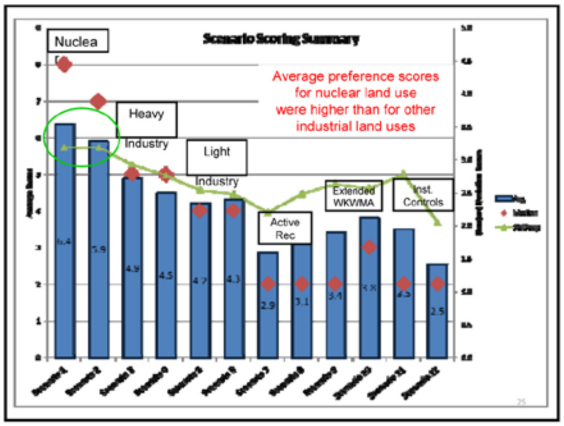


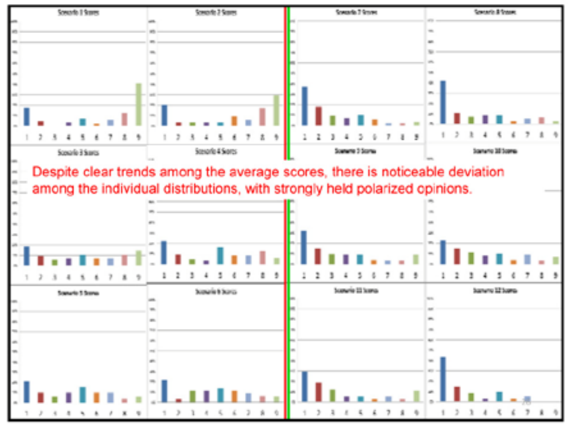
What is your gender for October 25th, 26th, 27th, 2010



Where do you live? For October 25th, 26th, 27th, 2010







Nuclear Industry Participant Discussion

Balancing Perceived Economic, Environmental, Health, & Seismic Risks

- "[T]he idea of nuclear power is appealing to me… I'm not really opposed to having that around us as long as…it can be made safe."
- "I like the idea of a nuclear power plant, using some alternative energy sources instead of coal…"
- "If it's safe, then I say yes it is a good future use…"
- "It would bring a lot of jobs into the community… But in the end…you've got potential environmental disaster [and] further contamination."
- "I'm all for nuclear power as long as you do two things. One, get nuclear power that doesn't leave waste. And second is repeal Murphy's Law."
- "I don't want another Chernobyl."
- "When God built a nuclear reactor, he put it 63 million miles away. That's where they ought to be."

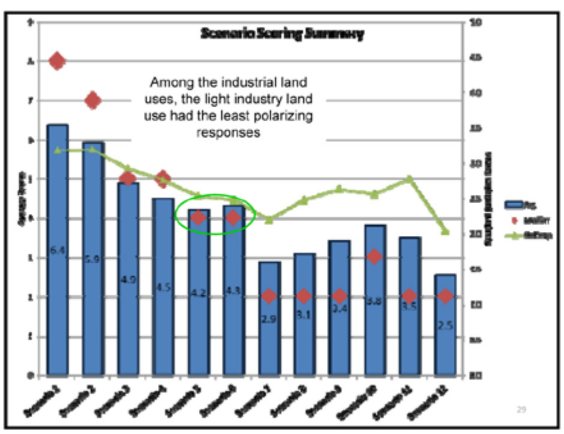
27

Heavy Industry Participant Discussion

Weighing jobs, the environment, waste disposal, & perceptions

- "We thought it was probably the most feasible thing you could do with the land."
- "We think it's probably a good idea, as long as the industry that it brings in doesn't damage the wildlife area anymore."
- "[Y]ou'd have a lot of jobs there, but you'd still have the same old problems we've always had."
- "I just don't see how you're gonna convince [industry] that this is perfectly safe and, you know, we can build right next to this [WDA]. I think…it's gonna, basically, condemn the site for any future development."

28



Light Industry Participant Discussion

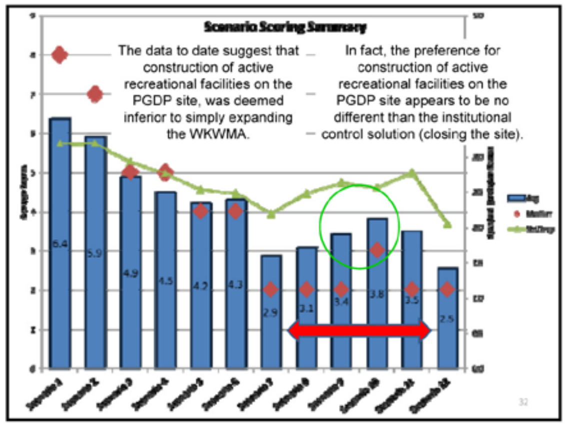
Public appeal; waste & recreation constraints

- "We thought it was one of the easier [scenarios] for maybe the public to accept."
- "The waste cell: some people may look at it as a buffer to the light industry…"
- "The rec facility could be a positive attraction for the facility, by attracting people to it and getting rid of the secretiveness of what was the Paducah Gaseous Diffusion Plant."
- "[This scenario represents] the continuation of jobs and employment here with light industry… That's encouraging 'cause we're all interested in continuing to have a job."
- "No use of the trained workforce—the nuclear workforce—we thought that was a negative…"

30

Stakeholder Observations On Economic Development

- "[U]nless we have the kinds of jobs that industry affords where people can make enough money to buy a home and educate their children, you're not going to be able to have the other items that make for a good community. You're not going to have nice homes. You're not going to have stores to shop in… Unless there's an economic base to provide for those things, then you're regressing as opposed to progressing."
- "I think the main issue most people are thinking about is the jobs. It's the impact on our economy… We're talking a thousand jobs or more right now. We all want to see something transition with this facility that will -- I don't know that we'll necessarily expect it to be on par with that number of jobs -- but we want to try and retain as many employees as we can."
- "[W]e're thinkin' back to these quality of life issues we've discussed, and which of the scenarios gets us closer to that… [Y]ou've got a lot of those cultural and community aspects, but you need jobs. So is one of the jobs options better than the other? Is nuclear better than heavy industry, or vice versa? Does it matter in that respect?"



Expanded Wildlife Participant Discussion

Economic and environmental tensions

- "[W]e thought this was probably the best use for the area, in the long run."
- "[Expanding the WMA represents] a lot of continued and enhanced recreational uses of the area; enhanced economic potential, secondary to widespread recreational uses.. And then, in a way, it would maintain and improve the overall quality of the life in the surrounding community."
- "It enhances the public use of the Western Kentucky Wildlife Management Area and Nature Preserve [and] would facilitate adjoining development… People would be more likely to use the surrounding area. Also, the economic impact of the area would be enhanced through the additional use for—potentially from the area…and around the country."
- "It blends well with the surrounding area… But…you've gotten rid of industry and the whole jobs and employment kind of thing has went away. So, I mean, good preserve, bad that you lose jobs."

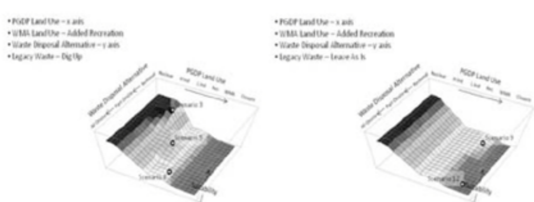
Stakeholder-Suggested Scenarios

- Top Scores on Scenarios Suggested by Participants
  - Alternative Energy Center
  - Federal Lab to Test Cleanup
  - Remediation Research Facility Combined with Power Plant
  - Remediation Research Facility
- This type of facility was suggested independently at all three scenario scoring meetings, and received the highest scores at all three meeting among all scenarios
- This type of facility was similar to one also recommended by the CAB in its 2005 recommendations

Observations

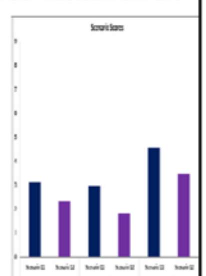
- To date, the data suggest that secondary factors:
  - WKWMA land use
  - Legacy Wastes (Burial Grounds)
  - Future Wastes (Waste Disposal Alternatives)

  Do not affect the preferred choice of the primary land use.



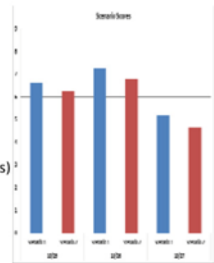
Observations

- From both the qualitative and quantitative analysis, the data would suggest that most participants favor removal of both the burial grounds and the D&D wastes from the site.
- Reasons
  - Health and safety concerns
  - Negative impact on recruiting new business
- Exceptions:
  - USEC employees
    - (keeping waste on-site insures jobs)
  - WKWMA users
    - (waste keeps others away)
  - Some environmentalists
    - (unethical to ship our wastes to others)

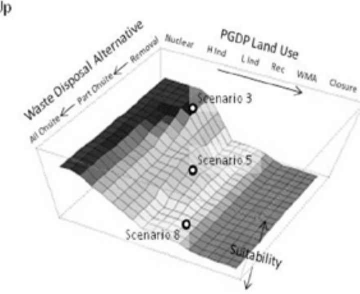


Observations

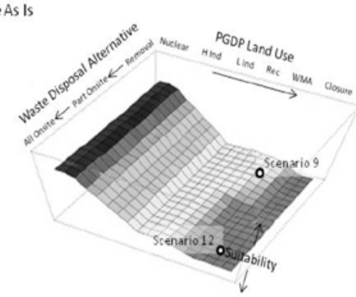
- From both the qualitative and quantitative analysis, the data would suggest that most participants place a higher priority on removal of the burial grounds than the D&D wastes from the site.
- Reasons
  - Health and safety concerns
- Exceptions:
  - USEC employees
    - (keeping waste on-site insures jobs)
  - Some environmentalists
    - (unethical to ship our wastes to others)



- PGDP Land Use – x axis
- WMA Land Use – Added Recreation
- Waste Disposal Alternative – y axis
- Legacy Waste – Dig Up

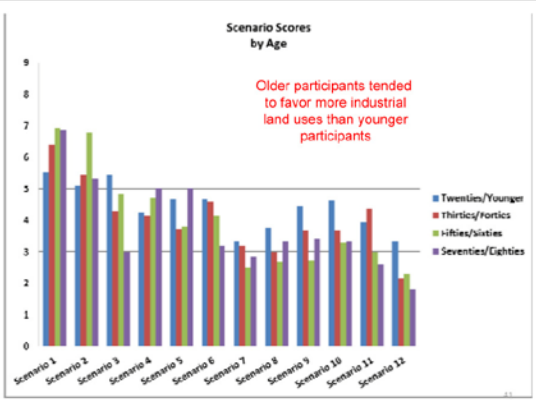


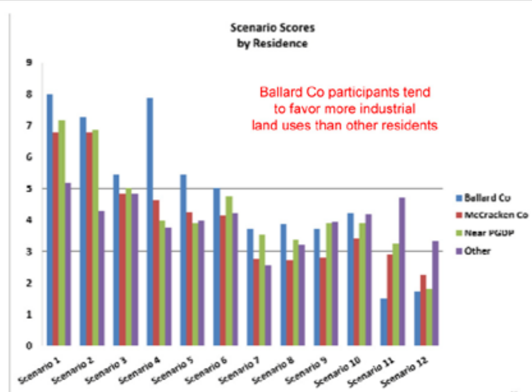
- PGDP Land Use – x axis
- WMA Land Use – Added Recreation
- Waste Disposal Alternative – y axis
- Legacy Waste – Leave As Is



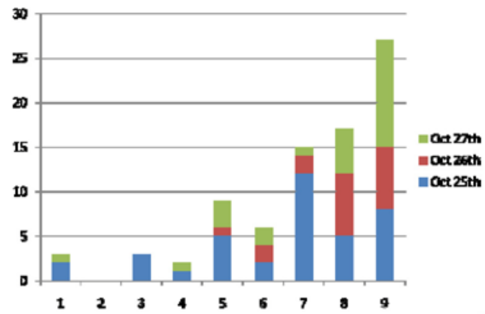
Demographic Analysis

- By Age
- By Gender
- By Residence
- By Meeting
- By Focus Group





Process Satisfaction Scoring for October 25th,26th,27th, 2010



Project Accomplishments

- Developed an effective process for public engagement that integrates:
  - Community Based-Participatory Communication
    - Basis for qualitative analysis
      - Unique use of visual instruments for discussion facilitation
      - Provides framework for citizen ownership of process
      - Provides an effective methodology for solicitation of community values
  - Structured Public Involvement
    - Basis for quantitative analysis
      - Use of computer visualizations for composite analysis of complex multi-faceted issues
      - Public empowerment through anonymous use of keypads
      - Public accountability through real-time process evaluation
      - The ability to demographically and anonymously measure who is in the room, and to track the varying pattern of their preferences

Project Accomplishments

- Developed an effective process for public engagement that:
  - Assesses and incorporates community values
  - Fosters community trust by providing accountability and transparency:
    - Stakeholder Pilot Group
    - Real-time results via key pads
    - Arnstein Ladder
  - Provides equal voice to all participants
    - Anonymous keypads
- Developed a process that has applicability to future DOE public engagement opportunities

Project Accomplishments

- Identified the diverse stakeholder groups
- Identified and documented community:
  - Values
  - Concerns
  - Data needs
  - Trusted data sources
- Documented community experiences and expectations with public engagement process
  - Community does not expect full citizen control
  - Present expectations may be influenced by past experiences

Project Accomplishments

- Assembled a significant amount of relevant project information into a single repository and published through www.paducahvision.com
  - Informational narrative summaries
  - FAQ
  - Document database
  - Computer generated scenario visualizations
- Documented community preferences with regard to a range of possible future visions
  - Quantitatively
  - Qualitatively

Community Preference Qualifiers

- Community Representation
  - Level of Participation (103)
  - Pattern of Participation (30-40 year olds missing)
- "This Project' vs. THE PROJECT VS. projecting
  - Long TERM PROJECT vs short term 'vision project'
  - Community has to 'project' preferences under inevitable long term uncertainty
    - Eg. Ongoing DOE WDS meetings
    - Eg. University of Louisville Worker Epidemiological Study published during 'This Project'

General Public Engagement Findings

- This is consistent with the findings of Battelle's 2003 Report "An Evaluation of DOE-EM Public Participation Programs"
  - Interviewees "who expressed concern that community interests were not being taken into account and that a combination of an inattentive public and an insufficiently aggressive public awareness and involvement effort was resulting in a civic failure."

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General Public Engagement Findings

- These findings are perhaps not surprising given the following possible complicating factors:
  - Possible perception that issues are too complex for "ordinary" citizens to understand
  - Negative experiences with public involvement
  - Fear of losing control of the process
  - Lack of public turnout for public meetings
- Which yields:
  - Lack of an effective strategy to truly involve the public
- This situation creates significant barriers in trying to implement the relevant recommendations of the "Politics of Cleanup" Report which was specified as a roadmap for this project to follow.

50

Politics of Cleanup Recommendations

- Recommendation #1: All Parties Must Collaborate — The federal government, local governments, community members, state and federal agencies, and Congress must collaborate when developing the cleanup and future use vision for the site.
- Recommendation #5: Understand Community Values — To properly collaborate, the parties must work to understand the values of the community, and must work to incorporate such values into the planning process.

51

Politics of Cleanup Recommendations

- Recommendation #6: Education Is Essential — The parties must take the time to educate each other on the technical and policy issues underlying the cleanup and to commit staff resources to engage each other. Discussion, which need to take place throughout the process, must also include the question of technical risk and perceptions of risk, recognizing perceptions of risks posed do not always align with the technical risk.
  - *DOE and the regulators need to exert whatever time and effort it takes to educate the affected entities about the various issues involved in site cleanups.*
- Recommendation #14: Following the Minimum in the Law Is Not Enough — Minimum regulatory requirements are insufficient to support substantive public involvement; the parties must develop public involvement processes that are tailored to site-specific needs, recognizing that process is different from negotiations.
  - *A public involvement process for the sake of process will yield little positive results and will not serve to support a timely cleanup*

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Policy Conclusion

- In conclusion, if the recommendations of the POC Report are to be fully achieved, Public Engagement can no longer be viewed as a single project, or an add-on to a larger project. It also cannot be viewed as a series of disjointed projects. Instead, it is our conviction that it must be both viewed and implemented as an ongoing, iterative, and evolving process that:
  - Involves the total community
  - Is tailored to local community
  - Incorporates community values
  - Fosters collaboration
  - Provides accountability and invokes trust
  - Continues to inform and educate stakeholders
  - Provides for an inclusive and truly democratic way for the concerns and preferences of the local citizens to be both heard and valued

53

Policy Conclusion

- In this context, we believe the results of this study should not be viewed as a means to an end (as significant as these initial insights of this study may be), but the first step in building a more effective process of public engagement.
- We believe that the methodologies that have been brought together in this project provide the tools and strategies to achieve such a goal.

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Final Recommendations

- DOE should consider providing a formal response to the March 18, 2004 CAB recommendations which addressed several important issues related to a future vision for the site.
- DOE should examine the potential for use of the existing site in support of a research facility which focuses on energy and/or remediation technologies.
- In the short run, DOE should seek to integrate ongoing public engagement activities in a more coordinated manner (e.g. the Future Vision Study and the parallel public meetings on waste disposal alternatives). Failure to do so can create confusion and send mixed signals to the community.
- In the long run, DOE should consider adopting the methodologies that have been integrated in this study as a template for implementing a long-term public engagement process consistent with the recommendations of the POC Report and the policy conclusions of this study.

55

Final Recommendations

- Based on stakeholder feedback, as well as the findings of the Battelle report (2003), the research team believes that the role of the PGDP Citizens Advisory Board (CAB) should be bettercan can be used more fully and efficiently fulfill its advisory role.
- The project team believes that current perceptions of the CAB as a surrogate for the general public misuse the many talents of CAB members, creating an unrealistic and unattainable expectation that results in a further polarization of the community around contentious issues.
- Given a workable framework to engage the public directly, as has been proposed, the CAB can be freed up to help facilitate such a process.
- This recommendation is consistent with the prior recommendations of both the ECA Report and the Battelle Report.

56

Final Recommendations

- US DOE should consider adopting a stakeholder engagement process that better integrates citizens into the decision making processes. The project team believes that the public engagement methodology developed in this study provides a framework for such a process.
- US DOE should accompany this with a closely coordinated public engagement process. Current practice includes a separate, uncoordinated public process regarding the location of the CERCLA cell. This creates confusion for the public and thus yields confusing feedback from the public.
- Given the increasing likelihood of plant closure, US DOE and the local community should initiate a formal transitional process. This recommendation echoes the 2004 CAB recommendations.
- In particular, US DOE should investigate the practicality of establishing some type of formal research facility at the plant that would focus on the development and testing of innovative methods for contaminated metals recovery, as well as soils and groundwater

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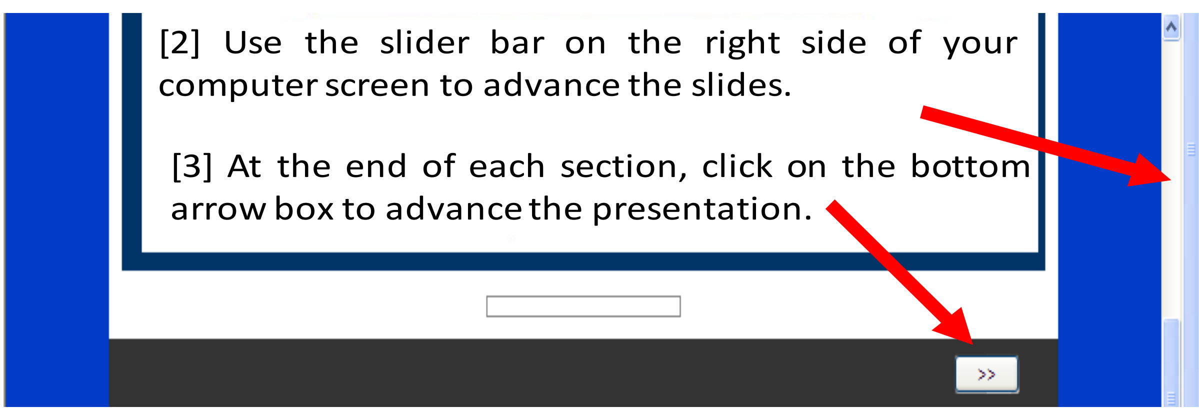
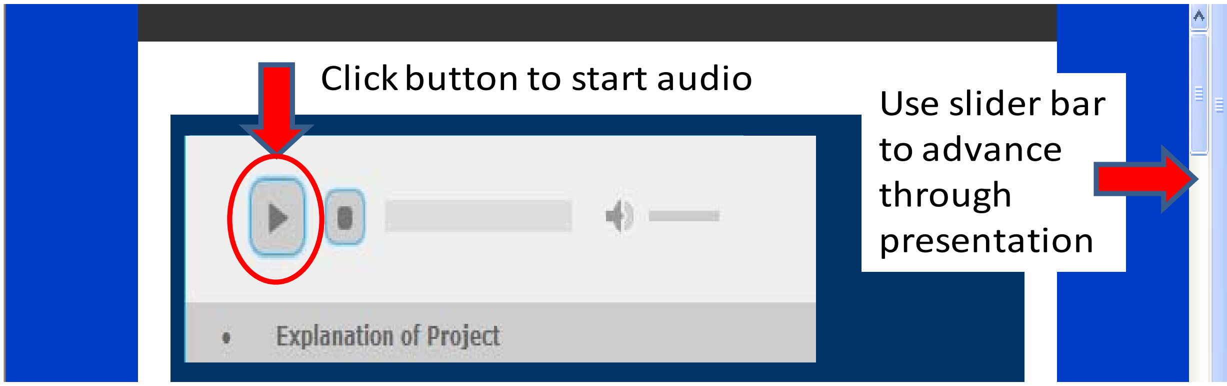
APPENDIX Y: HANDOUT FOR PADUCAH AREA CHAMBER OF COMMERCE APRIL POWER IN PARTNERSHIP BREAKFAST THURSDAY, APRIL 14, 2011

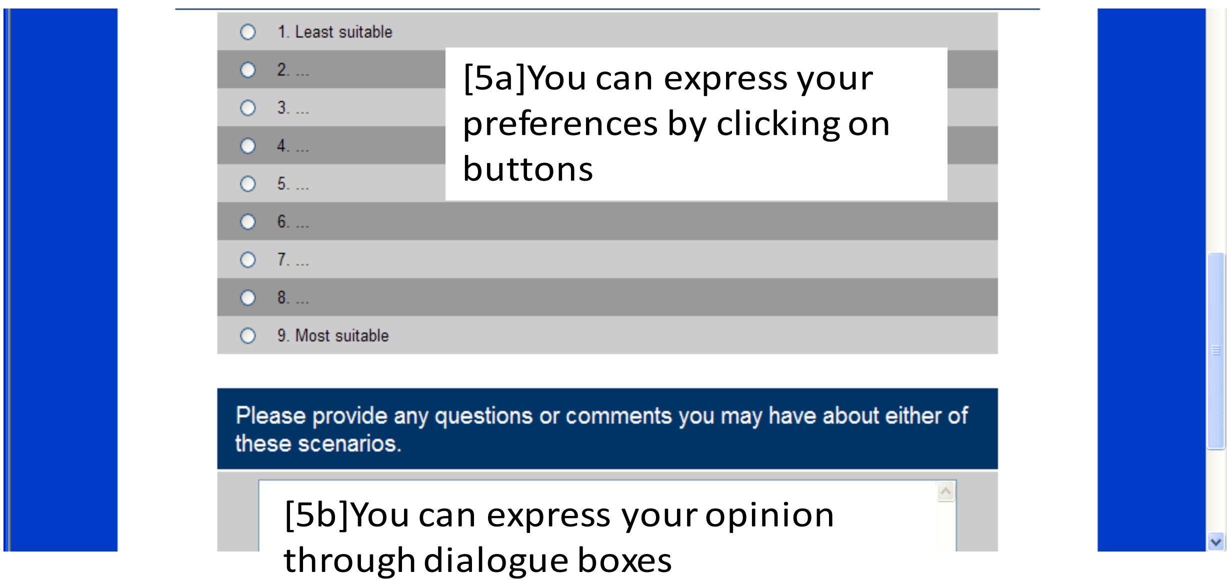
[1] Click "Take the scenario survey" to be guided through a presentation that will 1) ask you some demographic questions, 2) explain each of the 12 hypothetical scenarios, 3) ask you to provide a suitability score (1 to 9) for each scenario, 4) ask for input on additional scenarios, 5) solicit your own additional hypothetical scenarios, and 6) ask you to evaluate the process.



[4] After the opening slide of the scenario survey, each page will have an accompanying dialogue box, that will provide supporting audio. You can begin the audio by clicking on the first button. Use the slider bar of the computer screen to advance through the slides as the audio plays.



[5] At different points in the presentation you will be asked to provide Feedback. This can be done in two different ways:



You can move backward or forward through the presentation by using the arrow boxes at the bottom of each series of slides

APPENDIX Z: LOUISVILLE COURIER JOURNAL ARTICLE

ən by

ɘs Bruggers

PM, Apr. 25, 2011|

:ired engineer Ralph Young had hoped
, would be the year that Kentucky's
neral Assembly would ease its
trictions on nuclear plant construction,
aring the way for a plant near his
netown of Paducah.

: a bill to do just that died in committee
and that was in the days before the
ssive March 11 earthquake in Japan
ısed a tsunami that washed into a
:lear plant there, setting off serious
iation leaks that sent a trace amount of
iation around the world.

ν, given that Paducah sits in an area the
;. Geological Survey considers a high
:ard should an earthquake occur on one
he faults in the New Madrid seismic
ıe, Young and other supporters are
rried that the proposed nuclear plant
y not happen.

ıople see the news and they get
ɔoked," said Young, who serves on an
visory board for the Paducah Gaseous

already comfortable with nuclear energy.

Sen. Bob Leeper, I-Paducah, has pledged that next year he will again push a bill to kill a 27-year-old stipulation that before any nuclear plant is built, there must be a permanent disposal facility to handle its radioactive waste.

On one level, the debate is an academic argument, since no company has proposed building a nuclear power plant in Paducah or anywhere in Kentucky.

But some advocates say the crisis in Japan has become a new excuse for those who want to block any efforts to move from coal as the state's main energy source. And Young said he's skeptical about the bill's chances: "A lot of people here are saying there is no way … we will get that passed.

andy Hook, the majority floor leader in
Kentucky House, where Leeper's bill
; died three years in a row after passing
he Senate. "Kentucky has some of the
'est-cost energy in the nation," he said
he state's reliance on coal.

kins said House Democrats have long
en concerned about the cost of nuclear
ergy, as well as how to safely manage
ste that can be dangerous for centuries.
ow those concerns have been heightened
en more since the nuclear power crisis in
ban. A lot of members have voiced that
ncern with me since that happened."

me residents feel the same.

example, Linda Long, a longtime
ducah-area resident who lives near the
ichment plant, said she does not want a
clear plant brought there.

e got enough things that are dangerous
d objectionable around here," she said.

p. Mike Harmon, R-Danville, vice
airman of the House Tourism and Energy C
mittee, where Leeper's bill died, said
Japan crisis "does give you pause in
ard to nuclear energy."

he noted that while "Kentucky is a coal
te," eventually, "we will have to move to
nething different," and he hopes that
makers will at least be willing to discuss

as details that will likely confirm it was the
tsunami — not the quake — that caused the radiation releases. And, he quipped, there's no chance for a tsunami on the Ohio River.

The Kentucky Coal Association was neutral on the bill, said its president, Bill Bissett.

An uncertain future

Kentucky leaders have been considering the change in nuclear power policy for several years.

Gov. Steve Beshear's 2008 energy plan envisioned the state possibly meeting 30 percent of its electricity demand in 2030 from nuclear energy. Coal now supplies more than 90 percent of the electricity.

The governor has recently been very vocal

scussion on the pros and cons of nuclear
iergy."

ie push for nuclear power in Paducah
imes as work possibly winds down at the
iducah Gaseous Diffusion Plant.

ie United States Enrichment Corp. leases
e plant from the U.S. Department of
iergy on 3,400 acres. But it is nearly 60
ears old, and its contract to buy electricity
om the Tennessee Valley Authority
pires next year. The company, which
timates a $1.5 billion annual economic
ipact in the Paducah area, is looking to
iild a modern enrichment plant in Ohio.

iergy Department officials are working
th University of Kentucky researchers and
cal residents to figure out a future for the
e. Options discussed range from letting
e property return to nature, to putting a
iclear power plant there. A $14 billion
eanup of the fuel plant site is already
ider way and is expected to run through
)40.

ie site's proximity to the New Madrid
ismic zone, an area that covers parts of
ven states including Kentucky, has long
ien a sticking point in discussions about a
iclear power plant there.

ie U.S. Geological Survey doesn't envision
New Madrid earthquake as large as

over 4,000 years, including a series of
three quakes — magnitudes 7.7, 7.5 and
7.7 — that occurred 200 years ago.

State officials contest the hazard ranking for Western Kentucky, saying that major quakes don't occur very frequently and that USGS methods exaggerate the threat.

The USGS seismic hazard mapping for the New Madrid zone "puts a bull's eye that causes people from doing investment there," said James Cobb, the Kentucky state geologist and director of the Kentucky Geological Survey.

Nuclear power in Western Kentucky "shouldn't be ruled out without more study," he said.

But Williams said the hazard mapping includes a rigorous review process. The aking the public pulse

ı Paducah, research before the Japan uake showed a nuclear power plant as mong the most favored options for the nrichment plant site, said Lindell ırmsbee, director of the Kentucky ;esearch Consortium for Energy and :nvironment, which has been conducting ıe Paducah Vision project for the energy epartment.

ıut he also said the UK team found strong pposition to a nuclear power plant.

\ better solution for the community might e one that sort of minimized the olarization for the community," Ormsbee aid, adding that might involve light ıdustry.

ıecause the UK research was done before ıe Japan quake, researchers will be ›turning to see if attitudes have changed.

'aducah Mayor William F. Paxton III said ıat although the Japan quake gave him ome pause, community leaders have ·anted to bring nuclear industry jobs to ›place those that likely will go away.

Ve have worked and lived with the nrichment plant since 1952 and it's been

Reporter James Bruggers can be reached at (502) 582-4645.

How bad could it be?

The Federal Emergency Management Agency has predicted that a magnitude 7.7 earthquake in the New Madrid seismic zone could:

Kill 3,500 people and injure as many as 86,000.
Leave 2 million people homeless.
Cost $200 billion to $300 billion in direct economic losses.
Knock out 150 hospitals and 1,300 schools.
Damage and close 3,500 bridges.

Paducah Future Vision
To see images and read about 12 scenarios for future uses of the Paducah Gaseous Diffusion Plant site, and to comment on them, visit www.paducahvision.com

More news
Follow other environmental news and reporter James Bruggers' blog at www.kentuckianagreen.com

APPENDIX AA: FLYER FOR PUBLIC MEETING, FIRST CHRISTIAN CHURCH, APRIL 28, 2011

Create a Community-Driven Vision for the Paducah Gaseous Diffusion Plant Site

Vote on several land use options, including

--Permanent Site Closure
--Expanded Wildlife Management
--Recreation Areas
--Light Industry
--Heavy Manufacturing
--Nuclear Industry

Give us your ratings, participate in democracy, and influence your community's future!

Thursday, April 28th, 7:00pm
First Christian Church

APPENDIX AB: PRESENTATION TO PADUCAH ROTARY CLUB MAY 4, 2011

This meeting is part of the third phase of the Stakeholder Future Vision Project, an ongoing research project of the Kentucky Research Consortium for Energy and the Environment and the University of Kentucky. For more information, visit: www.paducahvision.com or call 859-257-1299.

PGDP Future Vision Project

KRCEE

UK

Kentucky Water Research Institute

www.uky.edu/krcee/project23.html

1

Project Objectives

1. Provide scoping/facilitation/document support for activities related to developing a publicly acceptable PGDP End State Vision for the PGDP based on "Politics of Cleanup" approaches.
2. Solicit, measure and characterize a reliable understanding of public and stakeholder values and preferences regarding a "PGDP End-State Vision Document."
3. Provide insight, development, and deployment of process methods to accomplish "2".

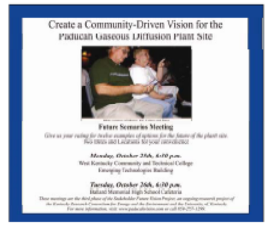
2

Public Scenario Scoring Meetings

October 25-27, 2010; April 28, 2011

Goals

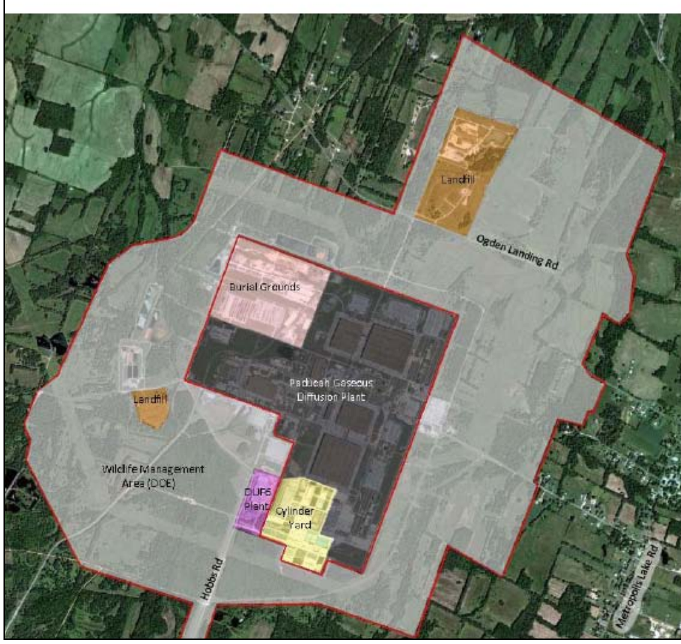
- Introduce Scenarios
- Answer Questions
- Score Scenarios
- Solicit Participant Scenarios
- Score Participant Scenarios



Scenario Scoring Meetings

- 12 Scenarios
- Utilize Structured Public Involvement Process
- Utilize Key Pad Technology

10



Current:

*DUF6 Flouride Extraction Plant

*Cylinder Yard

*Plant Site surrounded by WMA

*Burial Ground Area - site of older buried waste of many kinds

*Designed Landfills – site of newer buried wastes

Scenario 5

*Light Industry on Plant Site

* Active Recreational Facilities added to PGDP WMA

* Part of Plant Decommissioning Waste kept onsite in WDA and part placed in managed Landfill

* All Existing Burial Grounds excavated, some placed in the WDA and the rest shipped off-site.

17

General Land Use Findings: Oct. Meetings

- Of the range of six major possible land use options for the PGDP footprint, industrial land uses scored higher than non-industrial land uses. However, the responses were bi-modal.

32

Current Land Use Findings

- Based on the quantitative and qualitative data collected to date, it appears that a large proportion of respondents favor removal of all of the burial grounds. However, this preference is influenced by the actual land use.

38

Type a zoom percentage, or click the menu and choose a preset magnifcation

Current Land Use Findings

- To a slightly lesser extent, a larger proportion of respondents also oppose the construction of a new waste disposal facility on site. Reasons for opposition included:
  - Environmental and health concerns
  - Future development concerns
- However, some respondents support such a facility, citing:
  - Job security (e.g. individuals from USEC and DOE employee community)
  - Discourage competing interests (e.g. individuals from the WKMMA users)
  - Unethical to ship our waste to others (e.g. individuals from the environmental community)

39

Supplemental Land Use Findings

- The solicitation of additional scenarios from the public produced an additional land use scenario that received average scores greater than the best score (6.4) of any of the 6 original landuses:
  - Research Facility
    - Alternative Energy Research Center (6.5)
    - Remediation Research Center Combined with Power Plant (6.9)
    - Remediation Research Facility (7.2)
    - Federal Lab to Test Cleanup (7.1)
- Notably is the fact that the research facility was suggested independently at every public scoring meeting
- In general, this landuse also received very little opposition
- Supports similar previous CAB recommendations

42

Community Preference Qualifiers

- Community Representation
  - Level of Participation (103)
  - Pattern of Participation (30-40 year olds missing)
  - 25 new participants last week: 90% +50 yrs old
  - ~85 people working on web site, 6 completed

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RF Keypad System

Politics of Cleanup Recommendations

- **All Parties Must Collaborate** — The federal government, local governments, community members, state and federal agencies, and Congress must collaborate when developing the cleanup and future use vision for the site.
- **Understand Community Values** — To properly collaborate, the parties must work to understand the values of the community, and must work to incorporate such values into the planning process.

54

Politics of Cleanup Recommendations

- **Following the Minimum in the Law Is Not Enough** — Minimum regulatory requirements are insufficient to support substantive public involvement; the parties must develop public involvement processes that are tailored to site-specific needs, recognizing that process is different from negotiations.
  - *A public involvement process for the sake of process will yield little positive results and will not serve to support a timely cleanup*

56

Politics of Cleanup Recommendations

- **Following the Minimum in the Law Is Not Enough** — Minimum regulatory requirements are insufficient to support substantive public involvement; the parties must develop public involvement processes that are tailored to site-specific needs, recognizing that process is different from negotiations.
  - *A public involvement process for the sake of process will yield little positive results and will not serve to support a timely cleanup*

56

All Parties Must Collaborate — The federal government, local governments, community members, state and federal agencies, and Congress must collaborate when developing the cleanup and future use vision for the site.

1. Strongly Disagree
2. ..
3. Disagree
4. ..
5. Not Sure
6. ..
7. Agree
8. ..
9. Strongly Agree

Mean =

Understand Community Values — To properly collaborate, the parties must work to understand the values of the community, and must work to incorporate such values into the planning process.

1. Strongly Disagree
2. ..
3. Disagree
4. ..
5. Not Sure
6. ..
7. Agree
8. ..
9. Strongly Agree

Mean =

Education Is Essential — The parties must take the time to educate each other on the technical and policy issues underlying the cleanup and to commit staff resources to engage each other.

1. Strongly Disagree
2. ..
3. Disagree
4. ..
5. Not Sure
6. ..
7. Agree
8. ..
9. Strongly Agree

Mean =

Following the Minimum in the Law Is Not Enough —The parties must develop public involvement processes that are tailored to site-specific needs, recognizing that process is different from negotiations.

1. Strongly Disagree
2. ..
3. Disagree
4. ..
5. Not Sure
6. ..
7. Agree
8. ..
9. Strongly Agree

Mean =

What kinds of strategies would be most useful in helping the community deal with the uncertainties of PGDP?

1. First Idea
2. Second Idea
3. Third Idea
4. Fourth Idea
5. ...
6. ...
7. ...

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Other Venues? Clubs? Invitations?

- Scenario Presentation and Evaluation Takes About an 90 minutes
- We want to reach more people: several hundred would be nice!
- We want to reach more women.
- We want to reach more 30-50 demographic.
- Me: tgrossardt@uky.edu
  – 859-257-7522
- Anna Hoover: aghoov2@email.uky.edu
- Comment box www.paducahvision.com

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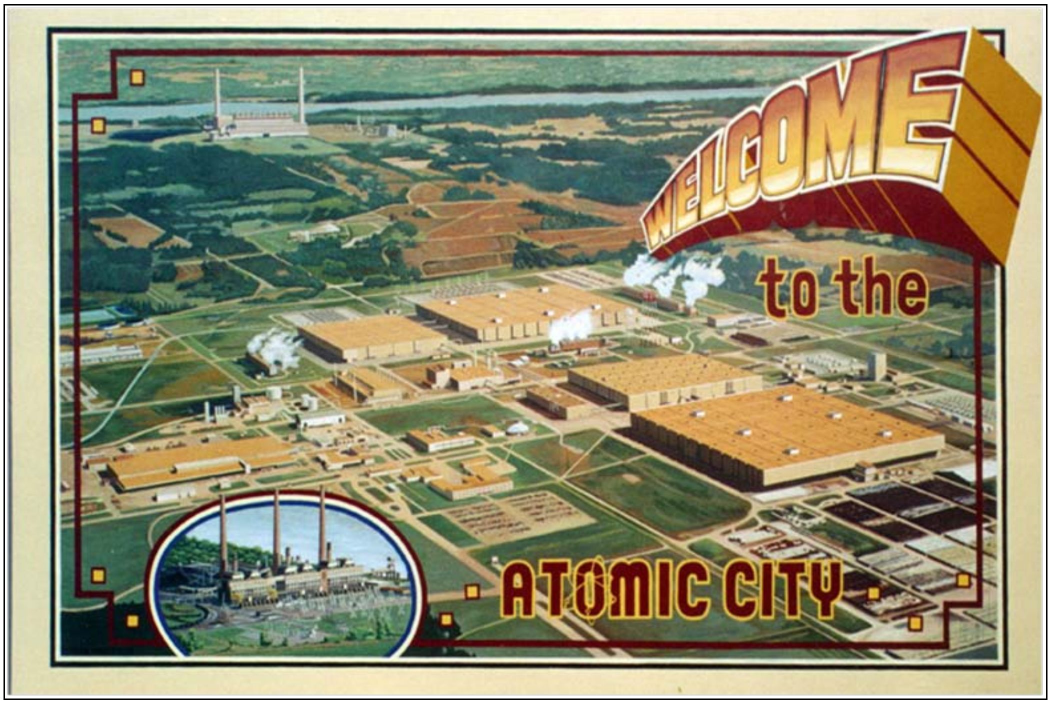
APPENDIX AC: HEATH MIDDLE SCHOOL PRESENTATION
MAY 16, 2011



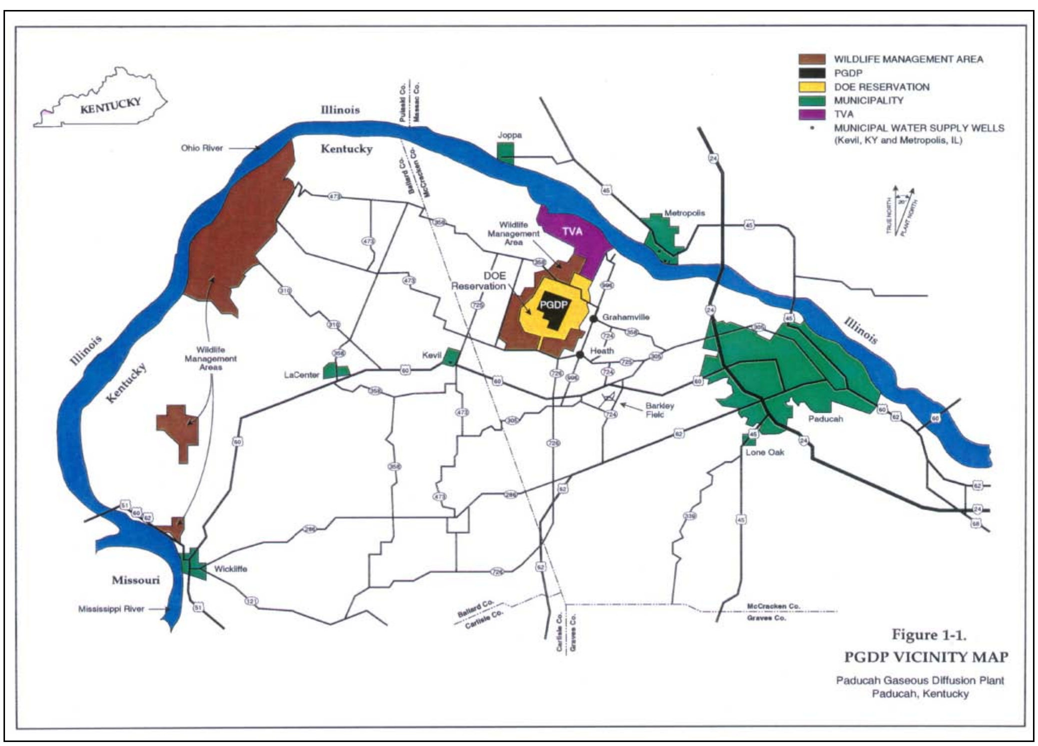
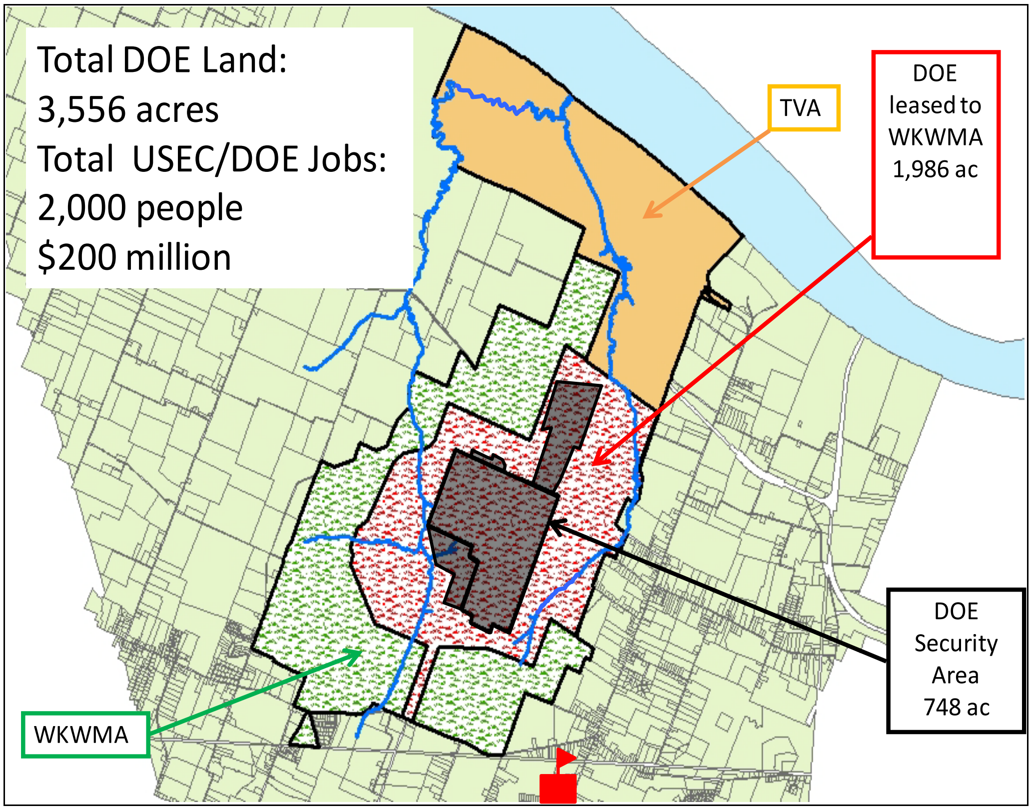
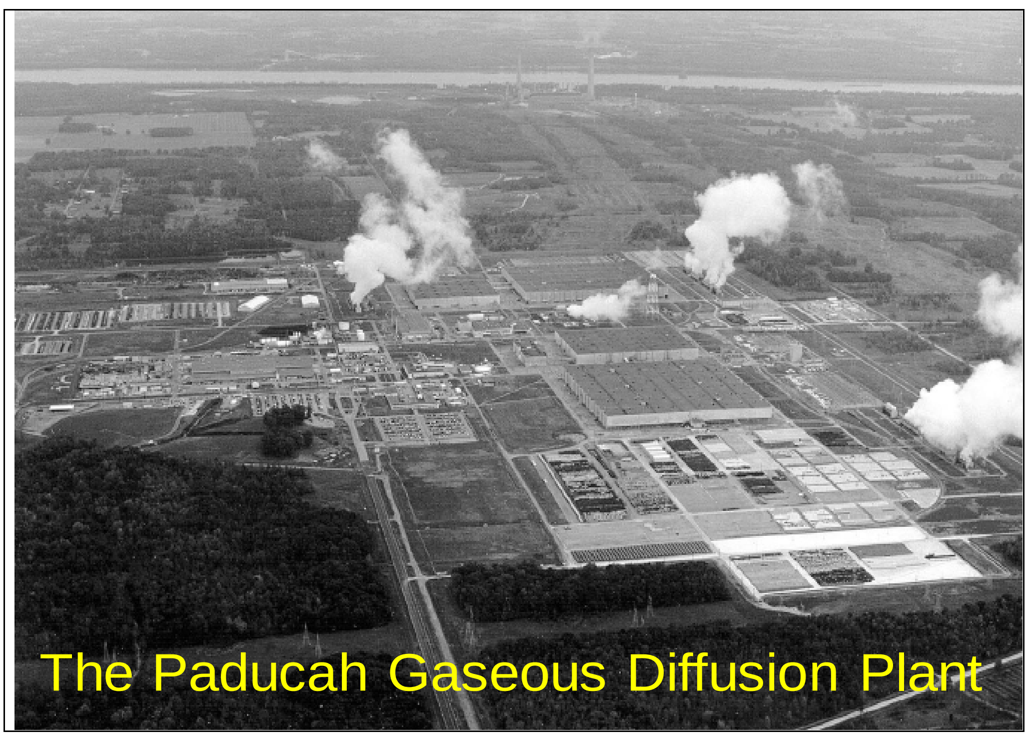


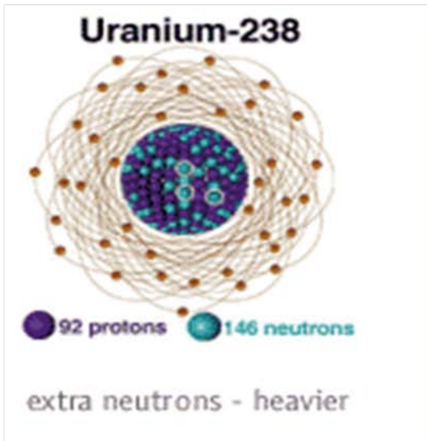
Figure 1-1.
PGDP VICINITY MAP
Paducah Gaseous Diffusion Plant
Paducah, Kentucky

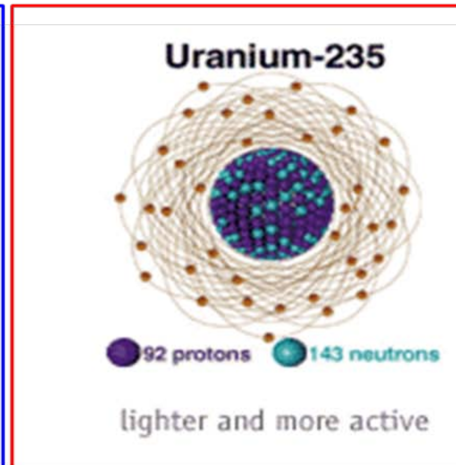

Total DOE Land:
3,556 acres
Total USEC/DOE Jobs:
2,000 people
$200 million
TVA
DOE
leased to
WKWMA
1,986 ac
DOE
Security
Area
748 ac
WKWMA


The Paducah Gaseous Diffusion Plant

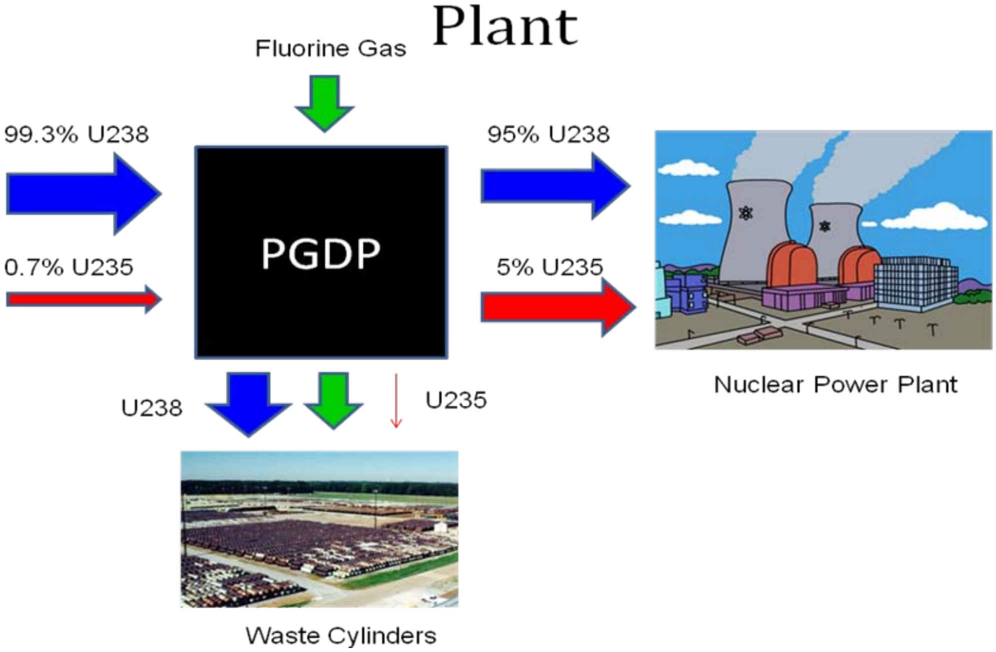
Uranium

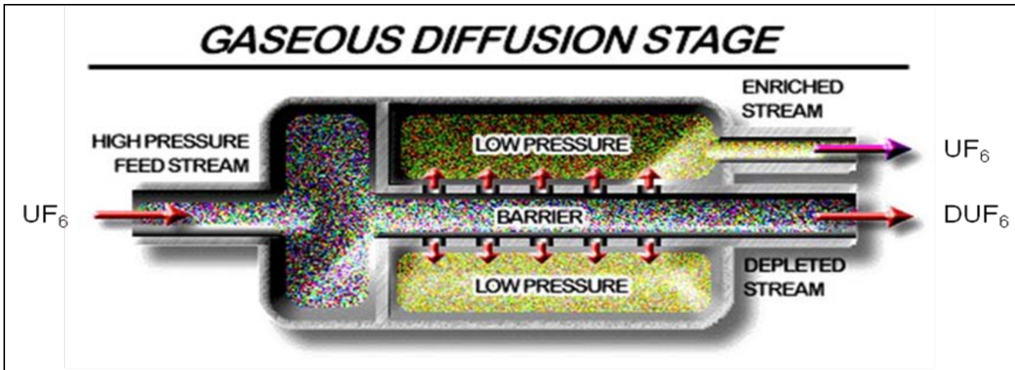
- Natural uranium exists in two major types called isotopes – Uranium 235 and Uranium 238. The number refers to the total number of neutrons and protons in the nucleus of the atom.





The Paducah Gaseous Diffusion Plant

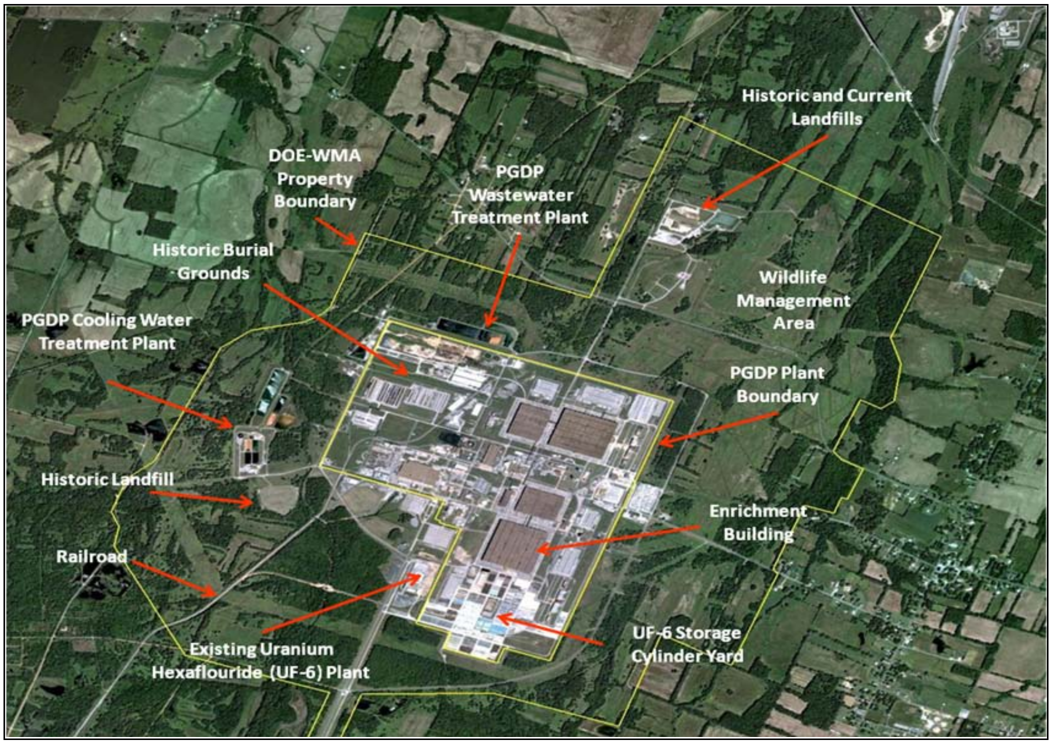




This process of uranium enrichment increases the concentration of U-235 from 0.7% up to 5.0%

http://www.usec.com/gaseousdiffusion.htm

PGDP has 1,760 enrichment stages

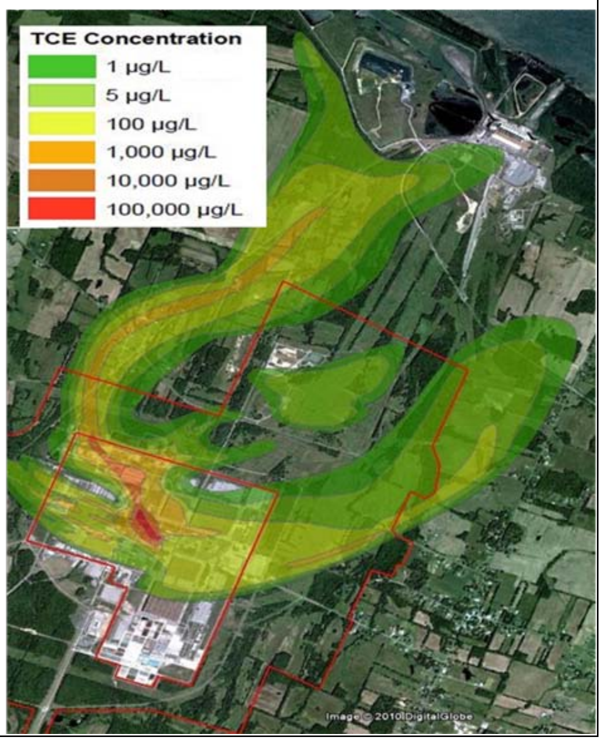


Environmental Impacts

- Groundwater Plumes
  - TCE
  - Tc99
- Burial Grounds
- Contaminated Soils and Sediments
  - Radioactive Metals
  - Heavy Metals
  - Toxic Chemicals

Environmental Cleanup

- The US Government is responsible for cleaning up the site.



Problem Statement

- The U.S. Department of Energy is planning on closing the Paducah Gaseous Diffusion Plant in the near future.
  - If the plant closes:
    - 2000 people will lose their jobs
    - $200 million/year will be lost
  - The current site is highly polluted
    - Before US DOE leaves, they will have to clean up the site

Questions

- Question 1: How do you think closing the site might affect your assigned community member?

- Question 2: What do you think should be done to minimize the impact?

APPENDIX AD: INTERNET SURVEY EMAIL TO STAKEHOLDERS, JUNE 6, 2011

For the last two years, researchers from the University of Kentucky have worked with Paducah stakeholders to identify a range of possible future uses for the Paducah Gaseous Diffusion Plant site after the plant closes. Through interviews, focus groups, and public meetings, a number of options have been identified, including permanent site closure, expanded wildlife management, active recreation, light industry, heavy manufacturing, and nuclear industry options. At various project stages, participants have been asked to evaluate the suitability of each of twelve different future uses.

Unfortunately, interested individuals do not always have the time or ability to attend meetings where their opinions can be registered. To increase participation levels, the entire scenario presentation and survey have been placed online at http://www.paducahvision.com/scenario-survey. The results of these online scenario evaluations will be included in a report on the community's vision for the site. This report will be made available to the public and will be presented to the U.S. Department of Energy to inform decision-making related to the plant's future.

The greater the number of participants, the better the research team's ability to capture the opinions of diverse segments of the community and the more accurate the final report can be.

If you have not already had an opportunity to evaluate the hypothetical scenarios during focus groups or public meetings, please visit http://www.paducahvision.com/scenario-survey and take the survey at your convenience. The entire presentation will take about 30-45 minutes to complete; however, the program allows you to stop and resume the survey at different times without losing the answers that you have already provided.

The attached flyer provides some additional instructions about how to use the website. Please share it and/or this message with anyone you feel might be interested in taking the survey.

Thank you in advance for your participation. Please do not hesitate to contact me with any questions at: lormsbee@engr.uky.edu or 859-257-6329.

Sincerely,

Lindell Ormsbee

Lindell Ormsbee, P.E., P.H., Ph.D., D.WRE, F.ASCE
Director, Kentucky Water Resources Research Institute
Director, Kentucky Center for Excellence for Watershed Management
Associate Director, NIEHS - UK Superfund Program
Raymond Blythe Professor of Civil Engineering
859-257-6329

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Paducah's Future Vision Site
Welcome!
Welcome
The Project
The Past
The Present
The Future
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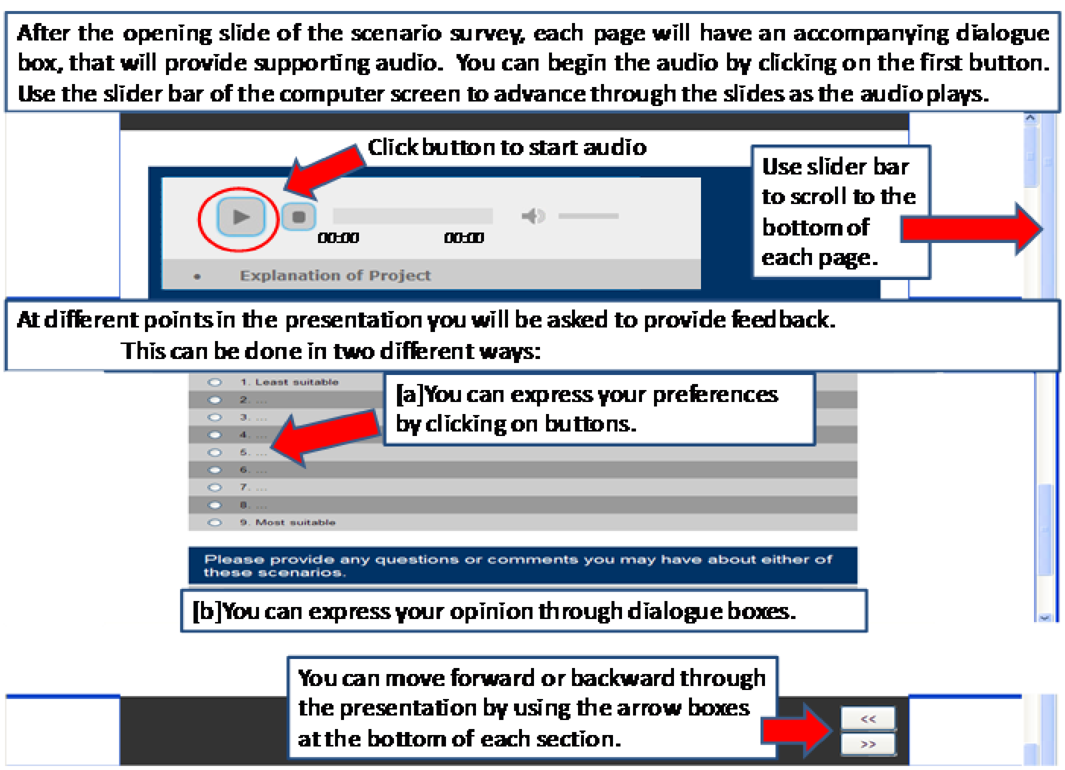
Cleanup
FAQ
Documents
Paducah Vision Project Website - http://www.paducahvision.com
Welcome
Project History
In 2003, the Kentucky Research Consortium for Energy and Environment (KRCEE) was created at the University of Kentucky. The Consortium's mission is to provide technical support to the US Department of Energy (US DOE), the US Environmental Protection Agency (US EPA), and the Kentucky Division of Waste Management regarding non-consensus issues associated with clean-up efforts at the Paducah Gaseous Diffusion Plant (PGDP), a National Priority List (NPL) Superfund site.
In 2009, KRCEE was asked to develop a community-based future vision for the PGPD that would identify the range of community perspectives and preferences for the site's future after US DOE closes the facility. This website has been constructed to document the project, as well as to provide important information relevant to potential future uses of the PGDP facility.
Pages: 1 2 3 4 5 6
Next
DOC
PDF
WELCOME
to the
ATOMIC CITY
Scenarios
View the scenarios here
OR
Take the scenario survey
[1] Click "Take the scenario survey" to be guided through a presentation that will:
1) ask you some demographic questions
2) explain each of the 12 hypothetical scenarios
3) ask you to provide a suitability score (1 to 9) for each scenario
4) ask for input on additional scenarios
5) solicit your own additional hypothetical scenarios
6) ask you to evaluate the process



After the opening slide of the scenario survey, each page will have an accompanying dialogue box, that will provide supporting audio. You can begin the audio by clicking on the first button. Use the slider bar of the computer screen to advance through the slides as the audio plays.
Click button to start audio
00:00
00:00
Explanation of Project
Use slider bar to scroll to the bottom of each page.
At different points in the presentation you will be asked to provide feedback.
This can be done in two different ways:
1. Least suitable
2. ...
3. ...
4. ...
5. ...
6. ...
7. ...
8. ...
9. Most suitable
[a]You can express your preferences by clicking on buttons.
Please provide any questions or comments you may have about either of these scenarios.
[b]You can express your opinion through dialogue boxes.
You can move forward or backward through the presentation by using the arrow boxes at the bottom of each section.
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APPENDIX AE: INTERNET SURVEY MAILING TO WATER POLICY RESIDENTS JUNE 10, 2011

UNIVERSITY OF KENTUCKY **Lindell Ormsbee, P.E., P.H., Ph.D., D.WRE, F.ASCE**

Kentucky Water Resources Research Institute

233 Mining and Minerals Building
Lexington, KY 40506-0107
Phone • (859) 257-6329
Fax • (859) 323-1049
Email • lormsbee@engr.uky.edu

June 10, 2011

Re: PGDP Future Use Survey Website

Dear Water Policy Area Resident:

For the last two years, researchers from the University of Kentucky have worked with Paducah stakeholders to identify a range of possible future uses for the Paducah Gaseous Diffusion Plant site after the plant closes. Through interviews, focus groups, and public meetings, a number of options have been identified, including permanent site closure, expanded wildlife management, active recreation, light industry, heavy manufacturing, and nuclear industry options. At various project stages, participants have been asked to evaluate the suitability of each of twelve different future uses.

Unfortunately, interested individuals do not always have the time or ability to attend meetings where their opinions can be registered. To increase participation levels, the entire scenario presentation and survey have been placed online at http://www.paducahvision.com/scenario-survey. The results of these online scenario evaluations will be included in a report on the community's vision for the site. This report will be made available to the public and will be presented to the U.S. Department of Energy to inform decision-making related to the plant's future.

The greater the number of participants, the better the research team's ability to capture the opinions of diverse segments of the community and the more accurate the final report can be.

If you have not already had an opportunity to evaluate the hypothetical scenarios during focus groups or public meetings, please visit http://www.paducahvision.com/scenario-survey and take the survey at your convenience. The entire presentation will take about 30-45 minutes to complete; however, the program allows you to stop and resume the survey at different times without losing the answers that you have already provided.

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Sincerely,

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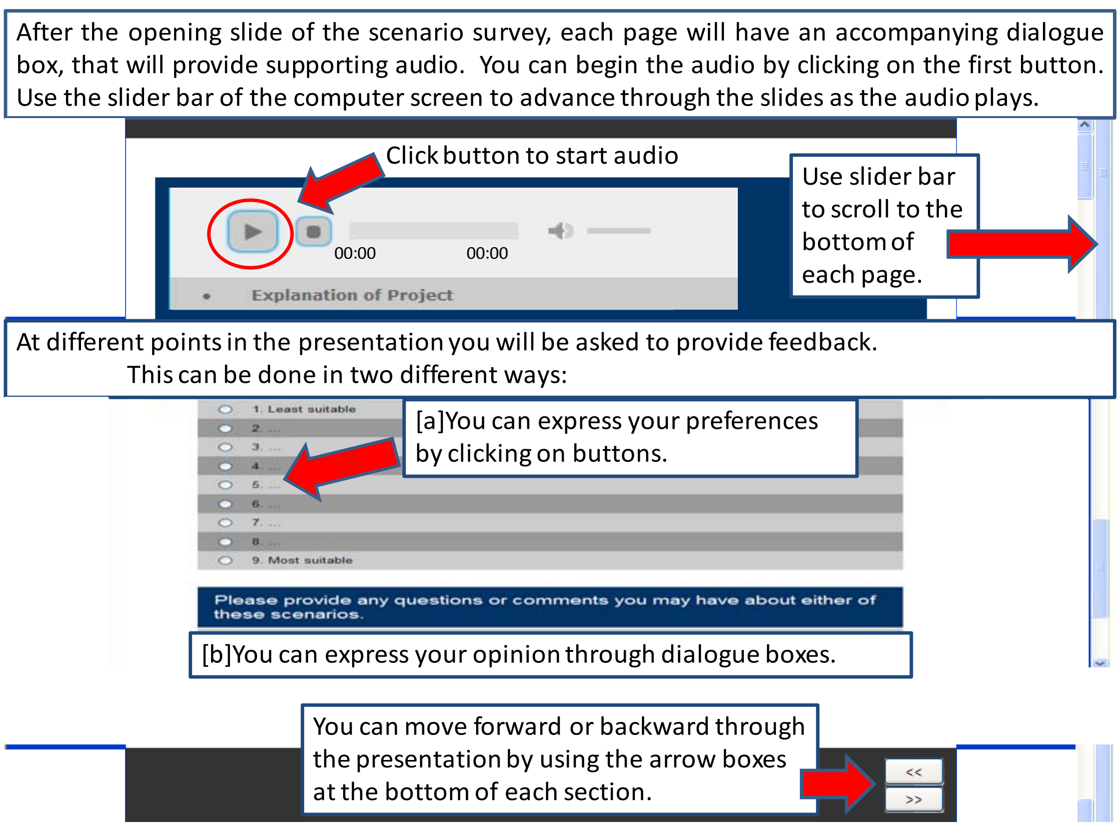
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APPENDIX AF: Internet Survey Advertisements (June 2011)

Paducah Sun, Advance Yeoman, West Kentucky News Scenario Evaluation Meetings Ad
(Total circulation of all outlets: ~44,000; ¼ page ad)

Ballard Weekly Public Information and Scenario Scoring Meetings Ads
(Circulation of all outlets: ~700; 1/2 page ad)