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The Dynamics of Technical Communities through the Multiple Phases of a Nuclear Waste Management Project

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Background & Purpose

- A nuclear waste management project is not only inherently long, but also one that must be implemented under very challenging technical and political environments
- As the project progresses from site selection to site characterization to development of the safety case to licensing it places shifting and often conflicting demands on the community of technical experts needed to ensure success through this phases.
- The evolving demands placed on these technical communities have received little systematic attention
- This paper employs interviews with technical professionals in the Yucca Mountain Project (YMP) to analyze the ways in which technical, social and political factors influence their performance in such a lengthy and complex projects
- The assumption is that lessons learned from this study can provide important insights for the success of future nuclear waste management projects

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Introduction

- The YMP consisted of nearly 30 years of intensive scientific enquiry and documented technical evaluations within the context of policy debates, budgetary struggles, ploitical machinations and public controversies
- At no time, was the YMP just a scientific exercise within a stable organizational structure or uncontested public relations environment
- Cultural and organizational transitions were commonplace
- This paper
  - Reports observations of the technical staff's experiences in performing their work amidst changing circumstances outside of their control or influence
  - Reflects reactions of the YMP technical workforce laboring under continuous federal oversight, frequent shifts in management, substantial tensions within the organization, and participating in on-going professional deliberations, while being subject to considerable public criticism

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Methodology

- The observations and insights reported here were gained through a set of focus group discussions with YMP technical staff in July 2009
- The technical staff were divided into three groups:
  - Extensive YMP experience (15+ years)
  - Moderate YMP experience (10-12 years)
  - Limited YMP experience (2-8 years)
- Each group consisted of six to seven individuals, who engaged in extensive discussions with one another and the investigators on:
  - Project development over time
  - Evolving nature of technical work
  - Perceptions of organizational structure and implications on technical staff
- Central point of enquiry was possible tensions generated by the interactions of the policy and regulatory process on the general principles of scientific and technical work
- Participants were encouraged to describe the impact of past organizational and cultural transitions as well as ongoing workplace dynamics they found relevant to their work

Timing of Study

- By mid 2009, the YMP license application (LA) had been submitted to the U.S. Nuclear Regulatory Commission (NRC) and the NRC's review was in earnest
- YMP staff were involved in responding to technical questions from the NRC staff on the substance of the LA and supporting the development of strategies to address hundreds of challenges against the LA filed by interveners
- Sandia National Laboratories (SNL) was the YMP Lead Laboratory (Lead Lab) with responsibility of the LA's post-closure safety analysis, having assumed this responsibility from the YMP's Management & Operating Contractor (M&O) in late 2006
- Many of the YMP technical staff had worked in earlier versions of the LA under the M&O had transitioned to the Lead Lab
- Changes in policy direction by the Obama administration had not fully manifested themselves yet, but other programs (e.g., DOE's Office of Nuclear Energy's Used Fuel Disposition Campaign) had started adding to uncertainties about the YMP's future

YMP Timeline
Policy, Regulatory & Licensing

- 1957 - Deep geologic disposal proposed by US National Academy of Sciences as approach to deal with back end of the nuclear fuel cycle
- 1970s – US studied potential repository sites without specific national policy
- 1982 – Nuclear Waste Policy Act
  - US EPA develops environmental and health standards
  - US NRC develop regulatory requirements
- 1987- NWPA Amendments
- 1987 to 2008 – Multiple versions of EPA Standards and NRC Regulations
- 2008 - License Application submitted to NRC and 3 to 4 year licensing process begins
- 2010 – Project terminated by Obama Administration
- 2011 – Project re-started???

YMP Timeline
Organizational Changes

- Through 1990, DOE's OCRWM manages all aspects of project, all project organizations are direct contractors to DOE
- 1991 – First YMP M&O(TRW Environmental Safety Systems, Inc.), all project organizations support DOE through M&O
- 2000 – Second M&O (Bechtel-SAIC, LLC)
- 2006 – SNL designated as YMP's Lead Laboratory with responsibility for post-closure science and safety analysis
- 2008 – Third M&O (USA Repository Services, LLC)

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Observations
Organization & Climate

- Dichotomy of organizational descriptors
  - Negative views about the program: expensive, defensive, unhealthy
  - Positive views about the workforce: idealistic, determined,. adaptive
- Workforce's consistent view on project's overall goal: safely dispose of nuclear waste at Yucca Mountain
- Workforce did not always find this goal reflected in organizational direction
- Many viewed YMP as:
  - An ongoing experiment in the design and operation of a lengthy scientific program in the public interest
  - Dedicated and relatively unchanging workforce requiring a period of "enculturation" before acceptable contributions could be made (i.e., project newcomers' views often not readily accepted)
  - External hostile portrayals of YMP and workforce unpleasant but not debilitating
- The belief that it's been too easy for unsubstantiated, non-scientific claims to influence public opinion reinforced the need for continuing with rigorous scientific work
- "Absolute certainty" in public and political minds particularly troubling

Observations
Workforce & Work

- Numerous organizationally inspired changes cause of some dissatisfaction with progress of technical efforts
- Numerous independent assessments over the years, while validating the results of the technical work seemed redundant
- Results of problem-solving efforts not manifested in a timely manner
- Numerous & frequent reviews and programmatic milestones slowed progress and viewed as cumbersome
- “Prescriptive” US regulations shaped and constrained the scientific endeavor

Observations
Workforce & Work (continued)

- The “regulatory construct” of developing a LA considered to be “scientific suicide” due to emphasis in organizing old data, rather than generating new data
- Difficult to accept concept of “this is adequate, this is enough”
- Tension during development of 2004 and 2005 draft LA versions caused by challenges with information integration
- LA defense process created a contested dynamic with the scientific approach; i.e., “less is better” or “more is the enemy of adequate” which is the tenet in adjudicatory processes
- Contentions filed by interveners viewed as attacking the integrity of the work rather than being fact-oriented
- Differing views regarding the licensing process:
  - Defensive mode in which recommendations for changing highly criticized
  - Opportunity for convincing public and decision makers of the validity of the work

Observations
External Influences

- Congress, as the primary authorizing and appropriating body, not reliable in their support of YMP
- Host state of Nevada and its political leaders as obvious antagonists
- Lackluster support and hostile external environment not negatively affecting pride in and loyalty to the project, but fostered a sense of dissatisfaction
- Local and national politics eclipsed science
- Lack of coherent and effective socialization and education as counter facts to prevalent misconceptions about nuclear waste disposal

Observations
Management Influences

- Changes of M&Os failed to take advantage of experience provided by long-term staff
- M&O changes accompanied by criticisms of previous management with a repeat of past mistakes
- Setting “artificial” deadlines for scientific work to meet management requirements
  - Multiple short-term projects rather than one single long-term project
  - Financial incentives to management for meeting specific *a priori* deadlines

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Retrospection & Conclusions

- Notwithstanding unique challenges and uncertainties faced by YMP technical workforce, important objectives of significant national importance were met: i.e., completion and submission of LA
- By terminating the YMP, the US runs the risk of losing a valuable national resource; i.e., nearly 30 years of expertise in nuclear waste disposal
- Establishment of an organization that focuses on maintaining the appropriate and unique technical capability to solve our national nuclear waste management problem that applies lessons learned while avoiding YMP re-invention.

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