



General Training On Methodologies For Geological Disposal in North America
IAEA Network of Centers of Excellence

International Views on Staged Repository Development

Tom Isaacs
 Lawrence Livermore National Laboratory
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What is Staging?

- Sequential decision making
- Fully consistent with good engineering practices
- Commitment to continuous learning and iterative safety review
- Cautious start-up/pilot stage
- Re-evaluation and reactions to new knowledge
- Seeks and is responsive to broad stakeholder input
- Designed for continual improvement with option of reversibility
- Stages separated by decision points

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Why Stage?

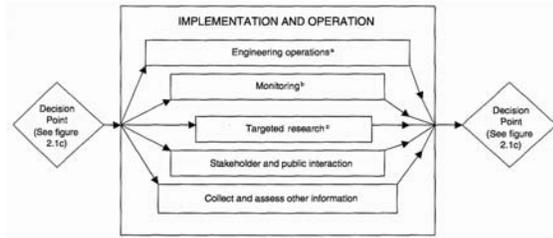
- First-of-a-kind
- Complex
- Very long-term operations and performance
- Risk and perceived risk
- Negative public image

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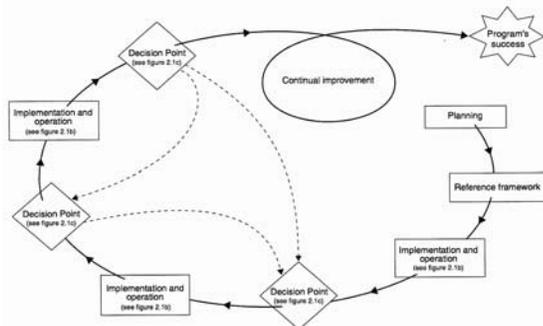
Key Features of Adaptive Staging

- Commitment to systematic learning
- Flexibility
- Reversibility
- Transparency
- Audit ability
- Integrity
- Responsiveness

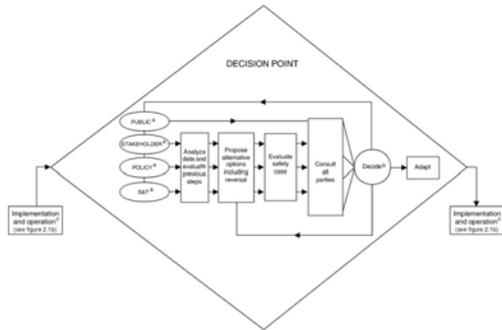
What is a Stage?



What is Adaptive Staging?



What is a Decision Point?



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The Decision Process

- Systematically gather, evaluate and apply information
- Develop options for next stage, including possible reversal
- Evaluate and update safety assessment
- Make findings publicly transparent and available
- Engage stakeholders
- Decide on next stage based upon the above
- Disseminate decisions and their rationale

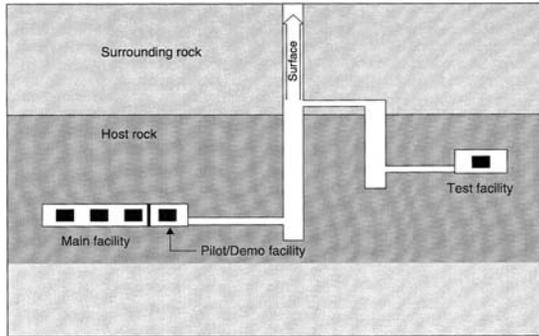
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A Clear Definition of Program Success

- A suitable repository site
- A license based upon demonstrable safety
- Sufficient societal consensus to begin and continue
- Initial waste emplacement with ability to reverse
- Measures in place to allow emplacement to continue
- Ongoing long-term monitoring and S&T programs
- Procedures and funding to either close repository or maintain long-term control, including option to retrieve
- Impacts on rest of the system accommodated

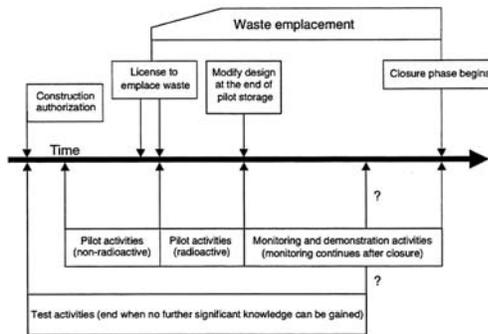
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Pilot, Test, and Demonstration Facilities



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Timeline for Pilot, Test, and Demo Activities



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The Safety Case

- The overriding priority
- An understandable explanation of how safety is achieved
- A description of assumptions and concepts
- A direct discussion of uncertainties
- A description of non-quantitative arguments

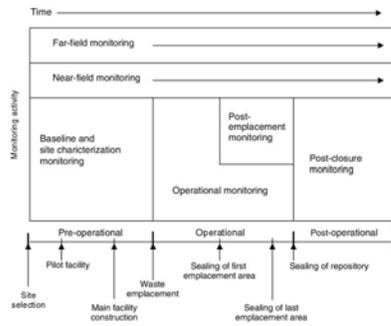
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A Robust Safety Case

- Meet direct and stringent safety goals
 - Multiple features
 - Redundant
 - Conservative
 - Diverse
 - Natural and Engineered
- Uncertainty increases slowly with time
- Performance degrades gracefully with error
- Transparent, demonstrable
- Analogues
- Retrievability, reparability, surveillance
- International Consensus

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Monitoring Activities



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Potential Implications of Staging

- Costs
- Schedules
- Pilot, Test, Demonstration Facilities
- Emplacement rates
- Buffer storage requirements
- Transportation
- Closure and post-closure
- Monitoring and S&T programs
- Regulatory licensing process
- Public confidence

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Institutional and Societal Issues

- Attitudes toward nuclear activities
- Public trust
- Public acceptance
- Stakeholder participation
- Institutional relationships

Promise - Then Deliver

Respond to Concerns

In Conclusion

- We meet our obligation to future generations
- We bear the political, institutional, and financial costs
- Does not preclude full-scale disposal
- But does not mandate it either
- Our great-grandchildren would close a repository
