U.S. DEPARTMENT OF ENERGY
OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT

NUCLEAR WASTE TECHNICAL REVIEW BOARD
FULL BOARD MEETING

SUBJECT: **DOE DECISION STRATEGY FOR THERMAL LOADING**

PRESENTER: **DR. WILLIAM SIMECKA**

PRESENTER'S TITLE
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Decision Strategy for Thermal Loading

- **Goal:** Develop a Civilian Radioactive Waste Disposal System (CRWMS) in which all system elements contribute to meeting applicable regulatory requirements
  - Mined Geologic Disposal System (MGDS) (pre-closure and post-closure)
  - Monitored Retrievable Storage (MRS) and transportation
- **Strategy:** Enhance the performance of the CRWMS by appropriate use of the repository waste heat

Regulatory Basis for Thermal-Loading Selection

- 60.133(i) "The underground facility shall be designed so that the performance objectives will be met taking into account the predicted thermal and thermomechanical response . ."
- 60.133(a) ". . . design of any engineered barriers . . . shall contribute to the containment and isolation of radionuclides"
- 60.133(h) "Engineered barriers shall be designed to assist the geologic setting in meeting the performance objectives for the period following permanent closure"

  - Others such as 10 CFR 60.111, 10 CFR 60.112, 10 CFR 60.113. . . .

- *Thermal loading is a key variable in EBS performance*

Importance of Thermal Loading

- Affects
  - Magnitude and content of site characterization
  - Material selection and design of waste package
  - Repository design and operation
- All of which affects
  - Overall system performance and licensability

Thermal-Loading Decision

Requires Integration of

- Site characterization
- Design
- Performance Assessment
- Multi-Purpose Canister (MPC) studies

Through

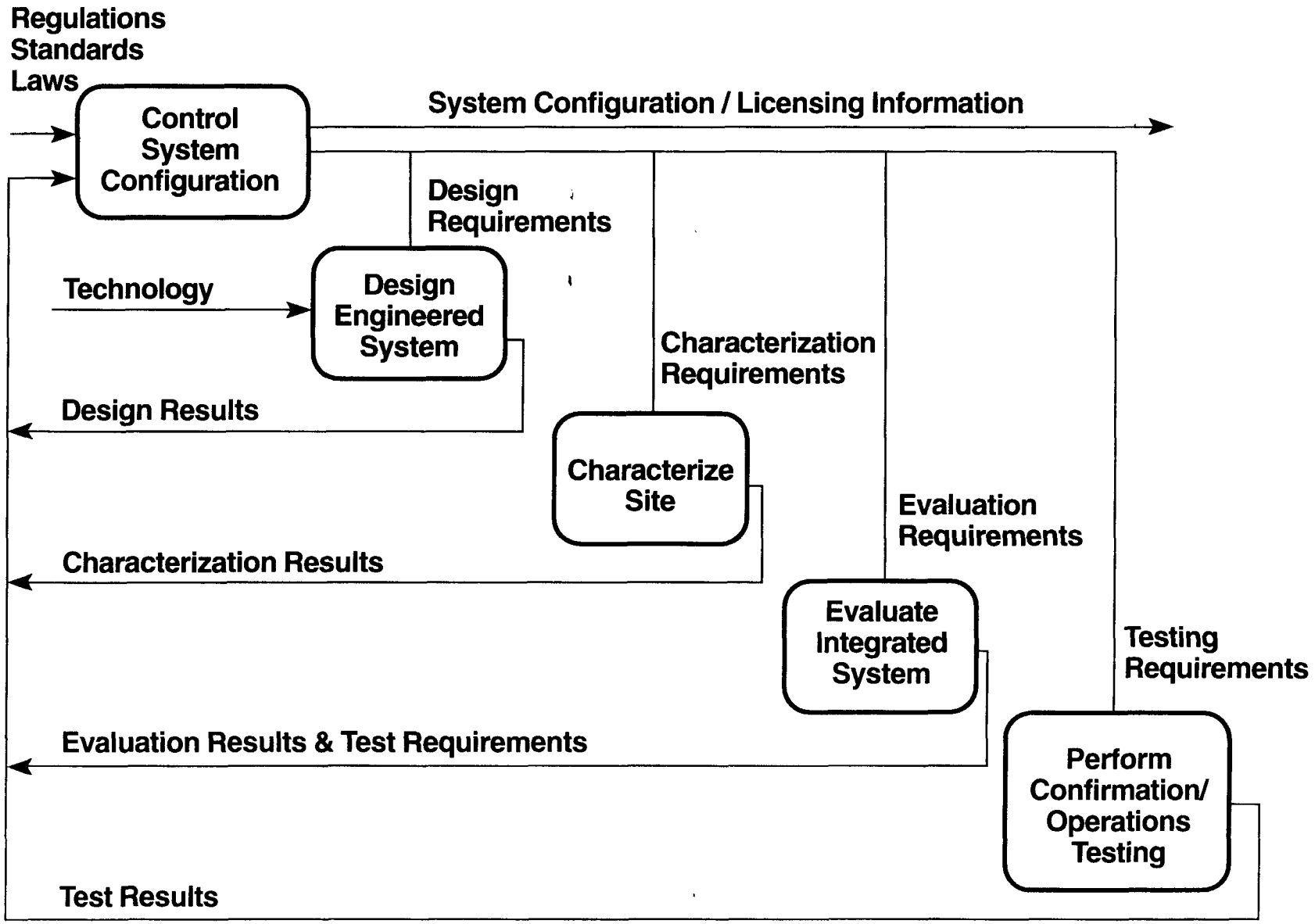
- Thermal-loading study
- Modeling and code development
- Laboratory and field testing
- Performance calculations
- MPC design studies

Thermal-Loading Decision

(Continued)

- **Major decision: above or below boiling**
  - Implemented by Technical Baseline Control Process based on technical analysis and system implications
  - Initial decision needed as early as possible
- **Follow-on decision: specific range of thermal loading**
  - Only needed if major decision is above boiling
  - Decision is included in design process
  - Will be developed over time as testing results are obtained
  - Final range selected by time of design freeze
- **Thermal-loading range confirmed by additional testing**

Decision Process



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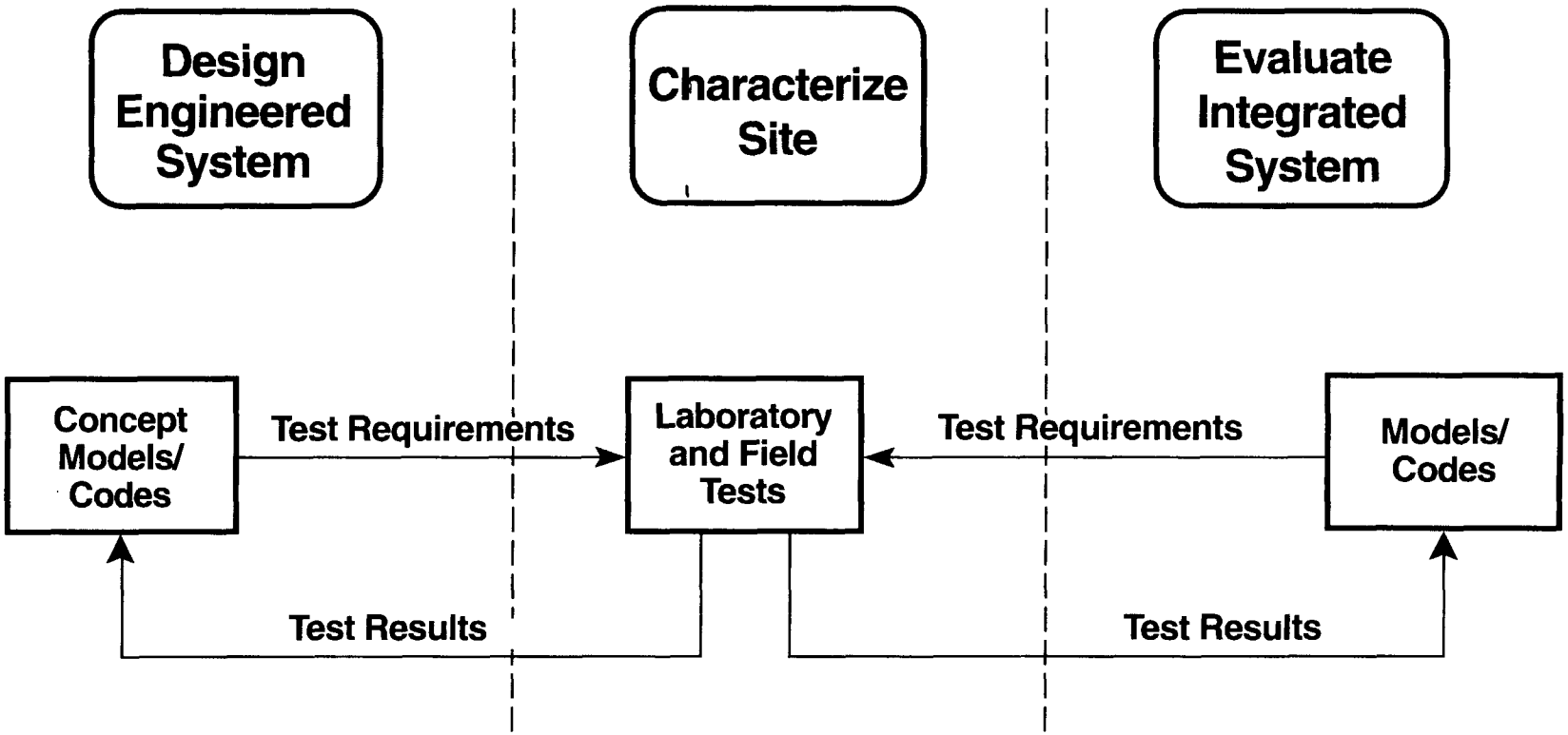
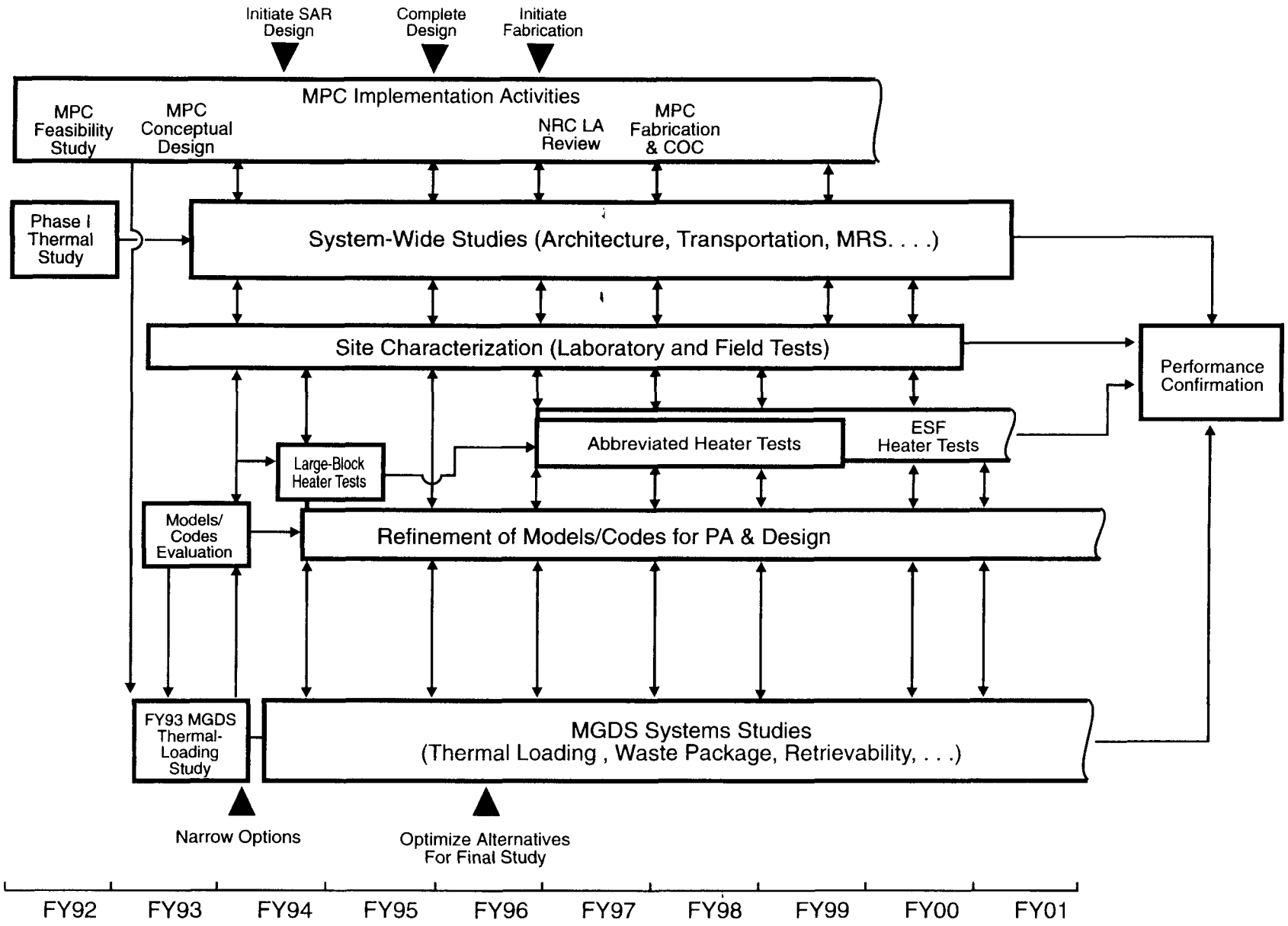
Thermal-Loading Model Development



Thermal-Loading Interactions



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Questions Being Addressed

- Can it be demonstrated that the thermal option will achieve post-closure performance?
  - Release and containment limits
  - Adequate multiple barriers
- Will the thermal options meet pre-closure requirements?
  - Safety
  - Environmental (radiation dose and temperature)
  - Retrieval
- What analytic models can be used to adequately predict post-closure performance?
  - Validation
  - Coupled effects
- What test data is required to support the above efforts and to reduce uncertainty to an adequate level?
- Does sufficient suitable area exist in Yucca Mountain to emplace waste at the thermal option that will be selected eventually?

Status

- A wide range of thermal loadings are being evaluated in systems studies
- State-of-the-art models have been developed and are being used to evaluate performance of the options
- Models have identified key hypotheses important to the thermal-loading issue
- A test program has been identified to test these hypotheses, to support model enhancement, and to support the decision process

Thermal-Loading Decision

Requires Integration of

- Site characterization
- Design
- Performance Assessment
- Multi-Purpose Canister (MPC) studies

Through

• Thermal-loading study	Steve Saterlie
• Modeling and code development	Dave Stahl
• Laboratory and field testing	Dave Stahl
• Performance calculations	Jerry Boak
• MPC design studies	Tom Doering