



U.S. Department of Energy
Office of Civilian Radioactive Waste Management

Design Update

Presented to:

Nuclear Waste Technical Review Board

Presented by:

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May 8-9, 2001

Arlington, Virginia

YUCCA
MOUNTAIN
PROJECT

Topics

- **Need for a flexible design**
- **Response to NWTRB questions**
 - **What exactly does “flexible” mean in this context?**
 - **What characteristics does DOE use to determine flexibility?**
 - **Is the current base-case design flexible?**
 - ◆ **If so, explain why**
 - ◆ **If not, explain what would need to be changed**
 - **How much may a design be changed and still be considered the same design?**
- **Current Engineering Analysis Summary**
- **What’s next?**
- **Summary**

Need for a flexible design

- **As we learn new information our design must be flexible enough to accommodate it**
 - ◆ **Since testing and modeling work are ongoing we need the flexibility to adjust to new information**
 - ◆ **Design must continue in parallel with the testing and modeling work**
 - ◆ **Flexibility reduces the possibility of major design changes in the future (risk management)**

The repository design needs to be able to operate over a range of thermal modes

What exactly does “flexible” mean in this context?

- **Flexibility includes the ability to control thermal input to the natural and engineered systems**
- **Control of the repository thermal response is achieved via:**
 - Design parameters
 - Operational parameters
- **Design parameters are flexible during design while operational parameters remain flexible throughout the operating period of the facility**

What exactly does “flexible” mean in this context?

(Continued)

- **Control of the repository thermal response can be achieved via:**
 - **Design parameters**
 - ◆ **Drift diameter and drift spacing (current layout configuration)**
 - ◆ **Waste Package (WP) with a corrosion resistant outer shell (Alloy-22) and structural steel inner shell**
 - ◆ **Drip shields of corrosion-resistant titanium**
 - ◆ **Amount of waste**
 - ◆ **Receipt/emplacement rate**
 - ◆ **Ventilation system design**
 - **Operational parameters**
 - ◆ **Ventilation rate, duration, and method**
 - ◆ **Waste package spacing**
 - ◆ **Heat output per WP (Aging, de-rating, etc.)**
 - ◆ **Sequence of WP emplacement**

What exactly does “flexible” mean in this context?

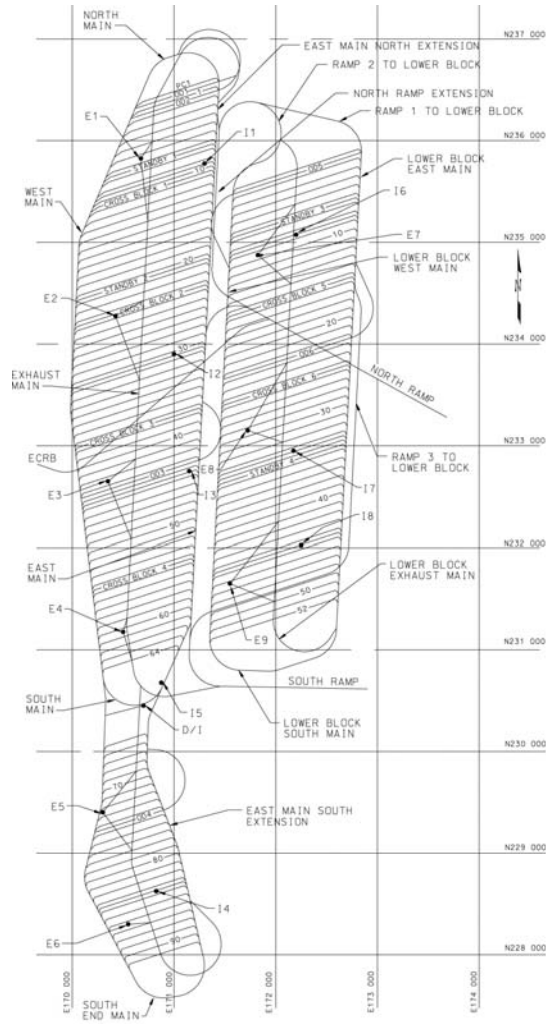
(Continued)

- **The design parameters, when combined with the operational parameters, may result in different utilization of the layout configuration**
- **Current layout configuration area provides up to 148 km of drift length at 81 meter drift spacing**

What exactly does “flexible” mean in this context?

(Continued)

Layout of Potential Repository Development Areas



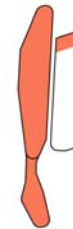
Potential Repository Development Areas_RevA.ai



Higher end of thermal operating mode



Lower end of thermal operating mode achieved via 2 meter WP spacing and/or aging



Lower end of thermal operating mode achieved via WP de-rating

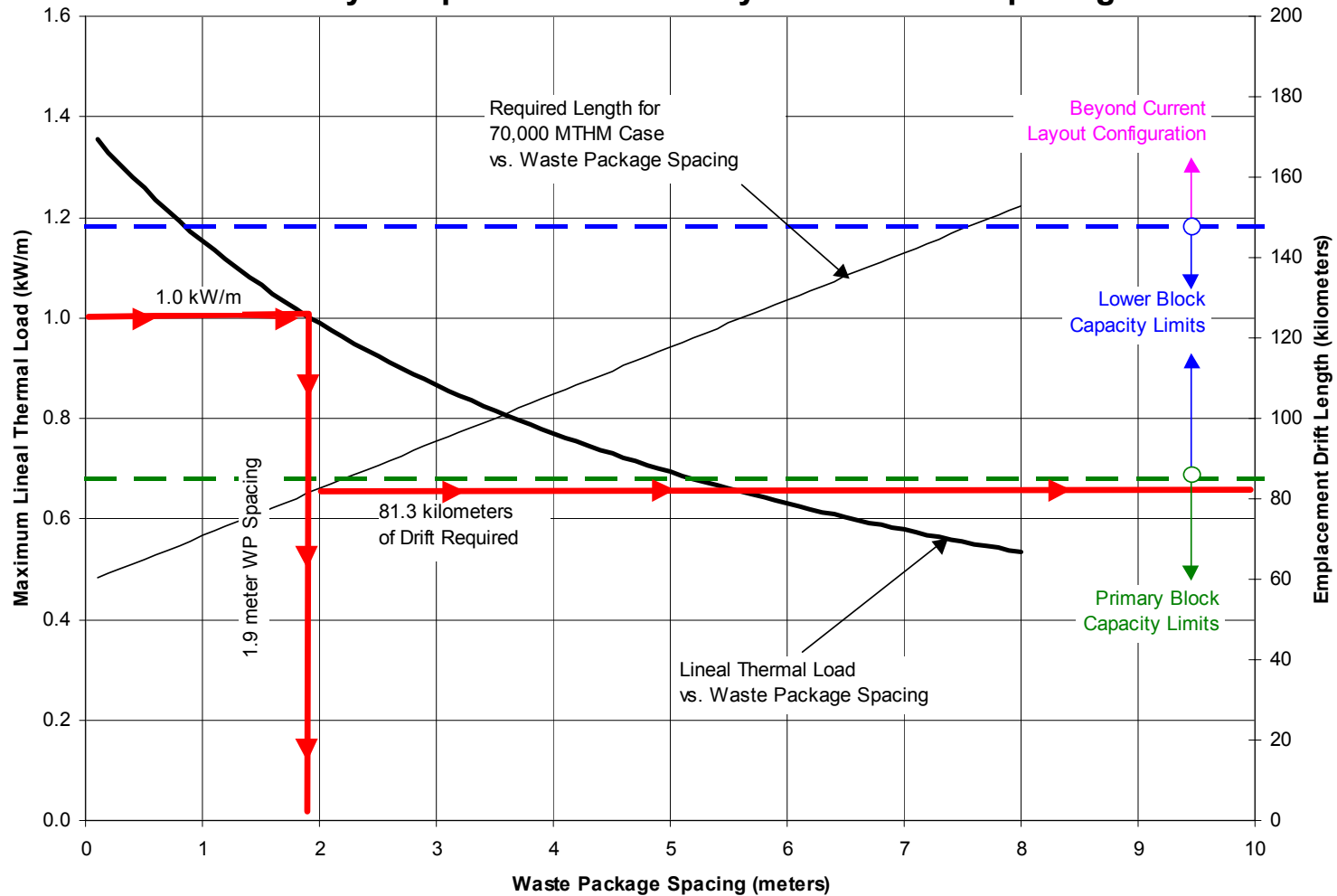


Lower end of thermal operating mode achieved via 6 meter WP spacing

What exactly does “flexible” mean in this context?

(Continued)

Summary of Operational flexibility 81 meter drift spacing



What characteristics does DOE use to determine flexibility?

- **Design parameters (during design)**
 - A set of parameters were identified to facilitate the Site Recommendation (SR) analyses, these parameters are not fixed and will evolve throughout the repository design
- **Operational parameters (throughout operating period of facility)**
 - A set of parameters that can be varied to achieve different thermal goals during operations

Is the current base-case design flexible?

- **Yes**
 - **If so, explain why**
 - ◆ **The base-case can be operated in a range of modes that allow the temperature and humidity in the underground environment to be controlled**
 - ◆ **The program is analyzing the design, construction, and performance of the repository over a range of thermal modes to assess uncertainties and performance**
 - ◆ **Preliminary results confirm the feasibility of the flexible concept**

How much may a design be changed and still be considered the same design?

- **The present concept consists of large, long-lived WPs loaded horizontally in emplacement drifts, along with other design parameters**
- **The design can be operated over a range of thermal modes by varying various operational parameters which does not represent a design change**
- **Once design parameters are selected and licensed, any changes to these parameters that require an amendment to the license would be considered a design change**

Current Engineering Analysis Summary

- Prepared engineering analyses for a representative lower-end thermal operating mode (2 m WP spacing, forced ventilation 50 years, natural ventilation 250 years) and is documented in ANL-WER-MD-000002 Rev 0B
- Purpose of analyses was to determine the design and construction feasibility of a representative lower-end thermal operating mode
- Results confirm the feasibility of designing and constructing a repository that can operate in the lower-end thermal operating mode

Current Engineering Analysis Summary

(Continued)

- In addition to evaluating a representative lower-end thermal mode, the current engineering analysis confirms the potential range of design and operational parameters
 - Parametric evaluation of operational parameter flexibility such as WP spacing, smaller or derated WPs, and ventilation rate, duration and method
 - Parametric evaluation of design parameters such as drift spacing (during the design phase)
 - Potential expansion capability within characterized volume

What's next?

- **Continue analyzing the performance of the repository over a range of thermal operating modes**
- **Design requirements are being revised to allow expanding the operating modes, for example:**
 - Duration of repository operation
 - De-coupling emplacement from receipt
- **Review and update the baseline to allow expanding the operating modes**

Summary

- **A set of design and operational parameters have been identified for the purpose of SR engineering and performance analyses**
- **The on going design and performance analyses provide us with a foundation that will allow us to continue to converge on a set of design and operational parameters should the site be selected**