

**PRESENTATION TO THE NUCLEAR WASTE
TECHNICAL REVIEW BOARD**

**Subject: NWMS Systems Analysis
and Trade-off Studies**

By

**William Bailey
Manager, Systems Analysis
Management and Operating Contractor
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System Implications of Hot vs Cold Repository

Expected Results

- **Evaluation of major system measures of effectiveness for the scenarios reflecting the range of thermal management strategies**
- **Major cost drivers (e.g., repository acreage, MRS size, cask thickness)**
- **Impacts on system requirements**
 - **blending**
 - **fuel selection**
 - **MRS size limit**
 - **Emplacement time**
 - **MGDS size or second repository**

Focus of System Level Studies

- **Provide sensitivities and tradeoffs to support design decisions**
- **Provide performance criteria for inclusion in specifications**
- **Build upon the extensive base of prior analytical work**
- **Facilitate closure on outstanding issues**
- **Establish basis for responding to changes imposed by policy or other external change requirements**

Study Sources

Initial Sources

- **OCRWM Physical System Requirements/Functional analysis documents**
- **OCRWM internal memoranda**
- **OCRWM Strategic Principles Document, March 8, 1991**
- **Technical Review Board Report to the U.S. Congress and the U.S. Secretary of Energy, November 1990**
- **Pacific National Laboratory Systems Study Plan - Fiscal Years 1991 and 1992, February 1991**
- **Internal priorities provided by MGDS Storage and Transportation projects**

Ongoing feedback from

- **OCRWM**
- **M&O MRS design team**

Study Sources (cont.)

Future study requirements are expected to be generated by

- **Regulatory or policy changes**
- **Support to Nuclear Waste Negotiator, as directed**
- **Specifications development**
 - **MGDS**
 - **MRS**
 - **Accept Waste**
 - **Transportation**
- **Functional analyses, RAM, safety, security, human factors programs**
- **Subsystem design activities**

Requirements from MRS Design Team

Inputs needed for MRS Specification

- **MRS receipt rates**
- **Shipping rates to MGDS**
- **Processing requirements**
 - **selection**
 - **consolidation**
- **MRS packaging requirements**
- **Technology selection methodology**

Current Study Plan

**Three interrelated studies are scheduled for completion in
CY 1992**

- **System Throughput Rate**
- **MRS Issue Assessment**
- **System Implications of Hot vs Cold Repository**

**Nuclear Waste
Management System**

**Management & Operating
Contractor**

SYSTEM THROUGHPUT STUDY

System Throughput Study

Background

A 3,000 MTU/yr receipt rate for both the MRS and the repository has been used as a reference.

- **No clearly documented rationale**
- **Originally based on a logistics calculation for different ground rules than exist today**

A recent draft study recommended higher throughputs:

- **Used Life Cycle Cost as the measure of effectiveness**
- **No inventory constraints were imposed for the MRS**
- **Post shutdown costs at reactors were major cost drivers**

System Throughput Study

Objectives

- **Develop data to establish throughput rate design basis for NWMS system elements**
- **Determine sensitivities to design and operational change**
- **Ensure configurations and costs are consistent with concurrent design activities**
- **Identify NWMS constraints and cost drivers**

System Throughput Study

Approach

- **Review prior studies**
- **Develop realistic loading scenarios (spent fuel and HLW)**
- **Select appropriate software tools and develop proficiency**
- **Develop measures of effectiveness**
- **Schedule:**
 - **Interim report to OCRWM, near term**
 - **Inputs to MRS specification, early 1992**
 - **Study completion, mid 1992**
- **Develop project methodology for throughput forecasting**

Software Tools

- **Characteristics data base**
 - projects annual metric ton discharges from reactors
 - maintained by ORNL, consistent with EIA database
- **Waste Stream Analysis (WSA) model**
 - characterizes the nuclear waste streams
 - sequences fuel shipments according to allocation rights
 - supports different selection strategies
- **Interface model**
 - reformulates WSA output for SECAM input
 - adds HLW stream
- **System Engineering Cost and Analysis Model (SECAM)**
 - calculates estimates of system and element costs for a specified scenario
 - developed by PNL

System Throughput Study

Study Features

- **Confidence intervals for cost estimates and projections**
- **Analysis of cost drivers (Capital, Fixed and Variable)**
- **Discounting of future costs**
- **NWMS associated non-OCRWM costs**
- **Advantages of non-uniform cask loading**
- **Reactor specific storage and transportation costs**
- **Mixed truck/rail transport alternatives**
- **Cask fleet as a cost driver**

System Throughput Study

Expected Results

- **Provide recommendations for:**
 - **MRS spent fuel receipt rate**
 - **MRS spent fuel shipping rates**
 - **MGDS high level waste receipt rate**
 - **MGDS spent fuel receipt rate**
- **Identify ranges for design parameters**
 - **Cost/technology uncertainty**
 - **LCC insensitivity**
- **Identify limiting factors and cost drivers**

MRS ISSUES ASSESSMENT

Background

- **Substantial prior work in identifying/assessing issues**
 - **MRS Commission studies**
 - **OCRWM sponsored studies**
- **Unresolved issues remain**
- **MRS design schedule requires specification inputs by January 1992**

MRS Issue Assessment Study

Objectives

- Analyze key issues
- Provide a basis for making decisions that may affect MRS Title I design

MRS Issues Assessment

Approach

- **Review previous MRS analysis studies**
- **Identify and evaluate MRS issues**
- **Determine and scope needs for further analyses**
- **Facilitate issue resolution through**
 - **assessments based on existing literature**
 - **supporting analyses**

MRS Issues Assessment

MRS Issues

- **Throughput Rate (Cost/Benefit)***
- **Storage Only vs. Consolidation***
- **Dual Purpose Casks (Dry Storage & Transportation)**
- **Storage Capacity**
- **MRS Capacity vs. MGDS Lag Storage Capacity**
- **Waste Packaging Location (MRS vs. MGDS)**
- **Hot vs. Cold Emplacement (Effects on MRS Design)***
- **MRS Role in Storage of Retrieved Waste Packages**
- **Commonality Issues with MGDS**
(Cask Handling and Storage, Rad. Monitoring, QA, etc.)
- **Impact of Receiving Damaged Fuel on MRS Throughput**

***Is or will be the subject of a separate study**

MRS Issues Assessment

Expected Results

- **Recommendations on key issues**
- **Identification of MRS/MGDS commonalities**
- **Cost/benefit trade-offs of MRS throughput and storage capacity/capability**

SYSTEM IMPLICATIONS OF HOT VS COLD REPOSITORY

System Implications of Hot vs Cold Repository

Background

- **Repository thermal loading strategy is still in development**
- **Selection of thermal loading strategy has system implications**
 - **MGDS capacity**
 - **Retrievability**
 - **Blending/fuel selection**
 - **MRS capacity**
 - **Emplacement time**

System Implications of Hot vs Cold Repository

Objectives

- **Determine the impacts on NWMS system elements of MGDS thermal loading concepts**
- **Determine the range of NWMS throughput schedules which meet thermal loading scenarios**

System Implications of Hot vs Cold Repository

Approach

- **Review prior thermal impact analyses (SNL, LLNL, PNL, etc.)**
- **Identify and determine:**
 - **Storage limitations**
 - **Alternate designs (including package thickness), alternate emplacement scenarios, alternate cooling methods, and consolidation**
 - **Preclosure safety and health differences**
 - **Increase/decrease in mining cost**
- **Examine alternative scenarios**
 - **Achieve thermal regimes**
 - **Differ primarily in factors which have system-wide impact (e.g., emplacement period, waste package loading)**
 - **Compute impacts (e.g., cost and schedule) on acceptance, transportation and store waste functions relative to the reference scenario**

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