Total System Model Interaction With National Spent Nuclear Fuel Program

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Overview

- **Presentation Overview**
  - **Total System Model Description**
  - **Capabilities of Analyzing NSNFP Interaction**
  - **Conclusions**

TSM Purpose

- **The TSM links all of the key program elements and activities with logic and constraints. OCRWM needs are addressed in an *integrated* methodology.**

Integrated Waste Acceptance, Transportation, and Repository Systems Analysis

SYSTEM ANALYSIS RESULTS

Truck/rail selection
Shipping Schedule
Cask Parameters (type, number, when)
Transportation Origin, Route, Time
Transportation Resources

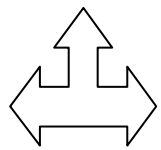
Dose
Life Cycle Cost
Total Project Cost

Aging Requirements/Schedule
Emplacement Schedule
Meet Design Basis Assumptions?
Uncertainties and Sensitivities

The TSM will analyze the interactions and optimization of all project elements and provide an integrated decision tool.

Transportation

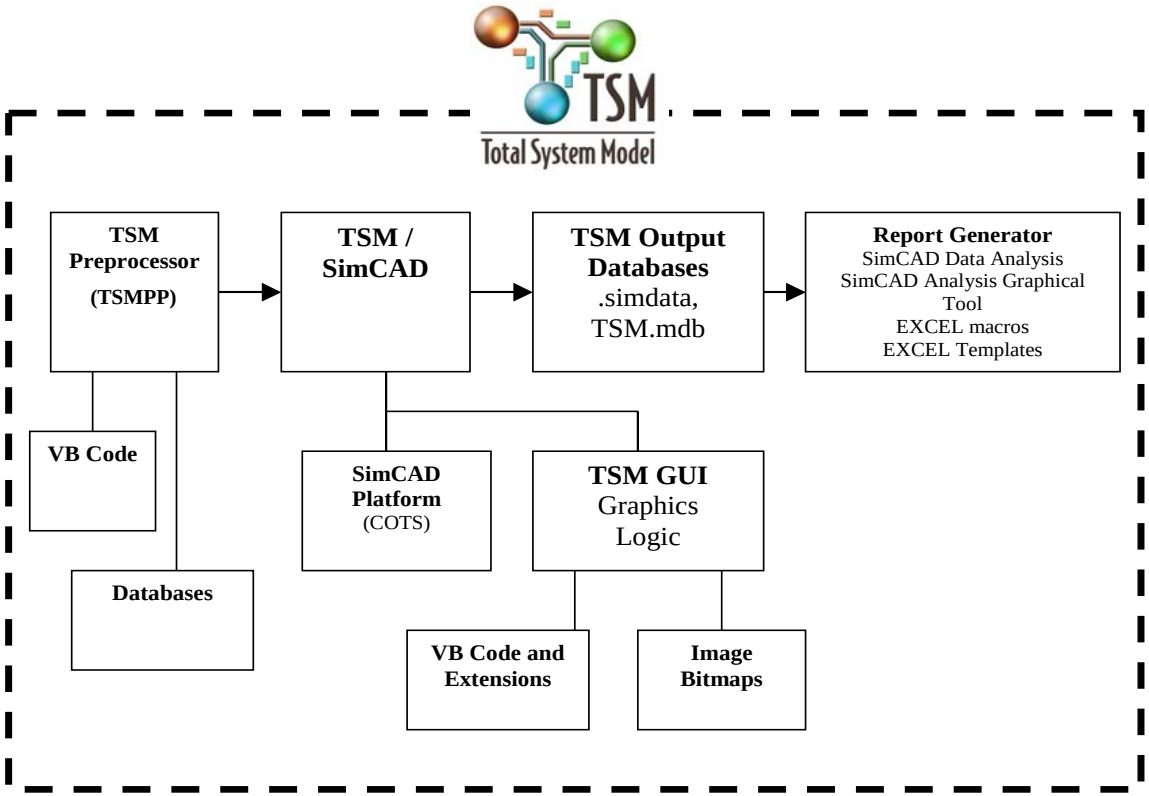
Waste Acceptance



Repository

Programmatic Decision Bases

TSM Structure

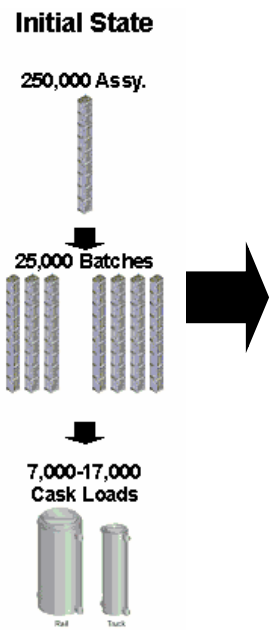


SCENARIO INPUT AND PARAMETERS

CRWMS DESIGN AND PLANS

Waste Acceptance: Initial State File

- The TSM Preprocessor (TSMPP) generates the Initial State file (IS) based on utility allocations, utility CSNF management schemes, waste site capability (ergo cask preferences), cask loading constraints and CSNF aging, and other parameters. The IS results are cask loads for shipment and the associated waste site and target shipping date. The IS shows the CRWMS WA mission on one spreadsheet.



Process Connection	Object	Count	Start Time	Buffer Type	Cask ID	Heat1	Heat2	Heat3	Heat4	Heat5	Heat6	Heat7	Heat8	Heat9	Heat10	Site_ID	Waste Type
Site6-203	T-GIN	1	0	PWRTruckBuffer	CASK6	0	0	0	0	0	0	0	0	0	4	GINT	PWR
Site221HAD	D-HAD	1	0	DPCPWRBuffer	CASK221	26	0	0	0	0	0	0	0	0	0	HADR	PWR
Site26-200	R-INLP	1	0	PWRBuffer	CASK26	0	0	0	0	0	0	29	3	0	0	INLR	PWR
Site26-200	D-LAC	1	0	DPCBWRBuffer	CASK200	61	0	0	0	0	0	0	0	0	0	LACR	BWR
Site44HLW	R-HANH	1	0	HLWBuffer	CASK44	5	0	0	0	0	0	0	0	0	0	HANR	HLW
Site50DSNF	R-INLD	1	0	DSNFBuffer	CASK50	9	0	0	0	0	0	0	0	0	0	INLR	DSNF
Site26-200	R-MOB	1	197	BWRBuffer	CASK26	0	4	64	0	0	0	0	0	0	0	MOR	BWR
Site1-200	T-MIL1	1	657	BWRTruckBuffer	CASK1	0	0	0	9	0	0	0	0	0	0	MILT	BWR
Site26-200	R-MOP	1	985	PWRBuffer	CASK26	0	0	0	0	18	12	2	0	0	0	MOR	PWR
Site1-200	T-MIL1	1	1095	BWRTruckBuffer	CASK1	0	0	0	9	0	0	0	0	0	0	MILT	BWR
Site26-200	R-BRU1	1	1095	PWRBuffer	CASK26	0	0	0	2	24	6	0	0	0	0	BRUR	PWR
Site28-224	R-OCO1	1	1095	PWRBuffer	CASK28	0	0	0	0	0	0	0	0	0	24	OCOR	PWR
Site239MY	D-MY	1	1137	DPCPWRBuffer	CASK239	4	0	0	0	0	0	0	0	0	0	MYR	PWR
Site212YR	D-YR	1	1179	DPCPWRBuffer	CASK212	36	0	0	0	0	0	0	0	0	0	YRR	PWR
Site6-203	T-IP1	1	1256	PWRTruckBuffer	CASK6	4	0	0	0	0	0	0	0	0	0	IPT	PWR
Site26-200	R-NMP1	1	1379	BWRBuffer	CASK26	0	0	0	68	0	0	0	0	0	0	NMPR	BWR

Time Steps are 8 hours.

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Generally 7,000-17,000 cask loads

TSM Graphical User Interface

WA Module:

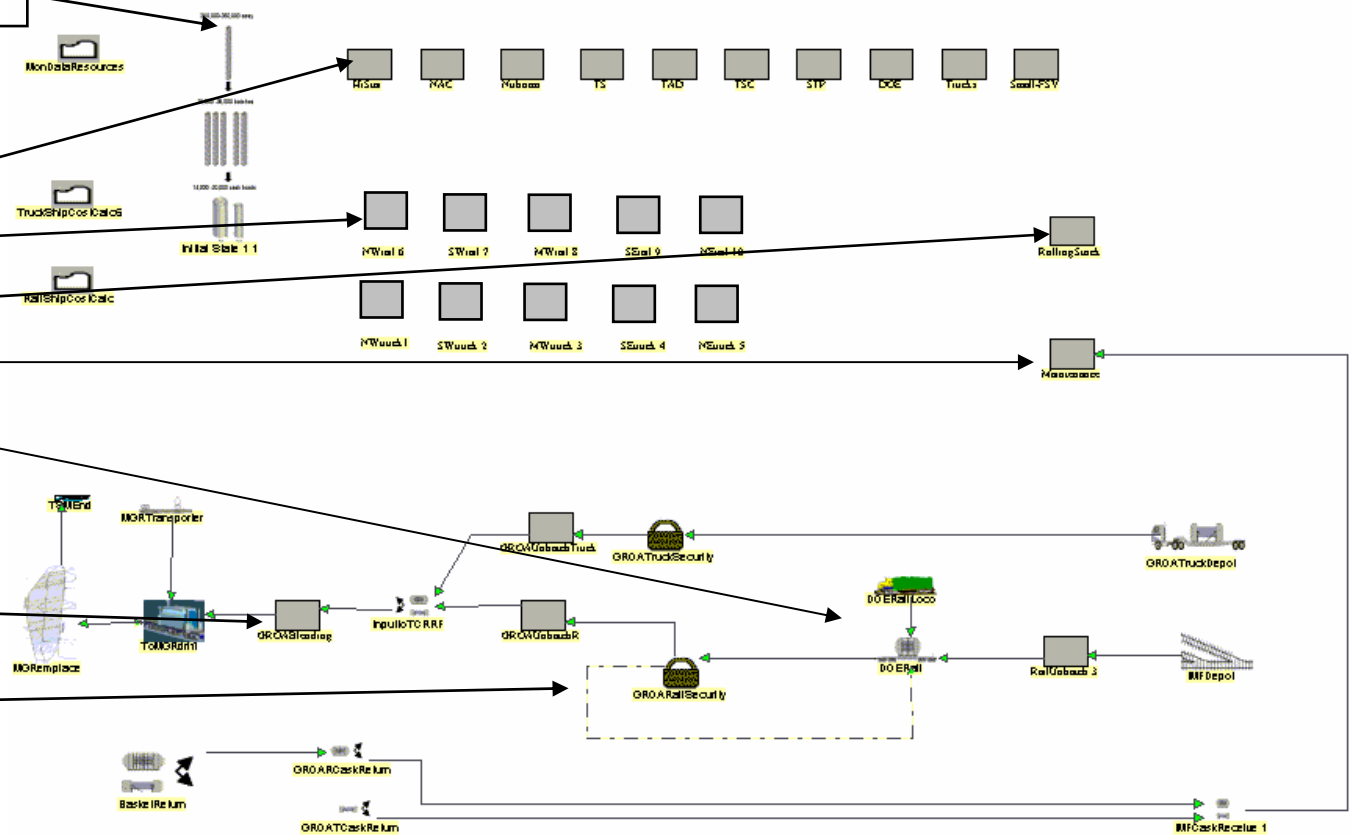
- Initial State (IS) calculation

Transportation Module:

- cask allocation functions
- routing maps
- rolling stock functions
- cask maintenance functions
- repository interface

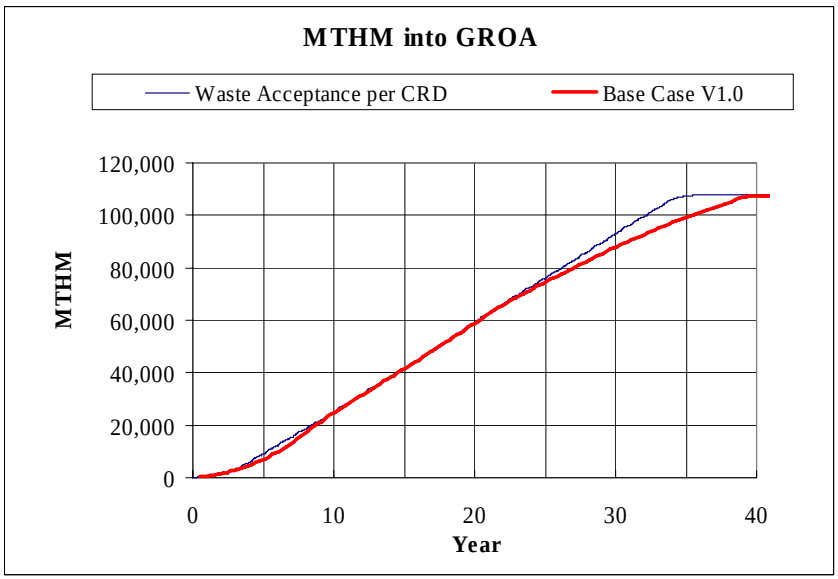
Repository Module:

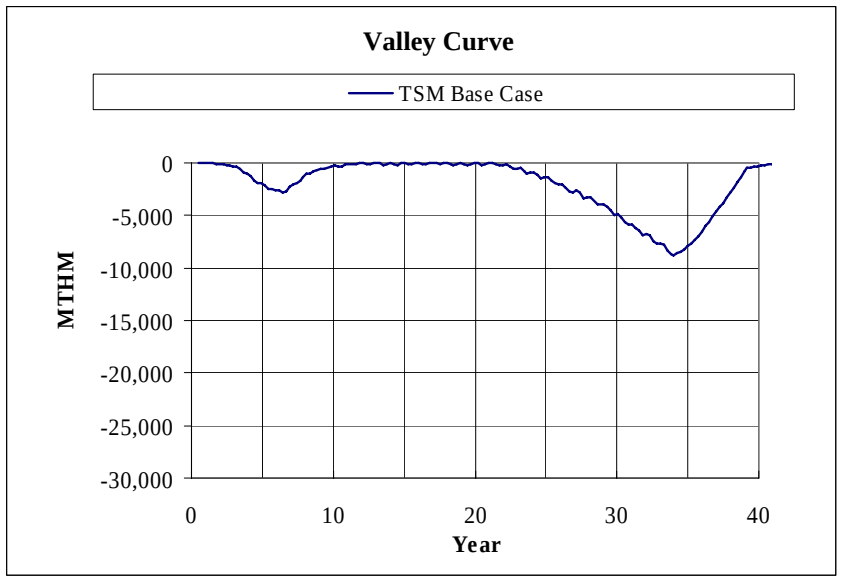
- GROA facility functions
- Transportation link into the GROA
- WP fuel loading/emplacement
- Fuel Aging and return



Typical Results

- **TSM Case 00 (10/04): 110,000 MTHM, mostly rail, shutdown sites dump to dry storage (use DPC), YFF10**

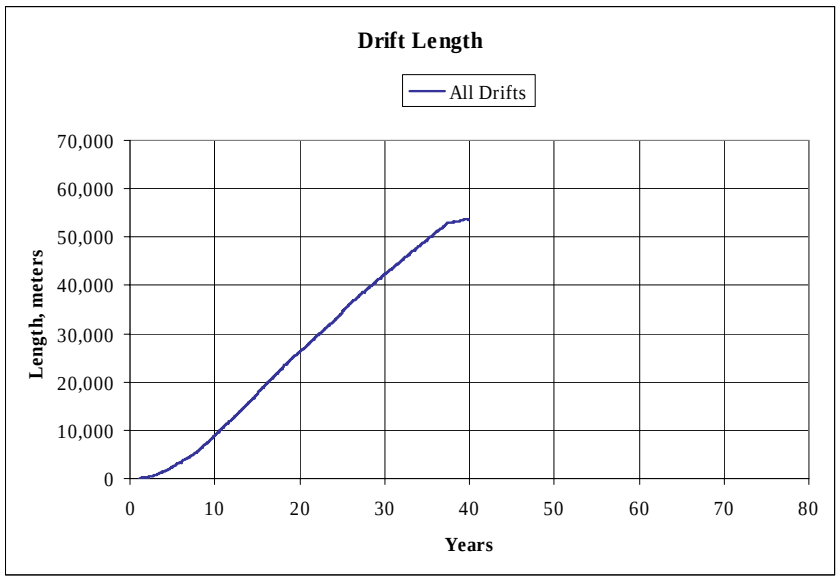


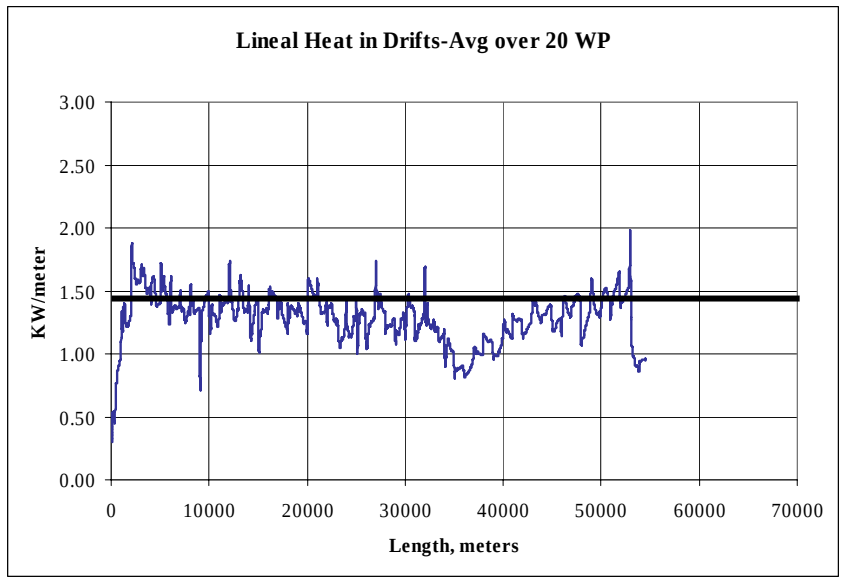


Results presented as "valley curves" are one key figure of merit

Drift Lineal Heat at Emplacement

- **TSM output is the running average of kW/meter for each 20 WP. TSM emplaces WP as they are made and does not attempt to emplace an optimum combination of BWR/PWR/DOE WP. The TSM DOE shipments are adjusted to provide arrivals at the GROA to try to achieve the lineal heat target. (Scn 25B1)**





Summary

- **TSM is the right tool to support OCRWM systems analysis needs.**
  - TSM can confirm the system effects of proposed GROA design and operations changes, such as a TAD-based system.
  - TSM results are believable
    - Comparison to previous documented and validated systems studies using proven models
    - Comparison to hand calculations
    - Simulation Graphical User Interface (GUI) allows analyst to see any setup or programming problems.
    - Detailed “mass balance” of objects and assemblies input and objects and assemblies completed “all accounted for and in the appropriate end processes”
    - Simulators are very sensitive to any logistics errors or objects in the wrong place and stop working
    - Results match intuition about system effects and “make sense”

Summary

- **The main advantage of the TSM is that it ensures there are no "surprises" because it**
  - Looks at all types of CSNF and all shipments for the duration of the project: no assumptions of "typical" casks or CSNF,
  - Considers the interactions of all the CRWMS program elements, and
  - Provides comprehensive coverage of all types of wastes and needs as prescribed by the CRWMS commitments.
- **Enhancements are being added to TSM to analyze potential system options that may be used to achieve current and future mission goals**