YUCCA MOUNTAIN PROJECT

Studies

Yucca Mountain Project Update

Presented to:
Nuclear Waste Technical Review Board

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

Agenda

- **Project Plans for FY98**
  - **Components of the Viability Assessment**
  - **Design and Scientific Testing**
  - **Enhanced Characterization of the Repository Block**
  - **Plutonium Migration at Nevada Test Site**
- **Near-Term Key Events**

Mined Geologic Disposal System - Viability Assessment Design

- **Performance driven design**
- **Design evolving from today through LA**
- **Priorities for FY98 and VA are those systems with no regulatory precedence:**
  - **engineered barrier system**
  - **ground control**
  - **subsurface ventilation**
  - **waste emplacement and retrieval**
  - **performance confirmation**

Waste Package/Materials/Surface Repository Consultant Sub-Board

- **The Consultant Sub-Board has been formed and consists of a Chairman and five board members**
  - **The Board is focusing on:**
  - **Waste package design and fabrication**
  - **Waste package material and waste form degradation**
  - **Surface facility function and design**
- **The Board met twice in FY97:**
  - **July 29- August 1**
  - **September 24-26**
- **Continuing interactions are planned through FY98**

Major or Key Supporting Activities

- **20 Design Issues** **12/97-8/98**

Issue #I:*	Thermal Loading	1/30/98
Issue #2:*	EBS Performance Enhancement	4/30/98
Issue #3:*	Criticality Control	12/16/97
Issue #4:	Emplacement Drift Ground Support	1/30/98
Issue #5*:	Performance Confirmation Concepts	6/30/98
Issue #6:	Retrievability Concept	3/30/98
Issue #7:	Confirmation of High Volume/Long Period Waste Handling	3/30/98
Issue #8:	Disposal of Site Generated Waste	3/30/98
Issue #9:	Strategy for Mapping the Repository	1/30/98
Issue #10:*	Postclosure Performance Standards	1/30/98
Issue #11:	Viability of Underground Remote Control Concepts	3/30/98

*Primary VA focus

Major or Key Supporting Activities
(continued)

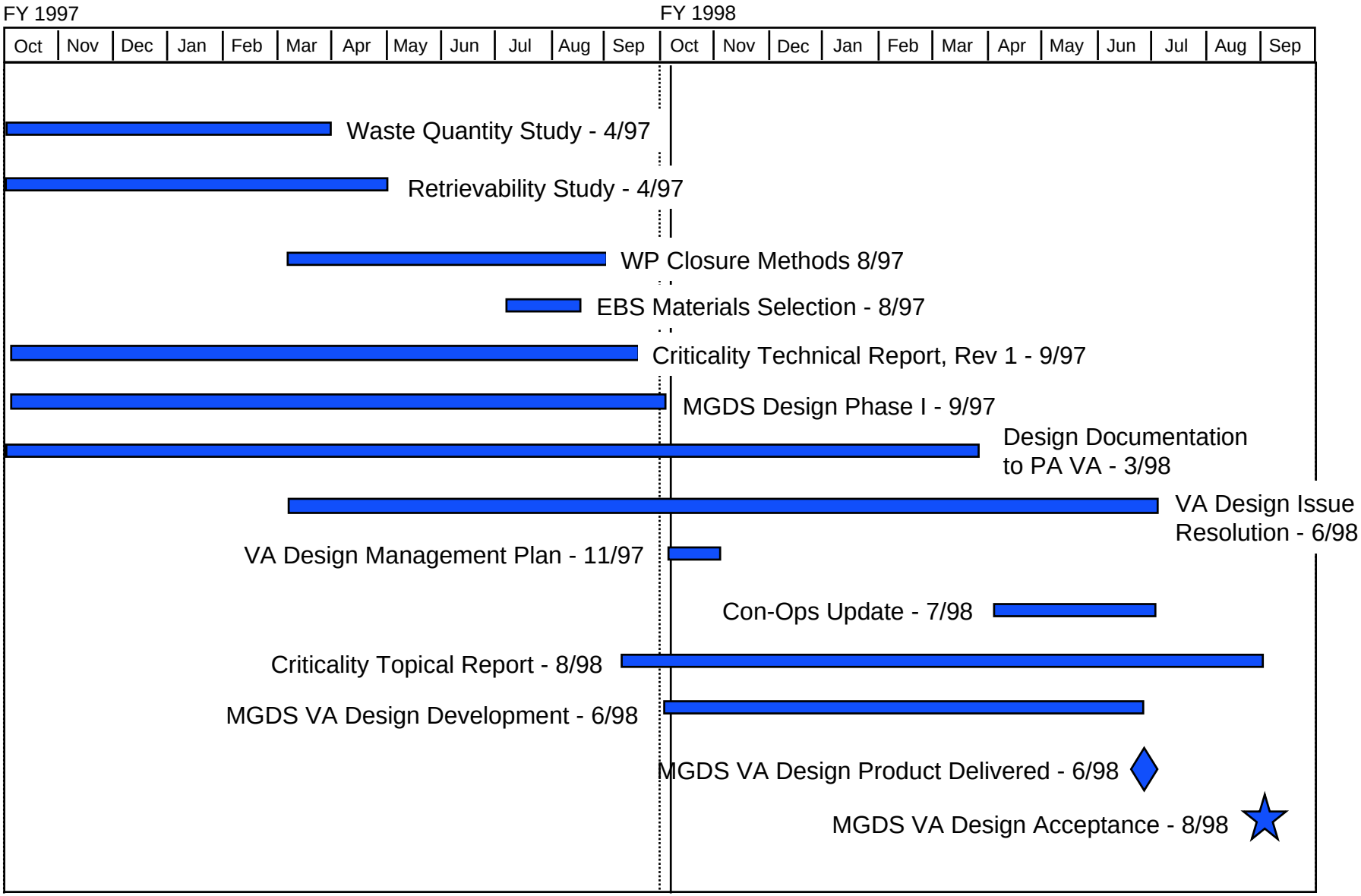
Issue #13:	Repository Seals Requirements and Concepts	3/30/98
Issue #14:	RSA/ISF Interface	3/31/98
Issue #15:*	Additional Waste Forms	6/30/98
Issue #16:	Waste Package Size and Weight	1/30/98
Issue #17:*	Waste Package Materials	1/30/98
Issue #18:*	Design Basis Model	8/21/98
Issue #19:	Subsurface Development	3/30/98
Issue #20:	Surface Development	3/30/98
Issue #21:	Site Development	3/30/98

*Primary VA focus

Major or Key Supporting Activities
(continued)

- **22 Design Packages for VA**
  - **General Site (7)**
  - **Surface Facilities (6)**
  - **Subsurface Facilities (5)**
  - **Waste Isolation System (4)**

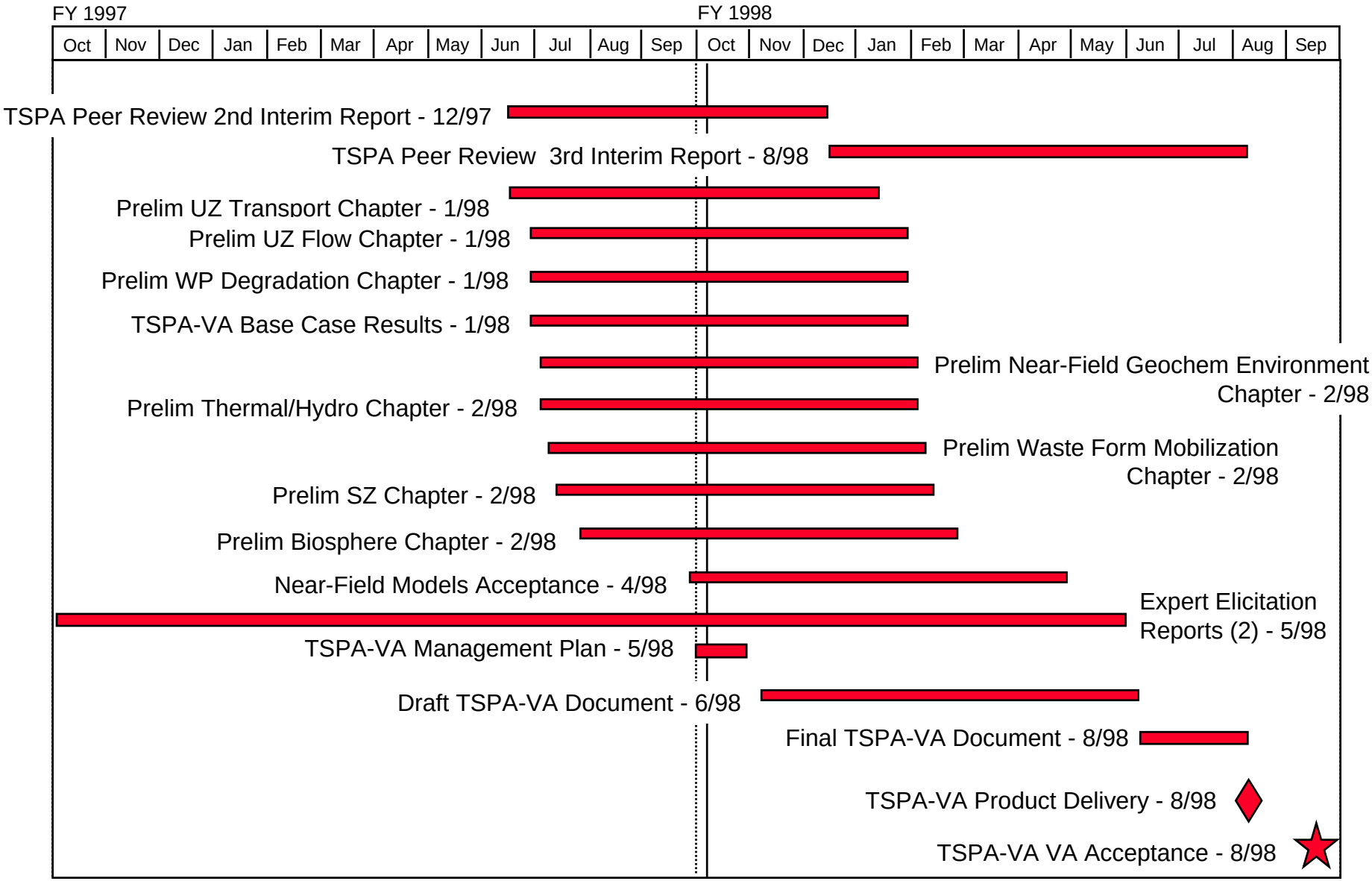
MGDS VA Design Product Development Status



Total System Performance Assessment for Viability Assessment

- **Priorities in implementing FY 1998 plans:**
  - **computer model development, documentation, and acceptance remains on schedule**
  - **uniform database of traceable model input used by all computer modelers**
  - **all computer models and input data move towards acceptable quality assurance (QA) pedigree**
  - **multiple lines of evidence used to provide "reality check" for modeling where possible**
- **An independent peer review is underway - comments being considered in development of TSPA-VA and will be considered for TSPA-LA**

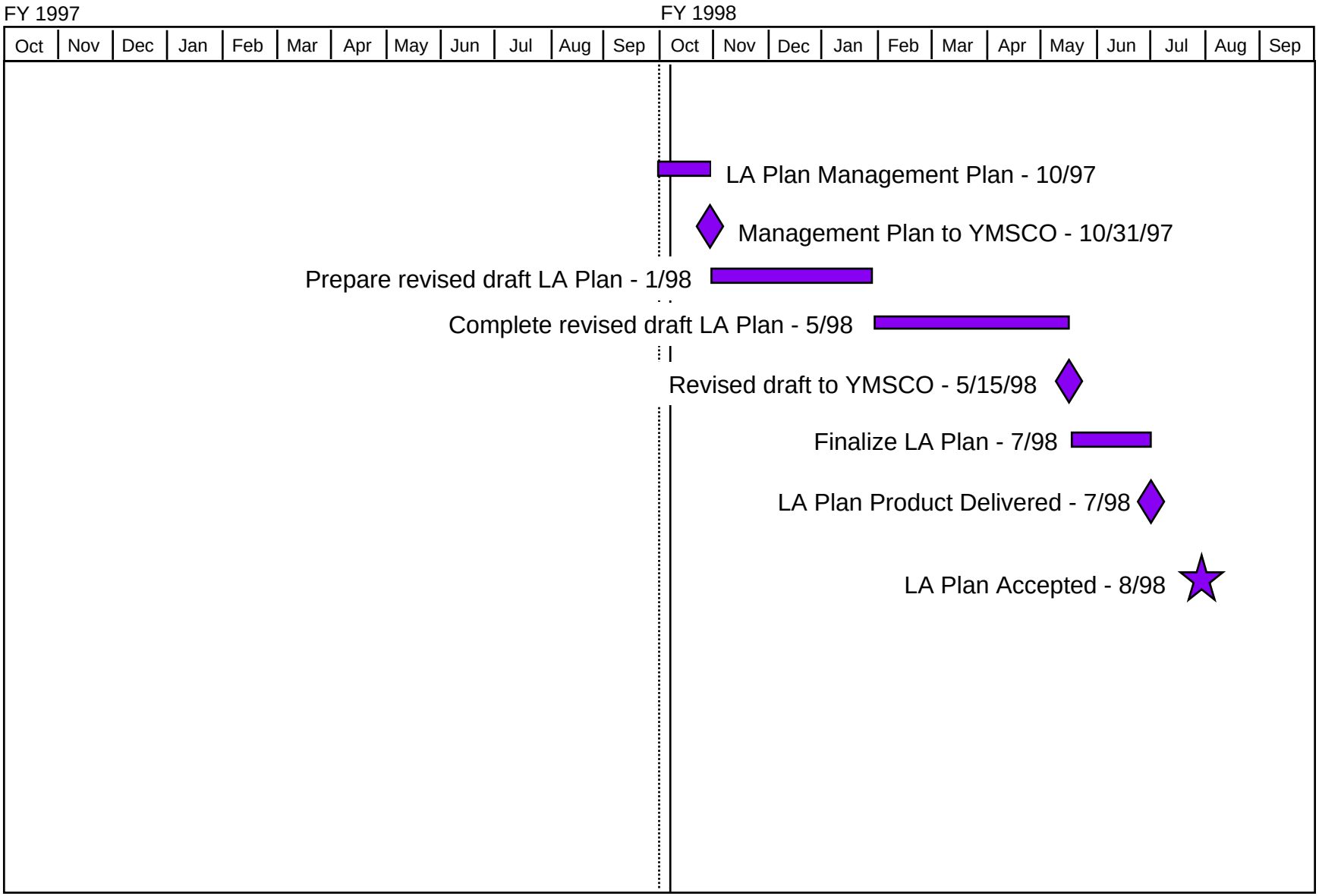
TSPA-VA Product Development Status



License Application Plan

- **LA Plan describes requirements and general approach for major products to be developed**
- **Describes requirements and general approach for major products to be developed**
  - **environmental impact statement**
  - **site recommendation**
  - **license application**
- **Explains why planned work is necessary and sufficient**
- **Provides summary schedule to develop major products supporting site recommendation and licensing**
- **Provides cost estimate for work to be accomplished through submittal of license application**

License Application Plan Product Development Status



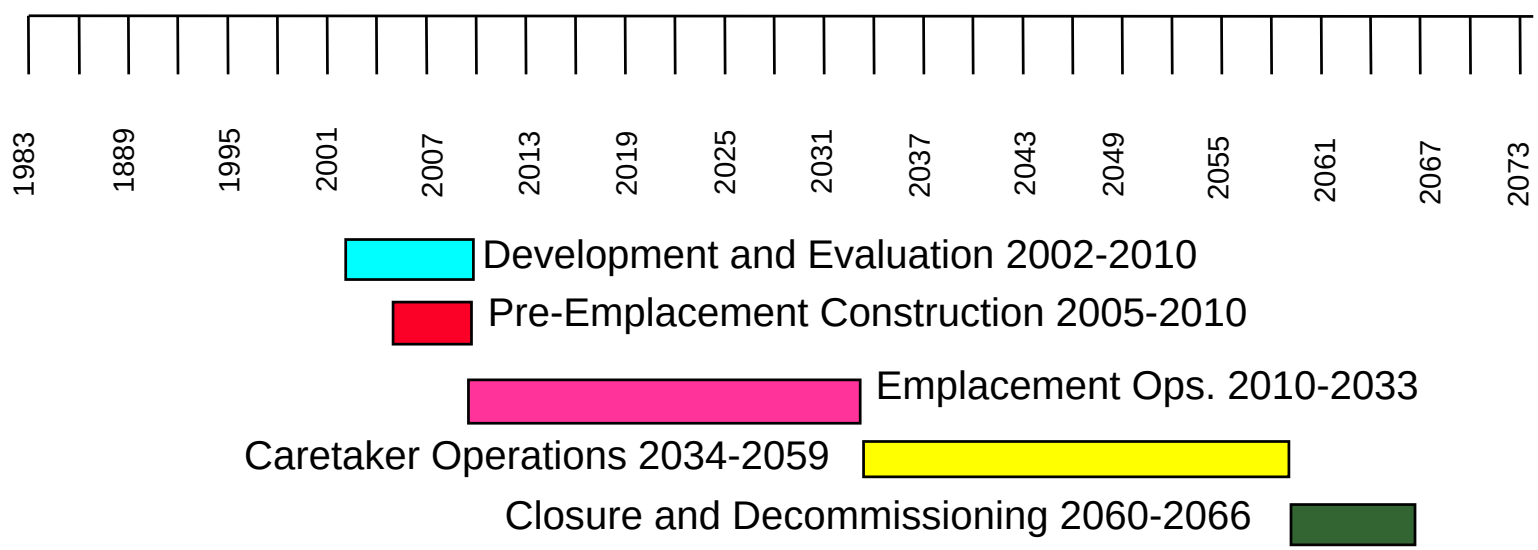
MGDS-VA Cost Estimate
Elements Excluded

- **Historical MGDS D&E costs (prior to 1998)**
  - **Site characterization, prior design activities**
- **License application plan cost (10/98 - 3/02)**
- **Program costs**
  - **Waste acceptance**
  - **Storage**
  - **National transportation (Regional Servicing Contractor (RSC) concept)**
  - **Other Program costs**

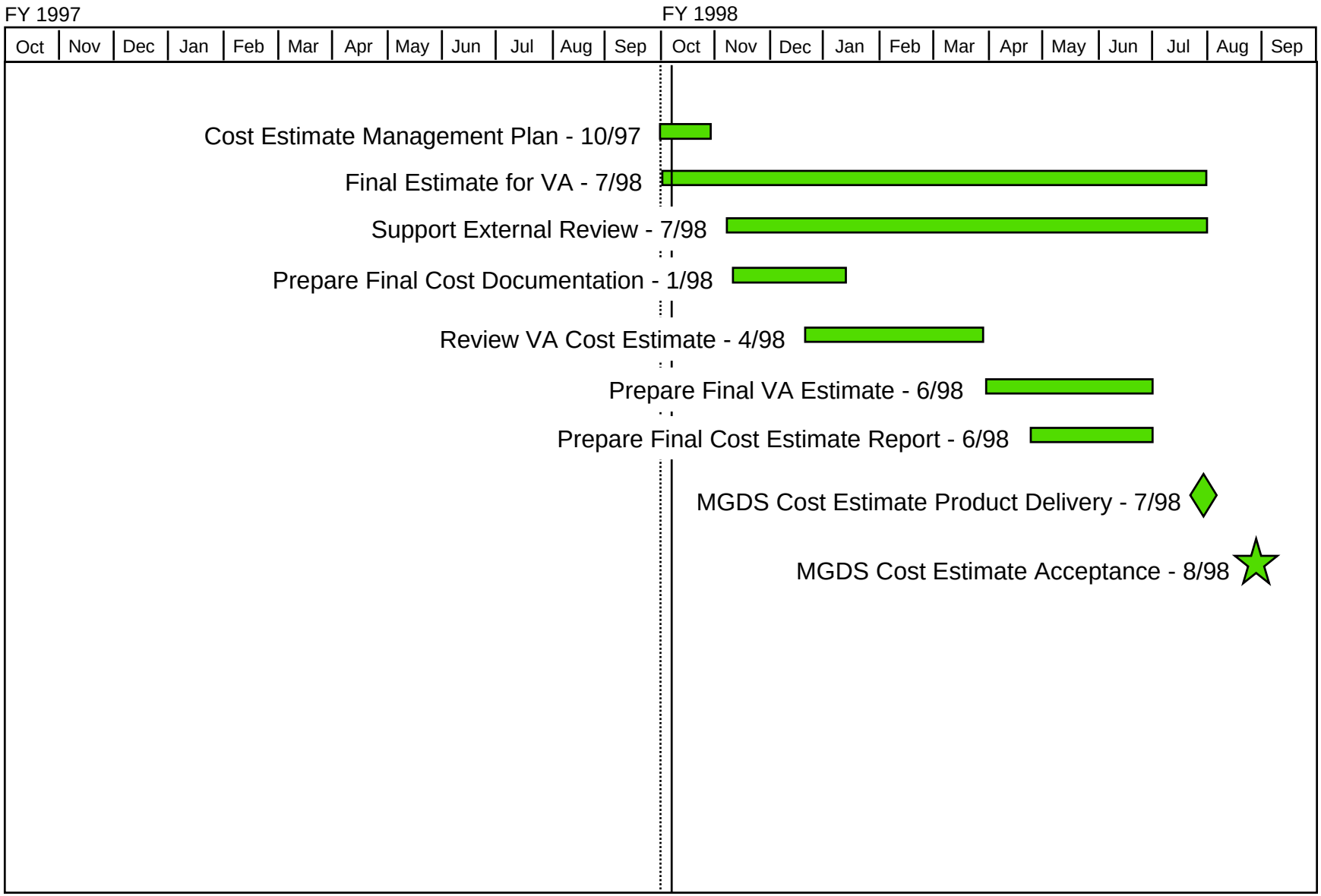
MGDS-VA Cost Estimate

- **Consists of the following repository life cycle phases:**
  - **development and evaluation**
  - **engineering and construction**
  - **emplacement operations**
  - **caretaker operations**
  - **closure and decommissioning**
- **Report will be reviewed and approved in accordance with MGDS-VA Cost Estimate Management Plan**
- **An independent review of cost-estimate will be performed**
  - **Foster Wheeler Environmental**
  - **Phased review beginning 10/97**

Timeline of Cost Estimate Components



MGDS Cost Estimate Product Development Status



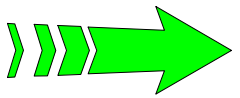
FY98 Plans - Design and Scientific Testing
Performance Attributes of a Repository

- **Limited water contacting waste packages**
- **Design containment - long waste package lifetime**
- **Slow rate of radionuclide release**
- **Concentration reduction of radionuclides during transport**

Hypotheses Evaluated in the Viability Assessment

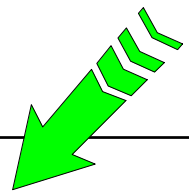
Limited Water Contacting Waste Packages

- Percolation flux at repository depth can be bounded
- Seepage into drifts is a fraction of percolation flux
- Thermally induced seepage can be bounded
- Seepage that contacts waste packages can be limited
- Seepage that contacts waste can be limited



Design Containment Long Waste Package Lifetime

- Heat reduces relative humidity at waste package surface
- Slow corrosion at low relative humidity
- Protection of inner barrier by the outer barrier



Slow Rate of Radionuclide Release

- Containment time sufficient to prevent oxidation of spent fuel
- Release rate of soluble radionuclides controlled by slow waste form dissolution
- Release rate of actinides dominated by solubility limits rather than colloidal stability

Concentration Reduction of Radionuclides During Transport

- Physical properties of barriers reduce concentrations during transport
- Chemical properties of barriers reduce concentrations during transport
- Lower volume flow in unsaturated zone will be diluted by higher volume flow in the saturated zone

Design and Scientific Testing Programs

Limited Water Contacting Waste Packages

- Initiate test of in-situ conditions in Alcove 7 (12/97)
- Fracture flow and seepage testing in ESF niches (9/98)
- Initiate drift-scale thermal test (12/97)

Design Containment/Long Waste Package Lifetime

- Complete preliminary waste package designs to accommodate commercial spent nuclear fuel (Conceptual designs for HLW Glass, DOE Spent Nuclear Fuel and Plutonium)
- Waste package containment barrier corrosion tests
- Galvanic protection tests
- Waste package containment preliminary degradation process models
- Engineered Materials Characteristics Report (7/98)

Slow Rate of Radionuclide Release

- Spent fuel degradation (oxidation and dissolution) tests and preliminary process models
- Borosilicate glass waste form degradation tests and preliminary process models
- Colloid stability testing
- Waste Form Characteristics Report (7/98)
- Disposal Criticality Analysis Methodology Topical Report (8/98)

Concentration Reduction of Radionuclides During Transport

- Complete Site Description document (8/98)
- Report: Geomechanics of Rock Mass (10/98)
- Begin Busted Butte UZ Transport Test
- Continue C-Wells Saturated Zone Flow and Transport Test
- Conduct Colloid Mobilization Studies
- Drilling and Testing in WT-24 and SD-6

Status of Enhanced Characterization Effort

- East-West Drift Intersecting Solitario Canyon Fault
- Northern Borehole (SD-13)
- Southern Borehole (SD-11)
- Laboratory Testing for Performance Assessment
- Southern Tracer Testing
- Single Heater Test

East-West Drift
Critical Schedule Elements

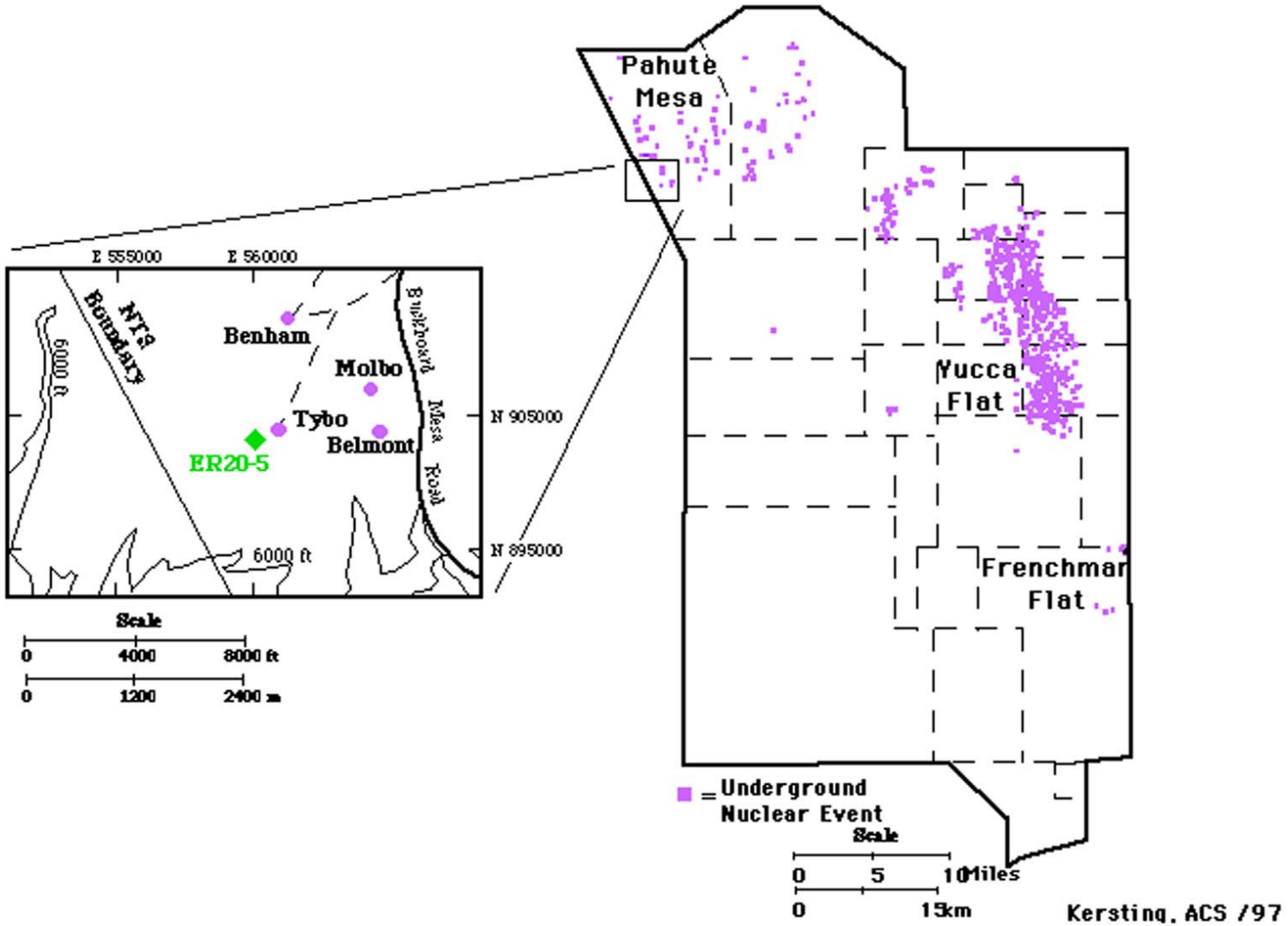
Finish	Start	Finish
Launch chamber design	07/31/97	10/24/97
TBM planning, acquisition, rehabilitation and assembly-delivered on-site	09/01/97	02/12/98
Design drift	10/27/97	12/09/97
Excavate launch chamber	12/05/97	02/05/98
Install excavation equipment	02/13/98	03/17/97
Predictive Report of Subsurface Conditions in East-West Drift		02/XX/98
Excavate Cross Drift	03/18/98	09/11/98
Station 00+90 to 28+15m		
Alcove Excavation	10/26/98	01/20/99

Other ECRB Schedule Elements

	Start	Finish
• SD-11		
– Drilling	12/98	02/99*
– Testing	02/99	08/99
• SD-13		
– Drilling	04/99	06/99*
– SZ Hydraulic Testing**	04/99	04/99
• Southern Testing Complex:		
– Siting of STC	10/98	12/98
– Tracer Tests #1	04/00	01/01
– Tracer Tests #2	11/00	07/01
– Tracer Tests #3	08/01	06/02

*approximate date
**sample testing and lithologic logging concurrent with drilling

Plutonium Migration at NTS



Yucca Mountain Work Related to Plutonium

- **DOE recognized the potential for the transport of radionuclides as colloids in the Site Characterization Plan in 1988**
- **YM Laboratory/Field Studies Completed (FY88-FY97)**
  - **Saturated column lab experiments were performed to test how natural colloids affect the transport of cesium**
  - **These results were supported by batch sorption experiments and also used to design field experiments such as the C-well reactive tracer test**
- **FY96/97 Completed Modeling:**
  - **Developed model for addressing colloid transport of Pu in UZ and SZ and incorporated into site-scale transport sensitivity models. Results of UZ predictions used as input to the SZ Pu transport model**

Yucca Mountain Work Related to Plutonium
(continued)

- **FY98-FY00 UZ Field Tests/Experiments with Colloids:**
  - **Bounding experiments for transport of radionuclides with the degraded materials in EBS and NFE, including corrosion products, cements/concretes**
  - **Initiate colloid transport studies for selected colloid/radionuclide species**
  - **LANL report to summarize occurrences and effects of radionuclide migration via colloids (10/98)**
- **FY98/99 Busted Butte Testing: UZ Transport:**
  - **Validate UZ transport models and lab databases**
  - **Colloid mobility in fractured welded/non-welded rocks**
  - **Fracture flow transport mechanisms in UZ rocks**
  - **Testing capabilities for E-W drift**

Yucca Mountain Work Related to Plutonium
(continued)

- **FY98-Out Transport and PA Modeling:**
  - **Waste form effluent testing was used to develop waste form degradation model. Tests will be used to determine nature and extent of interactions between effluent and corrosion products/cementitious materials. Focus will be on role of colloids**
  - **Conduct sensitivity studies to assess contribution to radionuclide release from colloids and provide an abstracted model for TSPA-VA by:**
    - **Develop simplified model to examine effect on Pu release from colloids resulting from weathering of EBS materials**
    - **Analyses will consider interaction of Pu with solids in drift/rock minerals in both matrix and fracture system**
    - **Test two flow/transport models using hydrologic parameters developed in the EBS transport activity of the waste form degradation/mobilization effort**

Near Term Key Events

Look Ahead
October 97 - January 98

Look Ahead
Viability Assessment Major Milestones
October 97 - January 98

Management Plans for VA Products	**11/97**
Initiate Drift Scale Thermal Test	**12/97**
Complete Process Model Review, Peer Review Interim Report	**12/97**
Initiate Test of In-Situ Conditions (Alcove 7)	**12/97**
Deterministic Evaluation for Type 1 Faults at Yucca Mountain	**12/97**
Preliminary UZ Transport (TSPA-VA Chapter)	**1/98**
Preliminary Waste Package Degradation (TSPA-VA Chapter)	**1/98**
Preliminary UZ Flow (TSPA-VA Chapter)	**1/98**
Present TSPA-VA Base Case Results	**1/98**
Complete Draft VA UZ Abstraction/Testing Document	**1/98**
Prepare Revised Draft License Application Plan	**1/98**
Prepare Final Cost Documentation (MGDS Cost Estimate)	**1/98**

Closing Remarks

- **We have less than 12 months to complete the components of the Viability Assessment**
- **Focus will be in the good science and engineering that provide the foundation for those products**
- **Goal is to assemble more than 15 years of information into a coherent repository concept, which will help guide the completion of site characterization**