YUCCA
MOUNTAIN
PROJECT

Studies

Update on Yucca Mountain Activities

Presented to:
Nuclear Waste Technical Review Board

Presented by:
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Las Vegas, Nevada

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

Agenda

- **Project Plans for FY98**
  - **Managing the Viability Assessment**
  - **Components of the Viability Assessment**
  - **Design and scientific testing**
  - **Core science activities**
- **Near-Term Key Events**

Managing the Viability Assessment

- Background
- Program documentation
- Summary schedule for completion of the VA
- VA management teams
- VA management groups

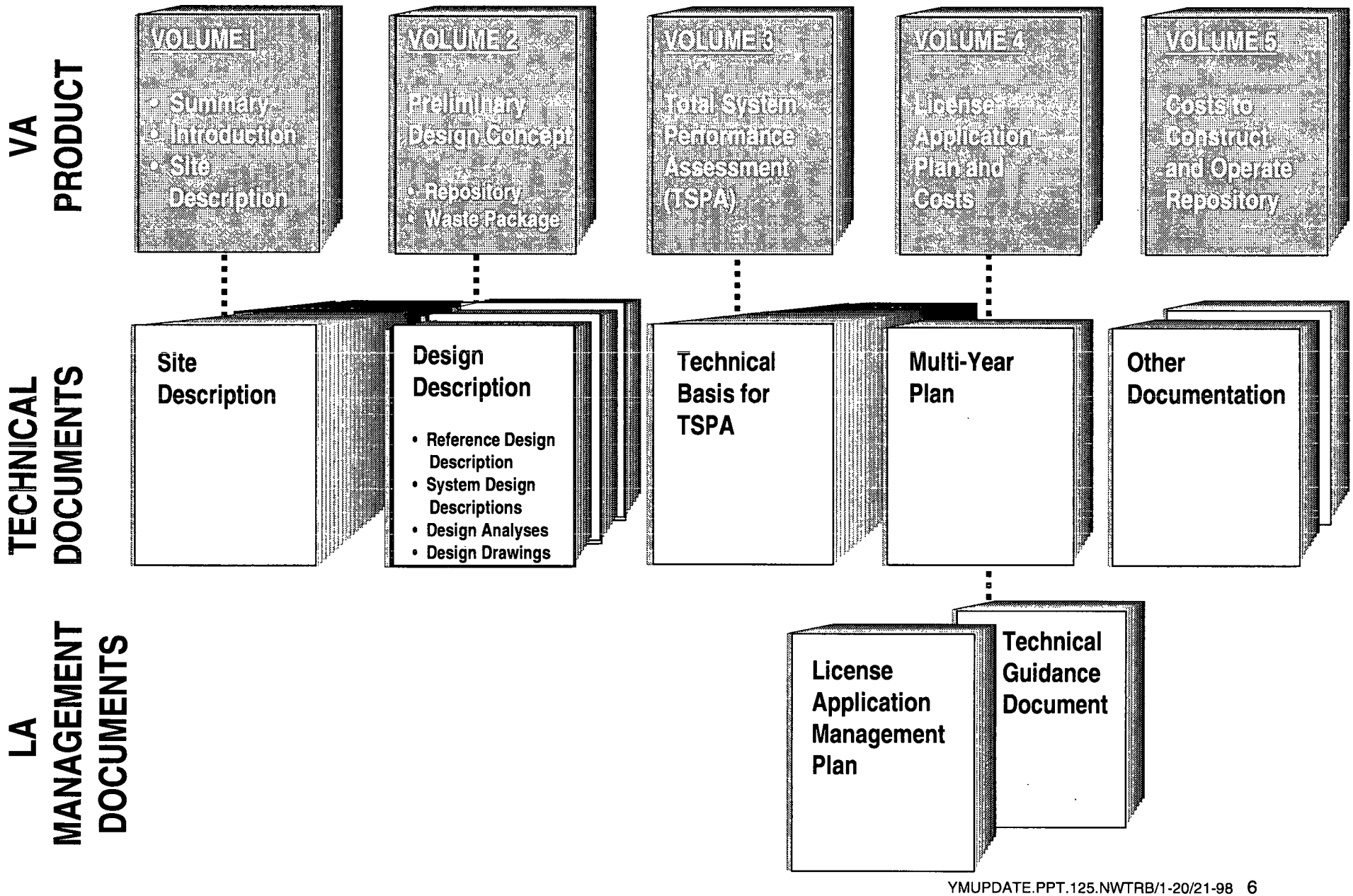
Background

- The Energy and Water Development Appropriations Acts of 1997 directed DOE to prepare and submit a viability assessment (VA) by September 1998.
- The Program's principal objectives for the Yucca Mountain Project for 1998 are to:
  - Prepare the VA and supporting documentation
  - Prepare groundwork for completing the LA
  - Continue site investigations and design activities leading to resolution of technical issues including the NRC's KTIs

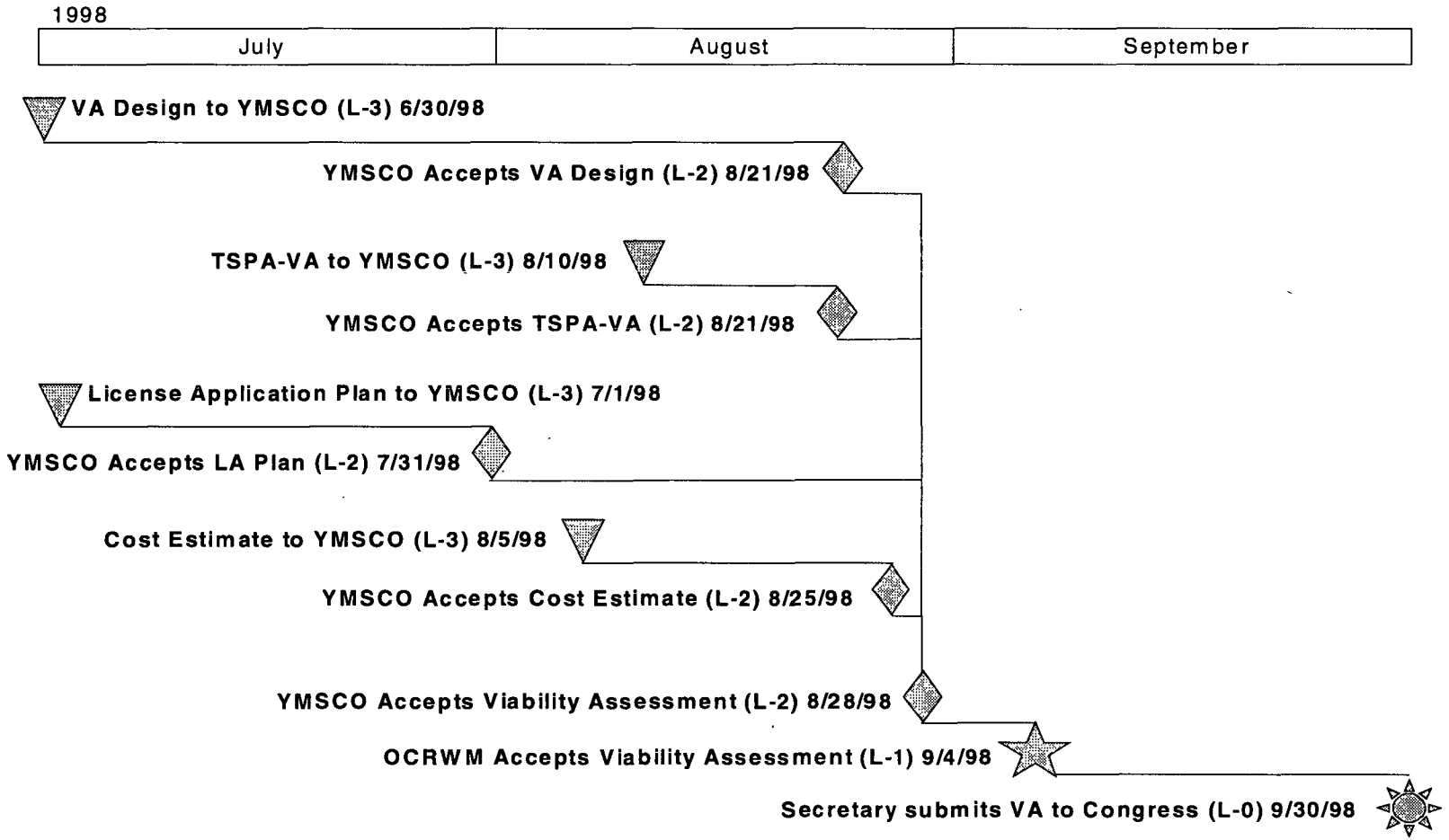
Background
(Continued)

- The VA will provide a basis for making an informed assessment of the feasibility to proceed with the process of licensing and constructing a repository at Yucca Mountain based on a current understanding of:
  - A preliminary design concept
  - System performance
  - A plan leading to LA
  - Cost to develop and operate a repository

Program Documentation



Summary Schedule for Completion of the Viability Assessment



Managing the Viability Assessment (VA)

- Overall responsibility for the VA lies with the YMSCO
- Major policy issues are the responsibility of RW-1
- Management groups have been chartered to ensure that:
  - Timely decisions are made on key VA issues and policies
  - Decisions and policies are adequately documented
  - Decisions are immediately communicated to line and VA product managers

VA Management Teams

- **Management Teams specified in the Charter have been assembled and are operational, they consist of:**
  - **Program Review Group (PRG)**
  - **Viability Assessment Integration Group (VAIG) and subgroups**
    - **VA (Product) Teams**
    - **VA External Parties Information and Outreach Working Group**

VA Management Groups

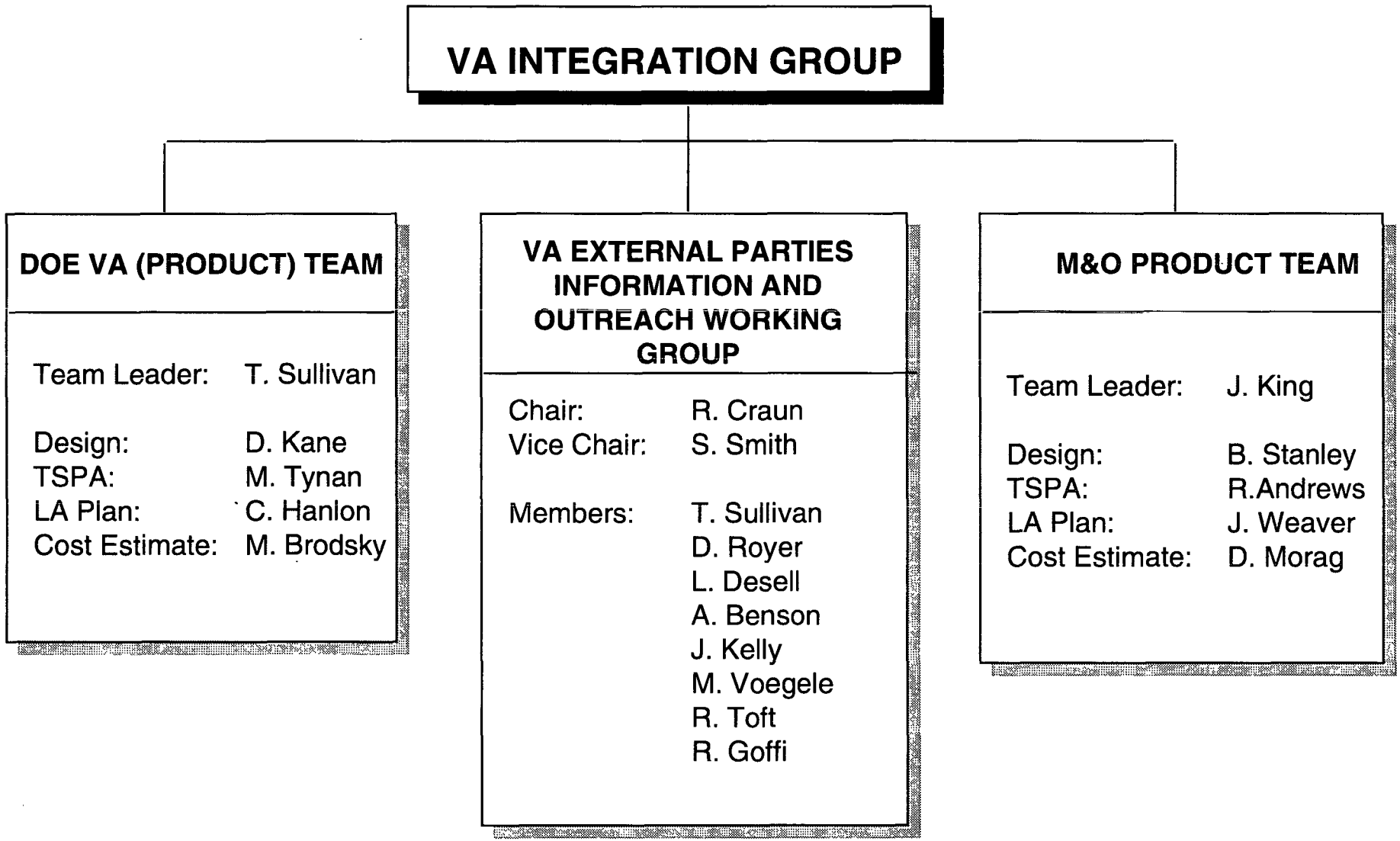
PROGRAM REVIEW GROUP

Chairman:	L. Barrett
Members:	R. Dyer
	D. Shelor
	S. Brocoum
	R. Strickler
	C. Metzger
Secretary:	L. Desell

VA INTEGRATION GROUP

Chairman:	S. Brocoum
Members:	R. Craun
	T. Sullivan
	D. Foust
	G. Vawter
	M. Voegele
	M. Lugo
	M. Cline
Secretary:	D. Royer

Management Groups Supporting VAIG



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

MGDS Consulting Board

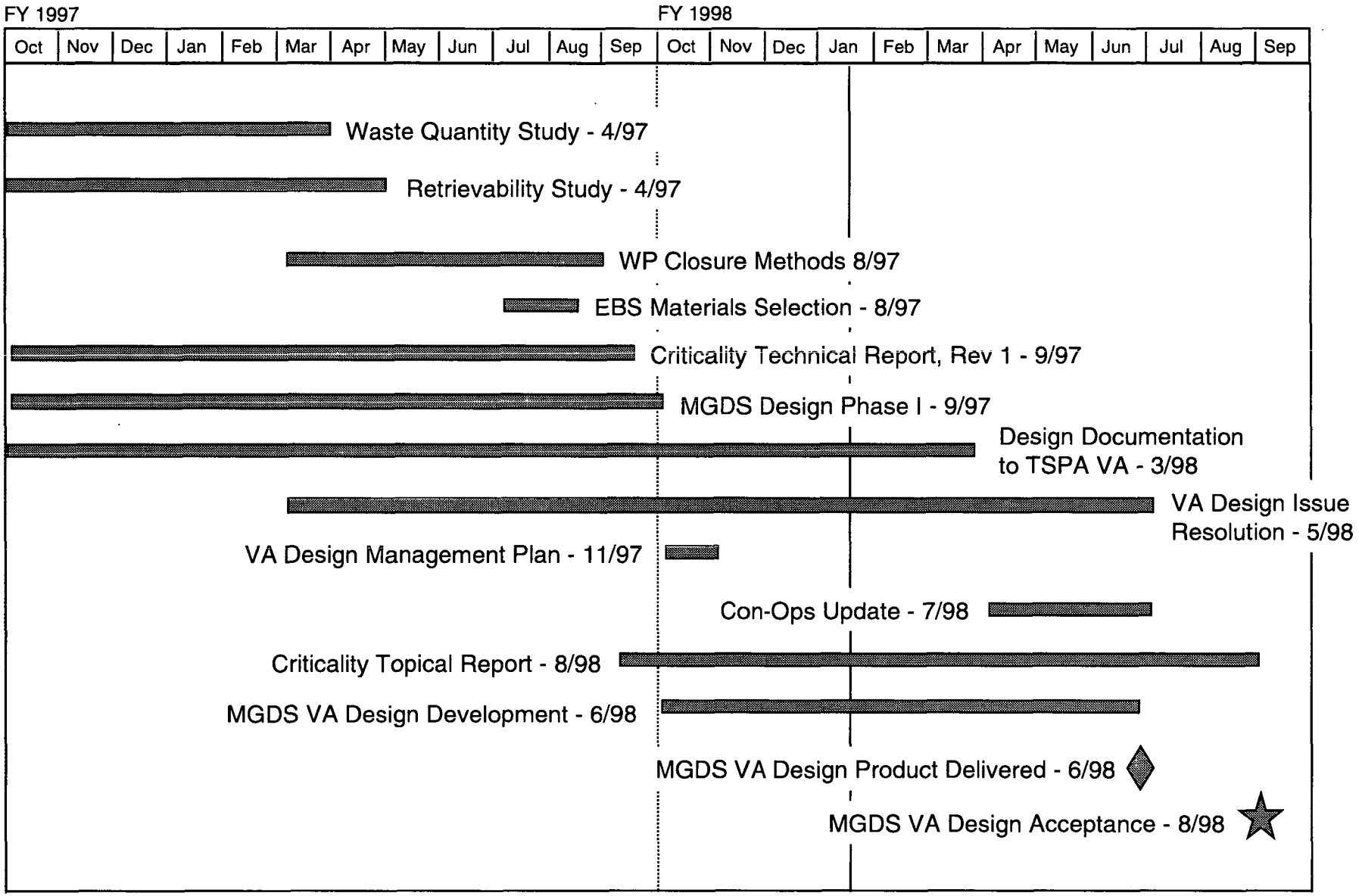
- An independent, multi-disciplinary panel of eight experts which provide feedback on the repository and waste package design
- The board's members serve on one or two sub-boards:
  - Waste Package and Subsurface Facility Sub-Board
  - Sub-Surface Repository Sub-Board

MGDS Consulting Board

(Continued)

- FY 1998 meetings between the board and M&O design team: December 17-19, 1997, March 25-27, 1998 (planned), and June 24-26, 1998 (planned)
- Recent board comments relevant to VA:
  - Move quickly to finalize design criteria, performance goals, and assumptions for VA
  - Plan to construct the perimeter drift, main ventilation drift, and ramps prior to any emplacement drifts

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**

Summary of Findings from TSPA Peer Review Panel - Second Interim Report 12 Dec 1997

Note: Objective of the TSPA-VA Peer Review is to provide formal, independent evaluation and critique of TSPA-VA for CRWMS M&O in order that the TSPA-LA process and presentation can be improved

- **Care required in overinterpretation of sensitivity results when varying levels of conservatism/realism are included in the models**
- **Recommends investigating methods to explicitly test subsystem models**
- **Athough impressed with use of expert elicitations, concerned that this process could be misused - it is not a substitute for data**

Summary of Findings from TSPA Peer Review Panel - Second Interim Report 12 Dec 1997

(Continued)

- Key elements of safety case should be presented in a framework including supporting models, underlying physical/chemical principles, conformance with available data, experience in comparable systems, and sensitivity analyses
- Further attention is needed to interpretation of environmental tracers
- Steps should be taken to assess the uncertainties in and range of validity for equivalent continuum fracture-matrix models

Summary of Findings from TSPA Peer Review Panel - Second Interim Report 12 Dec 1997

(Continued)

- Impact of thermochemical and thermohydrologic changes on repository performance should be investigated
- Support the selection of the most corrosion resistant metals, recognizing that realistic data are required

Summary of Findings from TSPA Peer Review Panel - Second Interim Report 12 Dec 1997

(Continued)

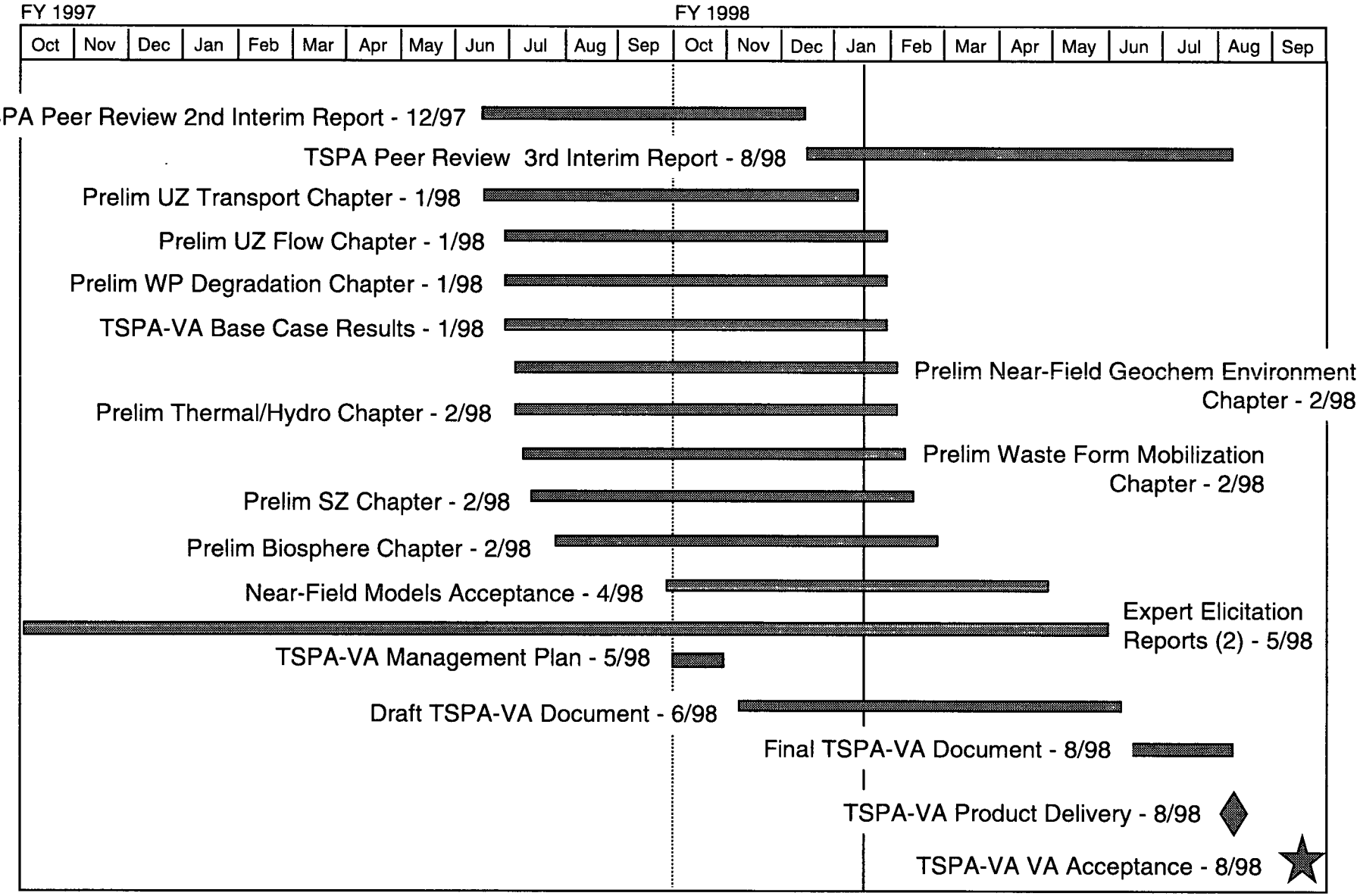
- More data on water chemistry are required to refine and validate existing models
- Better descriptions of transport from the EBS are required
- An analysis of backfill should be included in the TSPA-VA
- Mechanistic models of waste form degradation would provide a stronger basis than response surfaces
- Volcanism may be able to be screened out on the basis of the low probability of occurrence

Summary of Findings from TSPA Peer Review Panel - Second Interim Report 12 Dec 1997

(Continued)

- The consequences of criticality may be so low as to make it unimportant
- NTS data on colloidal transport should be carefully analyzed to determined their applicability to TSPA
- The conservatism underlying EPA and NRC dose conversion factors should be understood, quantified in a cursory sense and their implications discussed

TSPA-VA Product Development Status



License Application Plan

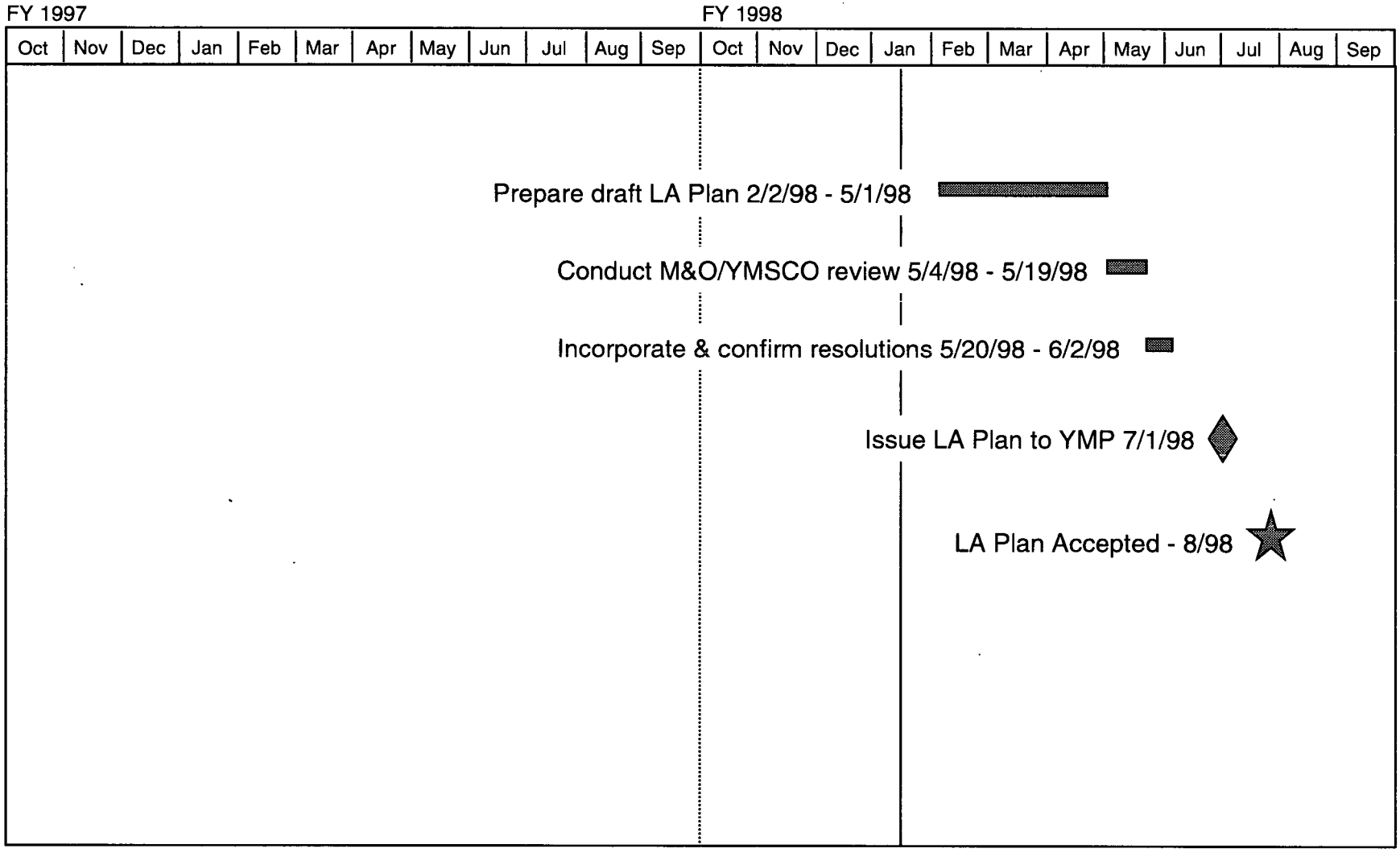
- Provides a link between the Viability Assessment and the License Application
- Identifies work to be performed to complete the License Application
  - Describes additional tests supporting the repository safety strategy
  - Describes remaining design work
  - Describes planned TSPA Analyses
  - Describes the performance confirmation program
- Includes cost of that additional work

License Application Plan

(Continued)

- Also describes other work necessary to support the License Application Submittal
  - Site Recommendation
  - Environmental Impact Statement and Environmental Compliance
  - Licensing
  - Field Construction and Operation
- Provides summary schedule to develop major products supporting the site recommendation and License Application Submittal

License Application Plan Product Development Status



MGDS-VA Cost Estimate

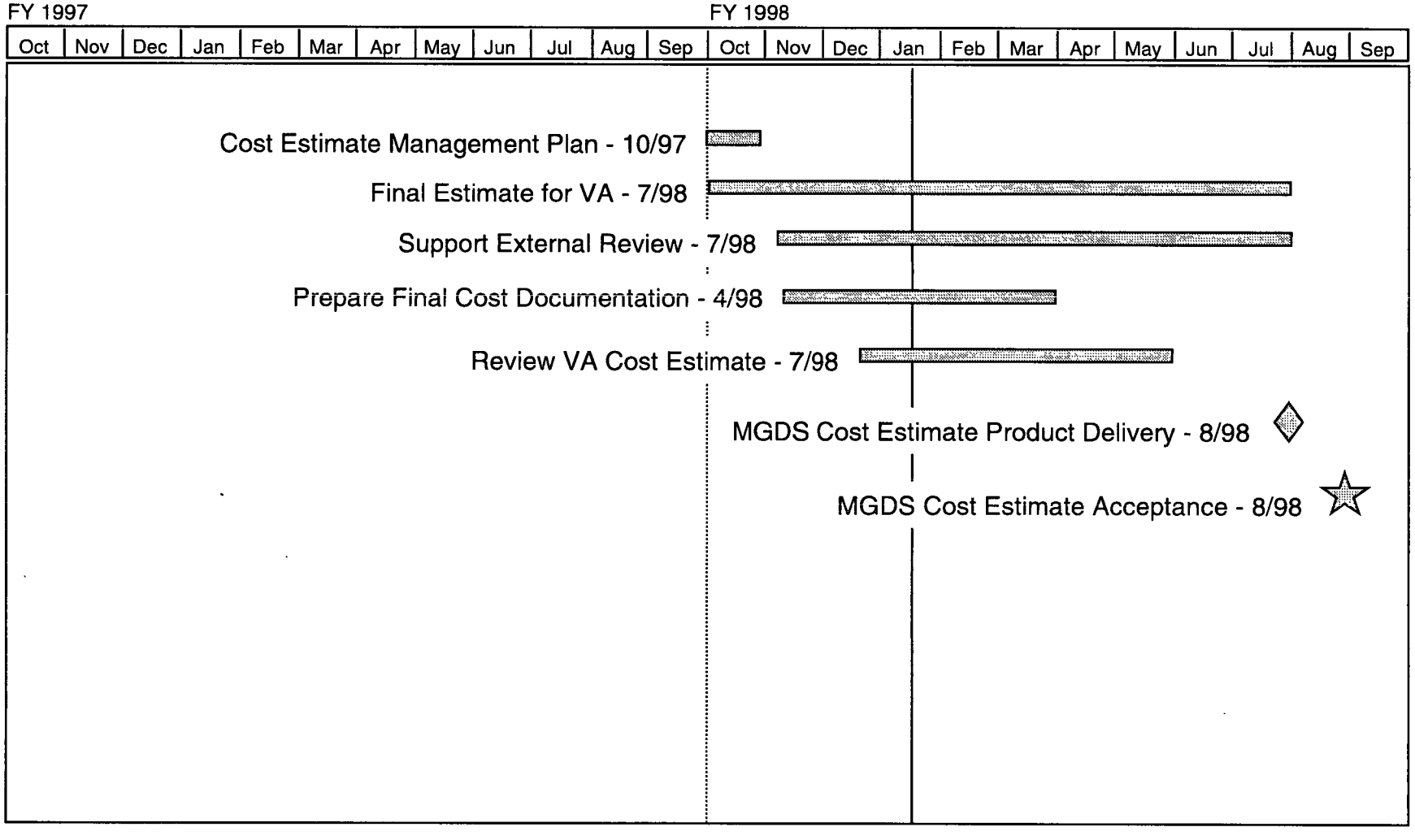
- Consists of the following repository life cycle phases:
  - Development and evaluation
  - Engineering and construction
  - Emplacement operations
  - Caretaker operations
  - Closure and decommissioning
- Report will be reviewed and approved in accordance with MGDS-VA Cost Estimate Management Plan
- An independent review of cost-estimate will be performed
  - Foster Wheeler Environmental
  - Phased review to be completed in July 1998

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 Cost Estimate Product Development Status



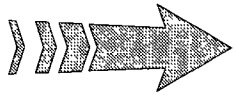
FY98 Plans - Design and Scientific Testing
Performance Attributes of a Repository

- 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

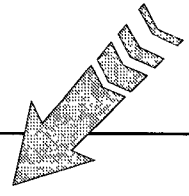
Limited Water Contacting Waste Packages

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



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
- Engineered enhancements extend the period of containment of the inner barrier



Slow Rate of Radionuclide Release

- Containment time sufficient to prevent oxidation of spent fuel
- Amount of water that contacts waste can be limited
- 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
- Contaminants in 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

- Test in-situ conditions in Alcove 7 (ongoing)
- Fracture flow and seepage testing in ESF niches (9/98)
- Monitor drift-scale thermal test (Ongoing)

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 (12/98)

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 (12/98)
- Disposal Criticality Analysis Methodology Topical Report (10/98)

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 SD-6

Update on Data Collection Activities

- Drilling and sampling
- Construction of testing facilities
- Peer review

Core Science Activities

- **Drilling and Sampling on Location**
  - **WT-24**
  - **WT-17 and WT-3**
  - **SD-6**
  - **C-Well Complex**
  - **Alcoves 3 & 4**
  - **Alcove 6**
  - **Niche studies**


WT-24
Repository Layout
YUCCA MOUNTAIN
Cross-Drift
ESF Tunnel
5
4
3
2
1
6
SD-6
7
C-wells
Conceptual Controlled Area Boundary
BUSTED BUTTE
ALCOVES
1 - UPPER TIVA CANYON ALCOVE
2 - BOW RIDGE FAULT ALCOVE
3 - UPPER PAINTBRUSH TUFF CONTACT ALCOVE
4 - LOWER PAINTBRUSH TUFF CONTACT ALCOVE
5 - THERMAL TEST FACILITY
6 - NORTHERN GHOST DANCE FAULT ALCOVE
7 - SOUTHERN GHOST DANCE FAULT ALCOVE
YMP-98-016.0

WT-24

- **Purpose of the Pump tests at WT-24**
  - Evaluate steep hydraulic gradient north of the proposed repository block
  - Determine whether the observed water level represents local perched water or regional water table.
- **Status of work:**
  - Hydraulic pumping test complete 01/12/98
  - Preliminary evaluation of drawdown data indicate a very low permeability zone that may be perched water
  - Hole is being deepened to investigate lower zones that may represent the regional water table

WT-17 and WT-3

- **Purpose**
  - Water level measurements
  - water chemistry sampling
- **Status of work**
  - Wells are being cleaned
  - New equipment will be installed

SD-6

- **Purpose of drilling at SD-6**
  - Obtain additional stratigraphic information on the western side of the repository block
  - Obtain hydrologic information on the west side of the proposed repository block
  - Compare with predicted stratigraphy from Integrated Site Model
- **Status of work**
  - Drilling has progressed to 1150 feet below land surface (in Topopah Spring lower lithophysal rock unit)
  - Drilling on hold - pipe stuck in hole

C-Well Complex

- **Purpose of C-wells testing**
  - Perform tracer tests to evaluate flow and transport characteristics in the saturated zone
- **Status of work**
  - Tracer testing in Bullfrog unit is complete
  - Installing new equipment
  - Next pump test will be conducted in the Prow Pass unit starting in February or March

Alcove 3 & 4

- **Purpose**
  - Testing and sampling to examine changes in:
    - Water geochemistry
    - Degree of saturation
- **Status of work**
  - Began coring downward in Alcove 3 to a depth of 9 meters
  - Plan on coring upward from Alcove 4

Alcove 6

- **Purpose**
  - Evaluation of North Ghost Dance Fault as potential fast-path location through Yucca Mountain
- **Status of work**
  - USGS continues pneumatic 3-d permeability testing
  - Drilling new hole for fracture-matrix interactions study

Niche Studies

- **Purpose**
  - Examine changes in moisture content in the repository horizon with differing geologic conditions
  - Examine effects of construction on permeability
- **Status of work**
  - Niche 1 - sealed for USGS testing
  - Niche 2 - excavated; LBNL conducting dye injection testing
  - Niche 3- boreholes drilled into the area for permeability testing

Construction of Test Facilities

- Busted Butte facility
- Cross Drift predictive reports

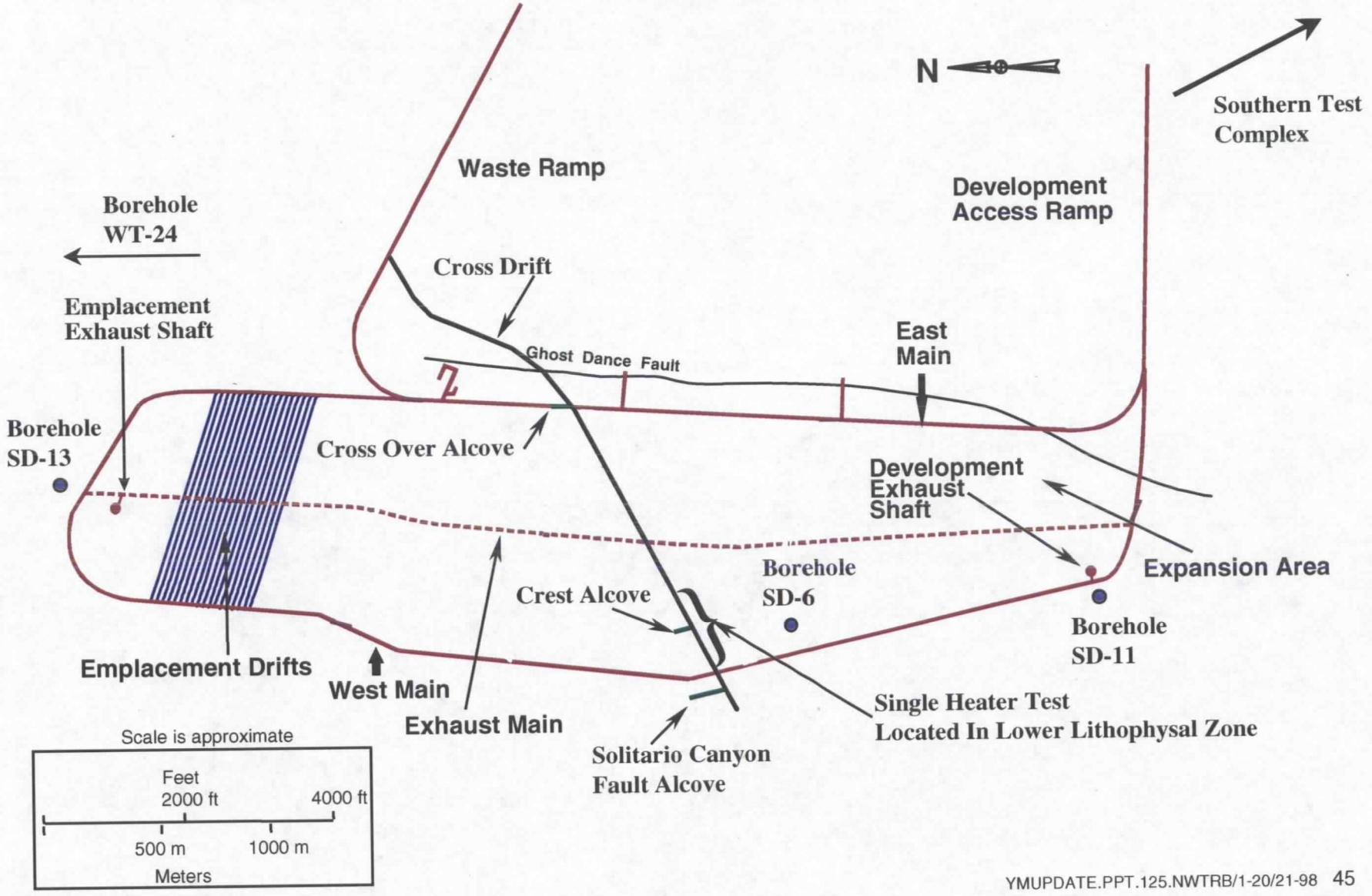
UZ Transport Test at Busted Butte

- **Purpose of the Busted Butte test**
  - **Validate lab data on radionuclide migration**
  - **Validate conceptual UZ flow and transport models**
  - **Reduce uncertainty in the transport of key radionuclides (Tc, I, Np and colloidal Pu)**

Status of the UZ Transport Test at Busted Butte

- The pad and high wall construction for the test tunnel was completed in late December 1997
- Drill and blast of the underground test tunnel 1998, ~48 meters of tunnel has been excavated
- The contact between the Calico Hills and Topopah Springs units was encountered on January 13, 1998 at 43.2 meters into the excavation drift

Enhanced Characterization Of The Repository Block



Cross Drift Hydrologic Predictive Report

- Use existing data and modeling capabilities to predict in advance of drift excavation in situ:
  - Hydrologic properties and conditions
  - Microbiologic populations
  - Fast-path related secondary mineralization
  - Isotope geochemistry, including Cl-36, O, U, and Sr
- Predictions will be made along the Cross Drift alignment for subsequent comparison with underground measurements and observations

Cross Drift Geotechnical Predictive Report

- Developed in accordance with the industry standard "Geotechnical Baseline Reports for Underground Construction" published by the ASCE
- Focus is to predict underground conditions relevant to tunnel construction within the zone of excavation such as:
  - Spatial distribution of the rock formations
  - Rock mass properties related to ground support including faults, fracture zones, key blocks, and rock strength
  - Rock mass properties for TBM performance predictions
  - Groundwater conditions that would influence tunneling
  - Hazardous minerals

Peer Review

Chlorine-36 Peer Review

- *Objective:* provide an independent evaluation of the use of Chlorine-36 to influence conceptual models of percolation flux through Yucca Mountain, particularly with respect to:
  - Sampling, analytical and data interpretations used for Chlorine-36 and other environmental isotopes
  - Adequacy of Chlorine-36 data integration with relevant site characteristics to predict groundwater flux at the potential repository horizon
- *Status of work:* panel members were provided with technical presentations and a tour of the site (01/16/98)

Near Term Key Events

Look Ahead
January 98 - April 98

Look Ahead
Viability Assessment Major Milestones
January 98 - April 98

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
Resolution of all 20 VA Design Issues	1/98-5/98
Complete Design Information Documentation in Support of TSPA-VA	3/98

Closing Remarks

- We have less than 178 working days 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