

**U.S. DEPARTMENT OF ENERGY  
OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT**

**NUCLEAR WASTE TECHNICAL REVIEW BOARD  
FULL BOARD MEETING**

**SUBJECT: YMP FISCAL YEAR 1996 PLANNING  
AND BUDGET**

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APRIL 19-20, 1995**

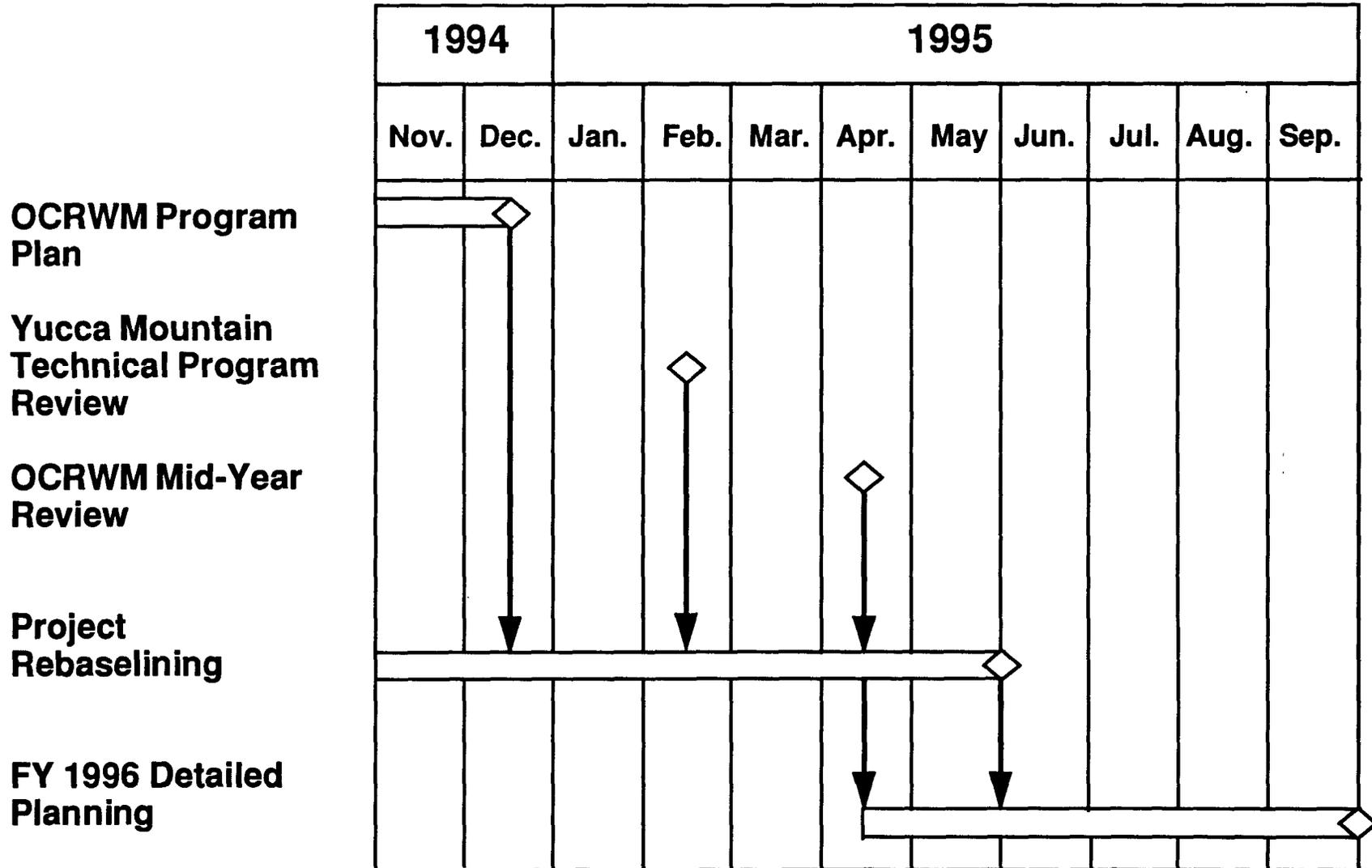
# Outline

- **Overview of FY96 budget/planning**
- **Project rebaselining effort**
- **FY96 planning basis**
- **Linkage to waste isolation strategy**
- **Summary**

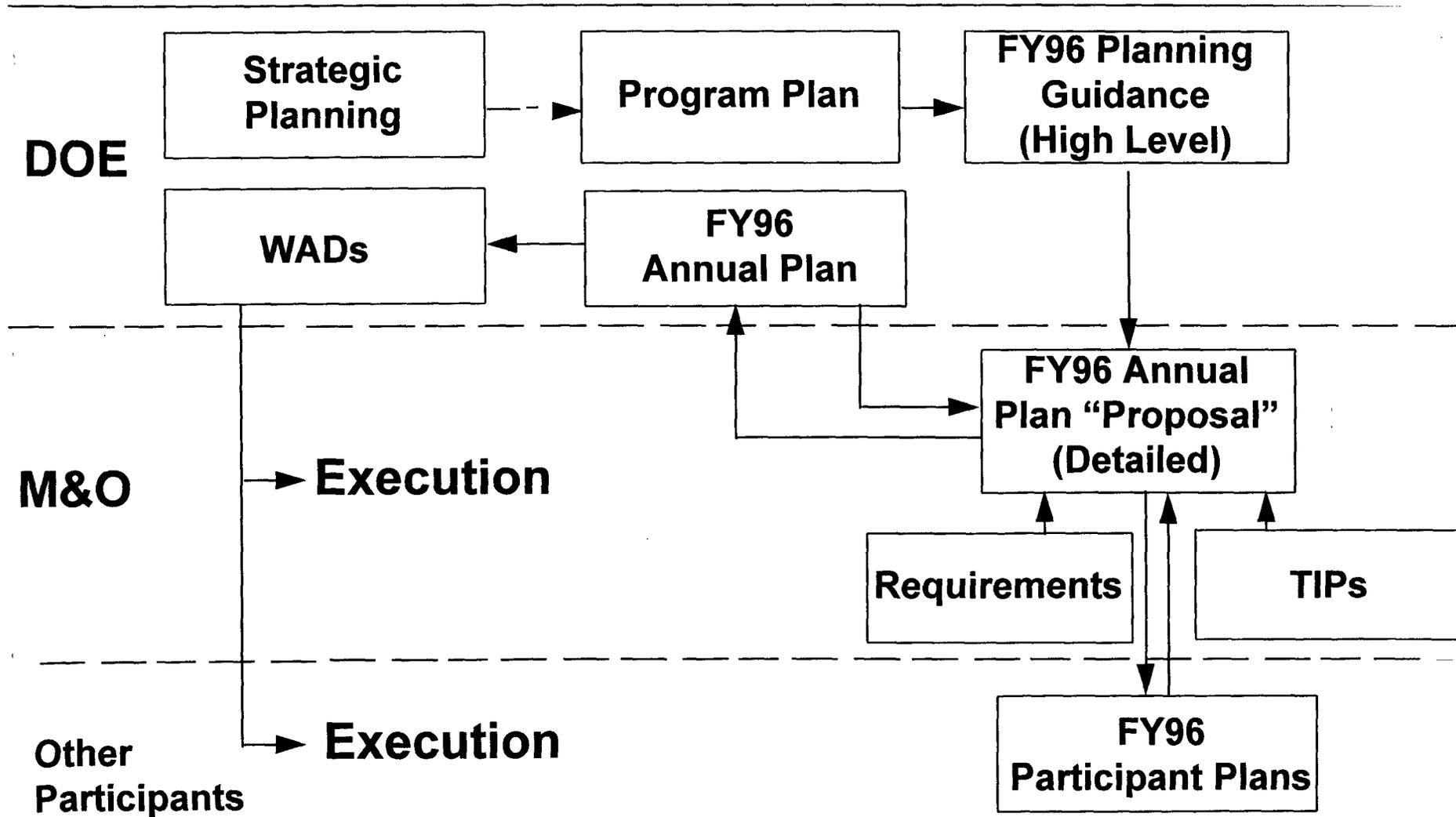
# Overview of FY96 YMP Budget

- **Planned FY96 budget for Yucca Mountain:**
  - **\$472.1M (25% increase from FY95)**
- **This funding level supports the Yucca Mountain activities reflected in the OCRWM Program Plan, December 1994**
- **This forms the top-level planning basis for upcoming FY96 detailed planning**

# FY96 Planning Overview



# Annual Budget Planning and Work Authorization Process



# **Project Rebaselining Effort**

- **Further expansion of level of detail in Program Plan**
- **Will provide an integrated, cost-loaded, long-range Project Summary Schedule (PSS)**
- **The PSS will provide input to the FY96 detailed planning**
- **The PSS incorporates results of the YMP Technical Program Review, February 1995**

# FY96 Planning Basis

- **Based on Program Plan, with the recommended enhancements that are reflected in the Project Summary Schedule**
- **Some strategic issues affecting FY96 planning:**
  - **Evolving thermal loading strategy**
    - » **Timing/location of *in situ* heater tests**
    - » **Potential characterization of expansion areas**
  - **Timing and extent of ESF drifting**
    - » **North ramp extension**
    - » **East-West drifting**
    - » **Calico Hills access**
  - **Balancing of ESF excavation and surface-based testing program**

# Planned FY96 Activities to Address Nominal Performance Uncertainties

Element or Barrier	Key Uncertainties	FY96 Activities to Address Uncertainties
 <b>Waste Package Environment</b>	<ul style="list-style-type: none"> <li>• Extent of perched water and seeps</li> <li>• Behavior of ground water within drifts</li> <li>• Time for water to reach repository horizon</li> <li>• Focusing/channeling of infiltration flux</li> <li>• Water chemistry</li> </ul>	<ul style="list-style-type: none"> <li>• Continue infiltration monitoring (98 neutron boreholes)</li> <li>• Observations/sampling of perched water/seeps from boreholes and ESF</li> <li>• Water chemistry and isotopic analysis of samples</li> <li>• Site and drift-scale hydrogeologic modeling</li> <li>• Laboratory analysis of fracture-matrix coupling</li> <li>• Characterize fault geometries and hydrologic properties</li> </ul>
 <b>Waste Package Performance</b>	<ul style="list-style-type: none"> <li>• Thermo-hydrologic-chemical environment on surface of package</li> <li>• Localized corrosion of corrosion-resistant materials</li> <li>• Role of cladding in limiting water contact</li> <li>• Potential extent of micro-biologically influenced corrosion</li> </ul>	<ul style="list-style-type: none"> <li>• Modeling &amp; testing of pit corrosion processes</li> <li>• Analogs for material durability</li> <li>• Test materials for resistance to microbially induced corrosion</li> </ul>

# Planned FY96 Activities to Address Nominal Performance Uncertainties

Element or Barrier	Key Uncertainties	FY96 Activities to Address Uncertainties
<p><b>3</b> Radionuclide Mobilization</p>	<ul style="list-style-type: none"> <li>• Chemistry of water, as conditioned by EBS materials</li> <li>• Oxidation state of spent fuel</li> <li>• Cladding breaching and surface area of waste matrix available for dissolution</li> <li>• Waste dissolution vs. particulate releases in presence of limited water</li> <li>• Colloid existence/stability</li> <li>• Bounding Np/Tc solubilities</li> <li>• Probability of events leading to criticality</li> </ul>	<ul style="list-style-type: none"> <li>• Lab testing of waste form dissolution</li> <li>• Colloid Investigations</li> <li>• Np and Tc solubility experiments</li> <li>• Probabilistic analyses of criticality potential</li> </ul>
<p><b>4</b> Release through EBS</p>	<ul style="list-style-type: none"> <li>• Fraction of waste package surface degraded</li> <li>• Potential for liquid film to support diffusive release</li> <li>• Diffusion rates in potential packing/backfill material</li> <li>• Advective flow in engineered barriers</li> <li>• Condition of EBS materials over long time frame</li> <li>• Transport processes in EBS materials</li> </ul>	<ul style="list-style-type: none"> <li>• Monitor seeps in ESF (ongoing)</li> <li>• Lab measurements of diffusion rates</li> <li>• Drift-scale thermohydrologic sensitivity analyses</li> </ul>

# Planned FY96 Activities to Address Nominal Performance Uncertainties

Element or Barrier	Key Uncertainties	FY96 Activities to Address Uncertainties
 <p><b>Radionuclide Migration in Geosphere</b></p>	<ul style="list-style-type: none"> <li>• Magnitude of infiltration flux</li> <li>• Travel time of water in unsaturated zone</li> <li>• Conceptual model for fracture-matrix coupling in partially saturated media</li> <li>• Dispersion caused by small-scale heterogeneity</li> <li>• Nature/role of steep gradient to the north</li> <li>• Extent of dilution by vertical groundwater mixing</li> </ul>	<ul style="list-style-type: none"> <li>• C-well convergence testing including analyses of mixing depth</li> <li>• Investigate steep gradient (WT 24)</li> <li>• Sensitivity analysis for UZ/SZ flow and transport models</li> <li>• Isotopic analyses of seeps from ESF and boreholes (<sup>36</sup>Cl, <sup>3</sup>H + <sup>14</sup>C)</li> <li>• Characterize fracture distributions and heterogeneity</li> <li>• Characterize fault geometries and structural framework</li> </ul>

# Planned FY96 Activities to Address Perturbing Effects on Nominal Performance

Effects on Strategy Elements/Barrier	Key Uncertainties	FY96 Activities to Address Uncertainties
<p><b>Thermal Effects</b></p>	<ul style="list-style-type: none"> <li>• Elevation of temperature and impacts on EBS</li> <li>• Effect on rock-mass stability</li> <li>• Effect on near-field humidity</li> <li>• Effect on waste package material corrosion rates</li> <li>• Effect on radionuclide mobilization rates</li> <li>• Effect on release from EBS</li> <li>• Effect on moisture distribution in unsaturated rock</li> <li>• Effect on minerals along flow paths</li> </ul>	<ul style="list-style-type: none"> <li>• Lab tests of corrosion rates for range of temperature/humidity</li> <li>• Lab tests of waste form dissolution and solubility for range of conditions (ongoing)</li> <li>• Rock properties testing (ongoing)</li> <li>• Large Block Test</li> </ul>
<p><b>Future Climate Changes</b></p>	<ul style="list-style-type: none"> <li>• Expected increases in infiltration and wetting of engineered barriers</li> <li>• Changes in saturation due to climate change</li> <li>• Expected increases in recharge to regional groundwater system</li> </ul>	<p>Initiate:</p> <ul style="list-style-type: none"> <li>• Modeling future climates</li> <li>• Determination of relationship between climate/hydrologic conditions</li> <li>• Estimates of effects on infiltration rates, saturation profiles, and saturated zone response</li> </ul>

# Planned FY96 Activities to Address Perturbing Effects on Nominal Performance

Effects on Strategy Elements/Barrier	Key Uncertainties	FY96 Activities to Address Uncertainties
Tectonics	<ul style="list-style-type: none"> <li>• Effect on EBS</li> <li>• Potential for development or renewal of flowpaths along faults</li> <li>• Potential for water table rise</li> <li>• Direct and indirect magmatic effects</li> </ul>	<ul style="list-style-type: none"> <li>• Characterize seismic sources</li> <li>• Evaluate alternate tectonic models</li> <li>• Monitor SGBSN</li> <li>• Evaluate ground motion attenuation with depth</li> <li>• Model water table response to earthquakes</li> <li>• Conduct PSHA</li> <li>• Magmatic effects analog studies</li> <li>• Characterize eruptive effects</li> </ul>

# Planned FY96 Activities to Address Perturbing Effects on Nominal Performance

<b>Effects on Strategy Elements/Barrier</b>	<b>Key Uncertainties</b>	<b>FY96 Activities to Address Uncertainties</b>
<p><b>Human Interference</b></p>	<ul style="list-style-type: none"> <li>• Direct intrusion by exploratory drilling</li> <li>• Introduction of fluids as result of exploratory drilling</li> </ul>	<ul style="list-style-type: none"> <li>• Evaluate resource potential</li> </ul>

# Summary

- **FY96 detailed planning is just being initiated**
- **This planning will address the activities needed to support the waste isolation strategy**
- **As part of this planning, recommendations made by the Board in its 11th report will be considered**