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

NUCLEAR WASTE TECHNICAL REVIEW BOARD
FULL BOARD MEETING

SUBJECT: SOURCE TERM CONCEPT AND DEFINITION

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LAS VEGAS, NEVADA
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Outline

- **Definition and interfaces**
- **Model hierarchy**
- **EBS components**
- **Waste acceptance**
- **Approach to model development**
- **Model information needs**
- **Near-term activities**

Source Term

- **Definition**
  - Radionuclide release from the Engineered Barrier System (EBS) into the host rock
- **Major interfaces**
  - Containment performance
  - EBS release
  - Near-field flow and transport

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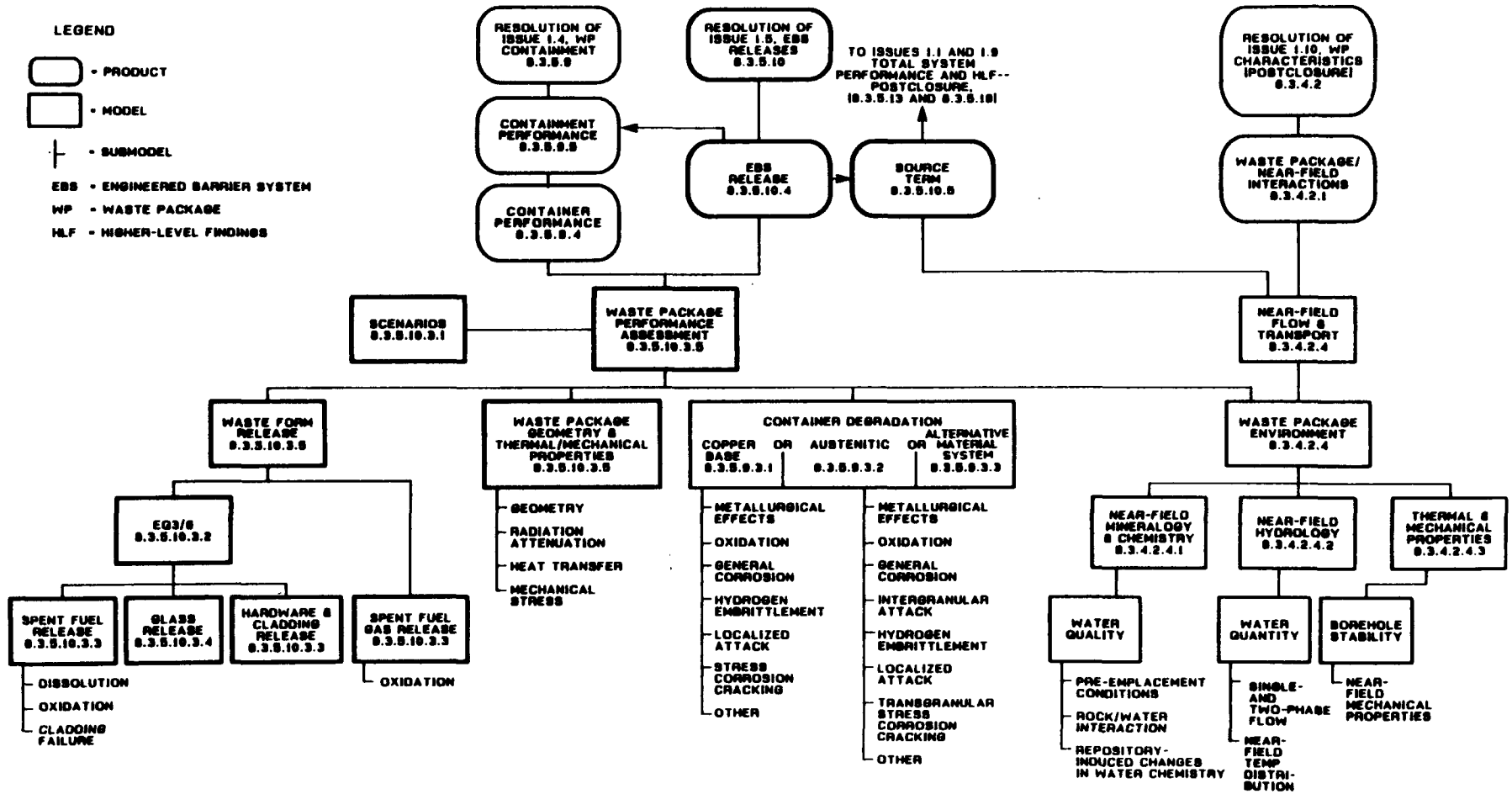
Model Hierarchy from the SCP



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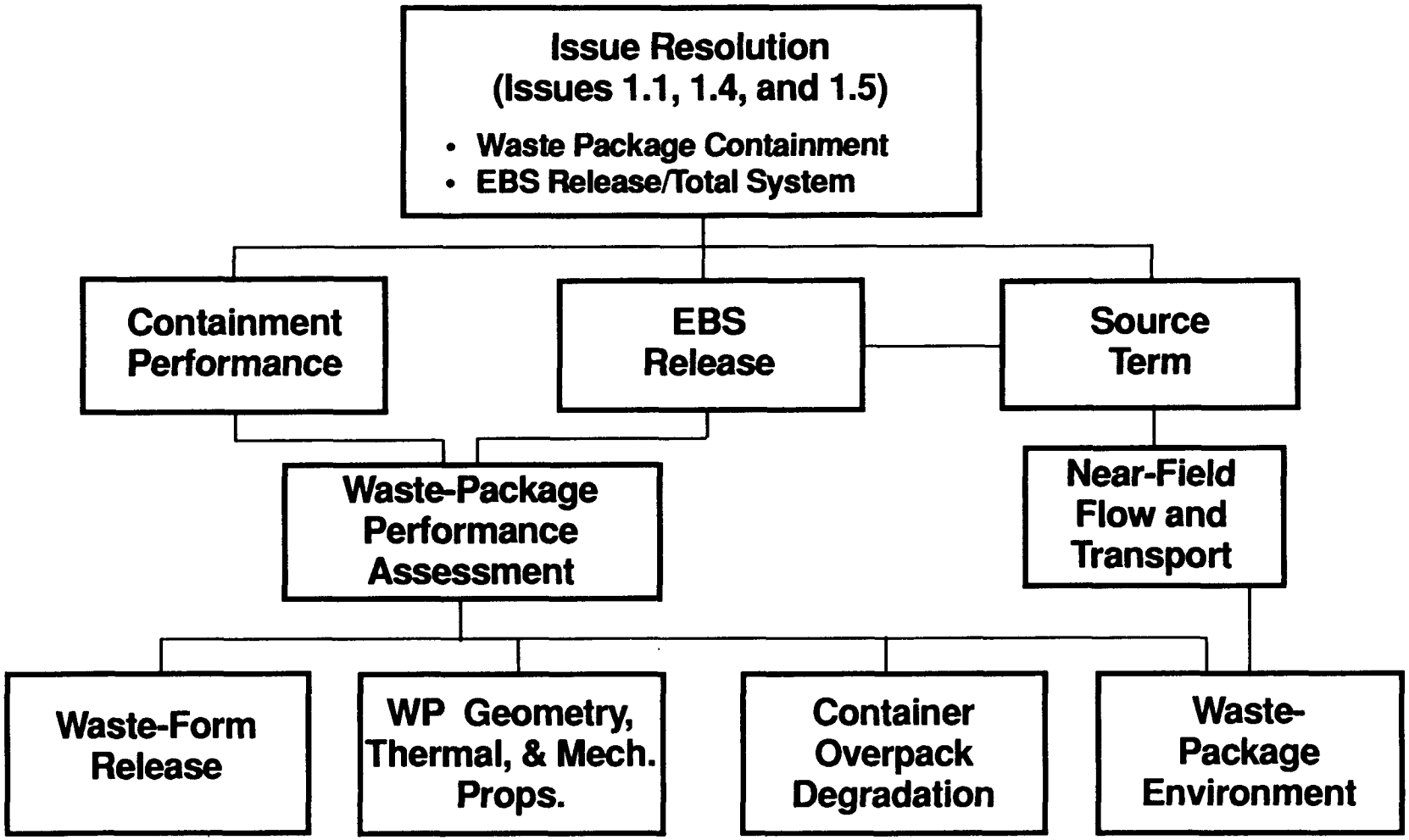
Model Hierarchy for Issue Resolution



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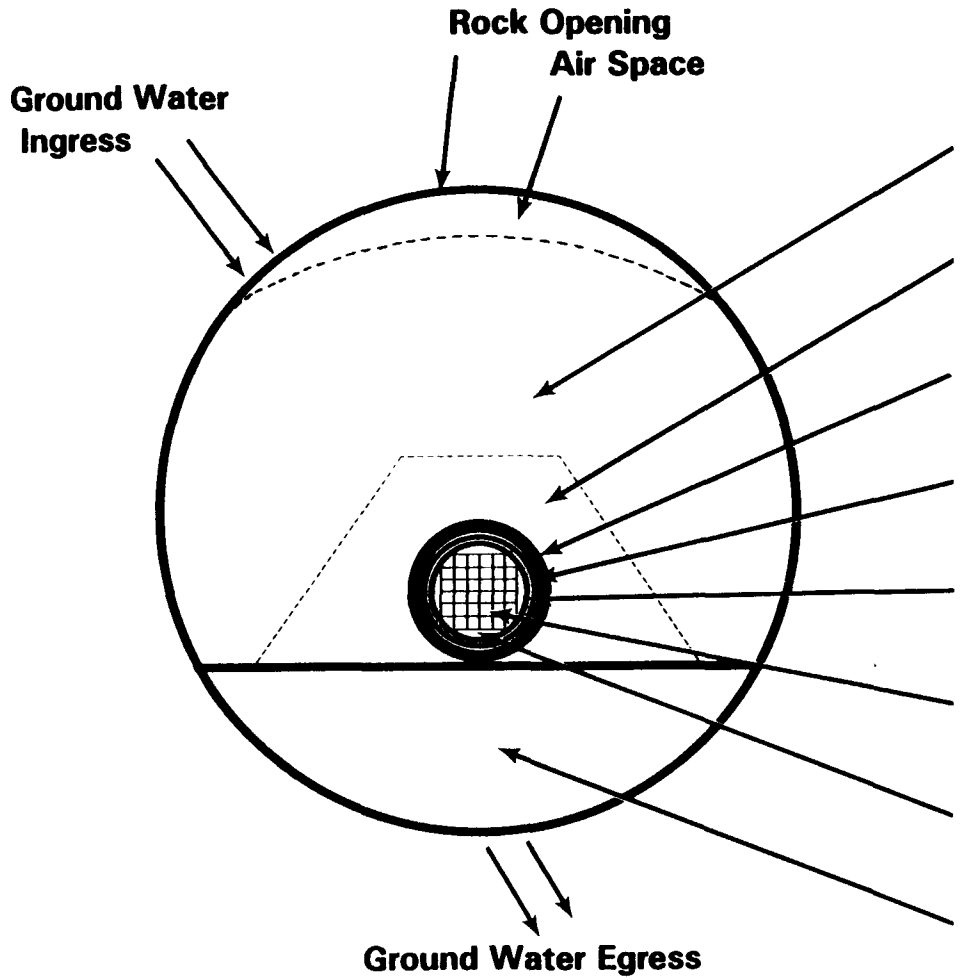
Waste Package/EBS Performance Assessment of One Design Concept

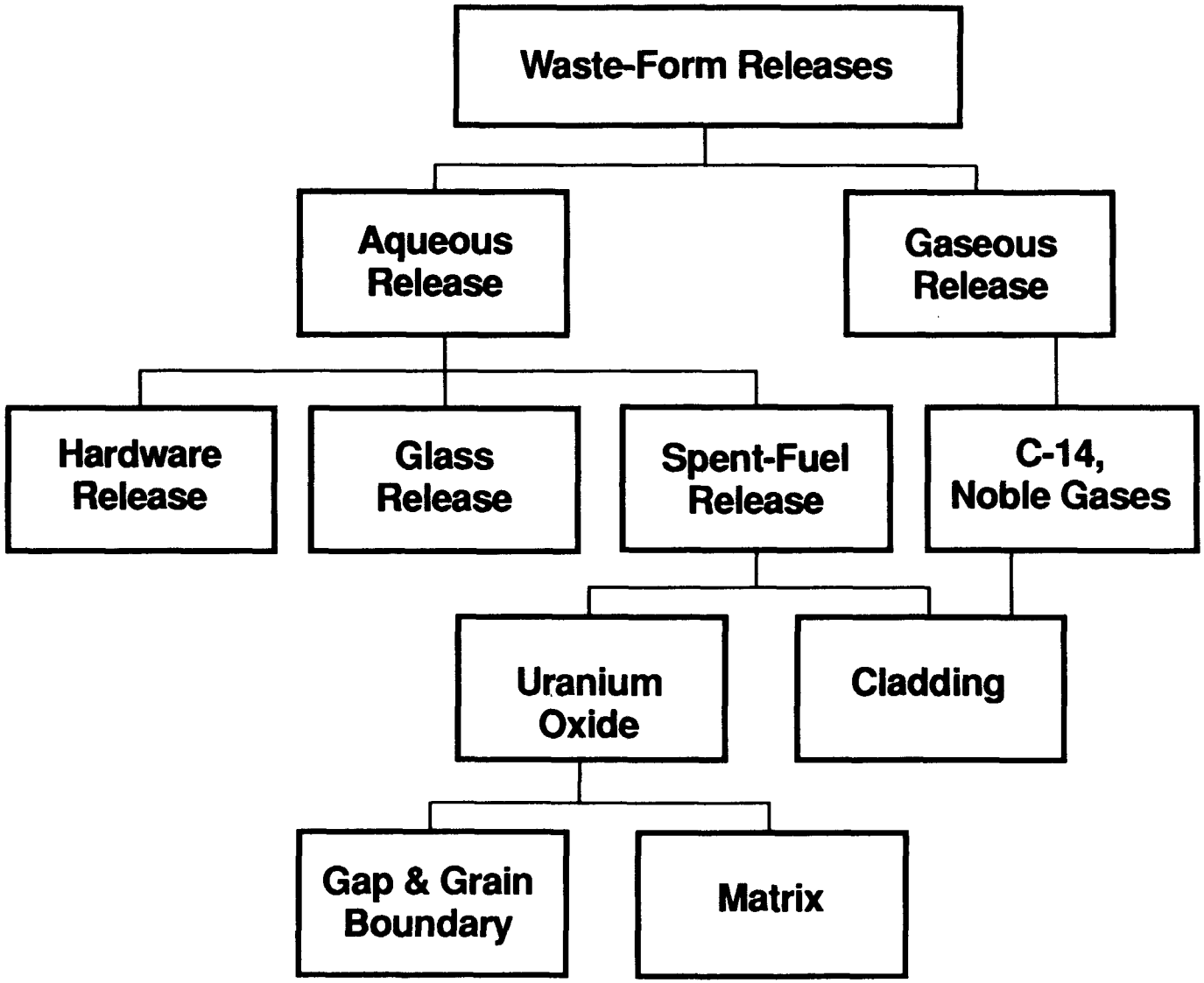


Components	Possible Materials
Engineered Backfill	Crushed Tuff
Engineered Packing	Coarse Tuff
Outer Containment Barrier	Weathering Steel
Separator	Stainless Steel Shot
Inner Containment Barrier	Alloy 825
Spent Fuel/Basket Assembly	Borated Material
Buffer/Filler Material	Iron Oxide Powder
Engineered Invert	Coarse Tuff

EBS/Waste Package Processes

- Water enters EBS
- Backfill/water interactions
- Water/waste-package contact
- Containment barrier degradation and failure
- Carbon-14 release
- Water/filler interactions
- Water (vapor)/waste-form contact
- Waste-form leaching/corrosion
- Radionuclide release from waste package
- Radionuclide/backfill/invert interactions
- Release from the EBS

Waste-Form Release Model Hierarchy



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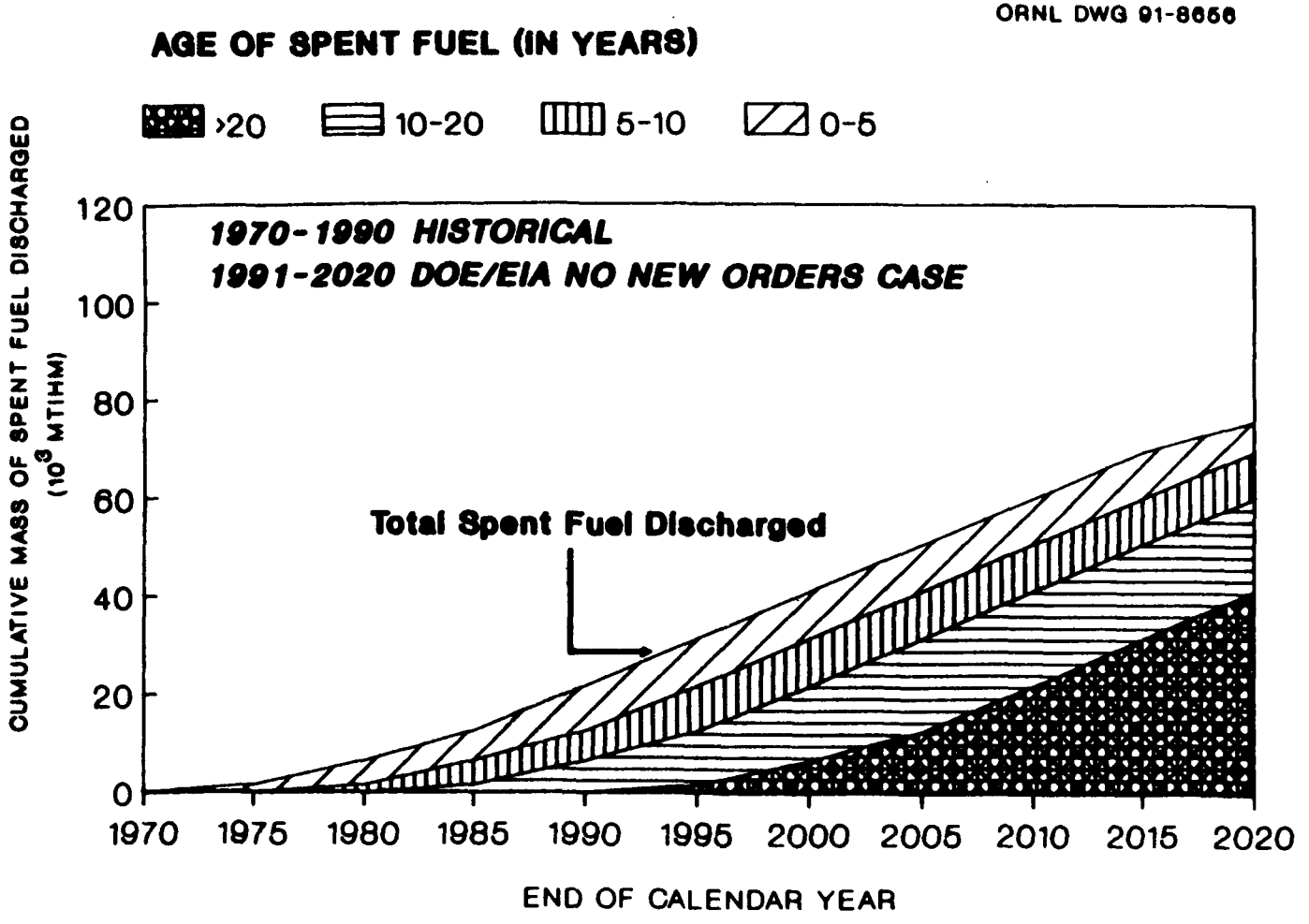
Waste Acceptance

- **Spent fuel**
  - Standard, nonstandard, and failed-fuel classifications defined in 10 CFR Part 961
  - Utility study suggested modifications
  - Acceptance criteria under review by DOE
- **High-level waste glass**
  - Waste-acceptance criteria
  - Provides high confidence that a large majority of the product falls within acceptable range of chemical and physical properties
  - Basis: product consistency test
  - Testing and modeling by OCRWM/YMP to confirm compliance with NRC and EPA regulations

Projected Cumulative Mass (MTIHM) of Commercial Spent Fuel Discharges for the DOE/EIA No New Orders Case



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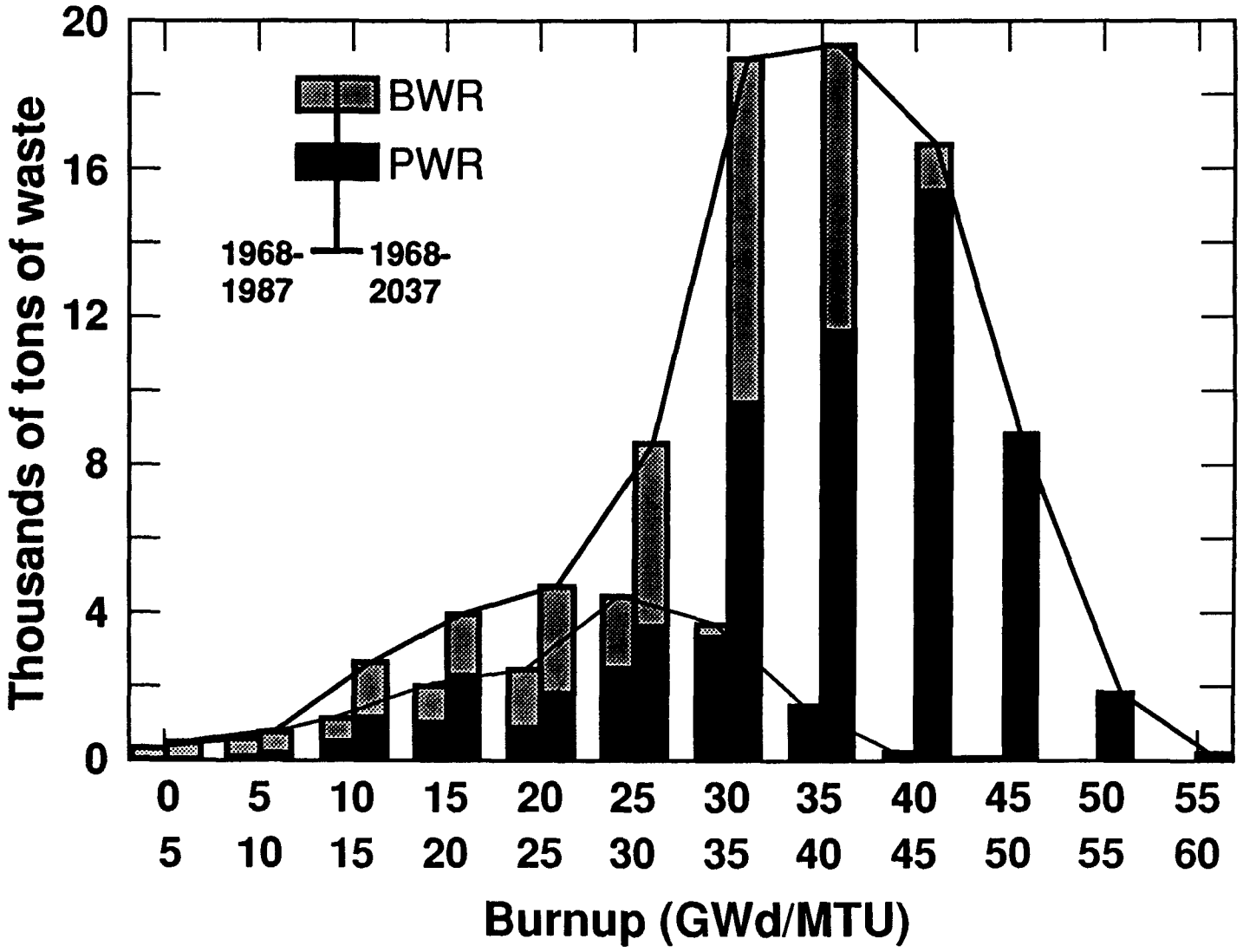
Waste Inventory-History and Projection



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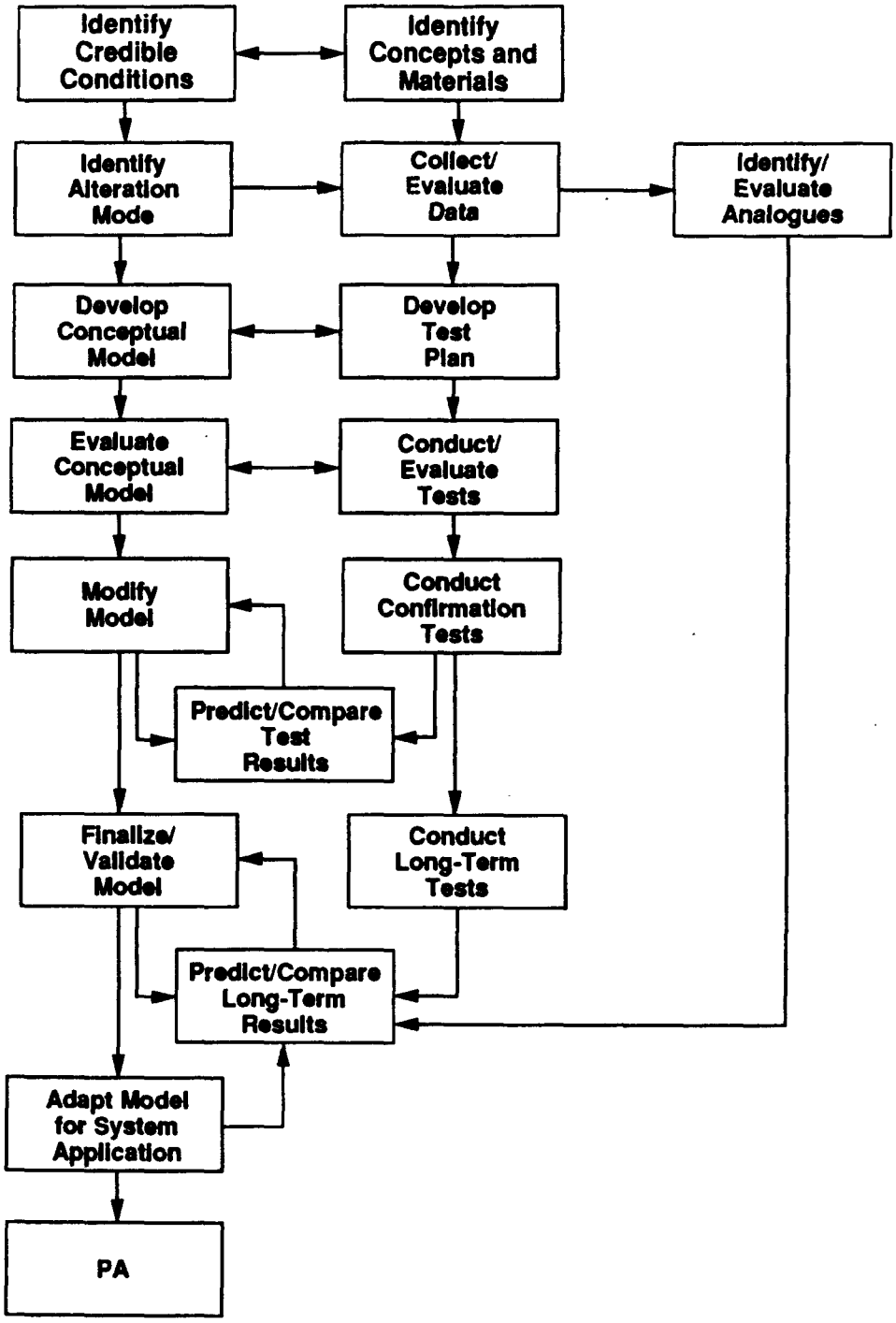
Approach to Model Development

- Bound the performance of the broad spectrum of spent fuels and HLW glass using American Society for Testing and Materials C 1174-91 Procedure
- Focus on mechanistic understanding as the basis for model development
- Perform saturated and unsaturated testing of unaltered and altered waste forms
- Utilize EQ3/6 simulations to aid modeling
- Evaluate natural analogues as a means to partially validate performance models
- Define/perform integrated tests to confirm in-repository interactions

Coupled Model Development Material Testing Program



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Information Needs

- To model spent-fuel behavior
  - Carbon-14 release mechanisms
  - Spent-fuel oxidation kinetics
  - Release of TC-99 and other soluble species
  - Impact of colloid formation
  - Cladding and hardware release
- To model HLW glass behavior
  - Reaction/hydration kinetics
  - Release from reacted glass

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Near-Term Actions

- Plan to characterize appropriate approved testing materials (ATMs)
- Define thermodynamic data base needs and generate data for geochemical simulations
- Determine oxidation threshold ?
- Continue spent fuel (UO_2) dissolution test matrix
- Reinstate glass testing and modeling effort
- Perform tests on altered waste forms