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

PRESENTATION TO
THE NUCLEAR WASTE TECHNICAL REVIEW BOARD

SUBJECT: CASK DEVELOPMENT/FABRICATION

PRESENTER: IRA K. HALL

PRESENTER'S TITLE
AND ORGANIZATION: MANAGER, SPENT FUEL TECHNOLOGIES
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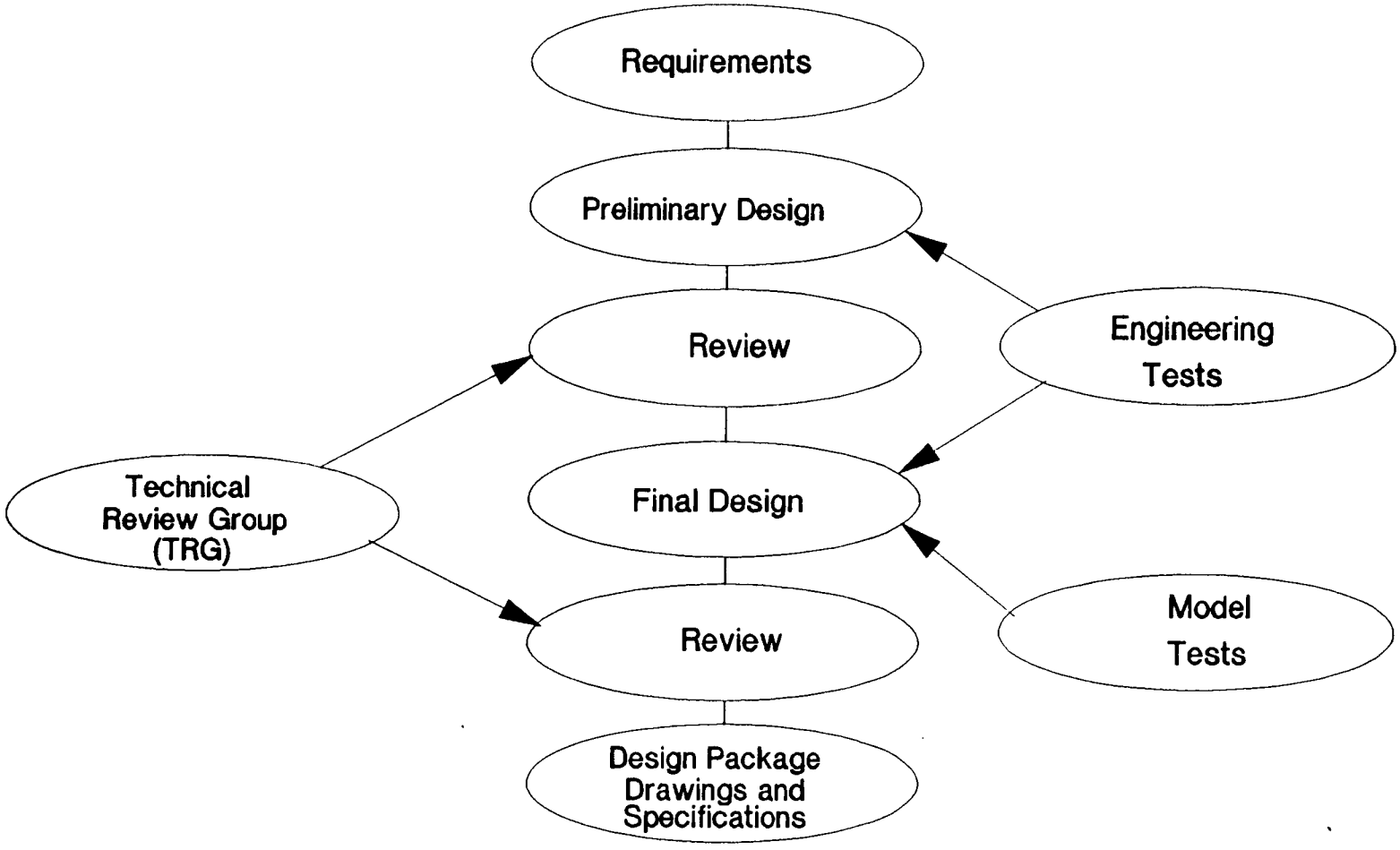
AUGUST 21-23, 1989

Cask Development

- Requirements
- Fabrication
- Cask Carriage Development

Design Process



Cask Requirements

- Safety
- Quality
- Interfaces
- Design
- Operational

Cask Safety Requirements

- Safety Considerations
  - Cask Contractor Statement of Work Provides Base Requirements
- Safety Addressed as Part of Certification
  - Meet 10CFR71 Requirements
  - Meetings with NRC
  - Safety Analysis Report for Packaging (SARP)
- The Design Process Ensures a Safe Design
  - Periodic Project Reviews
  - Preliminary and Final Design Reviews
- Design Specific
  - Low Center of Gravity
  - Ease of Inspection
  - Leak Test Capability

Cask Safety Requirements (Cont'd)

- Safeguards
  (Physical Protection From Theft And Sabotage)
  - General Design Requirement
    - Compliance with 10CFR73, "Physical Protection of Plants and Materials"
  - Specific Design Requirements
    - Ease of Safeguards Inspections
    - Avoidance of Areas for Concealed Explosives
    - Tamper-Indicating Seals

Cask Quality Requirements

- Quality Assurance
  - Program Philosophy
  - NRC/DOE-Approved Program
  - DOE-Approved Implementation Plan
  - ANSI/ASME NQA-1
- Quality Control
  - Audits
  - Tests
- Graded Quality Levels

Cask Interface Requirements

- Facility Interface Capability Assessment (FICA) Study Available - November 1989
- Preliminary Data Indicate Three Facilities Have Physical Restrictions Difficult to Remedy
- Specialty Casks May Be Required for These Facilities

Cask Interface Requirements

- Standard Fuel (From 10CFR961--Standard Contract)
  - Pressurized Water Reactor (PWR)
    - 9 in. x 9 in. x 178 in.
  - Boiling Water Reactor (BWR)
    - 6 in. x 6 in. x 179 in.
  - Nonfuel Bearing Components (NFBC)
  - Unfailed
  - > Five-year Cooling

Cask Interface Requirements (Cont'd)

- DOE Facilities
  - Coordinating with Repository on Cask Design

Cask Design Requirements

- Design Goals for OCRWM Casks
  - Maximum Payload Within:
    - Weight Constraints
    - Safety Considerations
  - Subcriticality
  - Shielding
  - Dissipate Fuel Heat
  - Maintain Containment
  - Minimize Handling Requirements (ALARA)
  - Life - 25 years, 1,000,000 Miles

Cask Operational Requirements

- Impact Limiter Removal and Storage
- Worker Platforms
- Personnel Barriers
- Bar Codes
- Tiedowns
- Contamination Control
- Cask Loading
- Standardization

Cask Operational Requirements (Cont'd)

- Component Interchangeability
- Fuel Protection
- Intermodal Considerations
- Robotics
- Lifting Devices
- Cask Penetrations

Cask Operational Requirements (Cont'd)

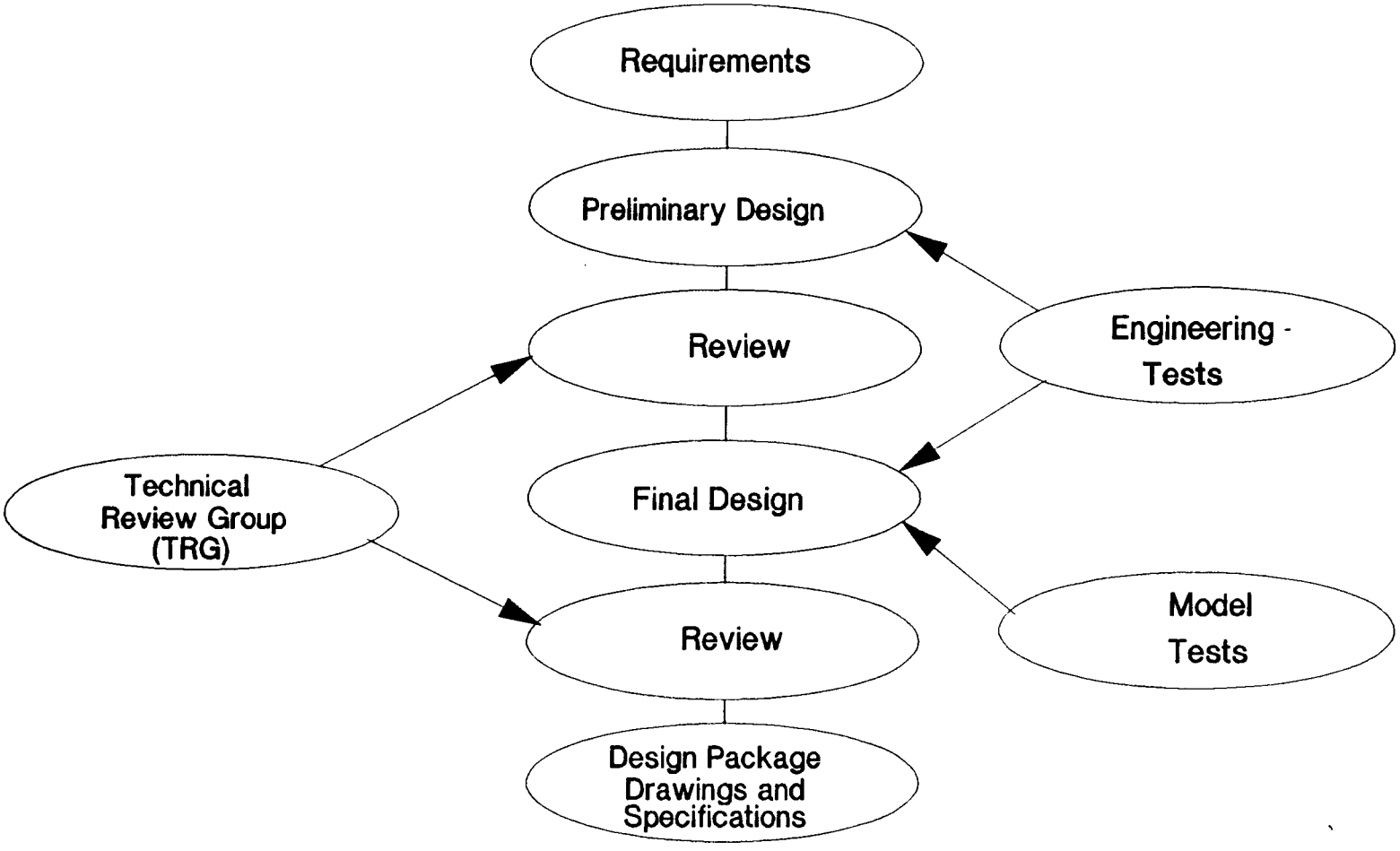
- Cask Lifting Devices
  - Trunnions to be Circular, Replaceable
  - Four Trunnions Near Closure End
  - Consider Offset Rear Trunnions
  - Require Only One Lifting Device
  - Lifting Device Self-Guiding, Remotely Activated
  - Consider Operator Visibility
  - Consider Accident Retrieval - Any Orientation

Cask Operational Requirements (Cont'd)

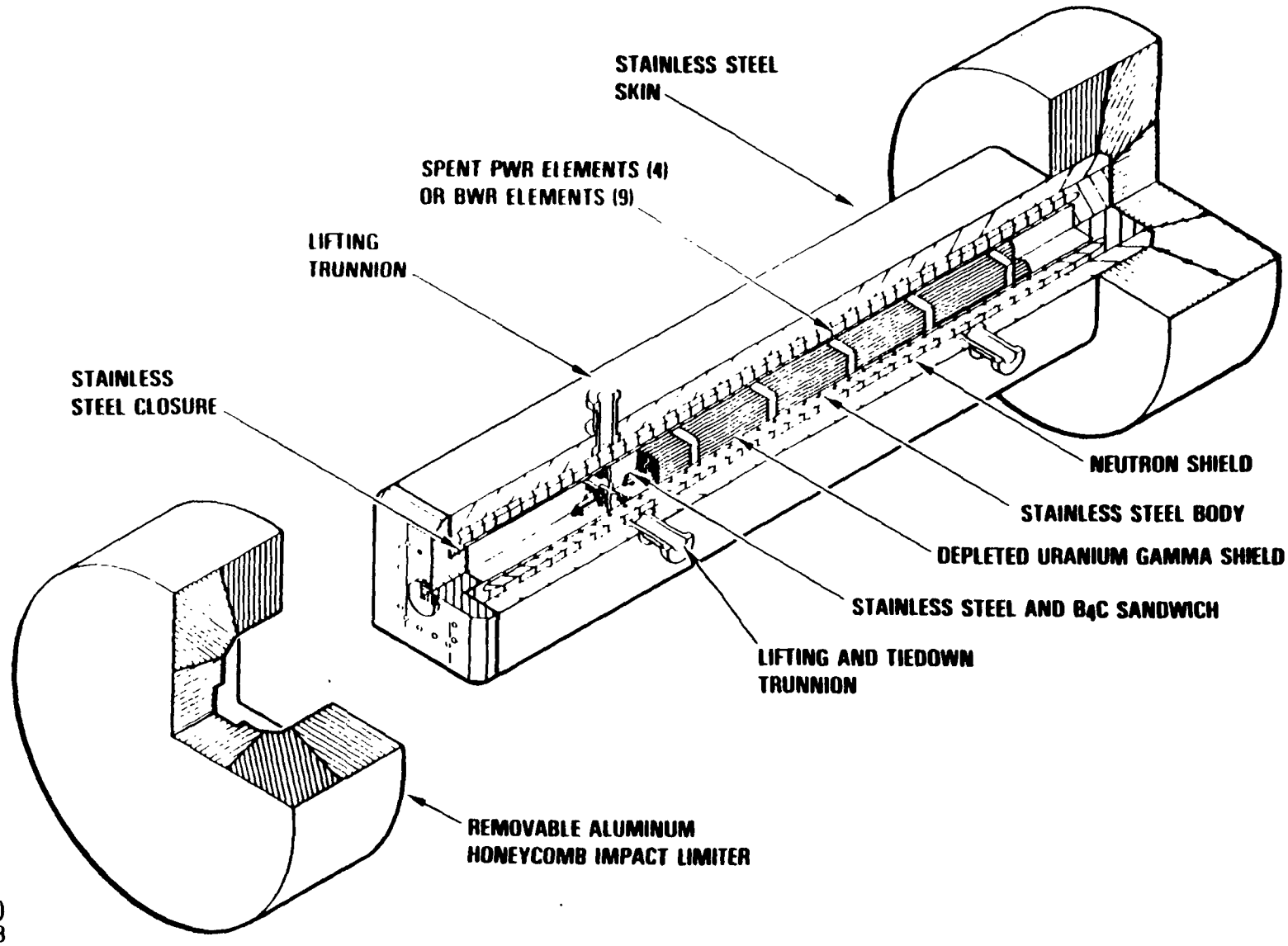
- Cask Penetrations
  - Cask Draining, Drying, Sampling, Purging
    - Minimum Penetrations, Double Closures
    - Limit Particulate Accumulation
    - Dissimilar Fittings
    - Remote Cavity Draining Verification
    - Vacuum Drying
    - Cavity Sampling, Top End
    - No Hydraulic Locks

CASK CONTRACTOR DESIGNS

Design Process



GA-4/GA-9 LEGAL WEIGHT TRUCK SPENT FUEL SHIPPING CASK



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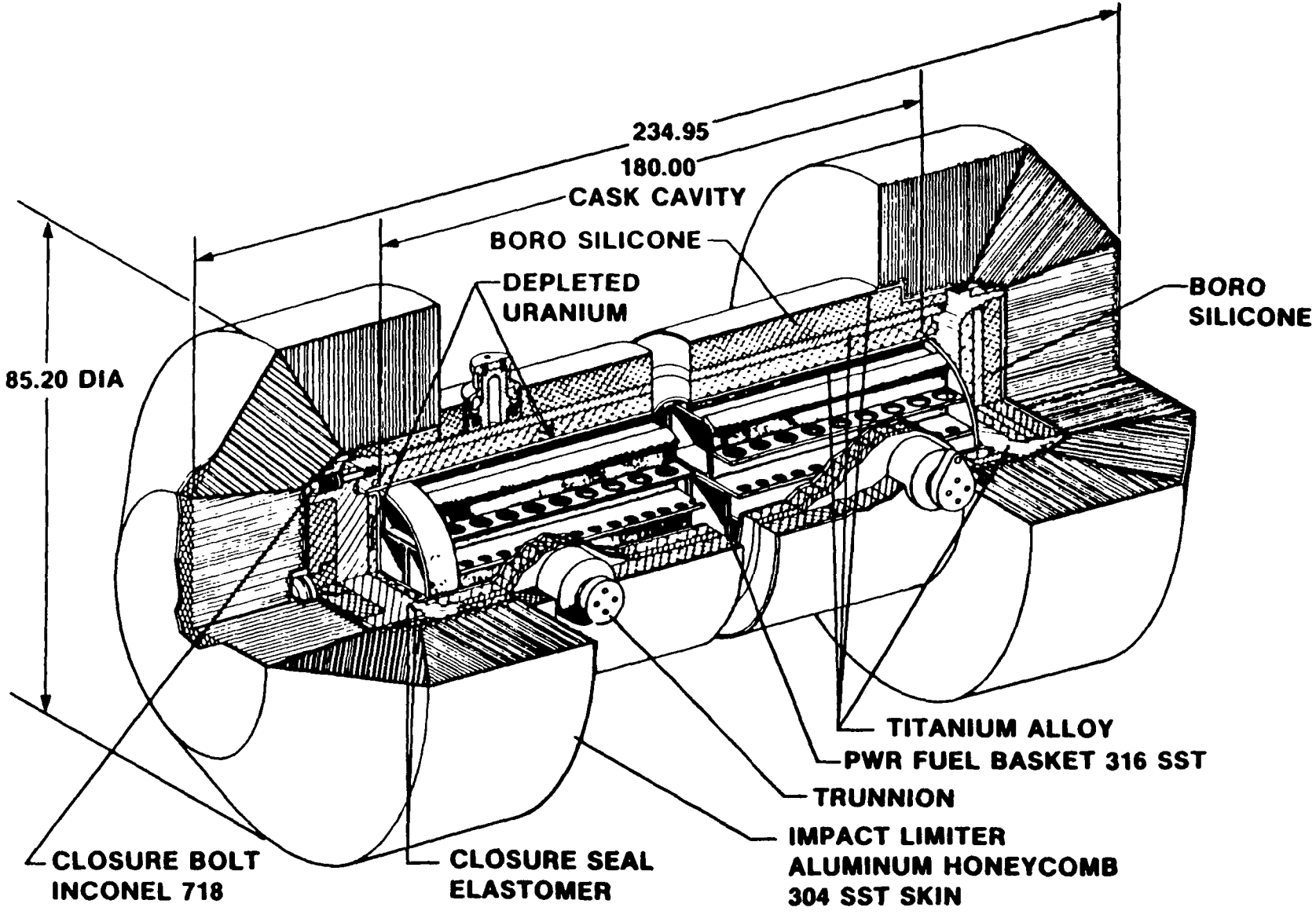
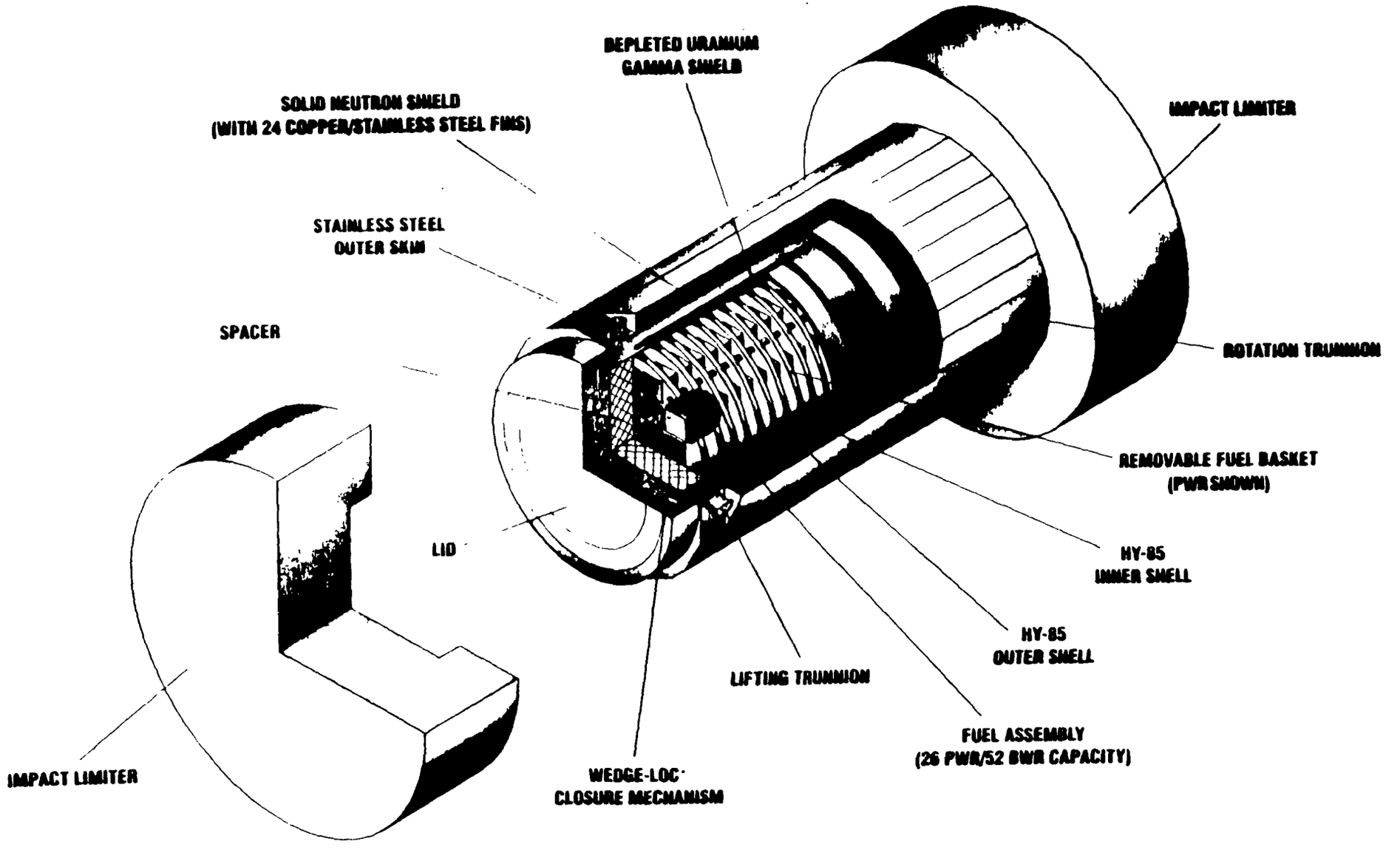
WESTINGHOUSE TITAN LEGAL WEIGHT TRUCK CASK

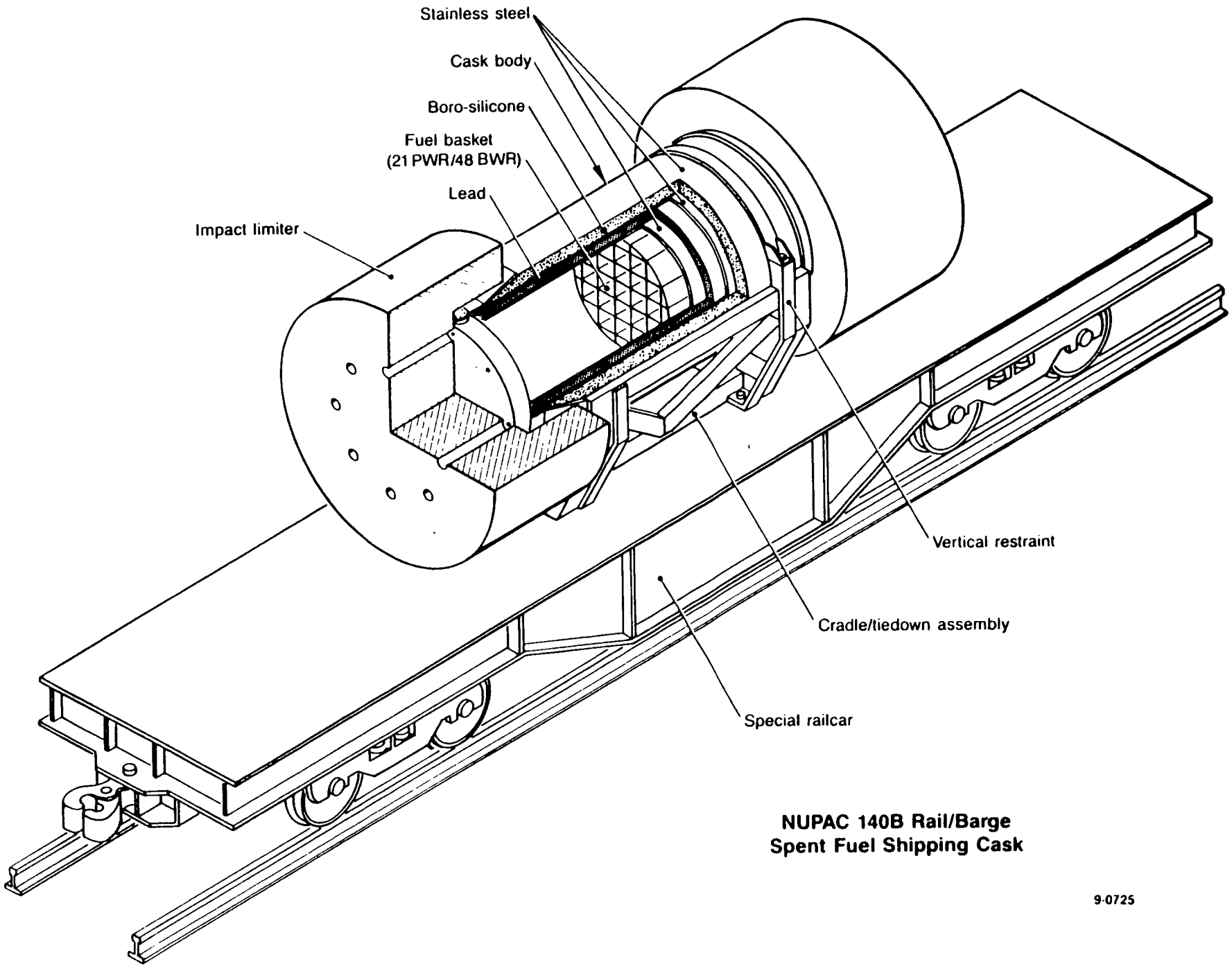


LWT CASKS

COMPANY	GA	W
CASK DESIGNATION	GA4/GA9	TITAN
PAYLOAD	4/9	3/7
STRUCTURAL MATERIAL	SS	TITANIUM ALLOY GR. 9
BASKET MATERIAL	SS	SS
IMPACT LIMITER MATERIAL	AL HONEYCOMB	AL HONEYCOMB W/SS SKIN
NEUTRON SHIELDING	BORATED SILICONE	BORATED SILICONE
GAMMA SHIELDING	DU	DU

NAC - CTC
100 TON COMBINED TRANSPORT CASK
RAIL/BARGE

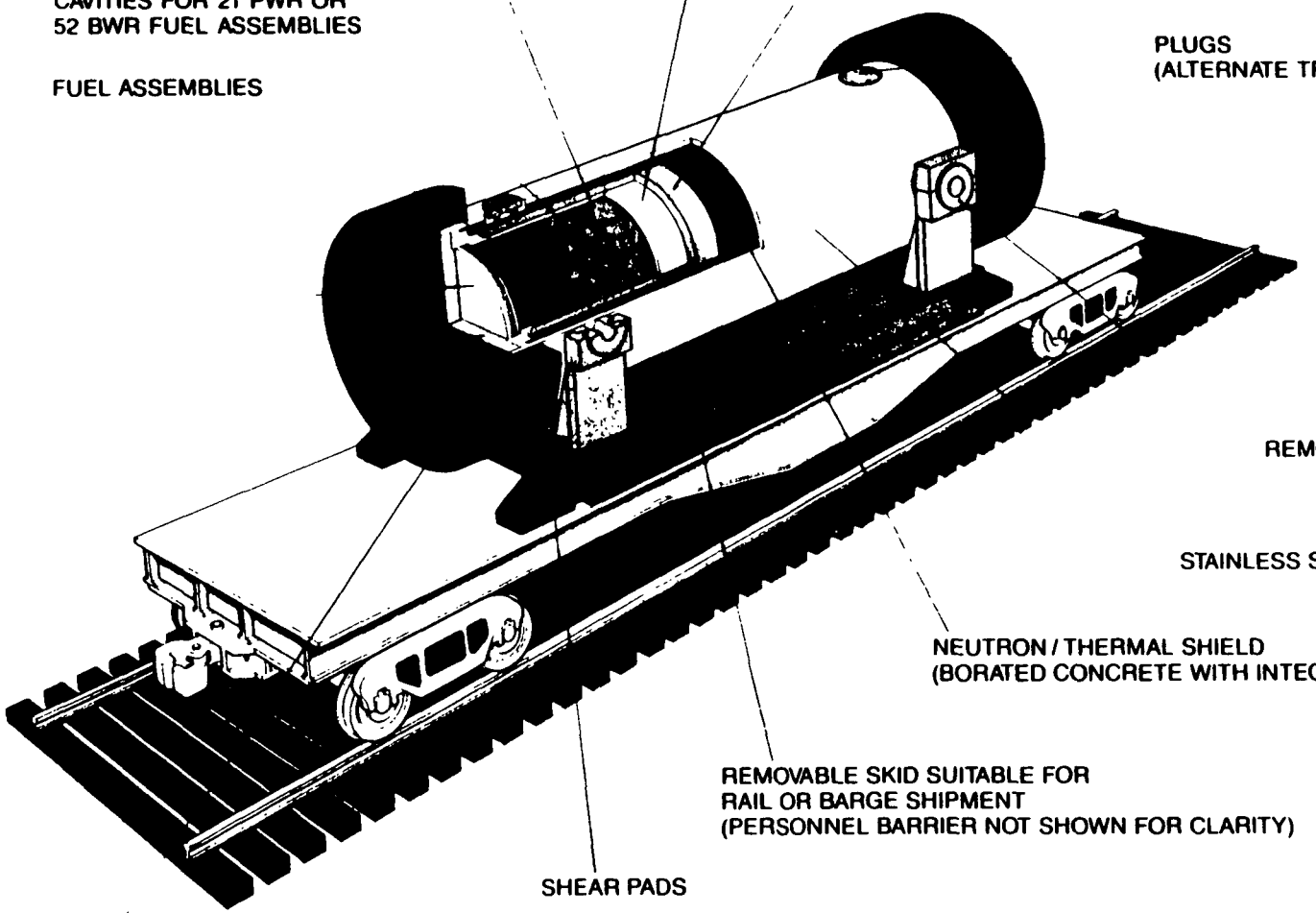




NUPAC 140B Rail/Barge
Spent Fuel Shipping Cask

9-0725

BABCOCK & WILCOX BR-100
100 TON RAIL / BARGE CASK



* PATENTED BY
ROBATEL SA

DEPARTMENT OF ENERGY
CONTRACT NO. DE-AC07-88ID12701

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APRIL, 1989

R/B CASKS

COMPANY	NAC	NUPAC	B&W
CASK DESIGNATION	NAC CTC	140 B	BR-100
PAYLOAD	26/52	21/48	21/52
STRUCTURAL MATERIAL	Hy 85	SS	SS
BASKET MATERIAL	Al	SS	Al
IMPACT LIMITER MATERIAL	Al Honeycomb	Foam	Balsa Wood Kevlar Reinforced

R/B CASKS

COMPANY	NAC	NUPAC	B&W
NEUTRON SHIELDING	NS4FR	Borated Silicone	Borated Concrete
GAMMA SHIELDING	DU	Pb	Pb
CLOSURE TYPE	Wedge Lock	Bolted	Bolted

Loaded Cask Weight (With Impact Limiters)

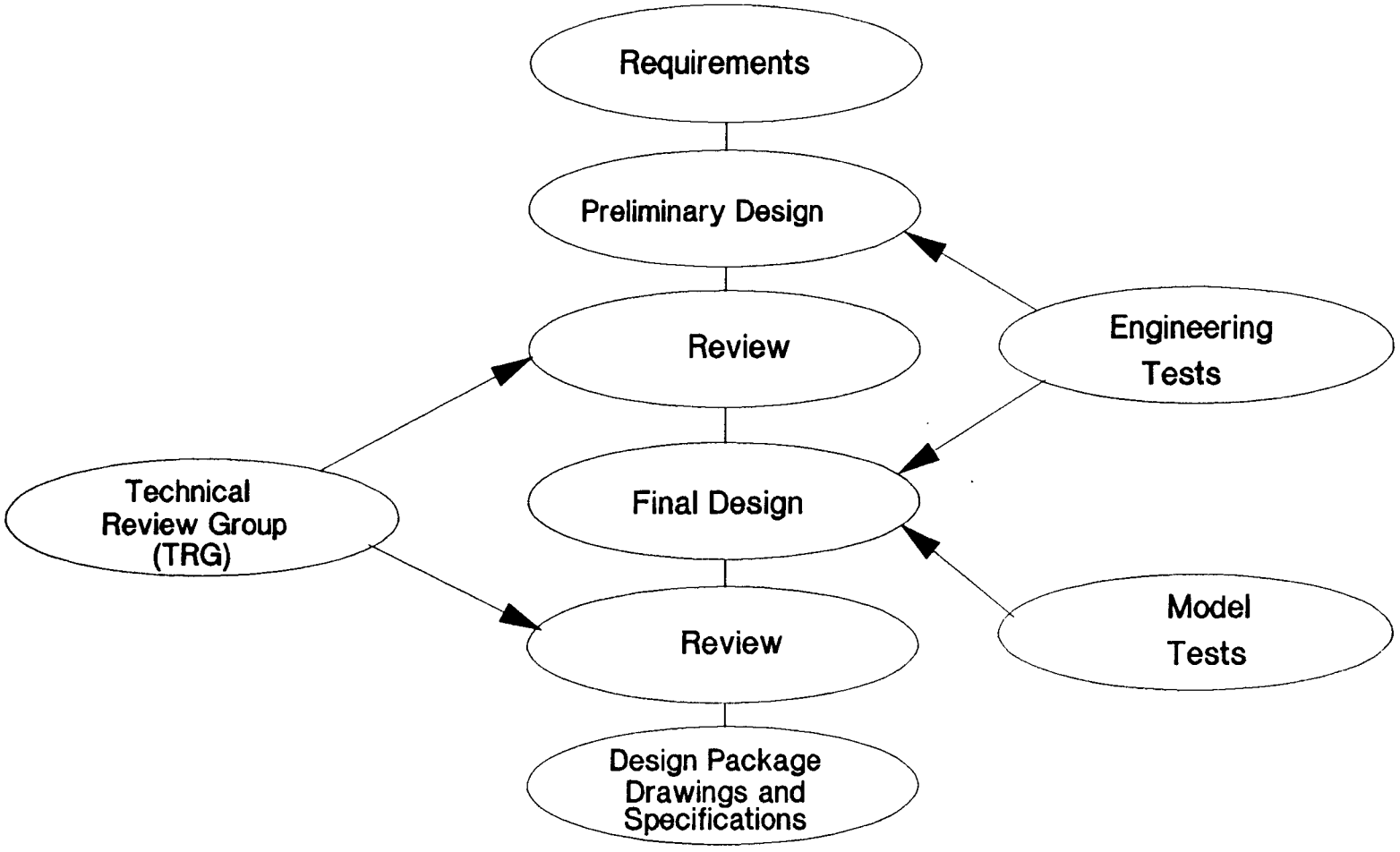
	Cask Weight (Lb)	GVW (Lb)
o LWT		
GA	53,800	80,000
W	53,200	80,000
o R/B		
B&W	204,000	263,000
NAC	207,000	263,000
NuPac	205,600	263,000

Innovative Design Features

- Rounded-square Cross-section
- Titanium Structure
- Wedge-loc Lid Closure
- Balsa Wood/Kevlar Impact Limiters
- Concrete/Neutron/Thermal Shield

Cask Fabrication

Design Process



Use of Codes and Standards In Fabrication

- Ensures Uniform and Widely Accepted Practices
- Facilitates NRC Approval
- Code of Federal Regulation (CFR) Documents
  - 10CFR20, "Standards for Protection Against Radiation"
  - 10CFR71, "Packaging and Transportation of Radioactive Material"
  - 10CFR73, "Physical Protection of Plants and Materials"
  - 49CFR109-199, "Hazardous Materials Regulations"

U. S. Department of Energy (DOE) Documents

- Order 1540.2, "Administrative Procedures for Hazardous Material Packaging for Transport"
- Order 5480.3, "Safety Requirements for the Packaging and Transportation of Hazardous Materials, Hazardous Substances, and Hazardous Wastes"

Non-Government Codes and Standards

- ASME Boiler and Pressure Vessel Code, 1985 Edition (Applicable Parts)
- American Iron and Steel Institute (AISI) Specifications
- International Atomic Energy Agency - Safety Series 6, Regulations for the Safe Transport of Radioactive Materials
- Association of American Railroads (AAR)
  - Field Manual of the AAR - Interchange Rules
  - Office Manual of the AAR - Interchange Rules
  - Manual of Standards and Recommended Practices, Section C - Part II, M-1001
- American Welding Society
  - AWS D1.1-80 "Structural Welding Code"
- Coppers Railway Bridge Ratings (E Ratings)

Codes and Standards Addressing Quality Assurance/Quality Control

- Quality Assurance Requirements (DOE/RW-214)
- DOE Order 4700.1, Section III Part D "Quality Assurance"
- DOE Order 5700.6B "Quality Assurance"
- DOE-ID CSDP Quality Management Plan
- ANSI/ASME NQA-1 Quality Assurance Program Requirements for Nuclear Facilities
- 10CFR71, subpart H, "Packaging and Transportation of Radioactive Materials, Quality Assurance" and Regulatory Guidance

OCWRM QA Requirements

- Quality List (Grouped by Importance)
- Graded Approach to Quality Assurance
- Quality Information Reporting
- Indoctrination and Training
- Annual Management Appraisal

Cask Fabrication - Verification of Fabricability

- Cask Design Contractors
  - Internal Personnel
  - Fabricators
- Technical Review Group (TRG)
- Quality Assurance Personnel

CASK CARRIAGE DEVELOPMENT

Legal Weight Truck Limits

- Axle Loading
  - Steering 12,000 lb
  - Single 20,000 lb
  - Tandem 34,000 lb
- Gross Vehicle Weight (GVW) 80,000 lb
- Length Regulated by States
- Width (Federal Standard) 102 in.

Semi-Trailer Requirements

- No Consensus Standard for Design
- ANSI N14.30 in Review Process
  - Performance Standards
  - Acceptance Criteria
- Truck Trailer Manufacturers Association (TTMA)
  - Recommended Practices and Guidelines for Construction

GA/W Are Collaborating to Develop LWT Trailers

- No Off-the-shelf Trailer Exists
  - Light Weight
  - Sufficiently Strong
- Both LWT Cask Contractors are Striving to Utilize a Minimum-Weight Common Design Trailer
  - Workshop
  - Operations Review and Input

GA/W LWT Trailer Development (cont'd)

- Reasonable weight values have been allowed for the LWT designs

	GA	W
Tractor with drivers and fuel	16,000	16,000
Trailer with tie downs and personnel barrier	9,000	10,000
Cask (loaded)	55,000	54,000
GVW	80,000	80,000

C9 3099

Tractor Requirements

- National Highway Traffic Safety Administration (NHTSA)
  - Safety Standards
- Individual Manufacturing Guidelines for Fabrication

Railcar Requirements

- Free Interchange
- 263,000 lbs GVW
  - Maximum Axle Loading - 65,750 lbs
- Maximum Length - 48 ft
- Maximum CG Above Rails - 98 in.
- Design and Testing
  - Regulated by Association of American Railroads (AAR)* Manual of Standards and Recommended Practices
- Operator Safety Equipment Standards
  - Regulated by Federal Railroad Administration (FRA)

*Not a Government Agency

Railcar Development

- DOE has Contract with AAR for Support
- 100-Ton "Hook Limit" is Cask Weight Restraint
- ~63,000 lb for Railcar, Tiedowns, and Personnel Barrier
- All Cask Contractors Have Employed Railcar Specialists
- Conceptual Designs in Progress