

**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
IDAHO NATIONAL ENGINEERING LABORATORY
EG&G IDAHO, INC.
IDAHO FALLS, ID**

PRESENTER'S

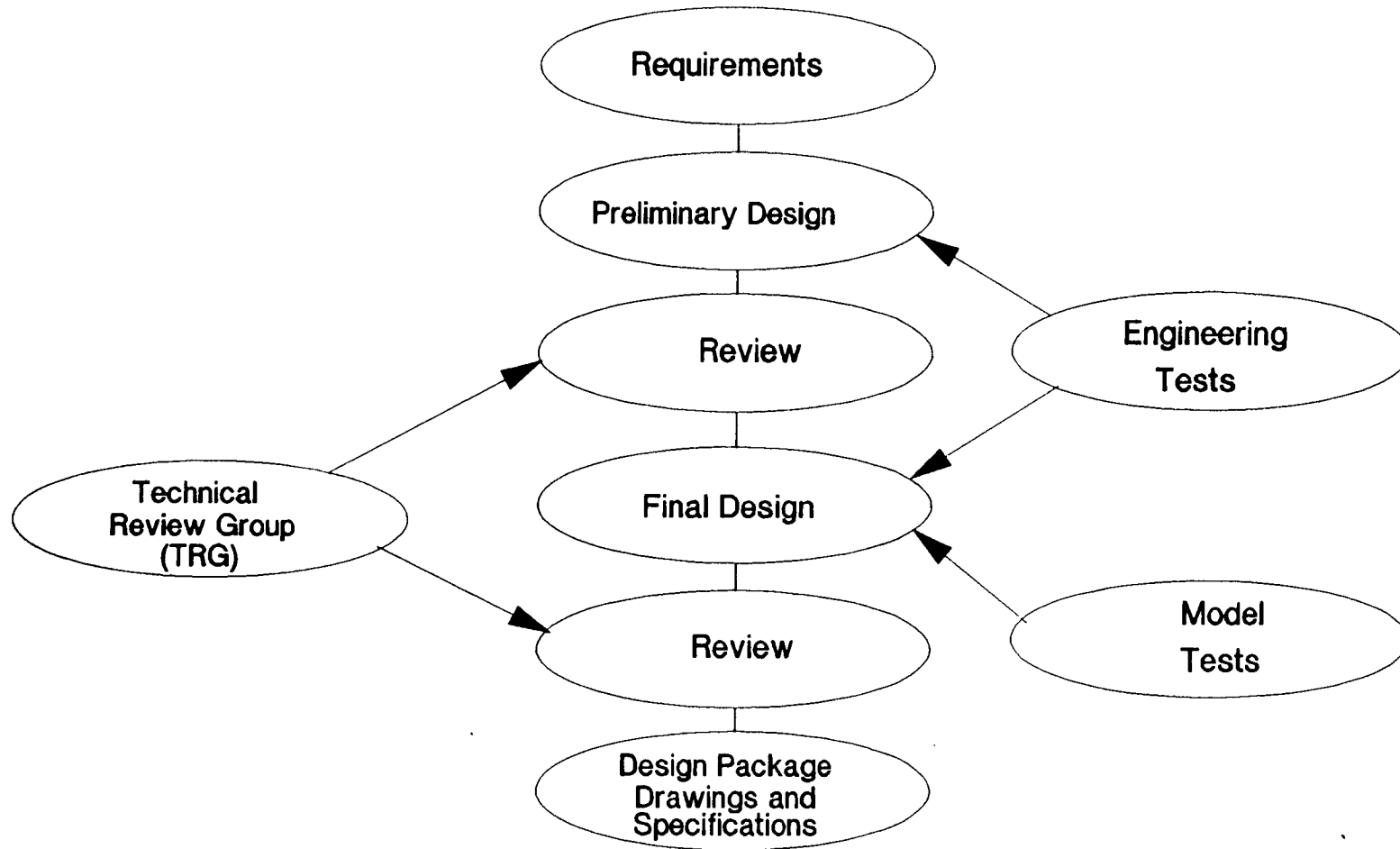
TELEPHONE No: (208) 526-1806

AUGUST 21-23, 1989

CASK DEVELOPMENT

- 0 REQUIREMENTS**
- 0 FABRICATION**
- 0 CASK CARRIAGE DEVELOPMENT**

Design Process



CASK REQUIREMENTS

- 0 SAFETY**
- 0 QUALITY**
- 0 INTERFACES**
- 0 DESIGN**
- 0 OPERATIONAL**

CASK SAFETY REQUIREMENTS

- 0 SAFETY CONSIDERATIONS**
 - CASK CONTRACTOR STATEMENT OF WORK PROVIDES BASE REQUIREMENTS**
- 0 SAFETY ADDRESSED AS PART OF CERTIFICATION**
 - MEET 10CFR71 REQUIREMENTS**
 - MEETINGS WITH NRC**
 - SAFETY ANALYSIS REPORT FOR PACKAGING (SARP)**
- 0 THE DESIGN PROCESS ENSURES A SAFE DESIGN**
 - PERIODIC PROJECT REVIEWS**
 - PRELIMINARY AND FINAL DESIGN REVIEWS**
- 0 DESIGN SPECIFIC**
 - LOW CENTER OF GRAVITY**
 - EASE OF INSPECTION**
 - LEAK TEST CAPABILITY**

CASK SAFETY REQUIREMENTS (CONT'D)

0 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

0 QUALITY ASSURANCE

- PROGRAM PHILOSOPHY**
- NRC/DOE-APPROVED PROGRAM**
- DOE-APPROVED IMPLEMENTATION PLAN**
- ANSI/ASME NQA-1**

0 QUALITY CONTROL

- AUDITS**
- TESTS**

0 GRADED QUALITY LEVELS

CASK INTERFACE REQUIREMENTS

- 0 FACILITY INTERFACE CAPABILITY ASSESSMENT (FICA) STUDY AVAILABLE - NOVEMBER 1989**
- 0 PRELIMINARY DATA INDICATE THREE FACILITIES HAVE PHYSICAL RESTRICTIONS DIFFICULT TO REMEDY**
- 0 SPECIALTY CASKS MAY BE REQUIRED FOR THESE FACILITIES**

CASK INTERFACE REQUIREMENTS

- 0 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)

o DOE FACILITIES

- COORDINATING WITH REPOSITORY ON CASK DESIGN**

CASK DESIGN REQUIREMENTS

0 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

- 0 IMPACT LIMITER REMOVAL AND STORAGE**
- 0 WORKER PLATFORMS**
- 0 PERSONNEL BARRIERS**
- 0 BAR CODES**
- 0 TIEDOWNS**
- 0 CONTAMINATION CONTROL**
- 0 CASK LOADING**
- 0 STANDARDIZATION**

CASK OPERATIONAL REQUIREMENTS (CONT'D)

- 0 COMPONENT INTERCHANGEABILITY**
- 0 FUEL PROTECTION**
- 0 INTERMODAL CONSIDERATIONS**
- 0 ROBOTICS**
- 0 LIFTING DEVICES**
- 0 CASK PENETRATIONS**

CASK OPERATIONAL REQUIREMENTS (CONT'D)

0 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**

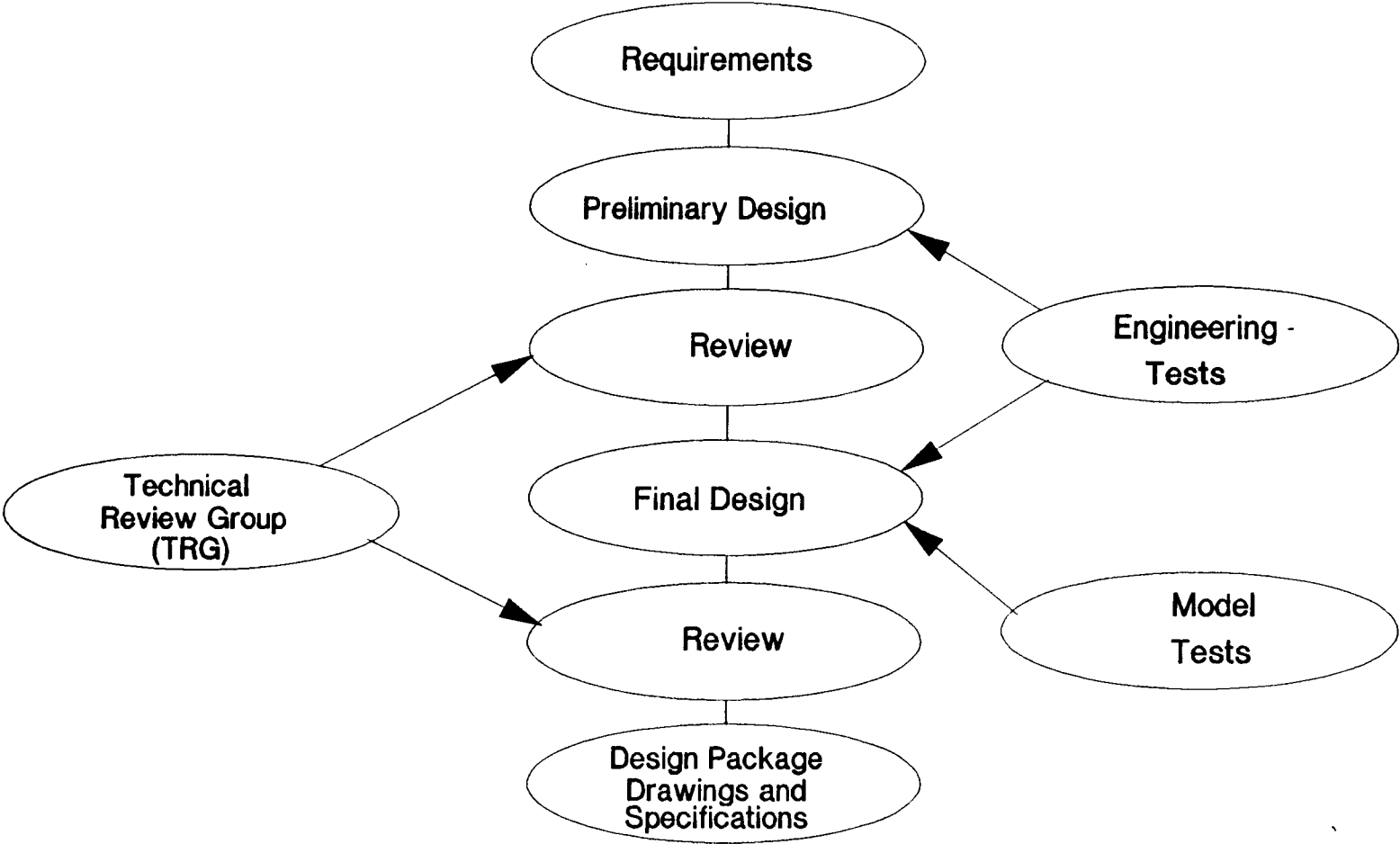
CASK OPERATIONAL REQUIREMENTS (CONT'D)

0 CASK PENETRATIONS

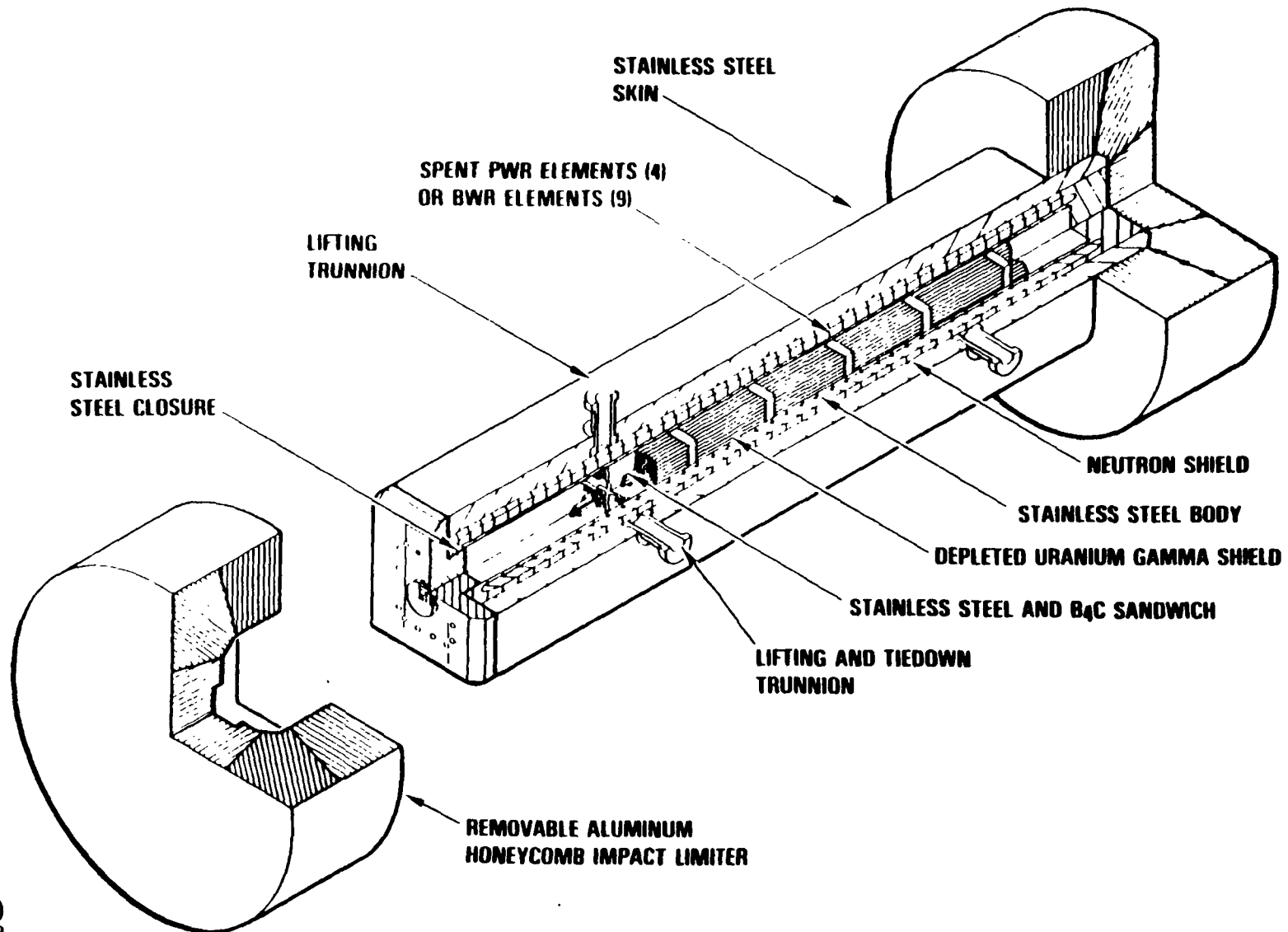
- CASK DRAINING, DRYING, SAMPLING, PURGING**
 - MINIMUM PENETRATIONS, DOUBLE CLOSURES**
 - LIMIT PARTICULATE ACCUMULATION**
 - DISSIMILAR FITTINGS**
 - REMOTE CAVITY DRAINING VERIFICATION**
 - VACUUM DRYING**
 - CAVITY SAMPLING, TOP END**
 - NO HYDRAULIC LOCKS**

CASK CONTRACTOR DESIGNS

Design Process

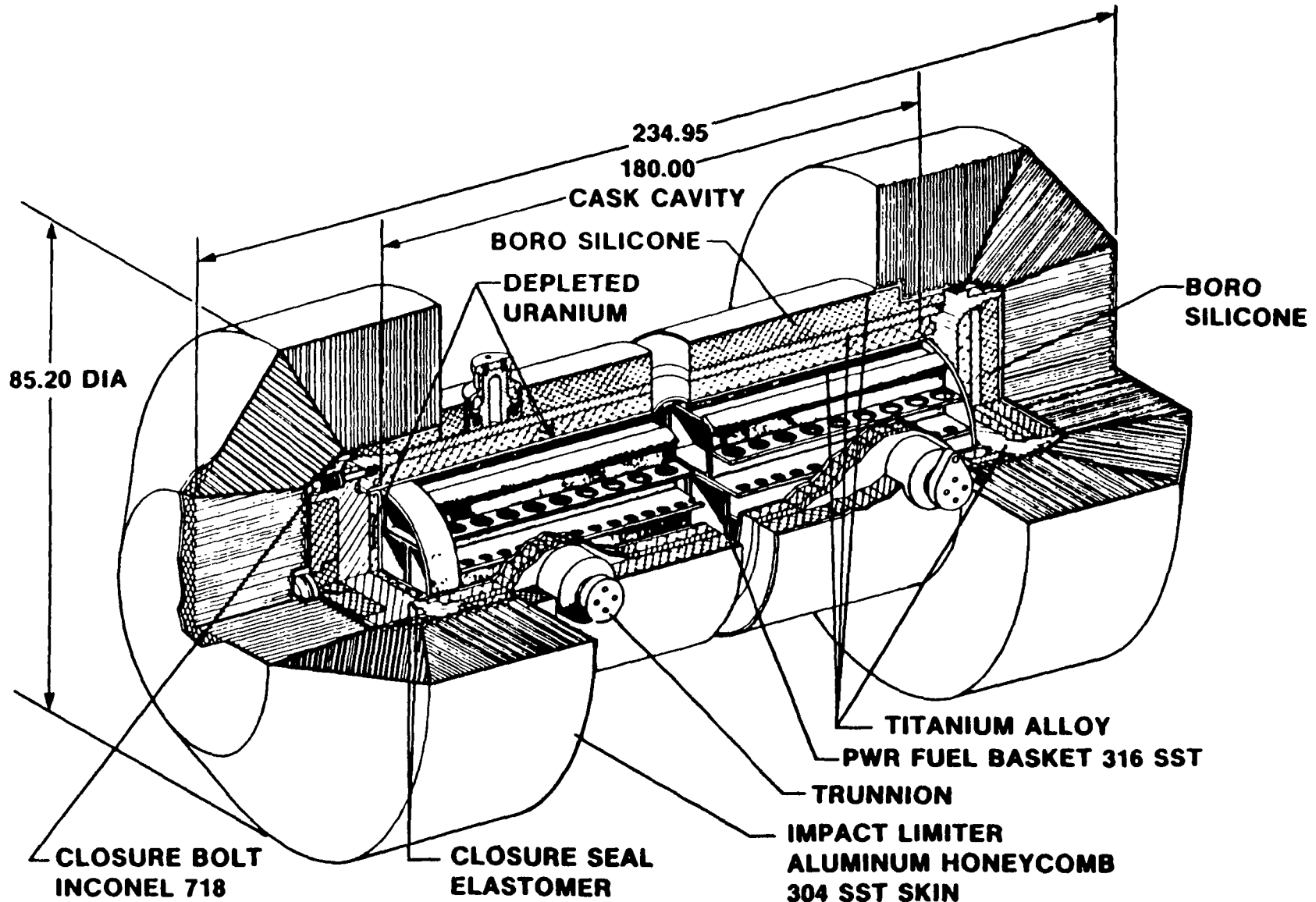


GA-4/GA-9 LEGAL WEIGHT TRUCK SPENT FUEL SHIPPING CASK



1-747(1)
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WESTINGHOUSE TITAN LEGAL WEIGHT TRUCK CASK

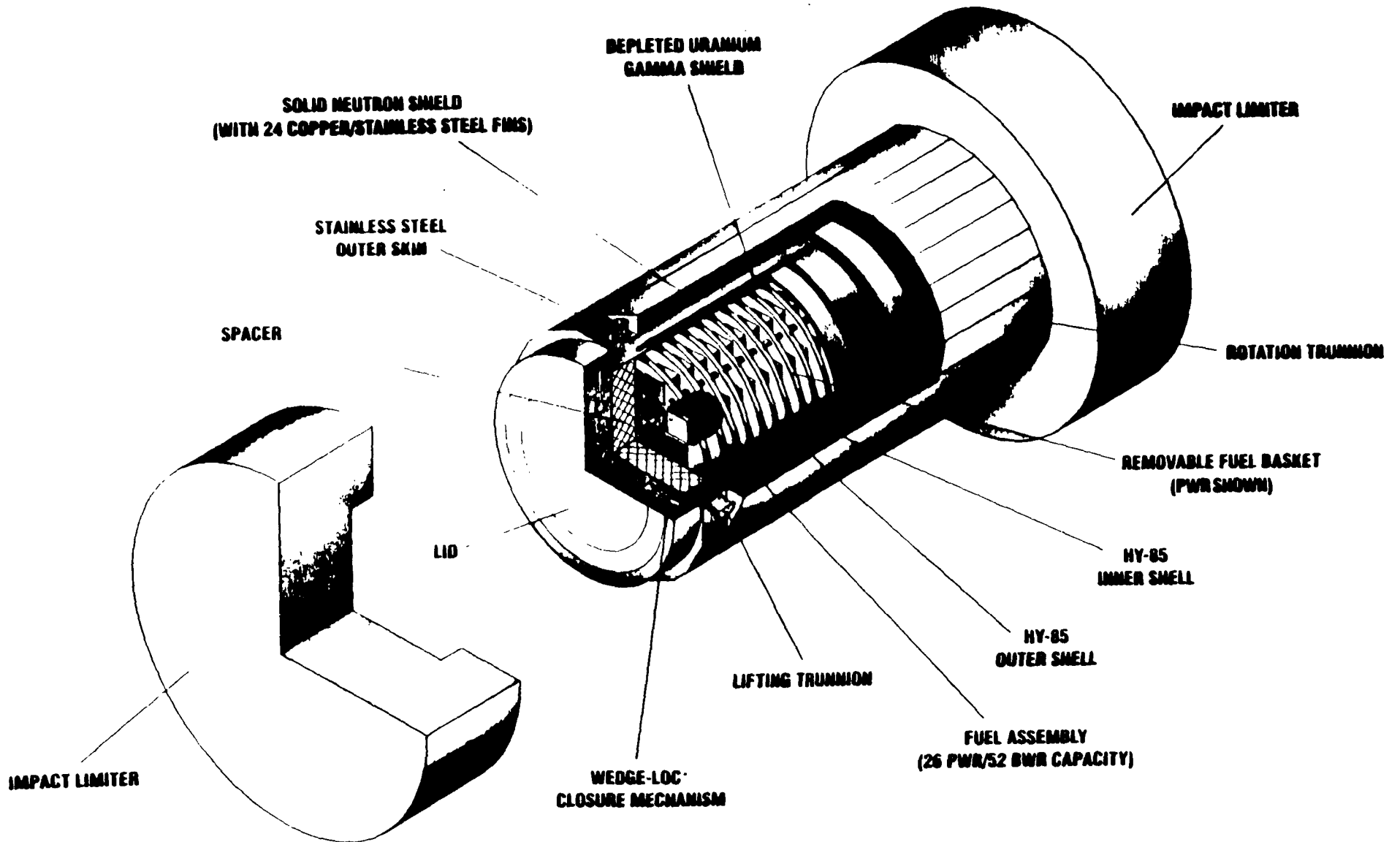


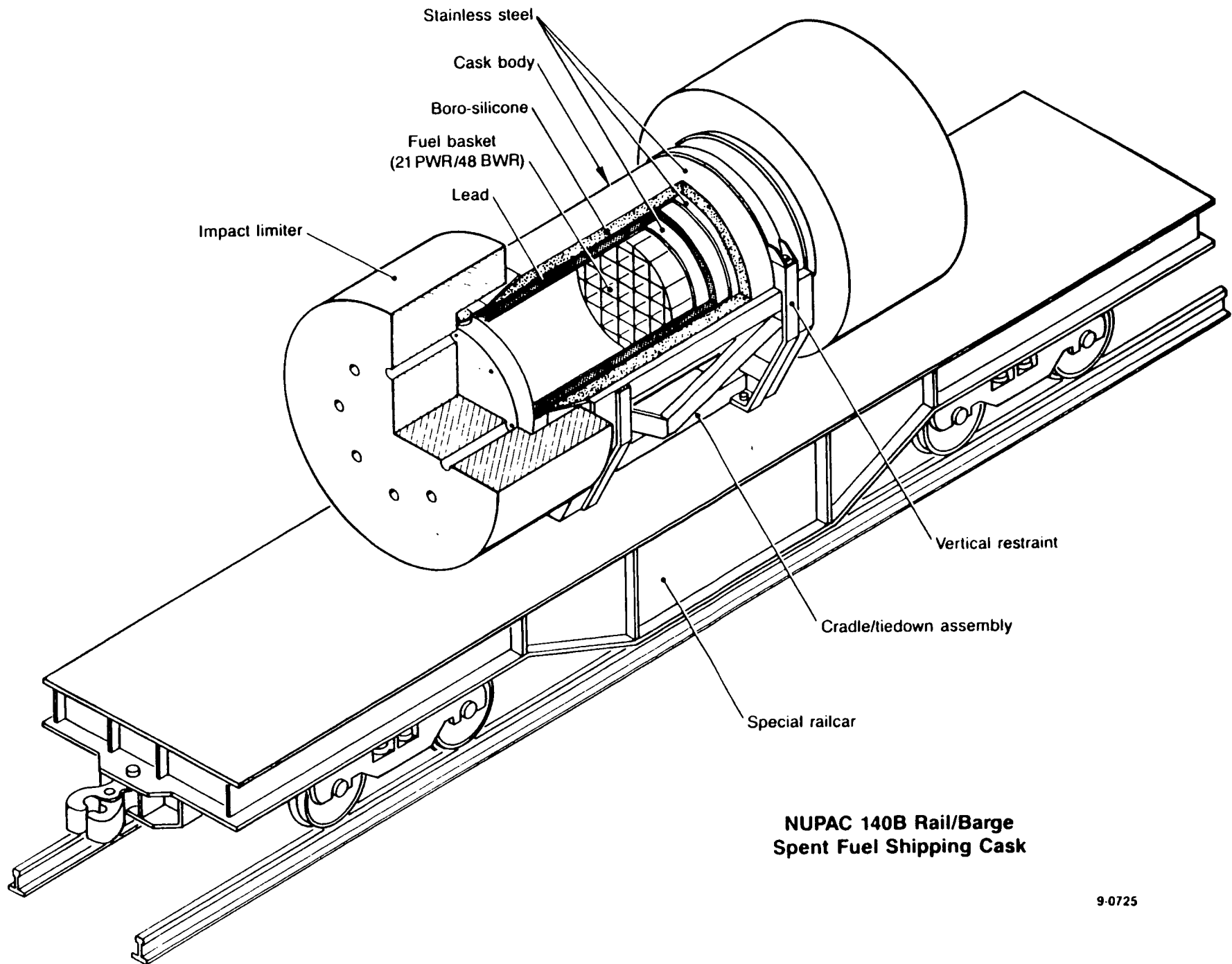
LWT CASKS

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

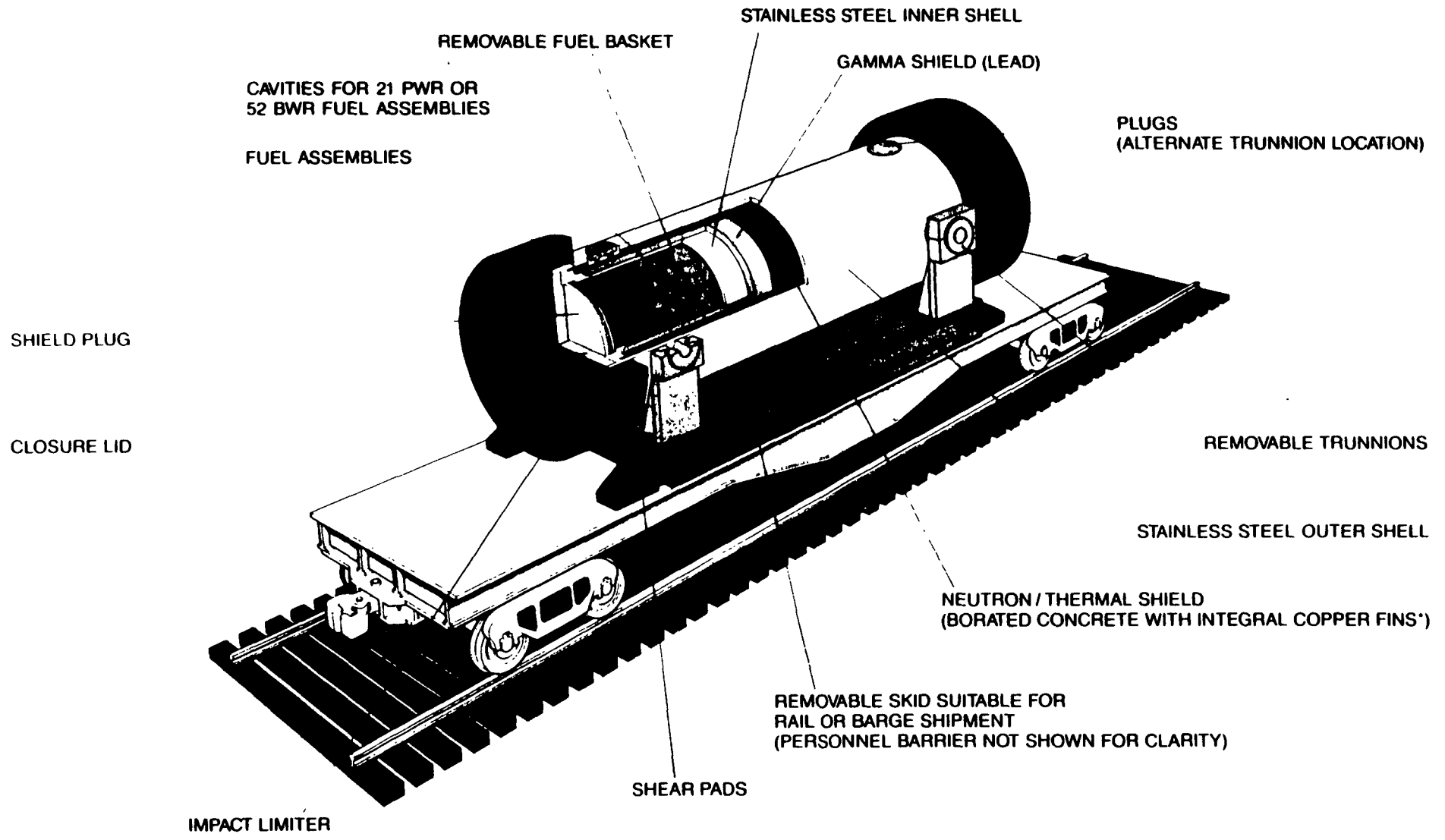




**NUPAC 140B Rail/Barge
Spent Fuel Shipping Cask**

9-0725

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



* PATENTED BY
ROBATEL SA

DEPARTMENT OF ENERGY
CONTRACT NO. DE-AC07-881D12701

3d
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)

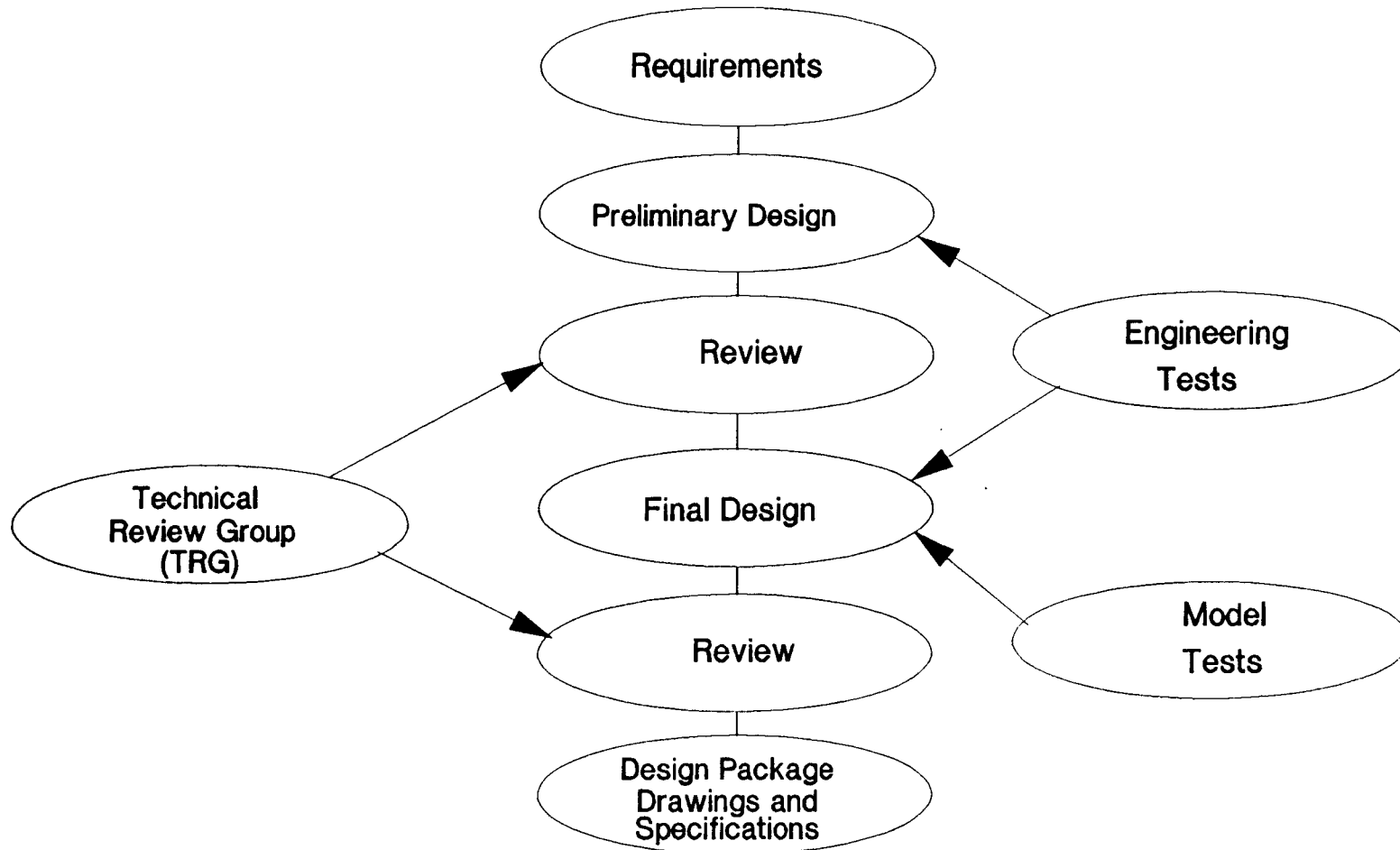
	<u>CASK WEIGHT (LB)</u>	<u>GVW (LB)</u>
o LWT		
GA	53,800	80,000
W	53,200	80,000
o R/B		
B&W	204,000	263,000
NAC	207,000	263,000
NUPAC	205,600	263,000

INNOVATIVE DESIGN FEATURES

- 0 ROUNDED-SQUARE CROSS-SECTION**
- 0 TITANIUM STRUCTURE**
- 0 WEDGE-LOC LID CLOSURE**
- 0 Balsa WOOD/KEVLAR IMPACT LIMITERS**
- 0 CONCRETE/NEUTRON/THERMAL SHIELD**

CASK FABRICATION

Design Process



USE OF CODES AND STANDARDS IN FABRICATION

- 0 ENSURES UNIFORM AND WIDELY ACCEPTED PRACTICES**
- 0 FACILITATES NRC APPROVAL**
- 0 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**

- 0 ORDER 1540.2, "ADMINISTRATIVE PROCEDURES FOR HAZARDOUS MATERIAL PACKAGING FOR TRANSPORT"**
- 0 ORDER 5480.3, "SAFETY REQUIREMENTS FOR THE PACKAGING AND TRANSPORTATION OF HAZARDOUS MATERIALS, HAZARDOUS SUBSTANCES, AND HAZARDOUS WASTES"**

NON-GOVERNMENT CODES AND STANDARDS

- 0 ASME BOILER AND PRESSURE VESSEL CODE, 1985 EDITION
(APPLICABLE PARTS)
- 0 AMERICAN IRON AND STEEL INSTITUTE (AISI) SPECIFICATIONS
- 0 INTERNATIONAL ATOMIC ENERGY AGENCY - SAFETY
SERIES 6, REGULATIONS FOR THE SAFE TRANSPORT
OF RADIOACTIVE MATERIALS
- 0 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
- 0 AMERICAN WELDING SOCIETY
 - AWS D1.1-80 "STRUCTURAL WELDING CODE"
- 0 COPPERS RAILWAY BRIDGE RATINGS (E RATINGS)

CODES AND STANDARDS ADDRESSING QUALITY ASSURANCE/QUALITY CONTROL

- 0 QUALITY ASSURANCE REQUIREMENTS (DOE/RW-214)**
- 0 DOE ORDER 4700.1, SECTION III PART D "QUALITY ASSURANCE"**
- 0 DOE ORDER 5700.6B "QUALITY ASSURANCE"**
- 0 DOE-ID CSDP QUALITY MANAGEMENT PLAN**
- 0 ANSI/ASME NQA-1 QUALITY ASSURANCE PROGRAM REQUIREMENTS FOR NUCLEAR FACILITIES**
- 0 10CFR71, SUBPART H, "PACKAGING AND TRANSPORTATION OF RADIOACTIVE MATERIALS, QUALITY ASSURANCE" AND REGULATORY GUIDANCE**

OCWRM QA REQUIREMENTS

- 0 QUALITY LIST (GROUPED BY IMPORTANCE)**
- 0 GRADED APPROACH TO QUALITY ASSURANCE**
- 0 QUALITY INFORMATION REPORTING**
- 0 INDOCTRINATION AND TRAINING**
- 0 ANNUAL MANAGEMENT APPRAISAL**

CASK FABRICATION - VERIFICATION OF FABRICABILITY

- 0 CASK DESIGN CONTRACTORS**
 - INTERNAL PERSONNEL**
 - FABRICATORS**
- 0 TECHNICAL REVIEW GROUP (TRG)**
- 0 QUALITY ASSURANCE PERSONNEL**

CASK CARRIAGE DEVELOPMENT

LEGAL WEIGHT TRUCK LIMITS

0 AXLE LOADING

- STEERING 12,000 LB
- SINGLE 20,000 LB
- TANDEM 34,000 LB

0 GROSS VEHICLE WEIGHT (GVW) 80,000 LB

0 LENGTH REGULATED BY STATES

0 WIDTH (FEDERAL STANDARD) 102 IN.

SEMI-TRAILER REQUIREMENTS

- 0 NO CONSENSUS STANDARD FOR DESIGN**
- 0 ANSI N14.30 IN REVIEW PROCESS**
 - PERFORMANCE STANDARDS**
 - ACCEPTANCE CRITERIA**
- 0 TRUCK TRAILER MANUFACTURERS ASSOCIATION (TTMA)**
 - RECOMMENDED PRACTICES AND GUIDELINES FOR CONSTRUCTION**

GA/W ARE COLLABORATING TO DEVELOP LWT TRAILERS

- 0 NO OFF-THE-SHELF TRAILER EXISTS**
 - LIGHT WEIGHT**
 - SUFFICIENTLY STRONG**

- 0 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	<u>W</u>
Tractor with drivers and fuel	16,000	16,000
Trailer with tie downs and personnel barrier	9,000	10,000
Cask (loaded)	<u>55,000</u>	<u>54,000</u>
GVW	80,000	80,000

TRACTOR REQUIREMENTS

- 0 NATIONAL HIGHWAY TRAFFIC SAFETY
ADMINISTRATION (NHTSA)**
 - SAFETY STANDARDS**

- 0 INDIVIDUAL MANUFACTURING GUIDELINES
FOR FABRICATION**

RAILCAR REQUIREMENTS

- 0 FREE INTERCHANGE**
- 0 263,000 LBS GVW**
 - MAXIMUM AXLE LOADING - 65,750 LBS**
- 0 MAXIMUM LENGTH - 48 FT**
- 0 MAXIMUM CG ABOVE RAILS - 98 IN.**
- 0 DESIGN AND TESTING**
 - REGULATED BY ASSOCIATION OF AMERICAN RAILROADS (AAR)* MANUAL OF STANDARDS AND RECOMMENDED PRACTICES**
- 0 OPERATOR SAFETY EQUIPMENT STANDARDS**
 - REGULATED BY FEDERAL RAILROAD ADMINISTRATION (FRA)**

***NOT A GOVERNMENT AGENCY**

RAILCAR DEVELOPMENT

- 0 DOE HAS CONTRACT WITH AAR FOR SUPPORT**
- 0 100-TON "HOOK LIMIT" IS CASK WEIGHT RESTRAINT**
- 0 ~63,000 LB FOR RAILCAR, TIEDOWNS, AND PERSONNEL BARRIER**
- 0 ALL CASK CONTRACTORS HAVE EMPLOYED RAILCAR SPECIALISTS**
- 0 CONCEPTUAL DESIGNS IN PROGRESS**