

Human Factors
in
Manufacturing

Spent Nuclear Fuel
Transportation Casks

July, 2000

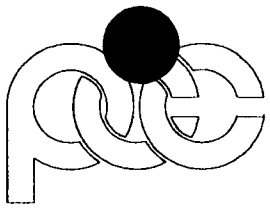
United States

Nuclear Waste Technical Review Board

Discussion

- Transportation Cask Characteristics
- Four Aspects of Quality
- How Do We Control Human Factors in Manufacturing?
- Challenges
- “Success Factors”
- Summary
- Discussion

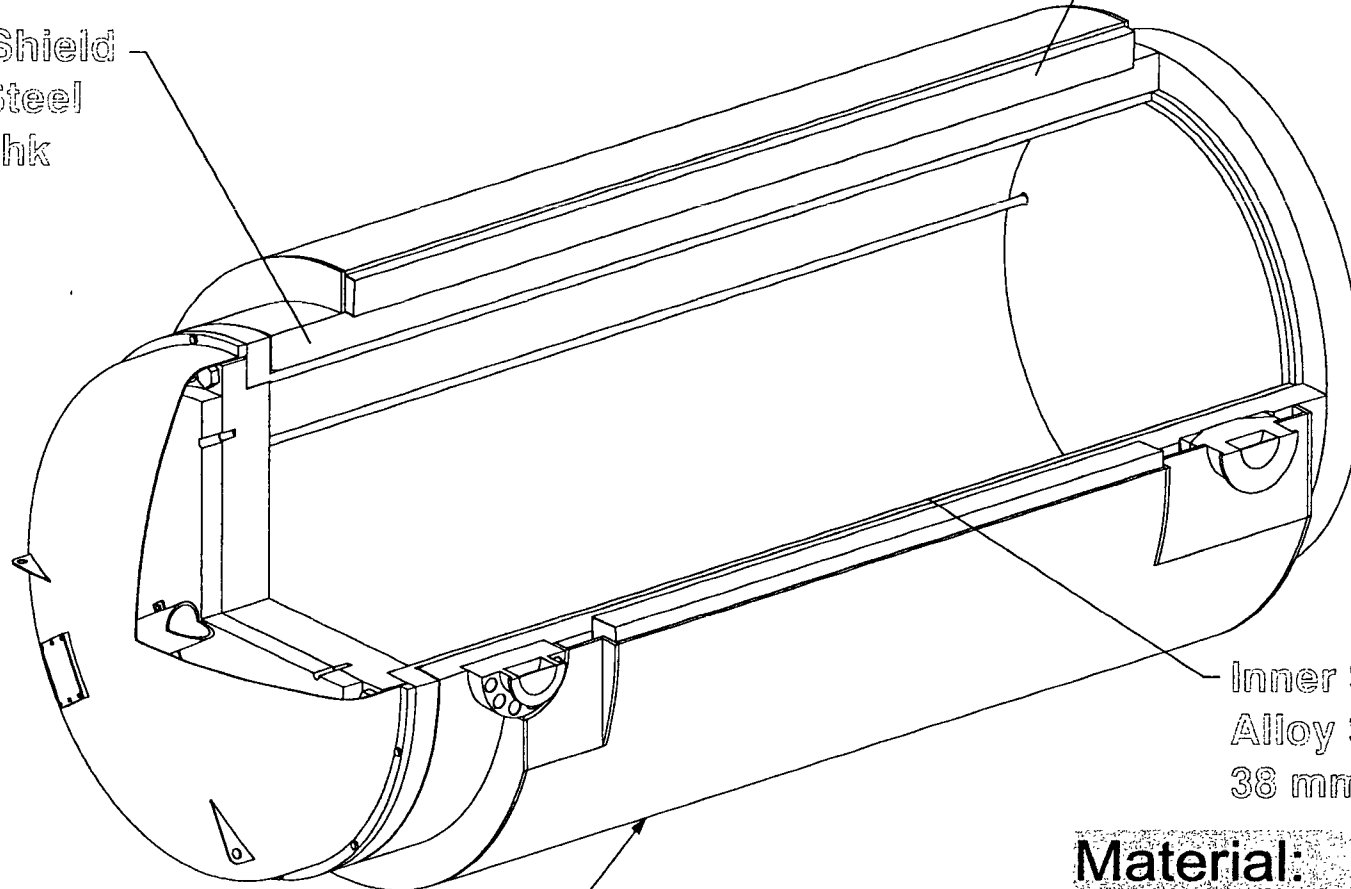
Transportation Cask Characteristics



TN-68 Dry Storage Cask

Gamma Shield
Carbon Steel
152 mm thk

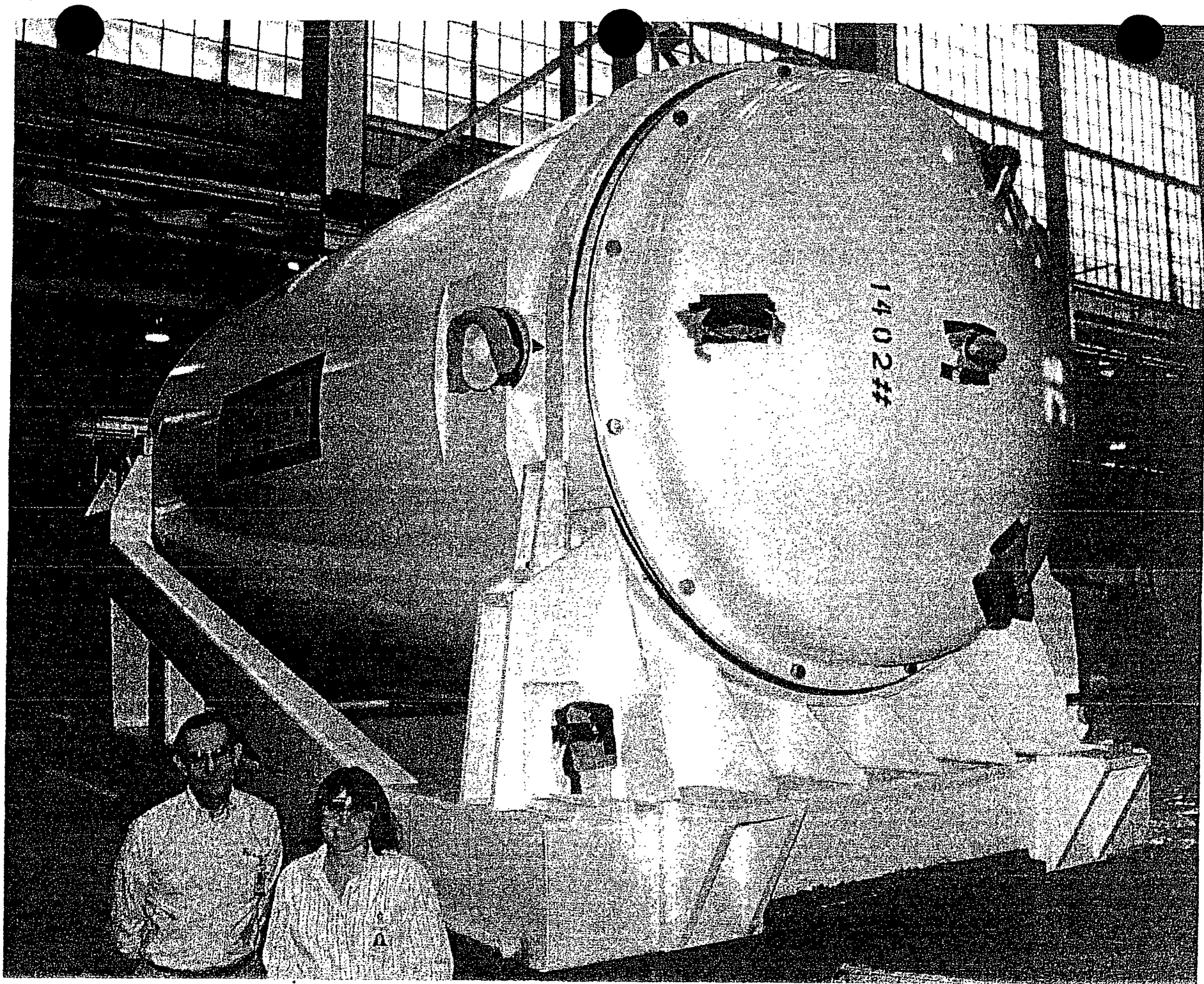
Neutron Shielding
Borated Polyesterin
Aluminum Boxes
149 mm thk



Inner Shell
Alloy Steel
38 mm thk

Outer Shell
Alloy Steel
19 mm thk

Material: See Above
Shielding: See Above
Weight: 81,000 Kg
Length: 5,461 mm
Max Dia: 2,576 mm

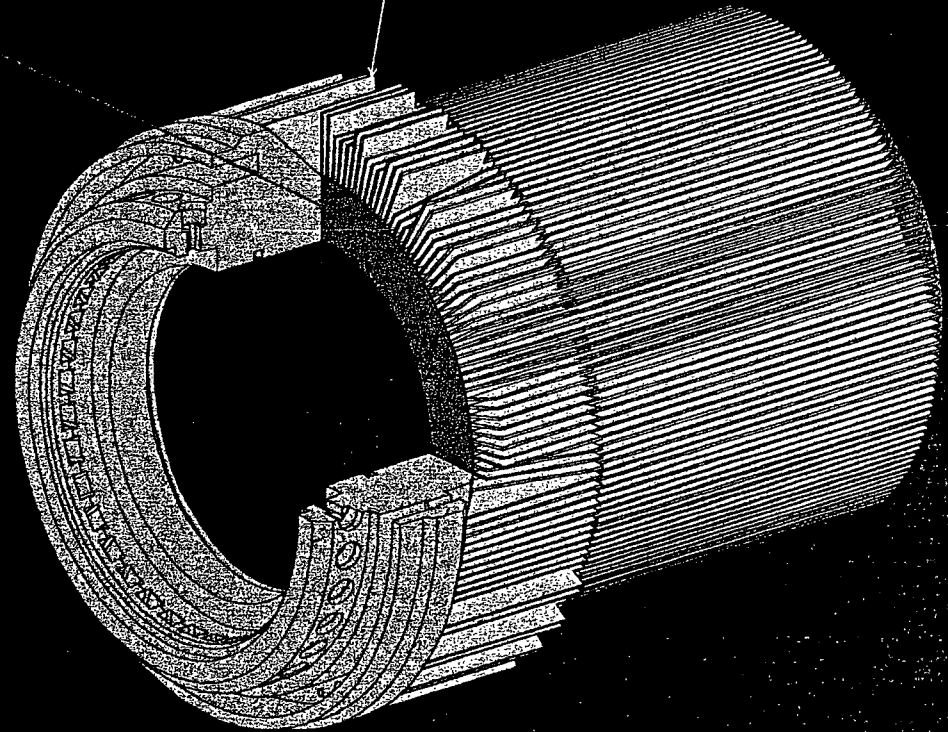
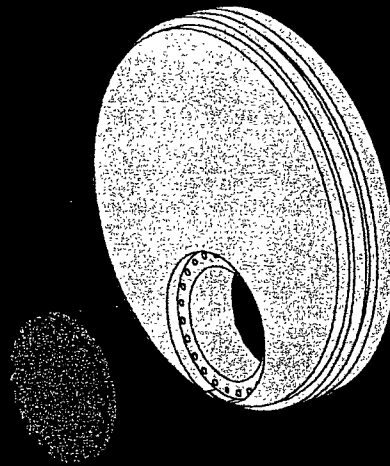
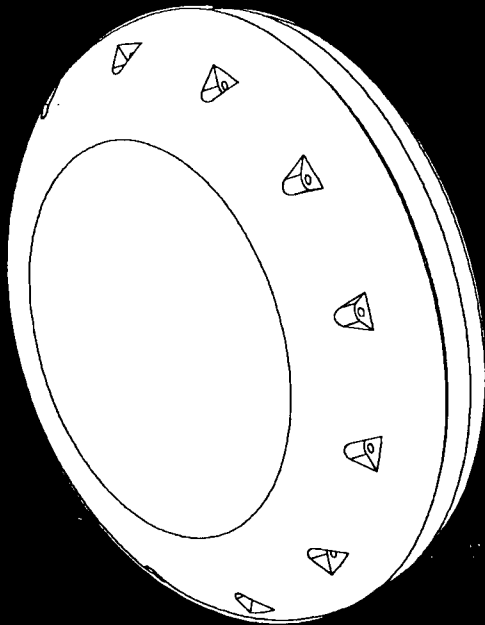




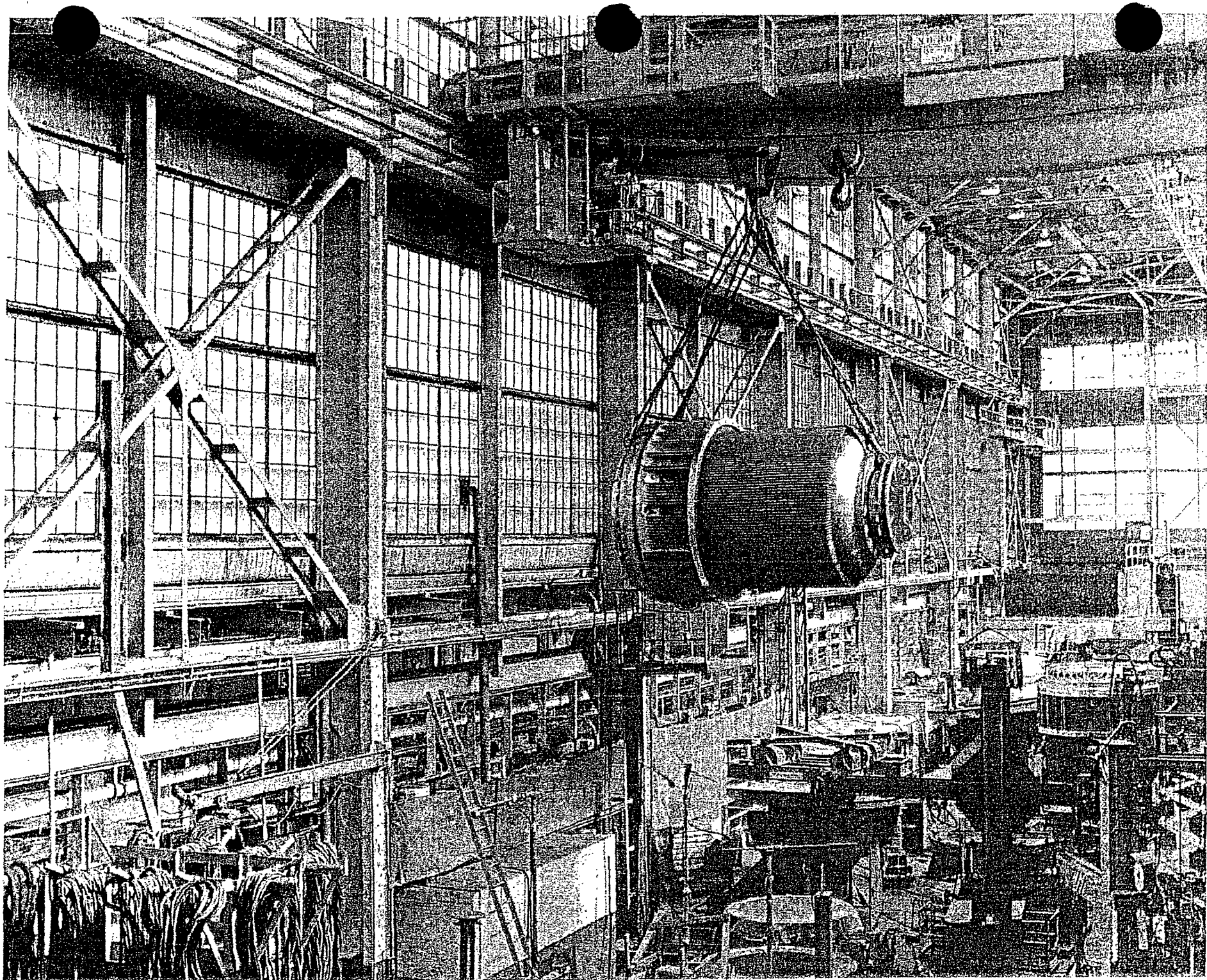
M140 Spent Fuel Shipping Cask

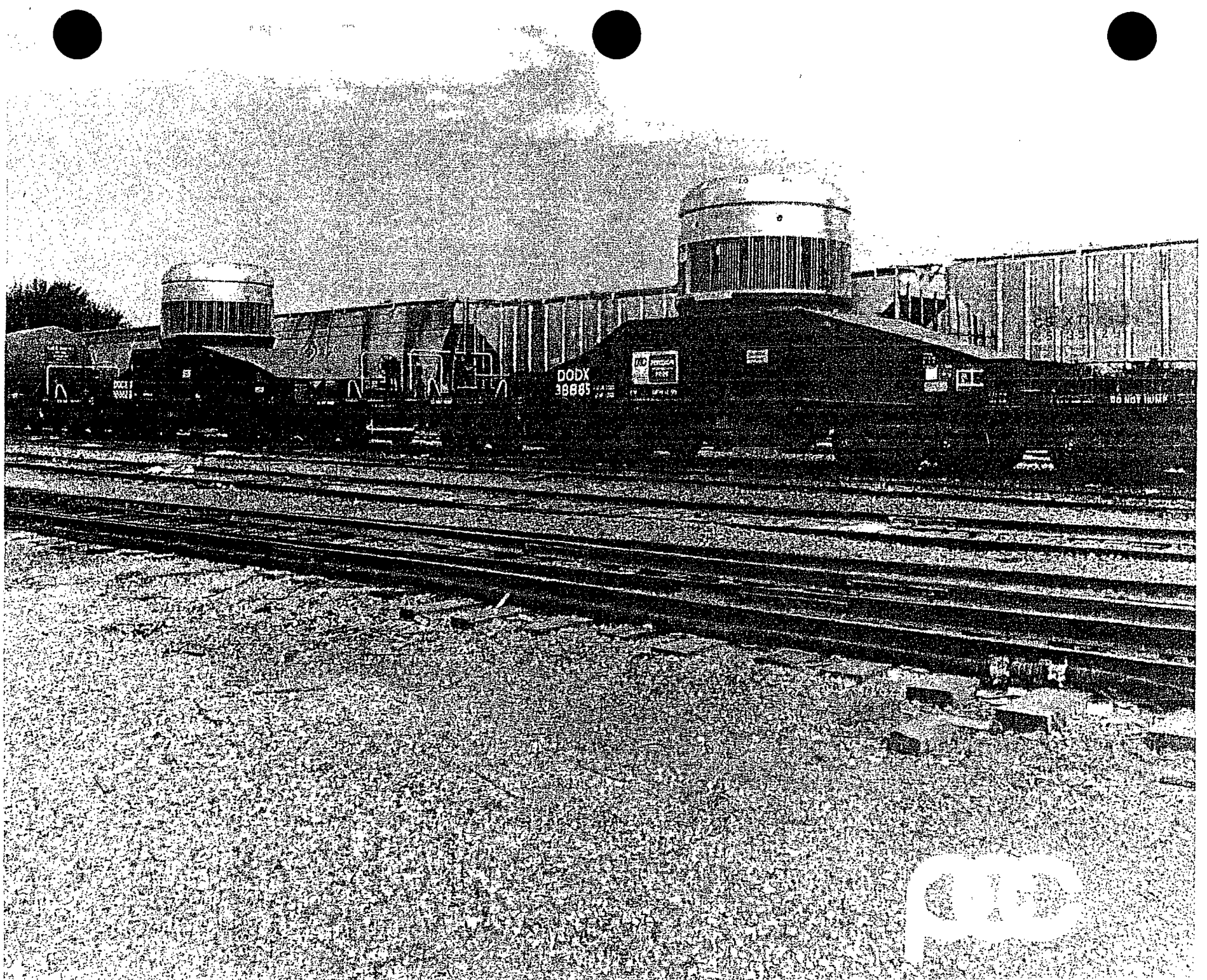
180 Stainless Steel Fins Welded Full Length

Shell
Stainless Steel
14 in thk.



Material:	Stainless Steel
Shielding:	SS
Weight:	110 Tons
Length:	192 in
Max. Dia.:	120 in





DODX
38885

AT

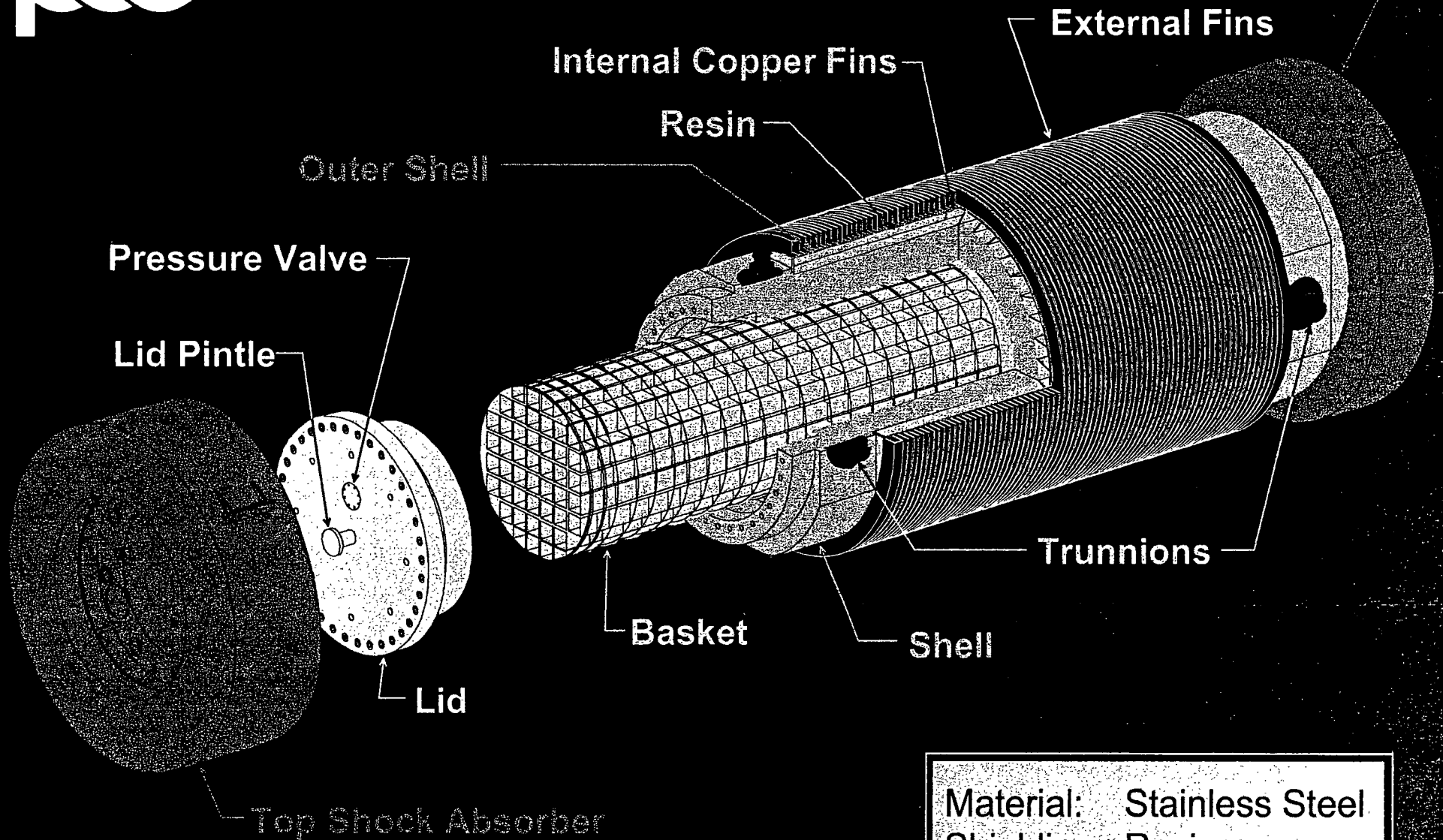
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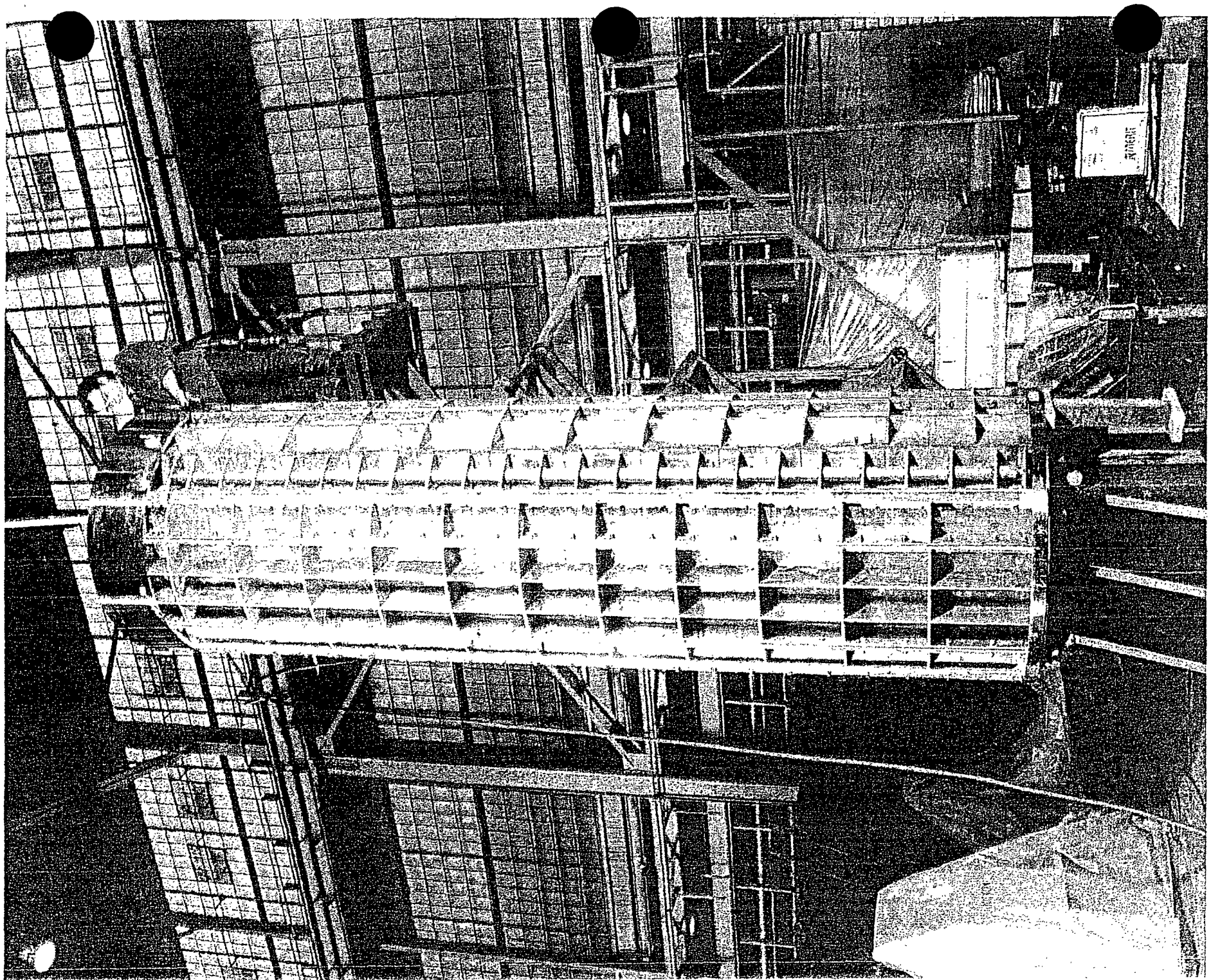


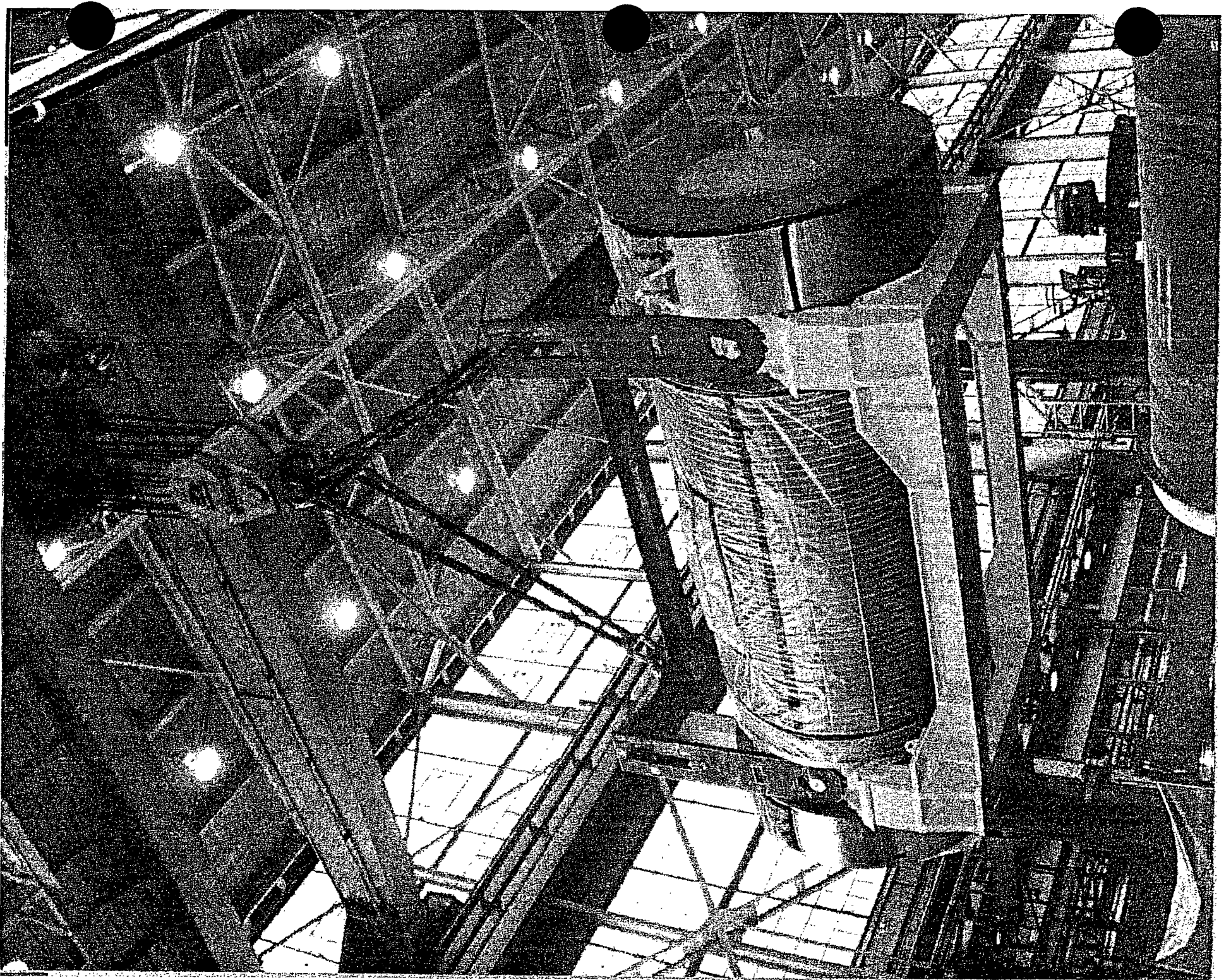
NFT-38B Cask

Bottom Shock Absorber



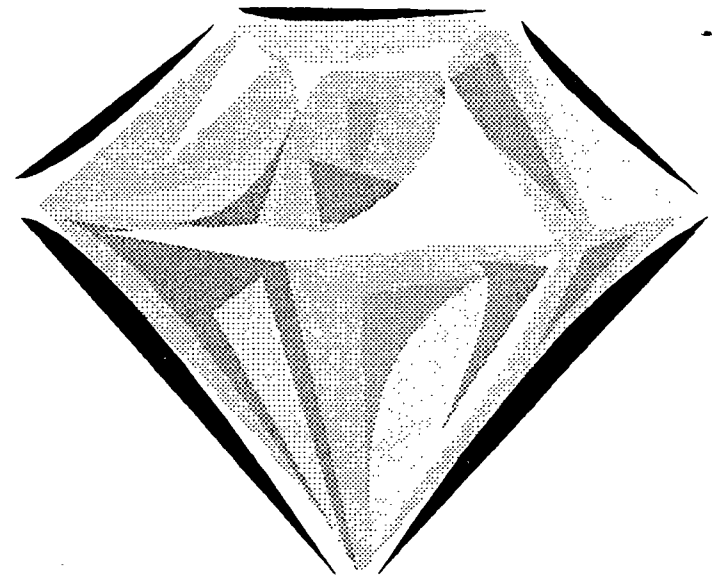
Material:	Stainless Steel
Shielding:	Resin
Weight:	150 Tons
Length:	192 in
Max. Dia.:	120 in





The Four Aspects of Quality*

- Quality
- Cost
- Delivery
- Service



* As Defined by Kaoru Ishikawa

“Human Factors Influence the
Ability to
Satisfy the Four Aspects of Quality”

Examples of Human Factors

- Competency & Experience
- Material Procurement & Traceability
- Work Instructions/Communications
- Workmanship/Craftsmanship
- Honesty
- Priorities in Production

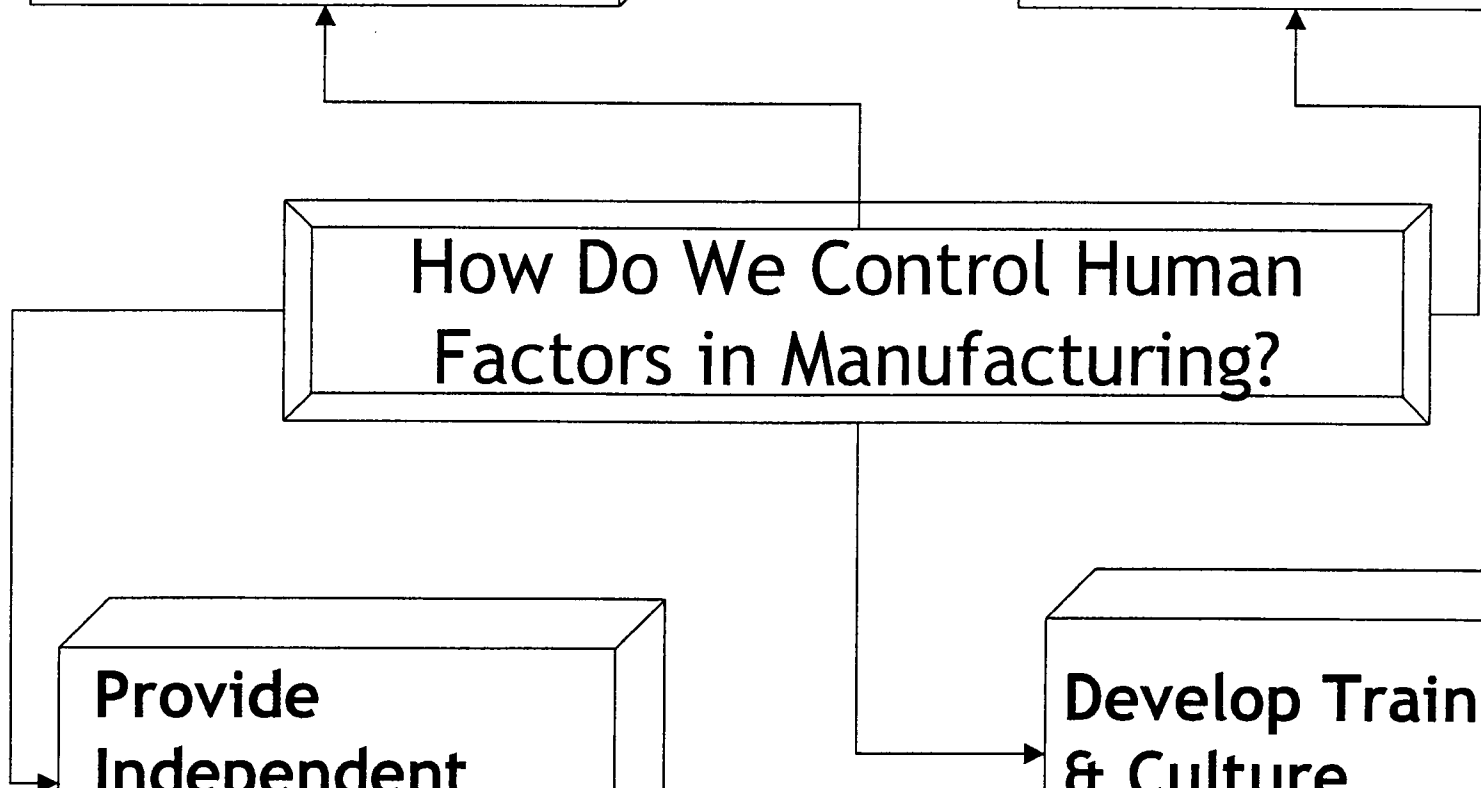
**Establish Quality
Systems &
Procedures**

**Identify
Technical
Requirements**

**How Do We Control Human
Factors in Manufacturing?**

**Provide
Independent
Oversight**

**Develop Training
& Culture**



Technical Requirements

- Design Documents & Licensing
- Fabrication Specification
- Industry Codes & Standards
- Fabrication Planning & Procedures
- Fabrication Drawings



ASME Code

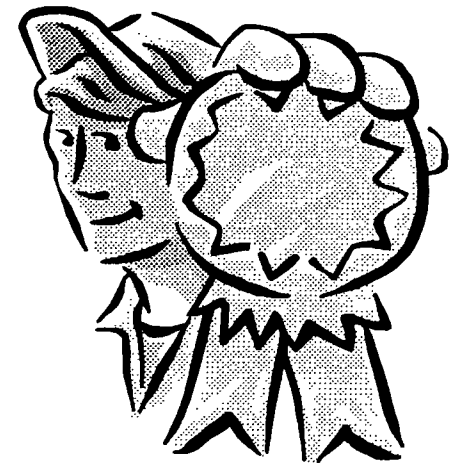
Section III, Division 3

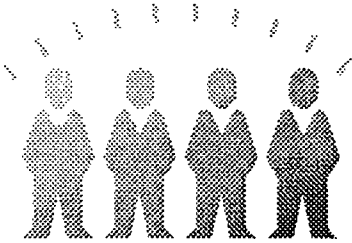
Storage and Transportation Containments

- Applies to Containment Boundary Only!
- Major Re-write
 - WA - General Requirements
 - WB - Transportation Containments
 - WC - Storage Containments
- Authorized Nuclear Inspector
- N-Stamp

Quality Systems & Procedures

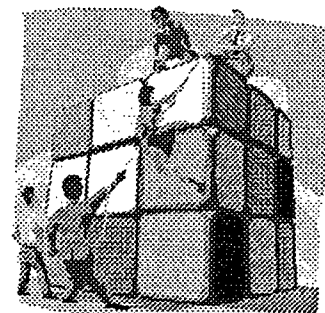
- Quality Assurance Program
- Quality Systems
- Quality Planning & Procedures
- Inspection
- Acceptance Testing
- Documentation





Training & Culture

- Proper Attitude
- Understand Customer's Expectations
- Management Commitment
- Develop Skills
- Provide Resources
- "Team Spirit"



Independent Oversight

- Internal Quality Control
- Regulators (e.g. NRC)
- Customer Inspectors (e.g. Designers)
- Owner's Inspectors (e.g. End-User)
- Authorized Nuclear Inspectors (e.g. ASME Code)
- EPRI Guidelines



EPRI Guidance Document

The scope of this guidance document covers items important to safety in dry spent fuel storage and transportation systems with an emphasis on the incorporation of licensing/design into fabrication, examination and testing requirements.

EPRI Guidance Document

- Planning
- Fabrication
- Examination
- Testing
- Oversight Program

Challenges BIG "3"

- Technical
- Documentation
- People



“Success Factors”

- Clear Understanding of Customer Expectations
- Definition of Critical Characteristics
- Manufacturability Review of Design
- Proper Material Selection & Procurement
- Critical or Special Processes
- Documentation Review
- People/Experience



Summary

“The measure of success in manufacturing spent fuel transportation is a function of having the right people and culture who can meet the expectations of the designer, customer, regulatory community, and the public”

Discussion