Human Factors in Manufacturing

Spent Nuclear Fuel Transportation Casks

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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
- Outer Shell Alloy Steel 19 mm thk
- Inner Shell Alloy Steel 36 mm thk
- Neutron Shielding Borated Polyesterin Aluminum Boxes 149 mm thk

Material: See Above
Shielding: See Above
Weight: 81,000 Kg
Length: 5,461 mm
Max Dia: 2,576 mm
NFT-38B Cask

- Internal Copper Fins
- External Fins
- Resin
- Outer Shell
- Pressure Valve
- Lid Pintle
- Basket
- Sheat
- Trunnions
- Top Shock Absorber
- 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
How Do We Control Human Factors in Manufacturing?

- Establish Quality Systems & Procedures
- Identify Technical Requirements
- 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
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