PACTEC

TRUPACT-III Transport Package

A Presentation to the
US Nuclear Regulatory Commission

Docket 71-9305

April 27, 2005

Agenda

- *Meeting Objectives*
- *Package Design Overview*
  - *Description of recent design changes*
- *Certification Approach*
- *Address Issues from Original Submittal*
- *Program Schedule*
- *Summary Discussion*

Meeting Objectives

- *Present the current state of TRUPACT-III design, certification strategy, and program*
- *Receive NRC staff views and comments*
- *Discuss program schedule*

TRUPACT-III Transport Package

- *Original SAR submittal (March 2004) was for a 20' long ISO container, essentially identical to the TN-Gemini (licensed in several European countries)*
- *Package has been shortened to achieve legal weight highway shipments for DOE*
- *Other changes have been made to enhance performance*
- *Certification approach has been changed in response to NRC staff feedback*

TRUPACT-III Transport Package

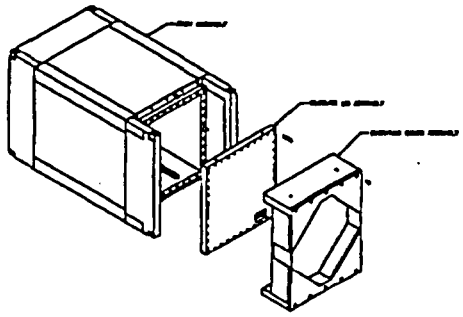
Configuration:

- *Rectangular ISO Container with non-standard length of 14' (was 20')*
- *External Dimensions (L x W x H):*
  4.25m x 2.50m x 2.65m [14 ft x 8.2 ft x 8.7 ft]
- *Internal Dimensions (L x W x H):*
  2.76m x 1.84m x 2.00m [9.1 ft x 6 ft x 6.6 ft]

- *Weight:*
  - *19,900 kg [43,800 lb] empty*
  - *25,000 kg [55,100 lb] fully loaded (was 30,000 kg)*

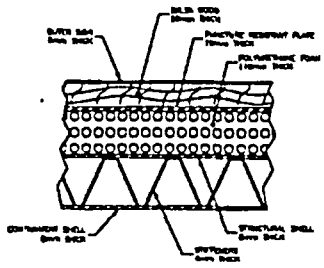
Attachment 2

TRUPACT-III Transport Package



TRUPACT-III Design

- Stiff, corrugated containment assembly
- Puncture-resistant plate protects containment

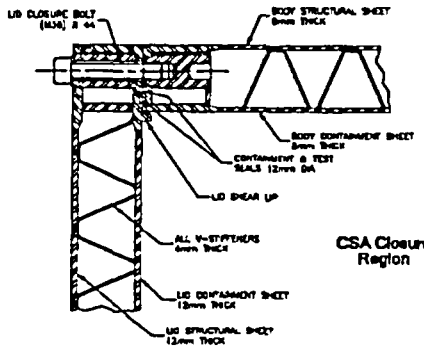


Typical Sidewall

TRUPACT-III Design

- All shells made from UNS S31803 stainless steel (ASME Section III Div 1 Class 1 material)
- Containment boundary welds ASME NB full penetration, radiographed
- Uses 44, M36 [approx. 1-7/16 in.] closure bolts made from ASTM A320, L43 material
- Containment seal is butyl, face-type O-ring, 12 mm [1/2 in.] diameter
- Package is leak tight per ANSI N14.5

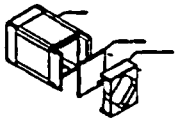
TRUPACT-III Design



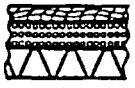
CSA Closure Region

TRUPACT-III Design

- Impact protection:
  - Fully enveloping polyurethane foam integral overpack

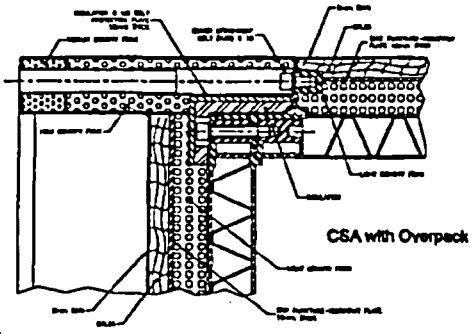


- Puncture protection:
  - Proven puncture-resistant system consisting of a sandwich of balsa wood, stainless steel plates, and polyurethane foam



- Thermal protection:
  - Seal region insulated by enveloping plates of ceramic material, protected by stainless steel plates 16 mm thick

TRUPACT-III Design



CSA with Overpack

TRUPACT-III Payloads

- Contents: Contact-Handled Transuranic waste materials similar to TRUPACT-II
- Primary payload: SLB-2 box (DOT 7A Type A container which essentially fills the payload cavity)
- Other payloads: SLB-1 box, SWBs, and drums
- Contents limits:
  - 80 Watts total
  - Payload weight 5,100 kg [11,300 lb], including roller floor, pallet, and dunnage (was 5,800 kg)

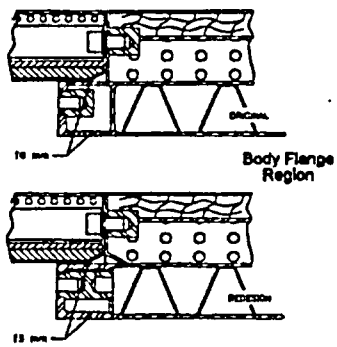
Recent Design Changes

- Primary change is to shorten the package by approx. 6 feet. Weight reduction makes legal weight truck shipments possible
- Other changes incorporated at this time:
  - Replaced most wood with polyurethane foam. This achieves:
    - Tighter bound on crush properties
    - Ability to "fine tune" crush strength
    - Adds fire resistance and intumescence
  - Exception: balsa wood adjacent to puncture-resistant plates is retained

Recent Design Changes

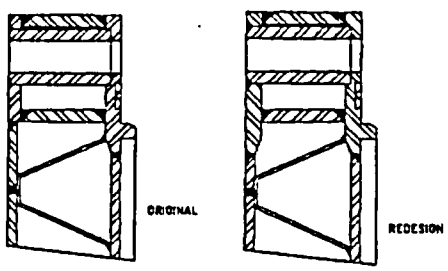
- Other changes incorporated at this time (cont.):
  - Revise body and lid flange structures to increase strength and reduce applied loading. Includes:
    - Add "dogleg" to radial rib
    - Thicken inner and outer body flange by 50%
    - Thicken outer lid flange plate by 25%
    - Extend bolting bosses through to rear of body flange
  - Improve overpack cover sheet seams

Recent Design Changes



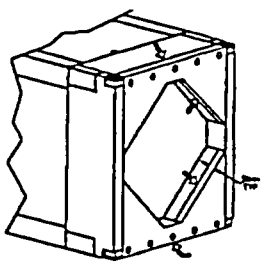
Body Flange Region

Recent Design Changes



Closure Lid Flange Region

Recent Design Changes



Overpack Cover

Certification Test Plan

- Objectives
  - To demonstrate that, after a worst-case sequence of free drop and puncture events, the package is leak tight
  - To demonstrate that no deformations will be incurred that would lead to failure of the elastomeric containment seals, or allow the CSA to exceed 600 °F in the subsequent HAC fire

Certification Test Plan

- Single, full-scale, prototypic CTU
- Demonstration basis: leak tight containment per ANSI N14.5 after full series of free drops and puncture drops
- Extensive pre- and post-test measurements
- Instrumented with accelerometers
- High-speed filming of free drops planned
- Prior half scale results utilized as engineering tests

Certification Test Plan

- Thermal evaluation by analysis
- Structural evaluations:
  - NCT free drop, and HAC free drop & puncture, by test
  - All other NCT and HAC load cases by analysis
- Initial conditions
  - Internal design pressure
  - For high-impact drops, temperature will be cold (-20 °F)
  - For maximum crush deformation drops, temperature will be ambient, with analytical correction to max. temperature

Certification Test Plan

- CTU configuration
  - Full-scale, prototypic package
  - Generally of nominal construction
    - Steel thickness and strength will be as-received
  - To the extent possible:
    - Foam strength which governs impact will be nominal-to-max
    - Foam strength which governs deformation will be nominal-to-min
  - CTU will feature special containment seal test ports
  - Test payload planned to be loose metal objects, such as steel or aluminum round bars

Certification Test Plan

- Free drops and punctures will result from a selection process
- Four 30-ft free drops tentatively planned
  - Two focus on impact
  - Two focus on deformation
- One NCT, 1-ft free drop planned
- Four puncture drops planned
  - Two focus on puncture-resistant panels
  - Two focus on other areas

Certification Test Plan – Free Drops

- Vertical on lid, cold (1 ft & 30 ft)
  - Most challenging for opening the lid joint
- Flat on lateral side, cold
  - Highest impact, challenges lid in lateral direction
  - Impact bounds slapdown
- CG-over-corner, ambient
  - Challenges deformation and weld seams
  - Planned for closed end corner due to damage accumulation on lid end
- CG-over-long edge horizontal, ambient
  - Challenges deformation

Certification Test Plan – Puncture Drops

- Center of side, oblique through CG
  - Challenges puncture-resistant system on long side panels
- Overpack cover, oblique through CG
  - Challenges puncture-resistant system on end panels
- On the CG-over-corner free drop damage
  - Maximizes damage for thermal analysis
- On the joint between cover and body
  - Challenges seal area at weakest point

Certification Test Plan

- Measurements (pre- and post-test)
  - Leak tests
  - Crush distance, puncture damage
  - Residual closure bolt torque
  - Cavity dimensions
- Acceptance Criteria
  - Leak tight per ANSI 14.5
  - Deformations bounded by thermal analysis assumptions

Certification Test Plan

- Detailed certification test plan will be shared with NRC prior to final pre-test meeting
- All aspects of plan will be described and justified
- Plan will be finalized after receiving NRC staff input

Safety Analysis Report

- SAR will be updated from the March 2004 submittal
- Revisions will include:
  - New Reg Guide 7.9 Revision 2 format
  - Update NCT sections for new design
  - Replace HAC free drop analysis with full-scale test results
  - Update thermal analysis for new design
  - Update criticality analysis for new design

Issues From Original Submittal

Four concerns with the SAR submittal of March 2004 were identified in a letter from the NRC to PacTec on 9/7/04:

- #1 – Non-linear analysis showing yielding in the seal region
  - Addressed by utilizing a full-scale test article, leak tight after test
- #2 – Margins too small given variability of impact limiter crush strength
  - Margins increased by reduced end drop impact, stronger flanges, and tighter crush strength control

Issues From Original Submittal

- #3 – Puncture drop tests of revised overpack cover not performed; insufficient instrumentation used in tests
  - Puncture drop tests will be performed on prototypic CTU
  - Instrumentation needs are reduced since no correlation with analysis will be necessary
- #4 – Temperature limits exceeded for material used in CSA
  - Original thermal analysis used coarse mesh over "radial rib", leading to overestimate of heat conduction
  - Re-analysis shows 160 °F margin on CSA material temperature limit

Program Schedule

- Long lead material order – May 2005
- CTU fabrication start – August 2005
- Detailed presentation of certification test plan – late 2005
- Certification testing at Sandia National Laboratory – May 2006
- Submittal of revised application to NRC – July 2006
- Planning on approximately 5 months to first round RAIs
- Production unit fabrication will likely parallel NRC review