Status of the TRUPACT-III and ARROW-PAK Applications

Western Governor's Association
WIPP Transportation Advisory Group
October 5, 2005

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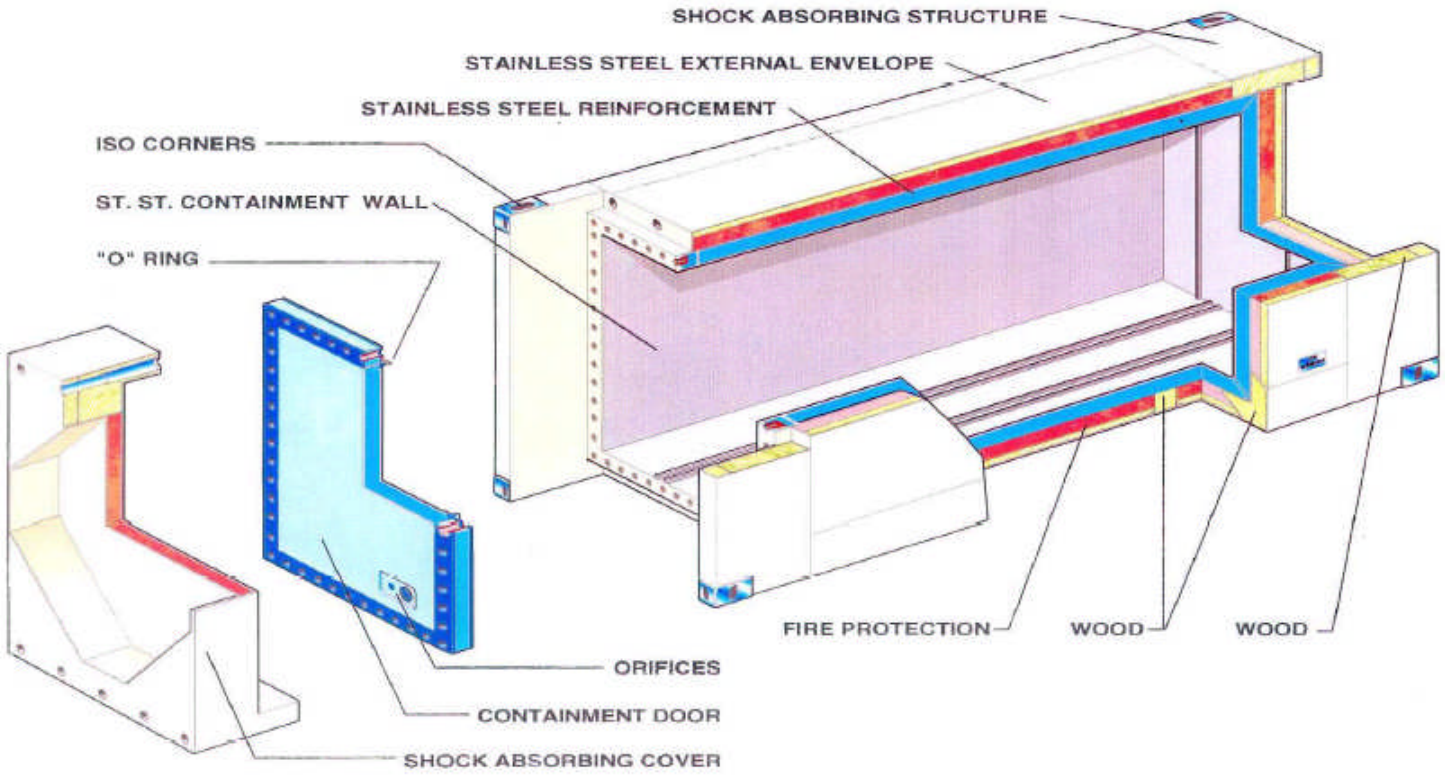
TRUPACT-III Transport Package



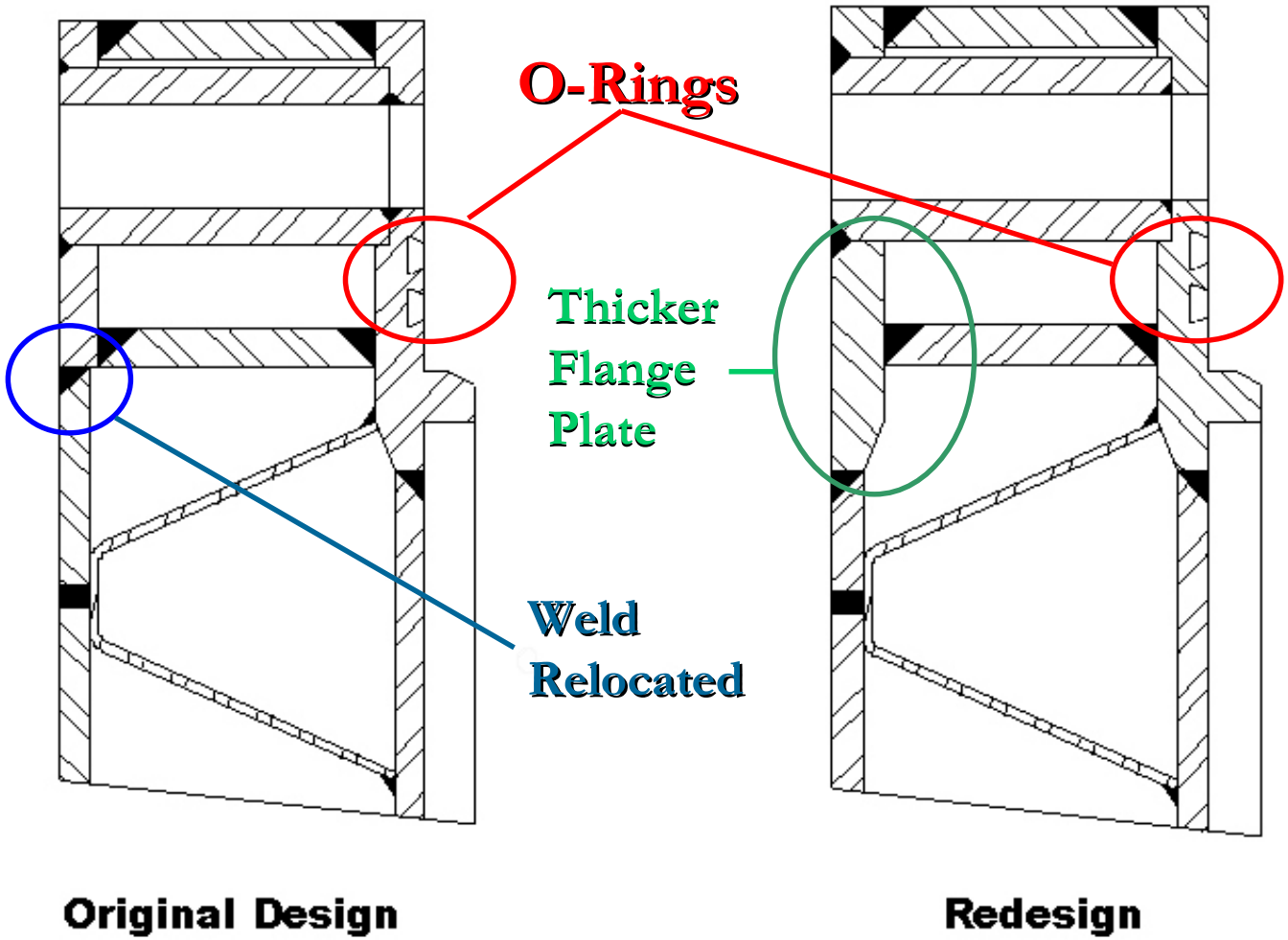
- Original TRUPACT-III application based on computer analysis and half scale tests.

- Test models were leak tight after drop tests.
- However, computer modeling predicted yielding in seal region and insufficient code margins.

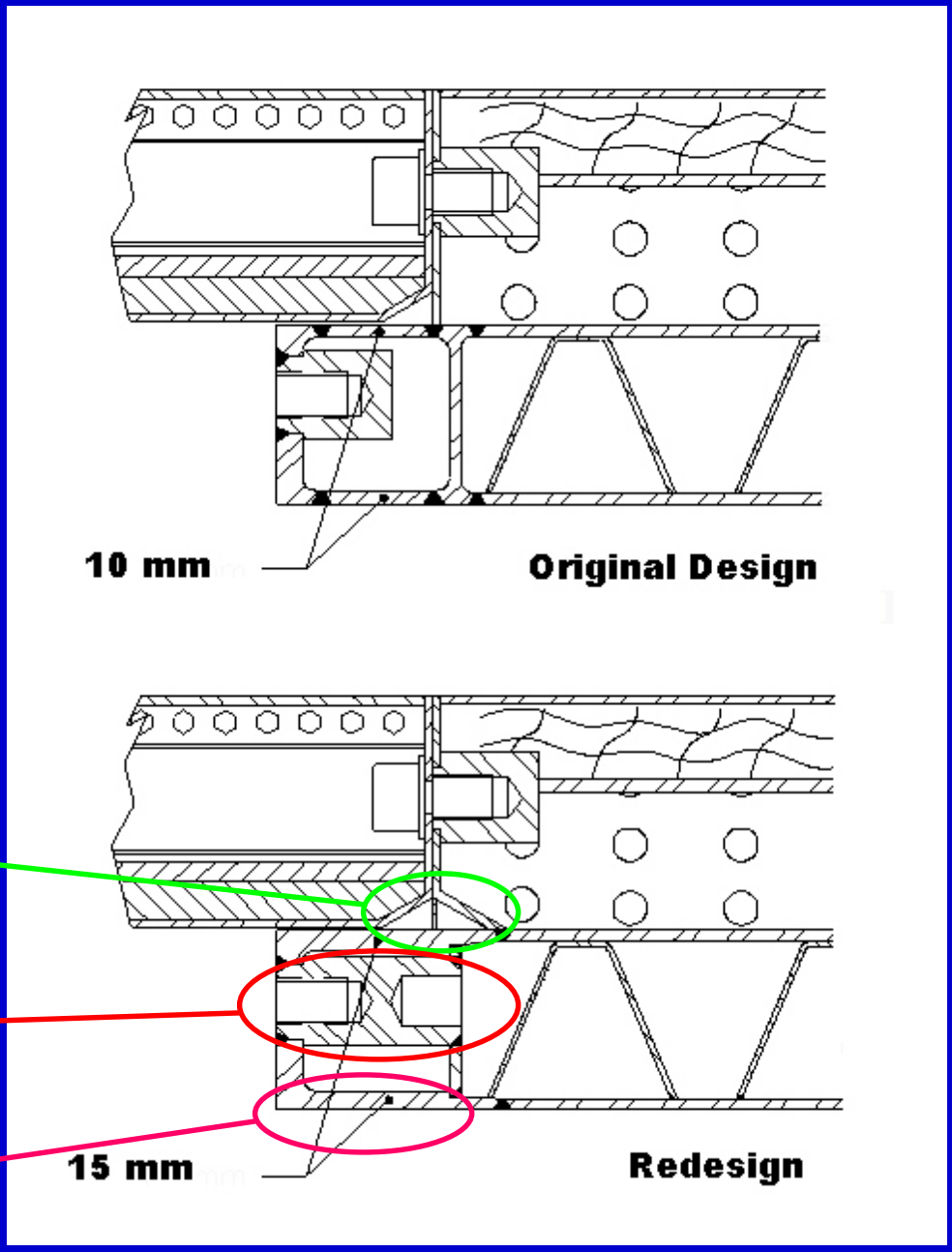
Comparison between TRUPACT-III Designs

	TRUPACT-III	TRUPACT-III (redesign)
External Dimensions (L x W x H)	20 x 8.2 x 8.7	14 x 8.2 x 8.7
Internal Dimensions (L x W x H)	14.8 x 6 x 6.6	9.1 x 6 x 6.6
Weight, empty	53,500 lbs.	43,800 lbs.
Weight, loaded	66,000 lbs.	55,100 lbs.
Payload	12,500 lbs.	11,300 lbs.

Closure Lid Flange Area



Body Flange Region

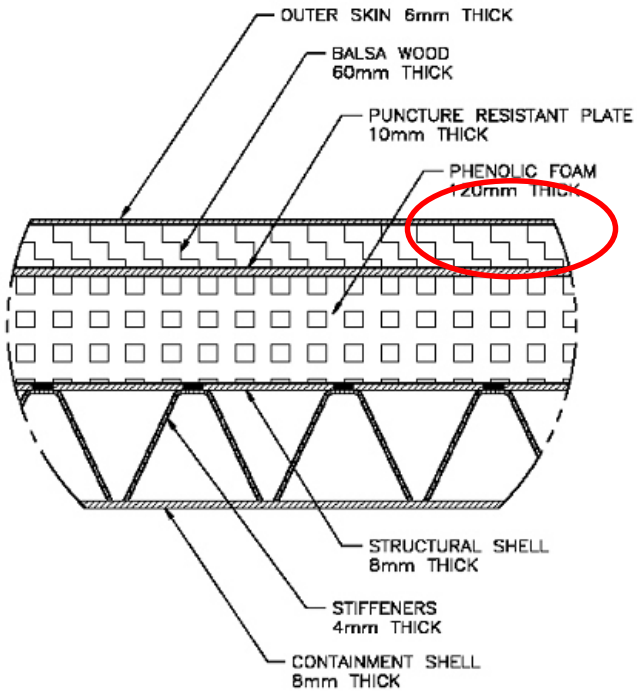


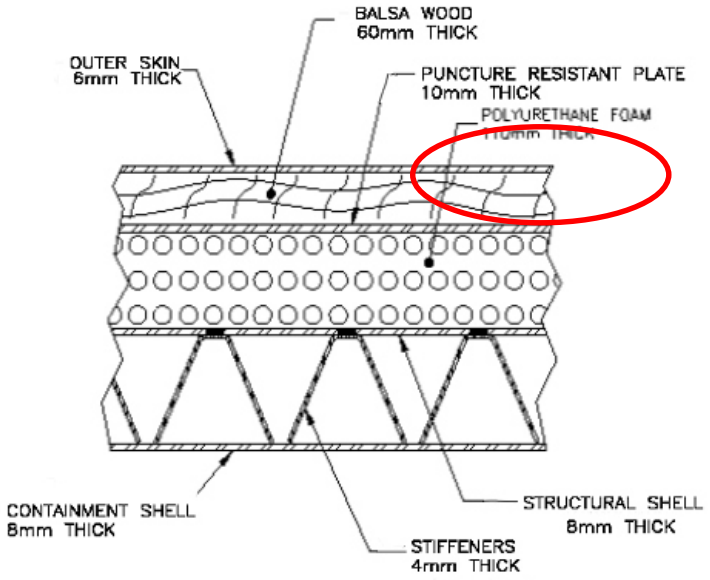
Added Dogleg

Extended Bolt Boss

Thicker Flange Plates

Wall Cross Section





Foam changed to enhance impact strength.

Application for TRUPACT-III Redesign

- Structural analysis and puncture evaluation based on full-scale testing
  - Four thirty foot drop tests
  - One NCT drop test (one foot)
  - Four puncture tests
  - Tests to be done on a single package; acceptance criteria is leaktight (ANSI 14.5)
- Thermal evaluation by analysis

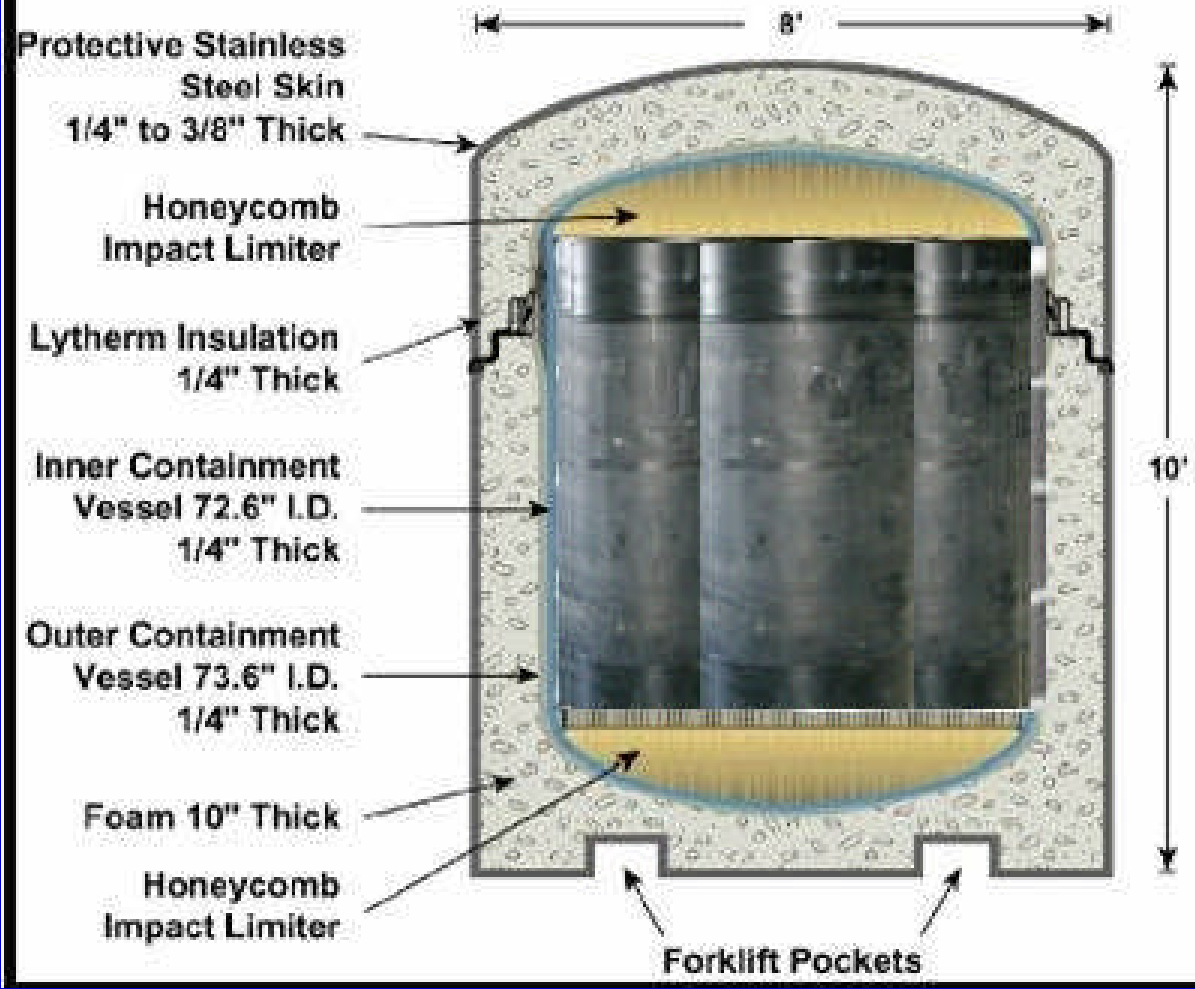
Tentative Schedule for TRUPACT-III Application

- Development of detailed test plan – late 2005
- Full scale testing at SANDIA – May 2006
- Submittal of revised application – July 2006
- NRC decision on application – 6 to 12 months

Status of ARROW-PAK Application

- Application submitted Jan. 31, 2005.
- ARROW-PAK would be used to ship waste that may generate higher amounts of hydrogen gas than currently allowed in TRUPACT-II (5% by volume).
- Requests exemption from 10 CFR § 71.43(d)
  - No significant chemical, galvanic, or other reaction among package components and contents.

TRUPACT-II



Weight

12,705 lbs. empty

19,250 lbs. loaded

Material

Stainless Steel

Polyurethane Foam

Ceramic Fiber

Insulation

ARROW-PAK

Weight

525 lbs. empty

1,900 lbs. loaded

Material

Extra-high Molecular Weight, High-density Polyethylene

Status of ARROW-PAK Application

- Application based on:
  - Full-scale drop testing of ARROW-PAK containers.
  - Pressure testing of ARROW-PAK containers.

Above: Three ARROW-PAK containers loaded into the TRUPACT-II Inner Containment Vessel

Above: ARROW-PAK containers

Left: TRUPACT-II Inner Containment Vessel (ICV) with Bottom Stiffeners

Left: The TRUPACT-II Inner Containment Vessel after a thirty foot end drop.

Right: The TRUPACT-II Inner Containment Vessel after a thirty foot side drop.

Above: External view of ARROW-PAK containers after thirty foot drop tests

Right: ARROW-PAK container tested with 55-gallon drum

Above: ARROW-PAK container tested with concrete disks

Pressure testing of ARROW-PAK containers

- ARROW-PAK Containers hydrostatically tested by injecting high pressure water.
- Containers pressurized four times up to 1000 psig. Burst occurred at 820 psig during pressure drop from 1000 psig.
- Rupture occurred as longitudinal split at center of sidewall.

High –Pressure Accumulator System

Hydrostatic Testing of ARROW-PAK Container

Theoretical Calculation of Maximum Internal Pressure due to An Hydrogen Deflagration Event

- Maximum pressure ratio of 8 occurs when a stoichiometric mixture of hydrogen and oxygen is present.
- Maximum internal pressure occurs for 75% hydrogen mixture

Percent Hydrogen	Liters of H_2 added	Pressure Ratio	Internal Pressure
33.3	237	8.0	153
50	564	5.8	156
75	1692	3.7	203

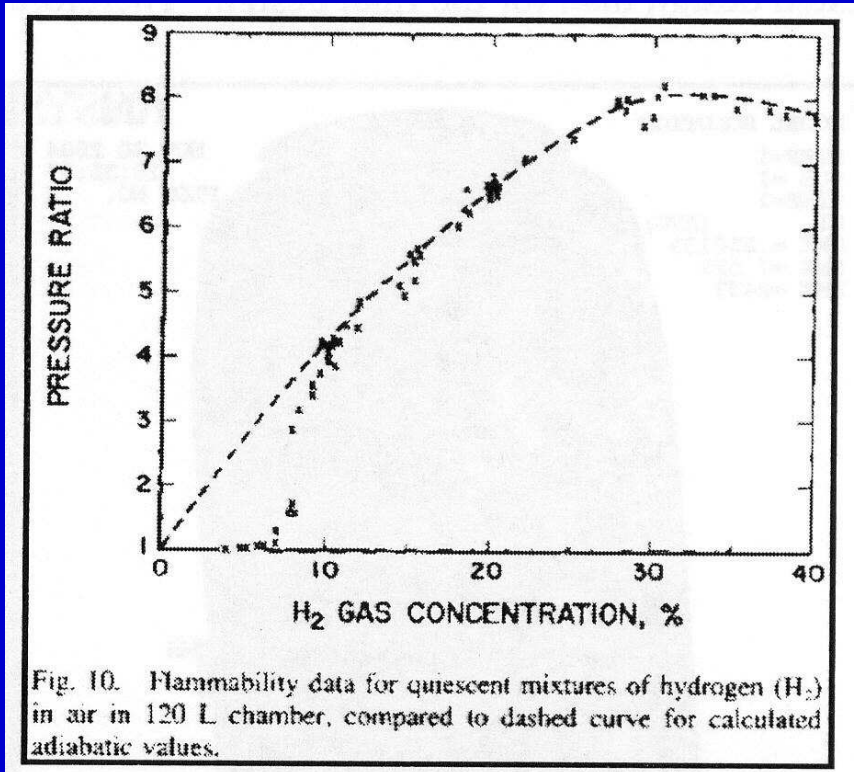
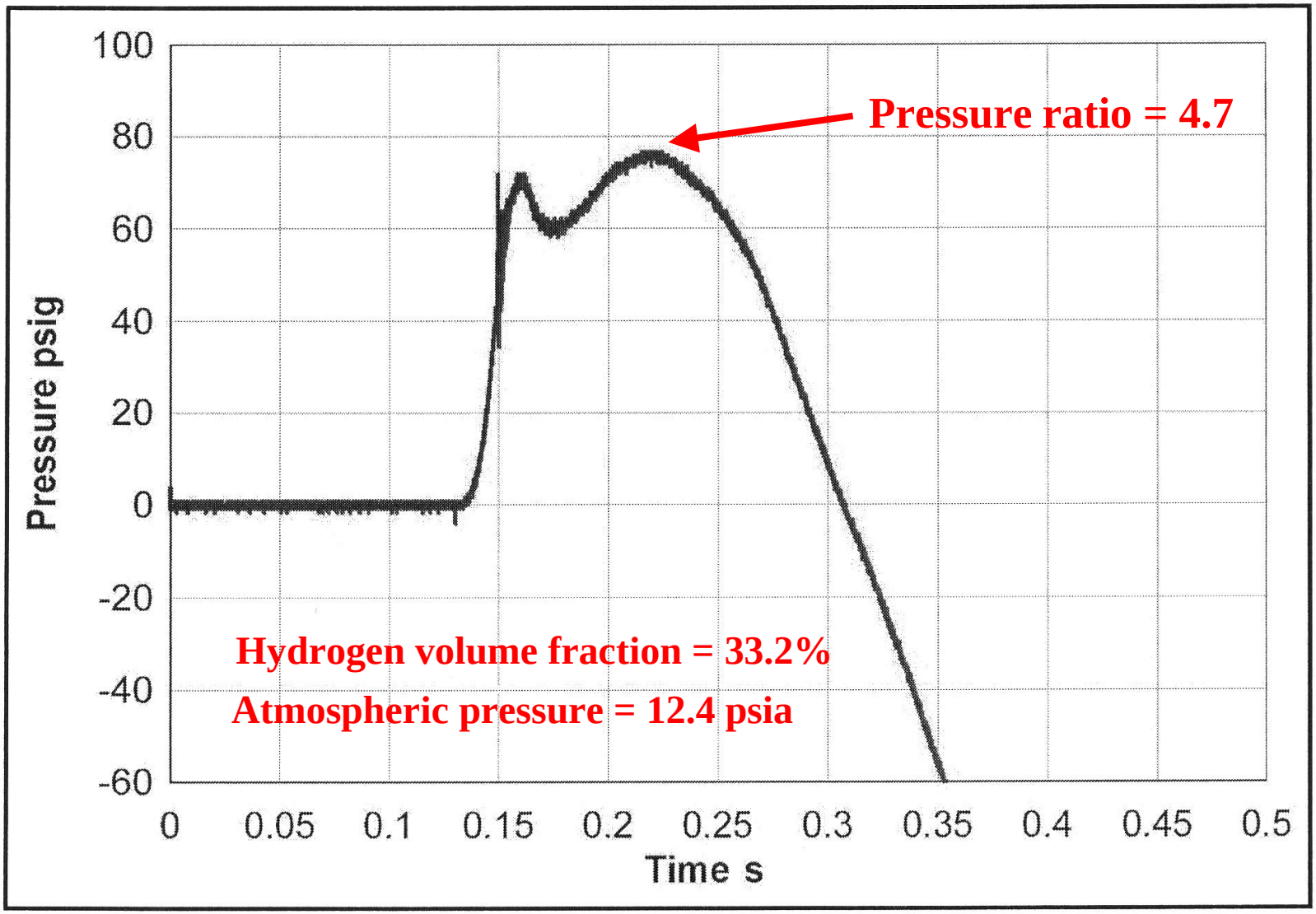


Fig. 10. Flammability data for quiescent mixtures of hydrogen (H_2) in air in 120 L chamber, compared to dashed curve for calculated adiabatic values.

Volume of ARROW-PAK Container = 564 liters

445 liters of nitrogen
119 liters of oxygen

Experimental Results



- Maximum theoretical internal pressure at room temperature predicted to be 203 psig.

- Factor of two applied to account for 140 ^{o}F internal temperature of container, 2 x 203 = 406 psig.

$$\text{Safety Margin} = \frac{820}{406} - 1 = 1.02$$

Tentative Schedule for ARROW-PAK Application

- NRC request for additional information sent to applicant on July 8, 2005 (ML051890325).
- Public meeting with applicant - September 21, 2005.
- Applicant response expected by end of November, 2005.