



“The World Has Changed” Tank Car Initiatives

Clay Producers Association

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Despite our vital economic growth, the safe transportation of crude oil, ethanol, and other flammable liquids have become politically challenged as a series of catastrophic train accidents manifest shortcomings in our engineering systems to ensure public safety.







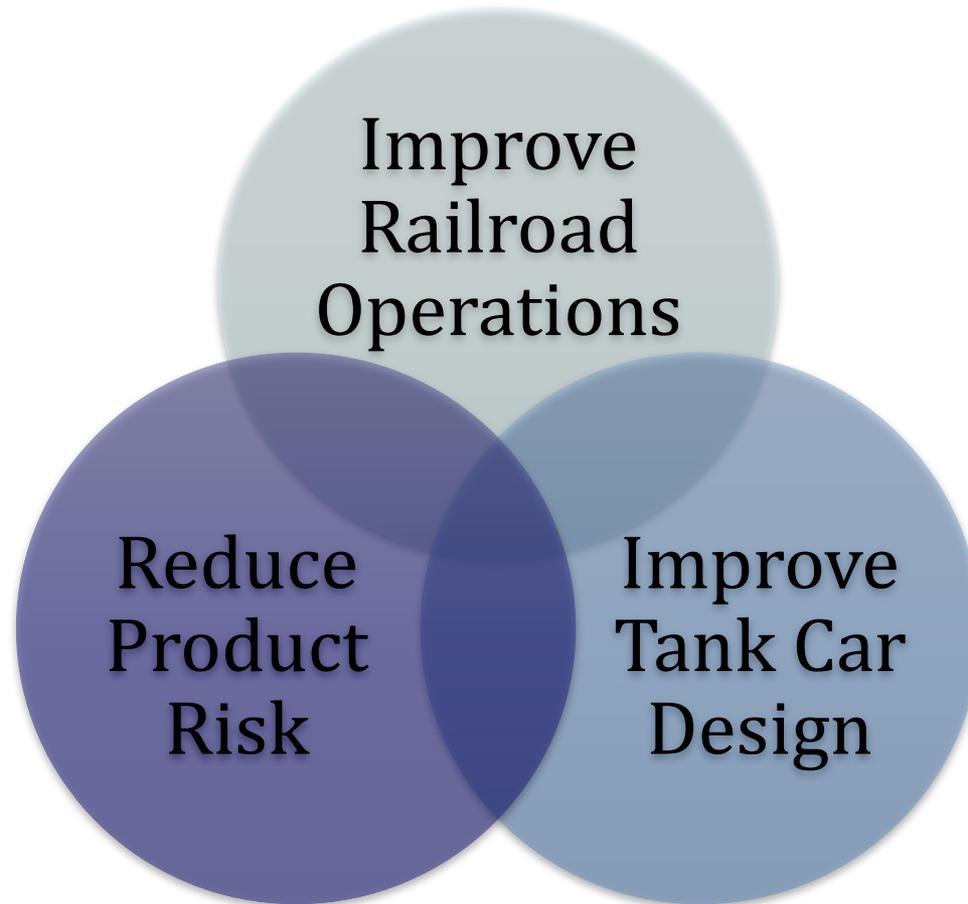


A Basis for Change

Incident	Date	# Cars derailed	Speed at derailment	Unit train	Product Loss (gal)	Cause of Derailment
New Brighton, PA	2006	23	37	Yes	485,278	Rail
Painesville, OH	2007	6	48	No	76,153	Rail
Luther, OK	2008	5		Yes	243,000	Cross level
Rockford, IL	2009	19	34	No	232,963	Washout/Rail
Arcadia, OH	2011	31	46	Yes	834,840	Rail
Tiskilwa, IL	2011	10	34	No	143,534	NTSB Investigation
Columbus, OH	2012	3	23	No	53,347	NTSB Investigation
Plevna, MT	2012	17	25	No	245,336	Undetermined
Lac Megantic	2012	63	43	Yes	1,500,000	Securement
Aliceville, AL	2013	26	39	Yes	700,000	Rail
Casselton, ND	2013	13	43	Yes	400,000	Broken Axle on an Adjacent Train



Pillars of Transportation Risk Reduction



Improve Tank Car Design

P-1577

- March 9, 2011
- AAR petitions PHMSA for a rulemaking to improve the crashworthiness of the existing DOT 111 tank car for flammable liquids in Packing Groups I and II

CPC-1232

- August 31, 2011
- AAR adopts as a standard the AAR petition car for only crude oil and ethanol shipments.

HM-251

- September 6, 2013
- PHMSA issues a ANPRM to collect additional information on the benefits and costs of adopting the AAR petition into it regulations.

Tank Car Comparisons

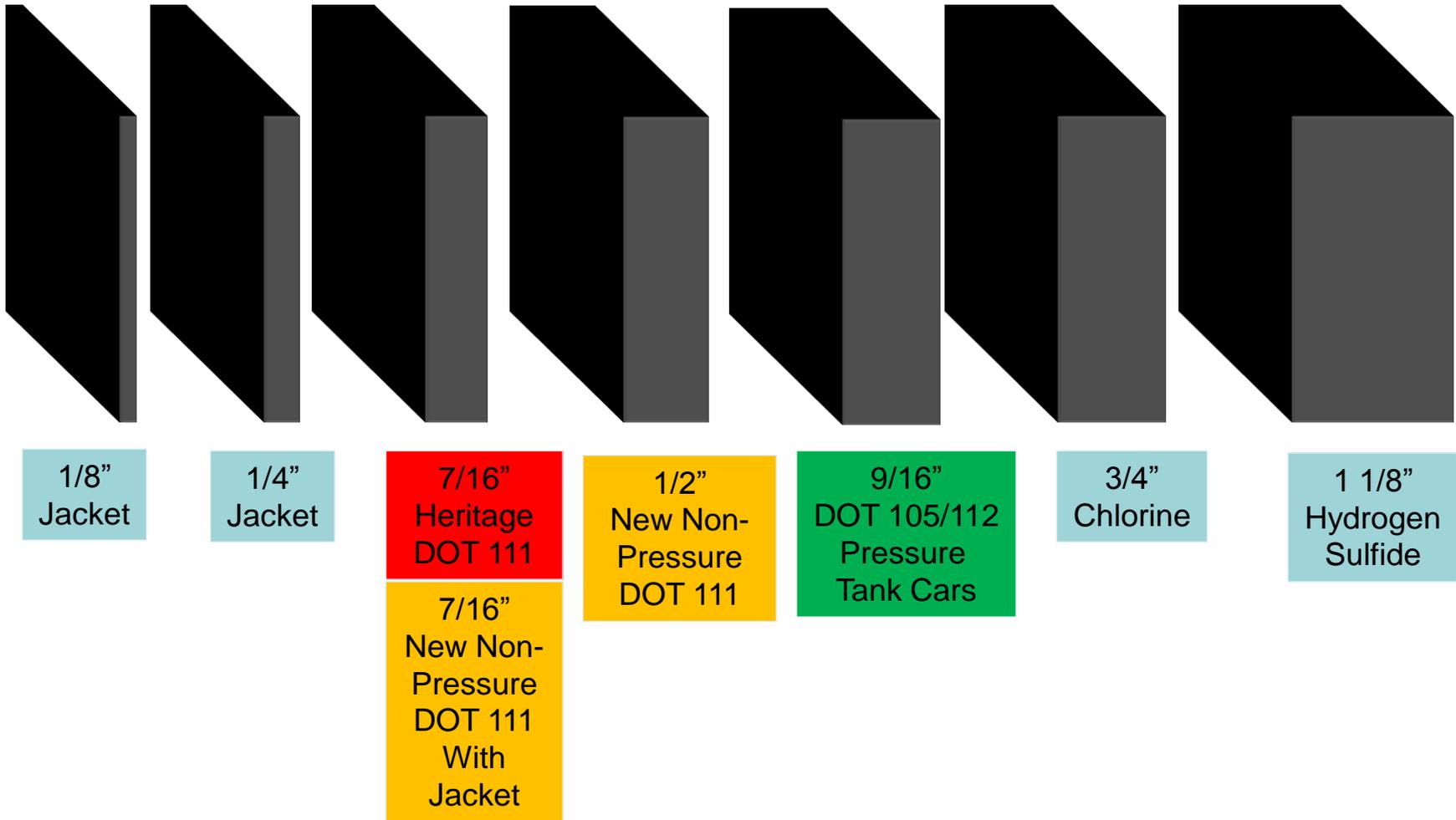
Component	Heritage DOT 111	Petition DOT 111	DOT 105J/112J/114J/120J
Shell Thickness (inches)	7/16	7/16 W Jacket 1/2 W/O Jacket	9/16
Shell Material	A516 TC 128	TC 128 Gr. B, N A 516 Gr. 70, N*	TC 128 Gr. B, N A 516 Gr. 70, N*
Protective Housing	No	Yes	Yes
Head Protection	No	1/2 Height**	Full Height
Metal Jacket	Optional	Optional	Yes
Thermal Protection	No	No	Yes
BOV	Optional	Optional	114J/120J
PRD	Appendix A	Appendix A	AFFTAC

* Requires an increase in tank thickness to compensate for lower tensile

** Full height if the tank has a metal jacket

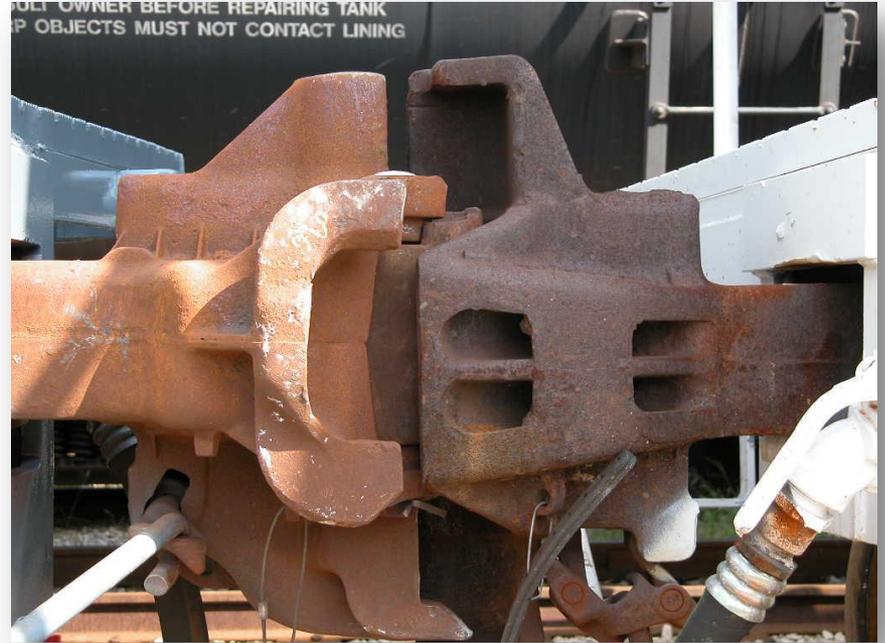


Head and Shell Thickness



Coupler Vertical Restraint

- All tank cars must have couplers designed to prevent vertical disengagement (*i.e.*, shelf couplers).



Half-Height Head Shield



Full-Height Head Shield



High Capacity Pressure Relief Device

- Start-to-discharge 75 psig
- 27,000, plus, SCFM
- The pressure relief device industry is working on a dual-system device capable of lowering the start-to-discharge pressure in fire environments.



Top Fitting Protection

- All pressure tank cars have top fitting protection.
- New general service tank cars conforming to CPC-1232 have top fitting protection.
- Tank cars designed to carry a gross weight on rail greater than 263,000 pounds commonly have top fitting protection.



Bottom Fitting Protection

- With certain and limited exceptions, tank cars must have bottom fitting protection.
 - For example, molten sulfur and elevated temperature materials do not require such protection.
- The AAR is currently developing standards to require disengagement of the bottom outlet valve handle during transport.



Thermal Protection



- Tank cars transporting a compressed gas must have thermal protection.
- Thermal protection is used to retard heat flow into the tank/product resulting from heat impingement on the tank surface.
- Thermal protection systems must prevent failure of the tank in a 100 minute pool fire / 30 minute torch fire.



Metal Tank Jacket

- Metal jackets:
 - Protect the insulation or thermal protection material, and
 - Adds puncture resistance to the tank shell and heads.
- Typically the jacket consists of an 11-gauge rolled sheet.



Conditional Probability of Release (CPR)

- The University of Illinois, Urbana-Champaign, developed estimates of probability of lading loss, given derailment, for individual components (head, shell, top fittings, bottom fittings) and for the car overall (Report RA-05-02).
- Tank car Risk Reduction Options (RROs) addressed include:
 - Thicker tank heads and/or shells
 - Addition of head shield, either half- or full-height
 - Addition of jacket and insulation
 - Removal of bottom fittings
 - Protection of top fittings



Preliminary CPRs Based on New Data

Percent Change in CPR Compared to:

Car Type	CPR	CPR (100)	Conventional Non-Jacketed DOT 111A100W1 (B1)		Non-Jacketed CPC-1232 (P1)		Jacketed CPC-1232 (P6)	
			CPR	CPR _(>100)	CPR	CPR _(>100)	CPR	CPR _(>100)
Conventional, Non-Jacketed DOT 111A100W1 (B1)	0.2662	0.1955	-	-	na	na	na	na
Conventional, Jacketed DOT 111A100W1 (B2)	0.1283	0.0853	51.8%	56.4%	2.6%	17.2%	na	na
Non-Jacketed CPC-1232 Compliant (P1)	0.1317	0.1030	50.5%	47.3%	-	-	na	na
Jacketed CPC-1232 Compliant (AAR ANPRM comments) (P6)	0.0639	0.0457	76.0%	76.6%	51.5%	55.6%	-	-
New Proposal (P11)	0.0421	0.0293	84.2%	85.0%	68.0%	71.5%	34.1%	35.9%



Tank Car Predictions

- Flammable liquids with a Reid Vapor Pressure $\geq ?$ psi will require the use of a DOT 105, 112, 114, or 120 tank car, or a robust DOT 111 tank car nearly conforming to one of the above standards.
- Flammable liquids with a Reid Vapor Pressure $< ?$ psi will require the use of a DOT 111 CPC-1232 tank car.
 - The two elements above will not occur overnight, and therefore, the industry may want to consider a phased approach.
- All tank cars in flammable liquid service will require modifications to the pressure relief device and bottom outlet valve handle.
- Pre-DOT 111 CPC-1232 cars in flammable liquid service will be phased out, unless modified to provide an equivalent level of safety with respect to the CPC-1232 cars.



