

# Best Practices for Loading Bobtails & Transports



UNITED IN MEETING TODAY'S CHALLENGES:

THE PROMISE OF  
**PROPANE**





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# Ice Breaker

By a show of hands, How many of you have:

- 30 or more years in the Industry?
- Your working on your third decade?
- Your in your second decade?
- Less than 10 years?



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# Ice Breaker

- How many of you are Marketers operating a Bulk Plant or Terminal?
- Service Technicians / Bobtail Operators
- Transport Operators
- Service providers/manufactures
- Engineering firms/consultants/regulatory
- Any others?
- Fans of propane?



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Stubborn = Resolute = Admirably Purposeful,  
Determined and unwavering



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# Perspective Alignment

- **This session is not intended to be consultative for any one application; it is intended to be a high-level discussion that applies to multiple industry segments and in no way illustrates all of the requirements for any particular location or industry segment.**
  - my hope is that you take some relevant “nuggets” back to your own operation and reevaluate things a bit - especially if it has been a while since you last did so..

**“The danger of repetition is it feels comfortable long after it has lost usefulness” - David Rockwell (Leadership Freak Blog)**



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# Perspective Alignment

If you are Storing / Transferring; offering for transportation; and or selling LP there are a number of groups that expect you to do things a certain way:



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# Perspective Alignment

- NFPA 58 (NFPA 30 for other flammable Material)
- State/Local Government
- ASME (Tank Design and Certification; Pipe welding - NFPA 58 6.11.3.1 requires compliance with ASME B31.3)
- DOT: PHMSA ; FMCSA; FRA
- AHJ
- OSHA (Federal and State)
- Federal/ State EPA
- SARAH Title iii (Superfund Amendments and Reauthorization Act, the Emergency Planning & Community Right-to-know Act)
- Industry stakeholders
- Neighbors of the facility
- Nist Handbook 44 (Specifications, Tolerances, and Other Technical Requirements for Weighing and Measuring Devices)



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# Perspective Alignment



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# Perspective Alignment

**Highly Regulated Industry + Hiring Challenges = The struggles are real**

- What tools are you giving your team?
  - Training
  - Policies/Procedures
  - Equipment
- Main goal is to ensure that they can operate safely and efficiently in such a way to prevent personal injuries or disasters.
- With the ever changing employee pool, do they have the basic knowledge to properly respond to an Abnormal Operating Condition?



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# Educate vs Train

**Training** is the process of learning something with a goal of performing a specific skill or behavior.

**Education**, on the other hand, is the systematic process of learning something with a goal of acquiring knowledge.



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# Abnormal Operating Condition Defined

49CFR195.503 (PHMSA)

- Abnormal operating condition means a condition identified by the operator that may indicate a malfunction of a component or deviation from normal operations that may:
  - Indicate a condition exceeding design limits; or
  - Result in a hazard(s) to persons, property, or the environment.
- Evaluation means a process, established and documented by the operator, to determine an individual's ability to perform a covered task.
- Qualified means that an individual has been evaluated and can:
  - Perform assigned covered tasks and
  - Recognize and react to abnormal operating conditions.



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# Back to the Basics

Does your team have a basic understanding of the physical characteristics of the products you are dealing with?



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	Propane	Butane	Natural Gas (Methane)
Chemical Formula	<b>C3H8</b>	C4H10	CH4
Specific Gravity of Liquid	<b>.504</b>	.582	.3
Vapor Density	<b>1.50</b>	2.01	.60
Atmospheric Boiling Point	<b>-44 F</b>	31 F	-260 F
Ignition Temperature	<b>920-1120 F</b>	900-1000 F	1,500 F
Upper Flammability Limit	<b>9.6%</b>	8.6%	14%
Lower Flammability Limit	<b>2.15%</b>	1.55%	4%
Ideal Combustion Ratio (Air to Gas)	<b>24 to 1</b>	31 to 1	10 to 1



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# Effects of Pressure and Temperature on Propane

Propane behaves in different ways when it is stored in containers under varying conditions; the three relationships concerning this behavior that must be understood:

1. The effect of heat on liquids
2. Liquids and their boiling points
3. Storing liquids above their normal boiling points in a closed container



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# The effect of heat on liquids

- Whether the liquid is water or propane, heat added to a liquid will always cause it to expand.
  - This results in an increase in the volume of liquid
    - Volumetric metering must be Temp Compensated



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# Propane Volume Correction Factor

- **60 degrees Fahrenheit = 1 gallon**
- 30 degrees Fahrenheit = 1.047 gallons
- 90 degrees Fahrenheit = 0.949 gallons
- 10,000 gallons:
  - At 30 degrees F = 10,470 gallons
  - At 90 degrees F = 9,490 gallons



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# Liquids and their boiling points

- The boiling point of a liquid is the temperature at which a liquid will change to a vapor under normal atmospheric conditions.
  - Water boils at 212 degrees F
    - Everest: 156 Deg F
    - Dead Sea: 214 Deg F
- Heat added to a liquid will proportionately raise the temperature of the liquid as long as the liquid temperature is below its boiling point.



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# Key Properties of all LP-Gases

- LP-gases will expand when heat is applied
  - If stored inside a container, this expansion will increase the volume of the liquid and the pressure inside the container.
- Under normal outdoor temperatures LP-gases expand rapidly into gas.
  - One cubic foot of liquid propane will boil off and produce 270 cubic feet of propane vapor.



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## Vapor Pressures of LP-Gasses

Temperature		Approximate Pressure (PSIG)	
(°F)	(°C)	Propane	Butane
-30	-34	8	
-20	-29	13.5	
-10	-23	23.3	
0	-18	28	
10	-12	37	
20	-7	47	
30	-1	58	
40	4	72	3
50	10	86	6.9
60	16	102	12
70	21	127	17
80	27	140	23
90	32	165	29
100	38	196	36
110	43	220	45



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• Vapor pressure of a large quantity mix of NH3 and Propane

Temperature (°F)	Vapor Pressure (psi)
-30	5
-20	14
-10	26
0	39
10	56
20	75
30	97
40	122
50	152
60	186
<b>70</b>	<b>224</b>
<b>80</b>	<b>268</b>
<b>90</b>	<b>317</b>
<b>100</b>	<b>371</b>



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# How can we apply this to quality control?

- Verifying the temp and pressure readings of inbound transports prior to unloading **& Document**
- **Documented** temp and pressure readings of storage tanks daily and after receiving a delivery
- **Documented** temp and pressure readings of Bobtail after each fill
- **Documented** temp and pressure readings of transport after filling
  - If able, of the tanks prior to filling.



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# Responding to AOC's

With a basic understanding of the product.



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## Potential AOC's during a Transport Delivery of LP?

- Temp/pressure out of line
- Smoking/hot trailer brake
- Tractor regenerates at the offload location
- Bill of Lading/Manifest doesn't indicate added Odorant
- Arrives wearing jeans, tennis shoes and a tank top



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## Potential AOC's during Bobtail Filling

- Operator sitting in the cab while filling
  - Truck running to stay warm
- Pumps and piping buried in snow
- Truck not bonded
- Driver not wearing PPE
- Driver Parks a full truck in a building
- Hot work in the area



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## Potential AOC's during Transport Filling

- New Driver
- Trailer out of date
- Facility ESV's Slam shut
- Driver wants to “stir the tank”
- Driver insists on loading in gross vs net gallons
- Second truck in line doesn't leave enough space



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# Facility Design

- Traffic Flow
- Flow Rates
  - Tank monitors
- Driver location while transferring
- Component location
- Type/size of meter
- Meter proving



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# Volumetric Prover



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# Electronic Meter Pulses

3 Inch Turbine:

- K-factor: 51.03 pulses per gallon
- Meter factor: 1

10,000 pulses divided by 51.03 = 195.96 gallons  
per run with a loop prover



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# Loop (Ball) Prover



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# Small Volume Prover



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# Summary

- Take a close look at each aspect of your operation and determine how you want it operated (risk tolerance)
- Identify potential AOC's
- Define SOP's (BMP's) that address both items above
- Educate (document), evaluate (document), & repeat



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# Summary

**WE ALL NEED TO BECOME VERY PROFICIENT AT HOW WE EDUCATE OUR TEAMS!**



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# Available Resources

- Local Associations
- NPGA
- PERC



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# Questions?



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