Methodology, Results, and Recommendations of the 2022 NCWM-NIST National Survey on 20 lb LPG (Propane) Cylinders

David Sefcik, Leader
National Legal Metrology Program
Office of Weights and Measures (OWM)
Overview

• Why a National Survey?
• Background and Scope of Survey
• Results
• Recommendations
Role of NIST OWM

- The NIST Office of Weights & Measures (OWM) cooperates with other Federal agencies, states, other countries, standards development organizations, business and industry and the National Conference on Weights and Measures (NCWM) to develop uniform laws and regulations related to legal metrology.
- NIST supports commercial measurement systems by providing traceability, uniform laws, regulations, training, technical and other assistance to administrators, metrologists and field enforcement officials as well as to business and industry.

Learn more about OWM here: www.nist.gov/owm
Role of NIST OWM

- The National Institute of Standards and Technology (NIST) is a non-regulatory agency of DOC.

- NIST has **statutory responsibility** to promote “cooperation with the states in securing uniformity in weights and measures laws and methods of inspection”.

- NIST has a duty under the Fair Packaging and Labeling Act (FPLA): Sec. 1458. Cooperation with State Authorities; Transmittal of Regulations to States.

Learn more about OWM here: [www.nist.gov/owm](http://www.nist.gov/owm)
# Participating Counties (and City)

<table>
<thead>
<tr>
<th>California</th>
<th>New York</th>
<th>Ohio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Almeda</td>
<td>Otsego</td>
<td>Fayette</td>
</tr>
<tr>
<td>El Dorado</td>
<td>Westchester</td>
<td>Lucas</td>
</tr>
<tr>
<td>Lassen</td>
<td>Putnam</td>
<td>Huron</td>
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<tr>
<td>Lake, Mendocino</td>
<td></td>
<td>Licking</td>
</tr>
<tr>
<td>Napa, Orange</td>
<td></td>
<td>Franklin</td>
</tr>
<tr>
<td>Sacramento</td>
<td></td>
<td>Columbus (City)</td>
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<tr>
<td>San Luis Obispo</td>
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<td>Cuyahoga</td>
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<td>San Bernadino</td>
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<td>Wayne</td>
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<td>San Mateo</td>
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<td>Homes</td>
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<td>Yolo</td>
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Why Conduct a National Survey?

NCWM Chairman Ivan Hankin’s vision:

• Systematic problems in the marketplace
• Promotion of Equity
• Role of W&M in marketplace
• DOT Final Rule
Why Conduct a National Survey?

In 2020, nearly 9.5 BILLION gallons of LPG were sold in the U.S.

- Included the sale of over 40 MILLION 20 lb cylinders of LPG
### 2.16. Method of Sale Regulation

(NIST Handbook 130 “Uniform Laws and Regulations”)

**Allowable Difference.**

± ½ % for tare weights of 9 kg (20 lb) or less; or

**Average Requirement.** – When used to determine the net contents of cylinders, the stamped or stenciled tare weights of cylinders at a single place of business found to be in error predominantly in a direction favorable to the seller and near the allowable difference limit shall be considered to be not in conformance with these requirements.

± ¼ % for tare weights of more than 9 kg (20 lb)

<table>
<thead>
<tr>
<th>DOT Federal Regulation - Dec 28, 2022</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tolerance.</strong></td>
</tr>
<tr>
<td>Minus 3 % or plus 1 % for a cylinder that weighs (25 lb) or less.</td>
</tr>
</tbody>
</table>

**Does Not Include an Average Requirement**

- Minus 2 % or plus 1 % for a cylinder that weighs greater than 25 lb.
Background: 1990 NCWM Adoption of Tare Weight Requirements for Compressed Gas Cylinders

- Purpose to ensure equity in the marketplace
- Existing requirements in place for over 30 years
- States unanimously adopted ± 0.5 % allowable difference
New Federal Requirements for MINUS Errors
Effective December 2022

Potential Loss of Over $30 Million to Industry

<table>
<thead>
<tr>
<th>Steel</th>
<th>Tare Weight</th>
<th>Allowable Difference</th>
<th>Calculation</th>
<th>Allowable Difference in lb</th>
</tr>
</thead>
<tbody>
<tr>
<td>HB 130</td>
<td>16.6 lb</td>
<td>½ %</td>
<td>$0.005 \times 16.6 = $</td>
<td>- 0.083 lb</td>
</tr>
<tr>
<td>DOT 22</td>
<td>16.6 lb</td>
<td>3.0 %</td>
<td>$0.03 \times 16.6 = $</td>
<td>- 0.498 lb</td>
</tr>
</tbody>
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</thead>
<tbody>
<tr>
<td>HB 130</td>
<td>18 lb</td>
<td>½ %</td>
<td>$0.005 \times 18 = $</td>
<td>- 0.09 lb</td>
</tr>
<tr>
<td>DOT 22</td>
<td>18 lb</td>
<td>3.0 %</td>
<td>$0.03 \times 18 = $</td>
<td>- 0.36 lb</td>
</tr>
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</table>
New Federal Requirements for PLUS Errors Effective December 2022

Potential Loss of Over $10 Million to Consumers

<table>
<thead>
<tr>
<th>Steel</th>
<th>Tare Weight</th>
<th>Allowable Difference</th>
<th>Calculation</th>
<th>Allowable Difference in lb</th>
</tr>
</thead>
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<tr>
<td></td>
<td>HB 130</td>
<td>16.6 lb</td>
<td>½ %</td>
<td>0.005 x 16.6 =</td>
</tr>
<tr>
<td></td>
<td>DOT 22</td>
<td>16.6 lb</td>
<td>1.0 %</td>
<td>0.01 x 16.6 =</td>
</tr>
</tbody>
</table>

Steel

<table>
<thead>
<tr>
<th>Steel</th>
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49 CFR states that “an accurate scale must be used to check the weight of liquified gas filled in the cylinder”

- NIST HB 44 Specifications, Tolerances and Other Technical Requirements is the “standard” for all states and USDA.
- The recommendation would be for DOT to place the same requirement (NIST HB 44) as part of its regulations
SCOPE:

1. To collect data comparing the actual tare weight of new and used cylinders to the stamped tare weight

2. To evaluate the Methods of Sale, Price Posting and Fill Procedures used at Direct Sale Refilling Locations

3. To determine net content compliance at exchange locations
PHASE 1: Actual vs stamped tare weight of NEW and USED cylinders

- Data collected at the Plant
  - New cylinders also tested at retail
- All cylinders verified to be empty (evacuated)
- Conducted in February 2022
PHASE 1: Actual vs stamped tare weight of NEW and USED cylinders

- 9,482 NEW cylinders tested
  - 702 lots
- 1,535 USED cylinders tested
  - 71 lots
### Summary of Percentage of New and Used Cylinders within Specified Tolerances

<table>
<thead>
<tr>
<th>Range of Tolerance (%)</th>
<th>New Cylinders (n = 9,482)</th>
<th>Used Cylinders (n = 1,535)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(− 0.5 to 0) %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(0 to + 0.5) %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(− 3 to 0) %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(0 to + 1) %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
PHASE 2: Direct Sale Refilling Locations

1,559 Locations Tested

- Method of Sale
- Fill Procedures
- Price Posting
PHASE 2: Direct Sale Refilling Locations

Method of Sale

- Weight?
- Volume?
- Flat Fee?
### PHASE 2: Direct Sale Refilling Locations

<table>
<thead>
<tr>
<th>Method of Sale (1,559 locations)</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight Only</td>
<td>11.0 %</td>
</tr>
<tr>
<td>Volume Only</td>
<td>53.6 %</td>
</tr>
<tr>
<td>Weight and Volume</td>
<td>2.2 %</td>
</tr>
<tr>
<td>Flat Fee Only</td>
<td>24.7 %</td>
</tr>
<tr>
<td>Combination of Weight and/or Volume, with a Flat Fee</td>
<td>8.5 %</td>
</tr>
</tbody>
</table>
PHASE 2: Direct Sale Refilling Locations

Fill Procedures

Only 2 Verification Methods Allowed:

1. By weight
2. By using “bleeder valve”

Verification by Overflow Protection Device (alone) is not permitted
### PHASE 2: Direct Sale Refilling Locations

#### Fill Level Verification Methods

<table>
<thead>
<tr>
<th>Fill Level Verification Method</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight Only</td>
<td>26.2 %</td>
</tr>
<tr>
<td>Bleeder Valve only</td>
<td>33.0 %</td>
</tr>
<tr>
<td>OPD Only</td>
<td>10.0 %</td>
</tr>
<tr>
<td>Combination of Weight, Bleeder Valve, and or OPD</td>
<td>30.8 %</td>
</tr>
</tbody>
</table>
PHASE 2: Direct Sale Refilling Locations

Price Posting at the 1,559 locations

• Only 6 of the 18 (1/3) states participating require price posting
• In 6 states that require price posting, only 68% posted prices
• In 12 states that do not require price posting, only 30% posted a price
PHASE 3: Exchange Locations

- Net Content Verification
- Product Left Behind
PHASE 3: Exchange Locations

**Net Content Verification**

- 959 lots tested
- 10,456 cylinders inspected
PHASE 3: Exchange Locations

Net Content Verification

• 959 lots tested – 74.2% passed (25.8% or 1 of 4 failed)

• of the 25.8% that failed:
  o 66 % (2 of 3) failed on the MAV alone
  o 5 % failed on the Average Requirement alone
  o 29 % failed on both the MAV and Average
PHASE 3: Exchange Locations

Cylinders Exceeding the Safe Fill Level

118 cylinders filled beyond 20 lb safe fill level
PHASE 3: Exchange Locations

Product Left Behind

Based on 6,896 cylinders tested, an average of 25.4 % of consumers return more than 1 lb of propane remaining

- 58.8 % of cylinders contained up to 1 lb
- 10.6 % of cylinders contained between 1 lb to 3 lbs
- 5.6 % of cylinders contained between 3 lbs to 5 lbs
- 9.1 % of cylinders contained over 5 lbs
- 15.9 % of cylinders were either empty (0 lb) or had negative values (< 0 lb)
Where are we now?

Survey completed and published in October 2022

• Plans to revise the MOS based on study results
• Continue inspections to ensure compliance
• Address key recommendations from study
• Petition U.S. DOT
Recommendations from Survey

• Industry Evaluate, Develop and Ensure Good Quantity Control Practices

• Industry must ensure that any weighing and measuring device meets the requirements of NIST Handbook 44

• That future DOT regulations include a requirement that scales must meet NIST Handbook 44

• DOT adopt the “Average Requirement” to tare regulations
Other Future Considerations

Relevant to and underpinning Marketplace Equity:

• Manufacturing
• Safety
• Consumer Protection
• Consumer Education
Future Considerations

Improving Manufacturing Processes:

• CGA and NPGA to establish new practices to ensure tare weight for new and used cylinders are within established tolerances throughout the cylinder’s life in the supply chain

• PERC to develop Good Quantity Control Practices for the industry and provide training to members

• CGA and NPGA add requirements for meeting the “Average Requirement” and “Maximum Allowable Variation” as part of their best practices for Good Quantity Control
Future Considerations

Improving Safety:

• NPGA working with their members to eliminate overfilling beyond the safe fill level

• NPGA working with Direct Sale Refilling Locations to ensure proper training takes place to ensure the correct procedure is used to determine the safe fill level
Future Considerations

Informing and Educating Consumers:

- PERC to educate consumers on product remaining in cylinders when performing an exchange or returns.

- NCWM to engage states that allow 20 lb cylinders of LPG to be sold by flat fee sales. Develop protections for consumers to receive credit for product returned in tank, which may require pricing and unit pricing.

- NCWM consider developing price posting requirements at the Direct Sale Refilling Location.
Future Considerations

Ensuring Marketplace Equity:

• The focus of this survey was on 20 lb cylinders but there may be similar issues and concerns for other types of compressed gases (acetylene, oxygen, argon, nitrogen, helium and hydrogen)

• All States to perform more routines inspections and enforcement beyond the 20 lb cylinders. Typical sizes of portable LPG cylinders in the marketplace can range from 1 lb to 100 lb.

• States should develop a program to ensure the accuracy of scales being used at the plant and at direct sale refilling locations
Ensuring Marketplace Equity (cont’d):

• Industry and their trade associations should consider conducting a “root cause analysis” to determine any underlying processes or procedures that may be contributing to non-compliance

• DOT to review and reconsider its tolerances which are based on safety, to recognize and include economic protection
NCWM Petition to DOT Pipeline and Hazardous Materials Safety Administration (PHMSA) in 2023

1. Re-evaluate the allowable differences to take into account:
   
   • Existing state law (NIST Handbook 130, ± 0.5% allowable difference)
   
   • Consider the data provided based on a National Survey
   
   • Clarify the stamped tare weight must be accurate for the life of the cylinder
NCWM Petition to DOT Pipeline and Hazardous Materials Safety Administration (PHMSA) in 2023

2. Consider citing and adopting NIST Handbook 44 as the DOT accuracy standard for scales used to weigh LPG cylinders

3. Consider adding an “Average Requirement” to improve measurement accuracy and production controls and to ensure a business is not using the allowable difference to gain a competitive advantage
Summary

“We believe narrower tolerances than currently specified in 49 CFR 178.35 are achievable and will provide safe handling and safe filling of cylinders, while helping to ensure equity for buyers and sellers in commercial transaction.”