MEASUREMENT MATTERS

News from the Office of Weights & Measures

July 2021 Volume 11, Issue 3

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Office of Weights and Measures

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Dr. Katrice Lippa to Become Chief of the Office of Weights and Measures

Byline: Douglas A. Olson

Dr. Katrice Lippa has been selected as the next Chief of the Office of Weights and Measures (OWM). Katrice brings a wealth of knowledge and experience as a leader and innovator in scientific and technical organizations with her to the position of OWM Chief. Since completing her Ph.D. in environmental chemistry in 2001, she has spent her professional career at NIST in a variety of roles as a research chemist, senior scientific advisor, and most recently as the leader of the Organic Chemical Metrology Group. That Group develops and promotes standard reference materials and data products for organic species in clinical diagnostics and metabolomics, food nutritional labeling, food safety, natural products, and chemical manufacturing and forensics project areas.

Katrice has held leadership positions in a number of high-impact national and international standards development activities, including the Metabolomics Quality Assurance and Quality Control Consortium (mQACC), the International Bureau of Weights and Measures (BIPM) Consultative Committee of Amount of Substance (CCQM), the Chemical Metrology Working Group of the Inter-American Metrology System (SIM), and the IUPAC Working Group on SI Value Assignment of the Purity of Organic Compounds. This article Katrice wrote in the NIST ***Taking Measures*** blog explains the role of accurate, trusted chemical measurements in assuring our quality of life and strengthening the national economy and international trade.

While at NIST, Katrice has been awarded a Department of Commerce Bronze Medal for the development of the "first of its kind" Primary Standard for quantitative nuclear magnetic resonance (qNMR) spectroscopy, and the Allen V. Astin Measurement Science Award for the successful NIST Vitamin D metrology

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Dr. Katrice Lippa to Become Chief...

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program. She has been a peer assessor for the National Research Council of Canada and the National Measurement Institute of Australia. Katrice has mentored young scientists and taught in the NIST Summer Institute for Middle School Science Teachers. Katrice places a high value on staff development and stakeholder engagement.

Dr. Douglas Olson, retiring chief of OWM, commented on the selection: "I could not be more pleased to welcome Dr. Lippa as the next Chief of OWM. I have known Katrice for many years, back when we were both working on measurement service activities for the BIPM. Katrice is a strategic thinker who has had a tremendous impact in all the programs she has led at NIST. She will lead OWM and legal metrology into the future, while maintaining its excellence in standards development, training, and traceability that has been its strength."

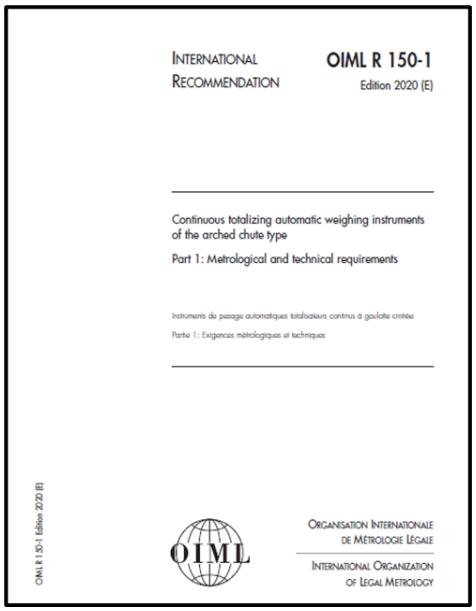
Katrice will begin in her role as OWM Chief on July 18, 2021.

The International Organization of Legal Metrology Adopts a New Recommendation for Arched Chute Type - Automatic Bulk Weighing Systems

Byline: Kenneth Butcher

The International Organization of Legal Metrology (OIML) has published a new international recommendation for automatic bulk weighing systems that use the arched chute type design weighing element.

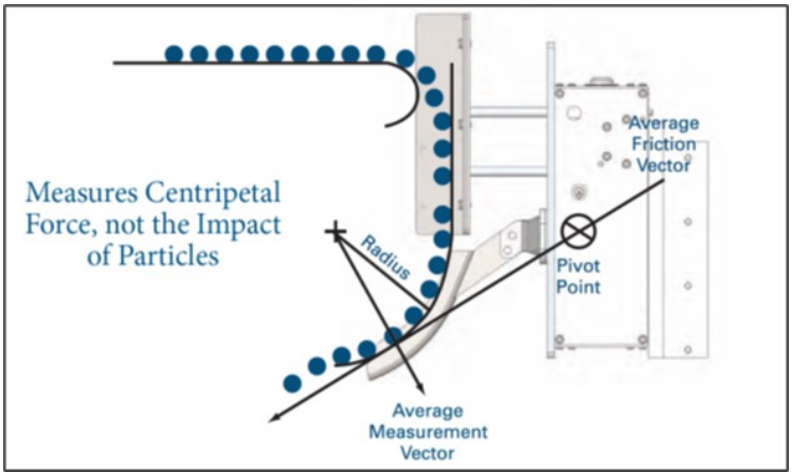
The recommendation, titled R 150-1, ***Continuous Totalizing Automatic Weighing Instruments of The Arched Chute Type*** is available for free download on OIML's website.



Credit: International Organization of Legal Metrology.

Designed for use in continuous weighing applications such as filling trucks, unit-trains, barges, and ships with coal, grain, ores, or any other flowable materials, these devices can be adapted for a wide range of applications including in-line production processes.

An arched chute type weighing device is designed so the vertical flow of the product affects centripetal force (not the impact of the product particles) proportionally to the weight of the product, passing along the circular arched surface of the force receptor. This concept is illustrated in the following graphic, used with permission from Eastern Instruments of Wilmington, North Carolina (pictured left).



Additional information about these devices can be found in the July 2016 edition of the ***OIML Bulletin***, which is available for free download on OIML's website. The article, ***Continuous Totalizing Weighing Instruments of the Arched Chute Type*** by Vincent Van Der Wel,

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OIML Adopts a New Recommendation for Arched Chute Type...

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Vice President, CECIP (an association of European manufacturers of weighing devices), begins on page 9.

One of the leading developers and manufacturers of these devices in the U.S. is Eastern Instruments, located in Wilmington, North Carolina. On their website, the company provides additional technical and operational information, along with videos illustrating the arched chute devices in operation, weighing everything from soy beans to ores, and even crushed aluminum cans. At the present time, these devices are primarily used in production processes, but their use is expanding internationally into legal for trade applications, which was one reason for OIML's decision to develop R 150-1.

For more information or questions, please contact Kenneth Butcher at **kenneth.butcher@nist.gov** or 301-975-4859.

Draft of Handbook 105-2 Posted for Comments

Byline: Micheal Hicks

The Office of Weights and Measures (OWM) is in the process of updating the NIST Handbook (HB) 105 series of documentary standards based on feedback from users regarding measurement feasibility and requirement concerns. In particular, OWM plans to update: **NIST HB 105-2,** ***Specifications and Tolerances for Field Standard Measuring Flasks***; **NIST HB 105-6,** ***Specifications and Tolerances for Thermometers***; and **NIST HB 105-7,** ***Specifications and Tolerances for Dynamic Small Volume Provers*** in the next couple of years. Currently, OWM is working on updates to NIST HB 105-2 due to tolerance requirements being more stringent than can be supported by most calibration laboratories and needed by the end users at the smaller nominals.

A draft of **NIST HB 105-2** for field standard glassware (last published in 1996) has been posted for comments on the OWM website. You can download and review the document and submit comments via a Word document or via the OWM Contacts System (instructions provided at the link).

The document has been reviewed against the latest requirements published in **NIST HB 44,** ***Specifications, Tolerances, and Other Technical Requirements for Weighing and Measuring Devices*** and **NIST HB 133,** ***Checking the Net Contents of Packaged Goods*** as well as the International Organization of Legal Metrology (OIML) and ASTM International references contained in the document. The primary updates being made relate to the decision rules associated with conformity assessments and statements of compliance.

Comments and proposed language for suggested changes should be submitted by Friday, October 1, 2021. The **draft of HB 105-2**, **comment form**, and **instructions** can be found on OWM's website.

Please contact Micheal Hicks at **micheal.hicks@nist.gov** with any questions.

Liquified Petroleum Gas 20 Pound Cylinders

Byline: David Sefcik

Pictured is an LPG 20 lb cylinder. Photo by David Sefcik.

Grilling and cooking, firepits, outdoor heat lamps, indoor heating, water heaters, furnaces, food trucks, RVs, power generators, yard equipment…the list goes on for the many uses of liquified petroleum gas (LPG), commonly called propane. Inspectors who verify the net content of LPG cylinders must have adequate knowledge of the product and take the proper precautions to ensure safety.

OWM is offering a webinar to provide officials with training on LPG. This 5-hour webinar will include a morning and afternoon session, with a 1-hour break in between. Participants will learn about the properties of LPG, where and how it is sold, ways cost and value comparisons (advertising) are being done, the method of sale, proper tare determination, labeling requirements, net content verification, and how to analyze test data.

There are no prerequisites to attend Part 1 of the LPG webinar series. OWM will also host parts 2 & 3 of the webinar series, ***Verifying the Net Contents at Refilling Locations and Point of Pack***. For additional information and to register, please see the OWM **Calendar of Events**.

Usage

There has been a significant increase in household and recreational use of LPG over the past decade. Exchange sites are now located at most retail locations, such as supermarkets, drugstores, hardware stores, and gas stations. There is even home delivery of the 20 lb LPG cylinders and 24-hour automated vending machines. In 2019 alone, there were over 10 billion gallons of propane sold, including over 50 million cylinders (**Propane Education and Research Council *Annual Retail Propane Sales Report 2019***).

The 20 lb LPG cylinder is the most common size in exchange programs, though they can be other sizes (e.g., 1 lb, 15 lb, 100 lb). It is called a 20 lb cylinder because that is the total weight of propane it will safely hold. Though it will safely hold 20 lb, most 20 lb cylinders are filled and labeled to a net weight of 15 lb. The total weight of a full cylinder, which includes the weight of the propane and the weight of the cylinder itself, can be close to 40 lb.

Properties of Propane

Propane gas is typically a mixture of propane and other gases, such as hydrocarbon gases (e.g., butane). Propane is colorless, odorless, and tasteless. But an additive must be added for safety reasons so that it will emit a smell (like a skunk) when exposed to oxygen. Even though propane is non-toxic, it is dangerous to inhale the vapor, which can cause dizziness, headache, and nausea at low concentrations and asphyxiation at high concentrations.

Propane has a specific gravity, based on 15.6 °C (60 °F) and 101 kPa (14.7 psia), that is 1.52, making it 1.52 times heavier than room temperature air. As a result, when released, the vapor will flow to the lowest point of a structure (e.g., drains, basements).

Method of Sale

The method of sale, or how LPG must be sold, can be found in **NIST Handbook 130 (HB 130), *Uniform Laws and Regulations in the Areas of Legal Metrology and Fuel Quality, Section 2.21. Liquified Petroleum Gas.***

LPG in general can be sold by weight, liquid measure, or gas vapor.

- The legal requirement for LPG sold in 20 lb cylinders is by the weight in either kilogram or pound.

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Liquified Petroleum Gas 20 Pound Cylinders

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- Refillers (e.g., when a 20 lb cylinder is taken to a refill location) of LPG can fill by liquid by the liter, defined at 15.6 °C (60 °F), or liquid by the gallon, defined at 231 in^3 at 15.6 °C (60 °F). Even though it is filled and sold by volume, federal law still requires that the seller verify the quantity by weight. This is done for safety reasons, primarily to prevent overfilling.
- LPG can also be sold by the cubic meter of gas vapor. A metered cubic foot of vapor [defined as 1 ft^3 at 60 °F (15.6 °C)], or the gallon [defined as 231 in^3 at 60 °F (15.6 °C)]. Selling by gas vapor often involves sub-metering, such as with supplying gas to apartment buildings or trailer parks using an underground or above ground storage tank.

Net Content Verification

The legal requirement for LPG sold in 20 lb cylinders is by weight. Whenever cylinders are used for the sale of compressed or liquefied gases by weight, or are filled by weight and converted to volume, the following must be applied for accurate net content verification. This can be found in **NIST HB 130, *Uniform Laws and Regulations in the Areas of Legal Metrology and Fuel Quality, Section 2.16. Compressed or Liquified Gases in Refillable Cylinders***.

- **Stamped or Stenciled Tare Weight** – For safety purposes, the tare weight shall be legibly and permanently stamped or stenciled on the cylinder. All tare weight values must be preceded by the letters "TW" or the words "tare weight." The tare weight must include the weight of the cylinder (including paint), valve, and other permanent attachments. Though not included as part of the stamped or stenciled tare weight, the weight of the label and the weight of the protective cap must be included in the total tare weight when verifying the net contents.
- **Allowable Difference** – If the stamped or stenciled tare is used to determine the net contents of the cylinder, the allowable difference between the actual tare weight and the stamped or stenciled tare weight, or the tare weight on a tag attached to the cylinder for a new or used cylinder, must be within the tolerances below. Comparing the actual to the stamped or stenciled tare weight is typically done at the plant.

  (1) ± $^1/_2$ % for tare weights of 9 kg (20 lb) or less; or

  (2) ± $^1/_4$ % for tare weights of more than 9 kg (20 lb).

- **Average Requirement** – At a single place of business, when used to determine the net contents of cylinders, the stamped or stenciled tare weights of cylinders found to be in error predominantly in a direction favorable to the seller and near the allowable difference limit is considered a method of sale violation.

New Department of Transportation Regulations

New Department of Transportation (DOT) Federal Regulations are set to go into effect and will be enforceable after December 28, 2022. The new requirements described below would increase the current tolerances found in **NIST HB 130, *Uniform Laws and Regulations in the Areas of Legal Metrology and Fuel Quality***. Unless opposing feedback regarding the new requirements is submitted to DOT prior to the effective date, the new regulation will automatically take effect on December 28, 2022.

- **Allowable Difference or Tolerance** – If the stamped or stenciled tare is used to determine the net contents of the cylinder, the tolerance between the actual tare weight and the stamped tare weight, shall be:

  (1) Minus 3 % or plus 1 % for a cylinder that weighs 11.34 kg (25 lb).

  (2) Minus 2 % or plus 1 % for a cylinder that weighs more than 11.34 kg (25 lb).

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Liquified Petroleum Gas 20 Pound Cylinders

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Currently in NIST HB 130 for cylinders that weigh 20 lb or less, the plus or minus tare weight is ½ %. Under the new DOT regulation, cylinders that weigh 25 lb or less, the minus tare weight tolerance will change to 3 % (more than 6 times the NIST HB 130 tolerance) and the plus tare weight will change to 1 % (double the NIST HB 130 tolerance).

For cylinders that weigh more than 25 lb, it gets even less stringent under the new DOT regulations. The minus tare weight tolerance will change to 2 % (8 times the NIST HB 130 tolerance) and the plus tare weight will change to 1 % (4 times the NIST HB 130 tolerance).

- **Average Requirement** – The DOT regulations do not recognize the "Average Requirement" (as required in NIST HB 130, Method of Sale Regulation), which ultimately will be removed.

Labeling Requirements

A cylinder is considered a package under the **NIST HB 130, *Uniform Packaging and Labeling Regulation* (UPLR).** Exchange cabinets and vending machines must also meet the requirements of the UPLR.

National Fire Protection Association 58 "Liquified Petroleum Gas Code"

The National Fire Protection Association (NFPA) is a non-profit organization that publishes a *Liquified Petroleum Gas Code*. All states adopt this code as their law. Most state and local fire marshals have also adopted this code as their law. The requirements found in NFPA 58 do not conflict with Federal Regulation or NIST HB 130, Method of Sale Regulation. NFPA 58 also provides valuable information on ensuring safety in the handling of LPG.

Next Steps

State weights and measures can play a key role in collecting and analyzing data from inspections. Some items that need to be addressed prior to determining next steps include:

- A better understanding of net weight compliance. This data could be used to show the consumer and industry impact of both underfill and overfill and could point to the need for development of new good quantity control practices for the LPG industry.
- Overfill and Underfill Levels – this data can be used to show that current industry filling procedures are adequate, or that there is a need for the states to work with the National Propane Gas Association (NPGA), NFPA, Occupational Safety and Health Administration (OSHA), and U.S. DOT to cooperate on establishing better procedures and oversight.
- Returned LPG cylinders need to be examined more closely to determine how much (if any) that consumers leave in the cylinders. This data could be used to develop informational and educational materials for consumers on good practices to save money and make value comparisons. It can also be used to reinforce the need for good weighing practices at refilling stations.
- Data is needed comparing stamped and stenciled tare weight accuracy to the actual tare weight. This is typically done at the plant. This data could show justification to petition DOT to reconsider its new regulations so that current requirements in NIST HB 130 method of sale are not preempted.
- Another consideration should be to develop a more comprehensive method of sale regulation for LPG in NIST HB 130 that would provide clear guidance on good weighing procedures, advertising, unit pricing, and other opportunities. This would provide an easily accessible reference for all weighing and net content requirements instead of having the principles spread among different state regulations, federal regulations, and industry standards.

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Liquified Petroleum Gas 20 Pound Cylinders

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Please contact David Sefcik at **david.sefcik@nist.gov** or Lisa Warfield at **lisa.warfield@nist.gov** or **OWM@nist.gov** or phone (301) 975-4004 for additional assistance and information.

New SI Superheroes Video

Byline: Elizabeth Benham

Figure 1. Updated animation style for the NIST League of SI Superheroes. Credit: J. Wang and B. Hayes/ NIST.

Figure 2. Guardians of the SI Characters include 7 superheroes and 1 villain. Credit: J. Wang and B. Hayes/NIST.

NIST has released the fourth installment of the SI superheroes animated video series, featuring an updated animation style (Figure 1). The Measurement League - Guardians of the SI superheroes are part of NIST's efforts to introduce the International System of Units (SI) to middle school students (grades 4 to 6).

Who are the cast of characters in the Measurement League? Professor Second, The Mole, Ms. Ampere, Monsieur Kilogram, Dr. Kelvin, Candela, Meter Man, and Major Uncertainty (Figure 2). The superheroes use measurement superpowers, based on their traditional SI base unit namesakes, to perform amazing feats of science and engineering. Major Uncertainty, the ever-present anti-hero, lurks among the shadows, waiting to introduce measurement challenges into every scenario.

The latest episode, ***Two Truths & a Lie***, begins shortly after Monsieur Kilogram's rescue. After capturing Major Uncertainty, the team is ready to take a break and play a game where the superheroes each share three fun statements about themselves. The challenge is that all statements are not true! Team members are tasked to analyze each statement and determine the false assertion. Each round is designed so that the video may be paused, allowing students to discuss and vote on which statement is untrue. After voting, the teacher resumes video play to reveal the facts as well as the false statement.

If you haven't seen the previous videos, now is a great time to visit the **NIST YouTube Channel** to catch up:

Episode 1: ***Desperate Measures!*** The SI Superheroes use the power of measurement to help a stranded soccer player get home.

Episode 2: ***Running Out of Time!*** The SI Superheroes battle archvillain Major Uncertainty in a race to keep the world's satellite navigation system "on time."

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New SI Superheroes Video

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Episode 3: ***Mass Hysteria!*** The nefarious Major Uncertainty has kidnapped Monsieur Kilogram, putting the world's measurements of mass in jeopardy.

Companion resources are available on the **NIST education website** including coloring pages and Valentine's Day cards. We're confident that the SI superheroes' fight against uncertainty, imprecision, and inaccuracy will help inspire young people to develop their own SI measurement superpowers and encourage their pursuit of STEM careers. Let us know how you use these education outreach resources within your community (**Tweet @nist**) or **submit feedback online**.

Congratulations to Tina Butcher, Juana Williams, & Lisa Warfield, 2020 DoC Bronze Medal Award Recipients

We are pleased to announce that Tina Butcher (Physical Scientist), Juana Williams (Physical Scientist), and Lisa Warfield (Weights & Measures Coordinator) were 2020 group recipients of the U.S. Department of Commerce Bronze Medal Award. Presented at the **48th Annual NIST Awards Ceremony**, this award recognizes work that has resulted in more effective and efficient management systems as well as the demonstration of unusual initiative or creative ability in the development and improvement of methods and procedures. It is also given for significant contributions affecting major programs, scientific accomplishments, and superior performance of assigned tasks for at least five consecutive years.

Tina, Juana, and Lisa were recognized for their leadership of the U.S. National Work Group for Electric Vehicle Refueling and Submetering, which developed uniform legal metrology requirements adopted in 2019 by the 50 states for electric vehicle refueling and other submetered electricity sales. These standards enable consumers to make informed value comparisons and purchasing decisions and provide charging equipment and electric vehicle manufacturers with guidance to jump-start the construction of a nationwide vehicle charging infrastructure.

Congratulations to Elizabeth J. Benham, 2021 U.S. Metric Association Fellow

We are pleased to announce that Elizabeth J. Benham, NIST's Metric Coordinator, has received the 2021 Fellow Award from the United States Metric Association (USMA). The USMA was founded in 1916 and has long promoted the use of the International System of Units (SI), the modernized metric system, in trade and commerce and other everyday activities through public information and educational efforts and in supporting conversion in business and industry.

The USMA grants the esteemed Fellow Award to members who have demonstrated longtime, active support of USMA activities and metrication. Elizabeth exemplifies this through her active role in organizing and contributing to online meetings with USMA officers as well as hosting the USMA Board of Directors meeting in 2019. These bimonthly online meetings have proven to be a great advancement for USMA officers, providing the opportunity for more timely interaction and engagement. As a result, USMA has been able to increase the number of activities offered on a yearly basis. Thanks to the organizing efforts of Elizabeth, USMA's total activity numbers are now at a higher level than they have been in many years and this joint

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Congratulations to Elizabeth J. Benham...

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effort has improved cooperation between USMA and NIST in promoting the use of the SI in trade, commerce, and other activities.

Elizabeth is one of USMA's most active members and was given this award for her dedicated efforts to collaborate with and assist the USMA. Elizabeth also serves as a judge for USMA's Blake Scholarship Awards program and actively promotes the SI by including USMA information and materials/supplies in NIST's Teachers Kits that are distributed to thousands of teachers and the public around the U.S. each year.

You can learn more about the United States Metric Association at **www.usma.org**.

Article adapted with permission from the USMA's Metric Today Newsletter, Vol 56 No 3.

Shelby Bowers (Geraci) Joins OWM as the Publications Coordinator

Shelby comes to the Office of Weights and Measures from The Maryland-National Capital Park and Planning Commission. There she served as a Publication Information Manager, ghostwriting and editing responses for local government leaders in reply to constituent concerns.

Prior to that role, she served as the Director of the Writing Center at Lancaster Bible College and has taught various undergraduate writing and communications courses. Shelby has a bachelor's degree in Communications from Lancaster Bible College and a master's degree in Communications from Stevenson University.

In her free time, she enjoys adjunct teaching, freelance copywriting and editing, working on her *Stories with Shelby* podcast, reading, and best of all, spending time with her husband Nathan and puppy Teddy.

Calendar of Events

OWM Training Events

Date	Time (Eastern Time Zone)	Event Name	Online or Location	Class
July 13, 2021	11:00 a.m. to 1:00 p.m.	**NIST Handbook 133 - How to Test Animal Bedding**	Online webinar	5741
July 14, 2021	11:00 a.m. to 1:00 p.m.	**NIST Handbook 130 - Examination Procedure for Price Verification**	Online webinar	5742
July 15, 2021	11:00 a.m. to 1:00 pm.	**NIST Handbook 130 - Overview of the Uniform Packaging and Labeling Regulation**	Online webinar	5743
July 22, 2021	2:00 p.m. to 4:00 p.m.	**Document Control and Record Keeping**	Online webinar	5747
July 26, 2021	10:00 a.m. to 3:00 p.m.	**LPG (Propane) - Verifying the Net Contents of 20 lb Cylinders (Part 1)**	Online webinar	5751
July 27, 2021	10:00 a.m. to 12:30 p.m.	**NIST Handbook 133 - Overview of Handbook 133**	Online webinar	5744

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Calendar of Events

OWM Training Events

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Date	Time (Eastern Time Zone)	Event Name	Online or Location	Class
July 29, 2021	2:00 p.m. to 4:00 p.m.	**Contract Review**	Online webinar	5748
August 2 to 5, 2021	1:00 p.m. to 5:00 p.m.	**Northeastern Measurement Assurance Program (NEMAP)**	Online webinar	5704
August 14, 2021	2:00 p.m. to 3:30 p.m.	**Metric System Estimation**	Online webinar	5737
August 24, 2021	10:00 a.m. to 3:00 p.m.	**LPG (Propane) - Verifying the Net Contents of 20 lb Cylinders (Part 1)**	Online webinar	5753
August 26, 2021	2:00 p.m. to 3:30 p.m.	**Measurement System Basics: SI & U.S. Customary Units for Regulatory Officials**	Online webinar	5738
August 28, 2021	2:00 p.m. to 3:30 p.m.	**Metric System Estimation**	Online webinar	5739
August 30 to September 02, 2021	1:00 p.m. to 5:00 p.m.	**Southwest Assurance Program (SWAP)**	Online webinar	5705
September 11, 2021	2:00 p.m. to 3:30 p.m.	**Metric System Education Resources**	Online webinar	5745
September 14 to October 7, 2021	12:00 p.m. to 4:00 p.m.	**Fundamentals and LAP Problems Preparation—Fall**	Online workshop	5749
September 25, 2021	2:00 p.m. to 3:30 p.m.	**Metric System Education Resources**	Online webinar	5746
October 4, 2021	1:00 p.m. to 5:00 p.m.	**MidAmerica Measurement Assurance Program (MidMAP)**	Online webinar	5706
October 18, 2021	8:00 a.m. to 5:30 p.m.	**Mass Metrology Seminar***	Gaithersburg, MD	5724
November 4, 2021 to January 20, 2022	2:00 p.m. to 4:00 p.m.	**Laboratory Administration Workshop**	Online workshop	5754

**Event scheduled at Gaithersburg, MD. Contingent upon NIST re-opening and allowing visitors on campus.*

Training events in this table are current as of July 1, 2021. Please refer to the OWM website for the most recent listing ***www.nist.gov/pml/weights-and-measures/about-owm/calendar-events****.*

Calendar of Events

Meetings

NCWM and Regional Associations			
July 18 to 23, 2021	Rochester, NY and Online	NCWM Annual Meeting	**www.ncwm.com**
August 21 to 26, 2021	Orlando, FL	NCSLI Workshop & Symposium 2021	**www.ncsli.org**
September 26 to 30, 2021	Golden, CO	Western Weights and Measures Association (WWMA)	**westernwma.org**
October 10 to 13, 2021	New Orleans, LA	Southern Weights and Measures Association (SWMA)	**www.swma.org**
October 18 to 21, 2021	Wisconsin Dells, WI	CWMA Interim Meeting	**www.cwma.net**
January 9 to 12, 2022	Tampa, FL	NCWM Interim Meeting	**www.ncwm.com**
May 23 to 26, 2022	Bismarck, ND	CWMA Annual Meeting	**www.cwma.net**
July 10 to 14, 2022	Tacoma, WA	NCWM Annual Meeting	**www.ncwm.com**

NIST OWM Staff Directory

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NIST OWM Staff Directory

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