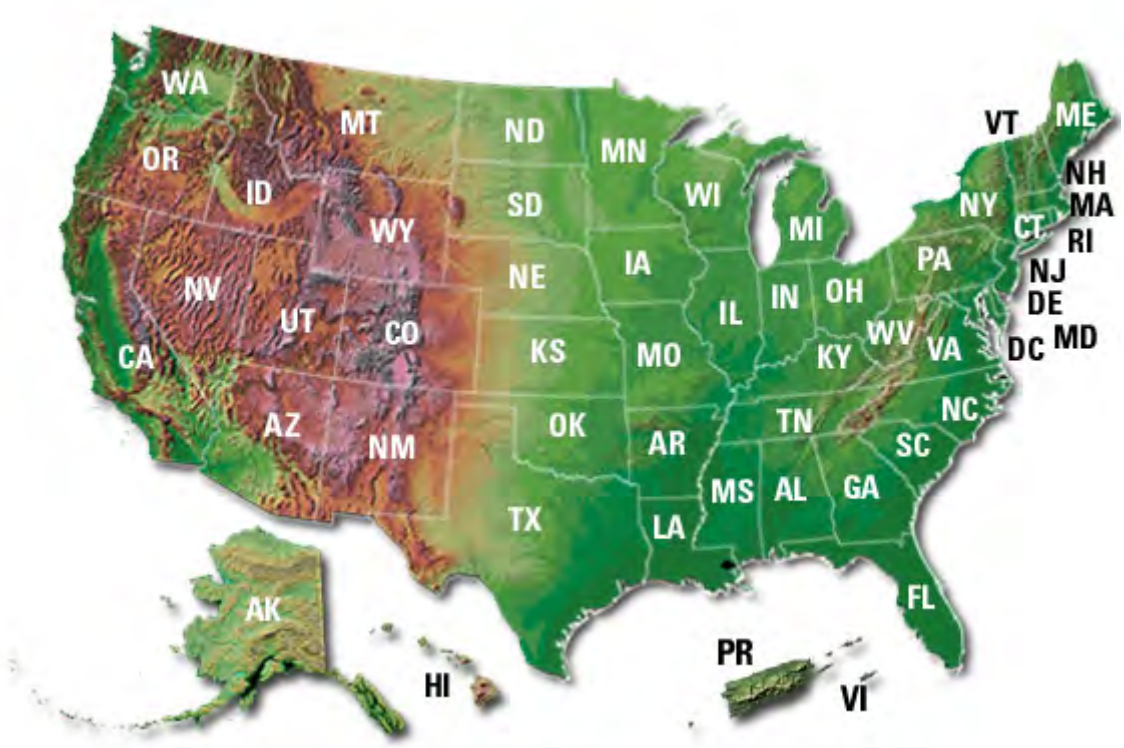
2018

State Laboratory Program Workload Survey



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Foreword

From the Editor

The 2018 state laboratory program survey represents the 6th survey which I have compiled for you. The 2008 survey is the first one which I prepared. The 2018 is the first survey to my knowledge with a foreword. It's hard for me to believe that 10+ years ago I naively offered to re-develop the choropleths which permeate the survey since Microsoft had deprecated this tool by the Office 2003 release. I did it then because I believed the work we do in our respective metrology labs is important. I do it now because I respect the professional metrologists who work to produce the high-quality measurements for which we are known.

The names of the survey team aren't often published in the survey (if ever). I suppose we are content to let the value of the survey speak for itself without a lot of self-promoting. Maybe we are a little too comfortable working behind the scenes. Personally, I blame a lasting imprint left upon on me while growing up in a small town in Missouri. I think it's written in their cultural by-laws . . . "Article I, Do your job and be quiet about it". Regardless the reason, after such a long run I really believe it's important to recognize the efforts of the team since we all work to publish the survey voluntarily.

- Georgia Harris, NIST Office of Weights and Measures

Georgia prepares the entire section of the survey describing the work of the Office of Weights and Measures (OWM) State Laboratory Program (SLP) and the impact NIST realizes through the work of the state metrology laboratories. She also helps develop the questions during the survey planning phase. Finally Geogia helps distribute the survey to the member labs upon publication.

- Van Hyder, North Carolina Metrology Laboratory, Chairman of the NCSLI's Legal Metrology Committee.

Van provides the majority of the communication out to the SLP member labs regarding the survey. He distributes, collects, and inventories the surveys as they come in and has the privilege of calling, emailing, and generally lobbying lab managers to complete surveys after the initial deadline has passed. Van is the sole reason we have such a high response rate. He also promotes the efforts of the state laboratories by making a biannual presentation to the NCSLI membership discussing the preliminary results of the survey.

- Steven Harrington, Oregon Weights and Measures, Metrology, and Motor Fuel Quality

I serve as something of the editor of the survey. It has been my job to convert the survey data into the final publication. I take all of the information on the individual surveys prepared by you and create the various charts, graphs, tables, and figures found in the survey. It's a daunting task each time I do it, however I really believe the finished product is valuable and your words of encouragement keep me coming back for more. That said, if you found an error in any of the surveys from '08-'18 there is a reasonable chance that it was my fault. For my defense I don't have too many proofreaders available to me at the moment. Van generally does this work.

Most people reading this know Georgia has retired from NIST this year leaving only Van and I as caretakers of the survey project. If either of us leave, retire, quit, win the lottery, get run over by a bus, or simply get promoted or find other careers then there is a significant risk that the

publication will die an unceremonious death. I really hope this won't be the case. For the 2020 survey Van and I will solicit help from additional volunteers to try and develop something of a succession plan for the survey. The length of time it takes us to publish is a clue that help is definitely needed as there are many pressures on our time alone. As Val Miller at NIST once put it "Hours in the day. Hours in the day.". There isn't any money, nor is there a plaque, certificate, honorable mention, or any other real recognition for the work done. We just have the pride of ownership. Please, volunteer! For my part, if you are great with Excel then I really want to talk to you!

Thanks for reading, enjoy the survey and I hope to run into you at an RMAP meeting sometime in the near future. Feel free to drop us a note to let us know how we are doing.

Sincerely,

Steven J. Harrington
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Salem, OR 97301
sharrington@oda.state.or.us

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Acknowledgements

This report was prepared with the help of the members of the NCSL International Committee 156 - Legal Metrology Committee. Special thanks must be given to all the metrology professionals working in the State Laboratory Program who have generously given their time to complete the 2018 State Program Workload Survey thus providing the data essential to make this report possible. Thanks also go to the staff of the National Institute of Standards and Technology, Office of Weights and Measures who have provided considerable support in collecting data and preparing and publishing this report.

It is our sincere hope that this biannual report continues to be a valuable resource to the State Laboratory Program laboratories and to those who use the service that these laboratories provide.

Objectives and History

Historically there has been inconsistency between survey titles and the year which data represents. Starting in 2008 the survey team adopted a convention of naming the report based upon the year which the data represents rather than the year the report was published. For example, the report titled “2008 State Laboratory Program Workload Survey" represents data collected during the 2008 calendar year. Table 1 correlates historical workload surveys to the year(s) during which the data was collected.

Survey Title	Year represented
1996 State Laboratory Program Workload Survey	1996
1999 State Laboratory Program Workload Survey	1998
2000 State Laboratory Program Workload Survey	1999
2001 State Laboratory Program Workload Survey	2000
2003 State Laboratory Program Workload Survey	2002
2005 State Laboratory Program Workload Survey	2004
2005 & 2006 State Laboratory Program Workload Survey	2005&2006
2008 State Laboratory Program Workload Survey	2008
2010 State Laboratory Program Workload Survey	2010
2012 State Laboratory Program Workload Survey	2012
2014 State Laboratory Program Workload Survey	2014
2016 State Laboratory Program Workload Survey	2016
2018 State Laboratory Program Workload Survey	2018

Table 1: Historical survey titles and the year represented by each.

In 1996, the National Conference on Weights and Measures (NCWM) Metrology Subcommittee surveyed the State Laboratory participants to quantify the workload of the State Laboratory Program (SLP) and document its impact on the United States economy. From the survey analysis, it was clear that the workload statistics were dynamic and only provided a snapshot of the workload at the time. Therefore, the Metrology Subcommittee circulated a revised survey April 16, 1999 to update program statistics and to investigate trends in the National workload. The subcommittee has since recommended that the survey be conducted on a regular basis and that the core survey be kept standardized in order for state labs to develop databases that could automatically generate the information for the survey.

Survey data is used not only to quantify the impact of the SLP on the United States economy, but also to plan and maximize its effectiveness. Training and inter-laboratory comparisons are designed to meet real needs of the workload. Ultimately, the survey information increases the efficiency of the entire SLP and maximize the benefits to the national economy. The results of previous surveys have been used extensively at NIST to gain support and attention for the State Laboratories and have been helpful in putting together budget proposals. The information from the survey is also useful in identifying the diversities of the workload on a national level.

Collection, Presentation, and Analysis of Data:

SLP laboratories submitted their data using standardized Microsoft Excel spreadsheets.

The data was copied from each individual completed survey forms into a master workbook for analysis. The copy process is automated using Excel macros in order to expedite the process and to minimize the potential for random data transcription errors.

The overall survey is presented in the following order;

1. The NIST Office of Weights and Measures (OWM) provides an initial report of workload data from the NIST Measurement Services Division summarizing calibration work done for State laboratories covering a range of measurements including mass, volume, temperature, pressure, etc. This report generally presents the leveraging effect that the SLP provides for the NIST Measurement Services Division. The NIST report begins on page 16.
2. The NIST OWM provides an overview of the SLP which;
    - details program metrics NIST OWM uses to track member laboratories,
    - reports on the accreditation status of each of the member laboratories,
    - reports on training provided by NIST OWM for the member laboratories,
    - reports on proficiency testing conducted within the SLP,
    - reports on documentary standards used by the SLP,
    - details each member laboratory's measurement scope as recognized by NIST OWM.
3. Individual laboratories participating in the survey are identified by name location, age, size, and number of customers served beginning on page 36. Current contact information for the individual SLP laboratories and their NIST OWM Certificate of Measurement Traceability can be found on the NIST Office of Weights and Measures website:

    https://www.nist.gov/pml/weights-and-measures/resources/state-laboratories-c.
4. Each laboratory's prior survey participation in previous surveys is reported from 1996 through 2016 beginning on page 41.
5. The SLP workload portion of the survey is broken down into four broad measurement categories; mass, length, volume, and other. Each category is further subdivided into three sub-categories identifying the type of customer for whom measurements are performed; laboratory, weights and measures enforcement, and external.

    The data is presented in the form of both choropleth maps, color coded to illustrate the distribution of work across the entire SLP, and bar charts, ordered from high to low displaying the number of tests performed by each member laboratory. Summary pie graphs are included to report totals across the entire SLP by customer type.

    Summary data from previous workload surveys are included for each measurement category covered in this survey for comparison purposes. Mass testing data begins on page 45, Length on page 59, Volume on page 64, and all other tests on page 80.

6. A report of fees charged for the various services provided by each member lab begins on page 93. Fee estimates for a range of routine measurement services are presented using bar graphs detailing individual laboratory fee estimates. Historical averages are included for each measurement service where the data is available.
7. A report of laboratory staffing begins on page 127. This report includes;
    - Position titles;
    - Salary ranges; and
    - Detailed list of metrologists employed in the SLP at the time of the survey. The data includes specific calibration authorizations, experience in years, and the approximate dates each person is eligible for full retirement.
8. Each laboratory is asked to identify from whom they will accept calibration certificates on page 147. Member laboratories often have a regulatory duty with respect to service personnel who are normally required to submit measurement equipment for calibration on a regular basis. The acceptance matrix identifies from whom a service company can purchase a calibration certificate which will then be given legal recognition within that member laboratory's jurisdiction.
9. Each year the survey team prepares a section of supplementary questions which, unlike the previous sections, changes significantly from year to year. This section begins on page 149.
10. Survey participants are invited to add comments to help clarify their responses to each of the survey questions. Survey comments are listed in this report beginning on page 151.
11. A reprint of the 2018 survey begins on page 169.

Additional Comments:

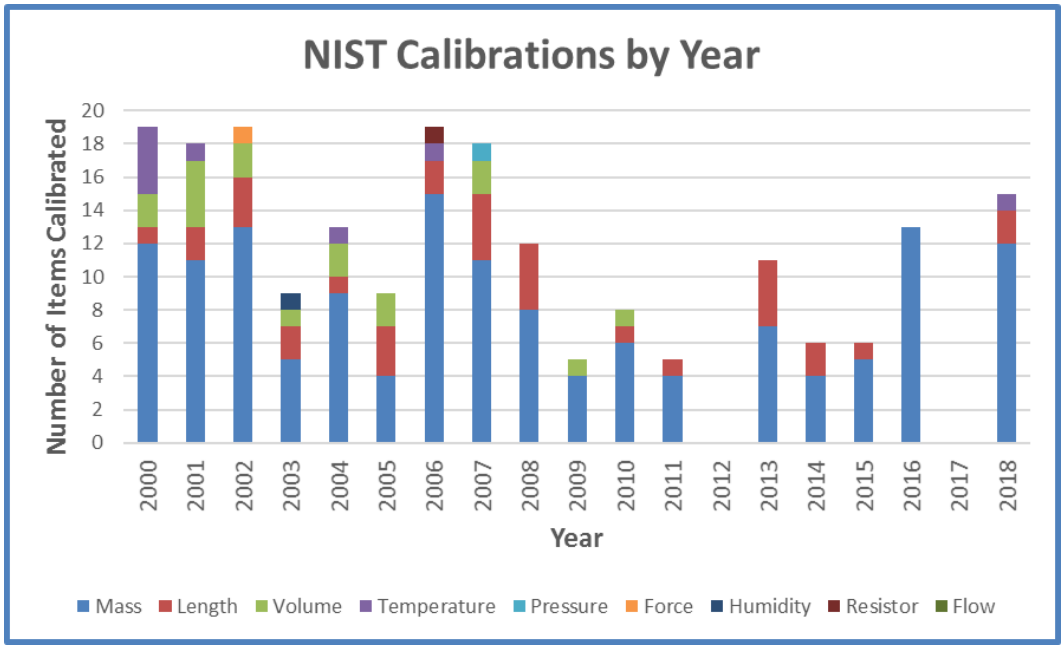
Caution should be used when comparing one state's data with data to another. It was determined in the 1996 survey that laboratory workload is influenced by industrial and population densities that vary by geographical location. Thus, low numbers for a lab may simply reflect low local demand for a laboratory's service. Variance in the number of devices tested, staffing, and facilities between individual laboratories are normal and cannot legitimately be used to rate the quality of any laboratory program.

No attempt was made to analyze the change in the workload of individual laboratories due to cyclic nature of the work. For example, a member laboratory may measure their volumetric glassware on a two-year calibration interval with the majority of these standards calibrated in sync with each other. The consequence being that few are tested in the following twelve-month period. This does not indicate that the workload is decreasing, it is just a reflection of the calibration interval assigned to those standards.

Impact and Leveraging of NIST Calibrations

(Information provided by NIST/OWM)

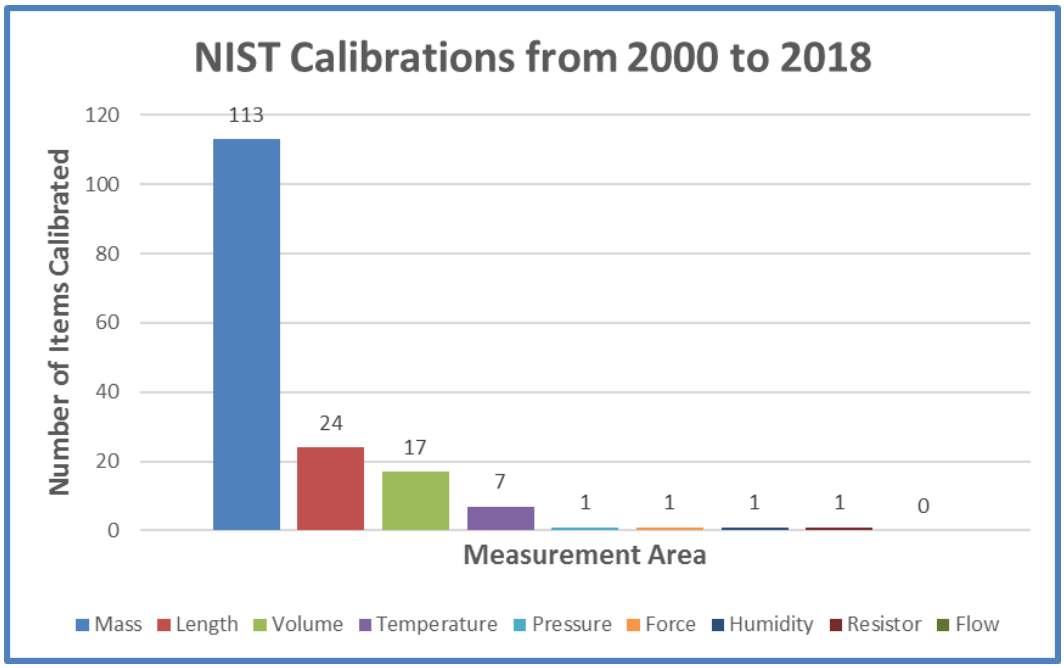
Calibration data for State laboratories was obtained from the NIST Measurement Services from 2000 through 2018. One of the measures of impact of NIST calibrations is to quantify the number and impact of downstream calibrations. How many additional calibrations are made by other laboratories using these calibrations? The answer to this question is a measure of the national impact of NIST calibration services and training. This leveraging of NIST calibrations to industry by the State weights and measures laboratories contributes greatly to the economy of the United States.



Data in the current survey includes measurements and calibrations performed at NIST in non-traditional measurement areas (e.g., those outside of mass, length, and volume).

State weights and measures laboratories account for a small portion of NIST's annual calibrations. Given data obtained in the Laboratory Program surveys in the 1990's, typically about half of the customer workload in the State laboratories is for industry and other government agencies (i.e., not weights and measures enforcement efforts). Many of these customers are the same customers who in other countries must obtain calibrations from a National Metrology Institute (NMI) such as NIST.

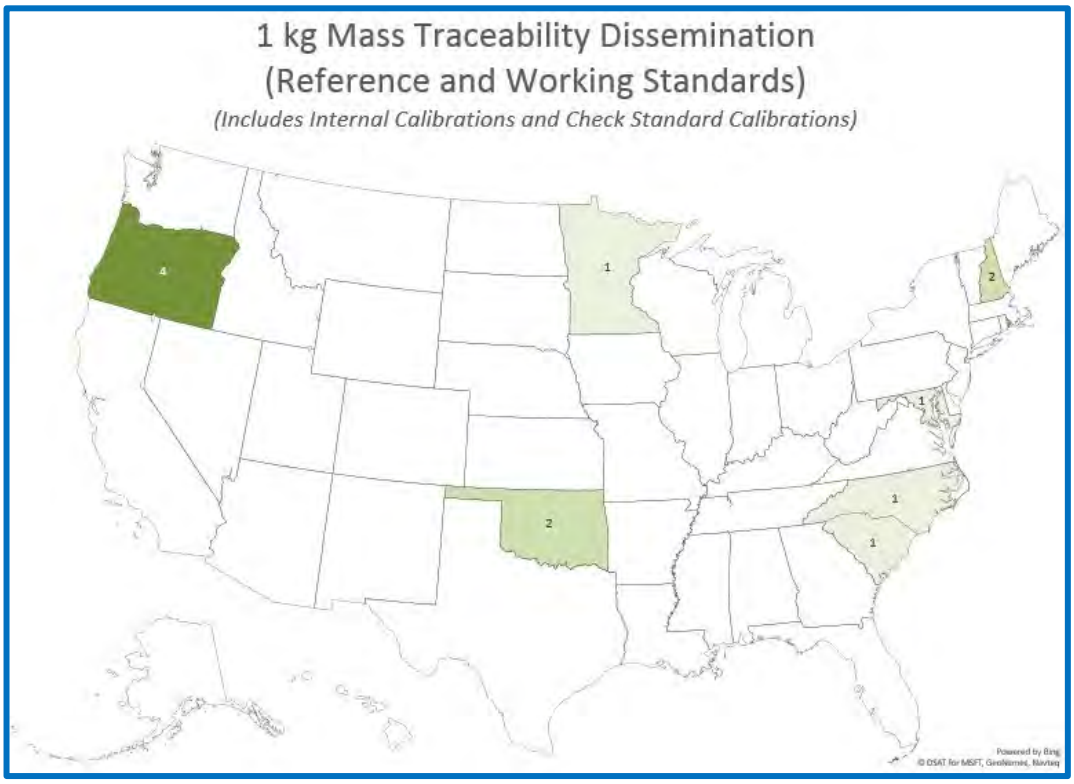
Economic statistics indicate that weights and measures enforcement, supported by these leveraged State weights and measures laboratory calibrations, affects more than half of the $20.50 trillion (2018) Gross Domestic Product (GDP). Since nearly half of the State weights and measures laboratory workload does not affect weights and measures enforcement, the economic impact of these calibrations influences virtually all of the U.S. GDP. Accurate measurements ensure product quality for practically every product manufactured, are required for other regulatory functions (EPA, FDA, DOD, DOE, DOT), and are requisite for international trade.

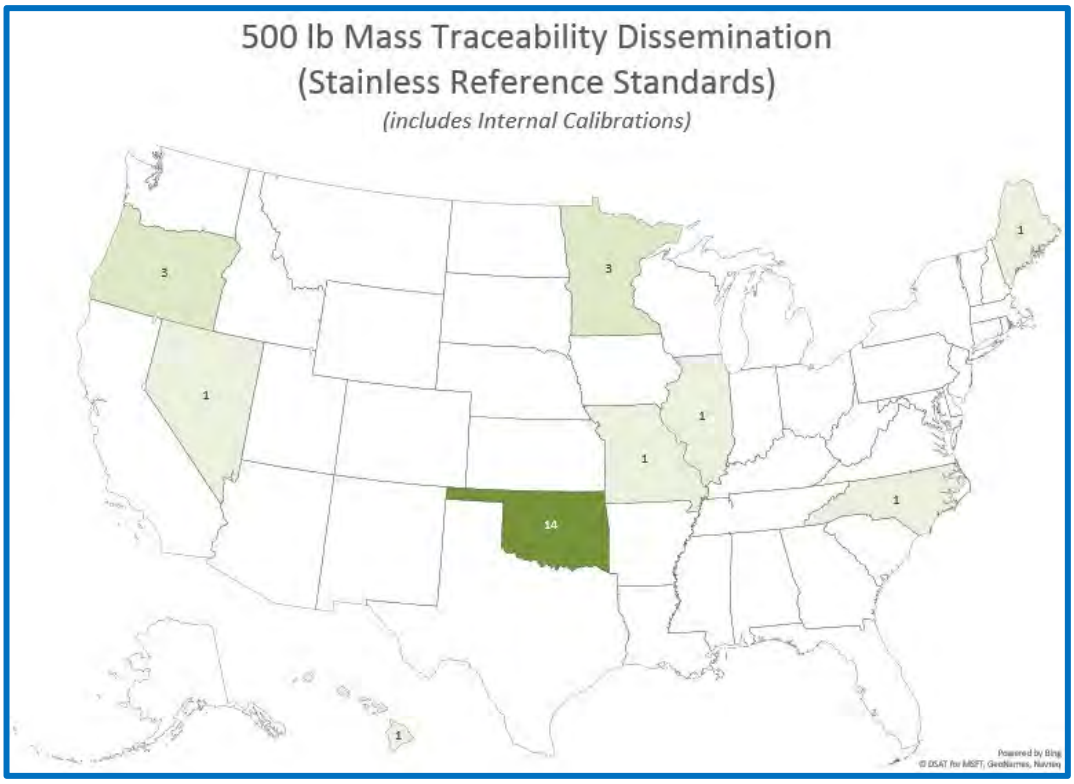


One question that might be asked in looking at this kind of leveraging data is "are enough calibrations being obtained from NIST by the States?" One responsibility of the NIST Office of Weights and Measures (OWM) is to coordinate the Laboratory Metrology Program. Each state laboratory that is recognized by OWM or accredited by NVLAP is required to have calibrations from acceptable sources, which are most often from NIST or other accredited laboratories. OWM Recognition or NVLAP Accreditation ensures that enough calibrations are obtained from NIST by the State weights and measures laboratories and that the State metrologists are trained adequately. Furthermore, metrologists must prove their competency/proficiency and have specified calibration intervals for laboratory standards to ensure the ongoing ability to provide calibration results that are traceable to SI units or international and national standards. The number one corrective action following failed PTs/ILCs is that of obtaining updated calibrations for laboratory reference standards. It is estimated that better than 96 % of the laboratory standards are calibrated in a timely manner according to established calibration intervals. A special assessment to catalog and document calibration standards and intervals was completed during the 2011 and 2017 assessment cycles as a part of "traceability evaluation" projects. One goal of the 2017 assessment was to identify the number of calibration sources State laboratories are using in addition to those provided directly by NIST. Laboratories that are accredited to a "better" level of service can provide services to other laboratories. In this case, State laboratories provide services for other State laboratories. In addition, calibrations are provided by accredited industry laboratories for lower level services for standards such as those used for environmental monitoring.

The following maps provide insight as to which laboratories are providing key calibration services for other State laboratories based on the 2017 Traceability assessment. For mass calibrations, the providers who calibrated the most reference, working, or check standards for other state laboratories, beyond their own internal calibrations were: Oklahoma, Minnesota, Oregon, and North Carolina, all of which are also accredited by NVLAP. Two additional laboratories, New Hampshire and South Carolina, that previously provided mass calibrations were not open during 2018 to provide calibrations. For volume calibrations, States providing calibrations of reference standards for other states included: North Carolina, Oklahoma, Minnesota, Arizona, Maine, New York, Pennsylvania, Michigan, and Oregon, all of which are also NVLAP accredited. What this assessment shows is that calibrations are regularly being done, not only directly by NIST, but also by State laboratories that are accredited by NVLAP. This data demonstrates additional value

added support provided by the Office of Weights and Measures for NVLAP accreditation of State laboratories.




500 lb Mass Traceability Dissemination
(Stainless Reference Standards)
(includes Internal Calibrations)
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3
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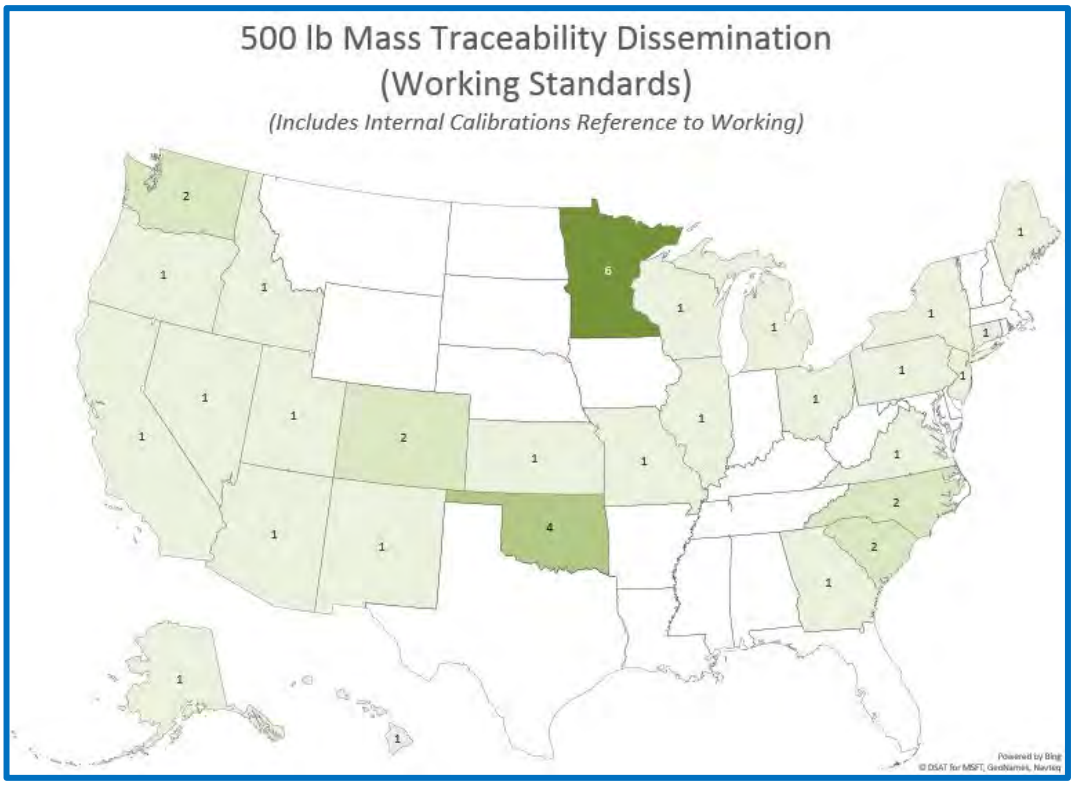
500 lb Mass Traceability Dissemination
(Working Standards)
(Includes Internal Calibrations Reference to Working)
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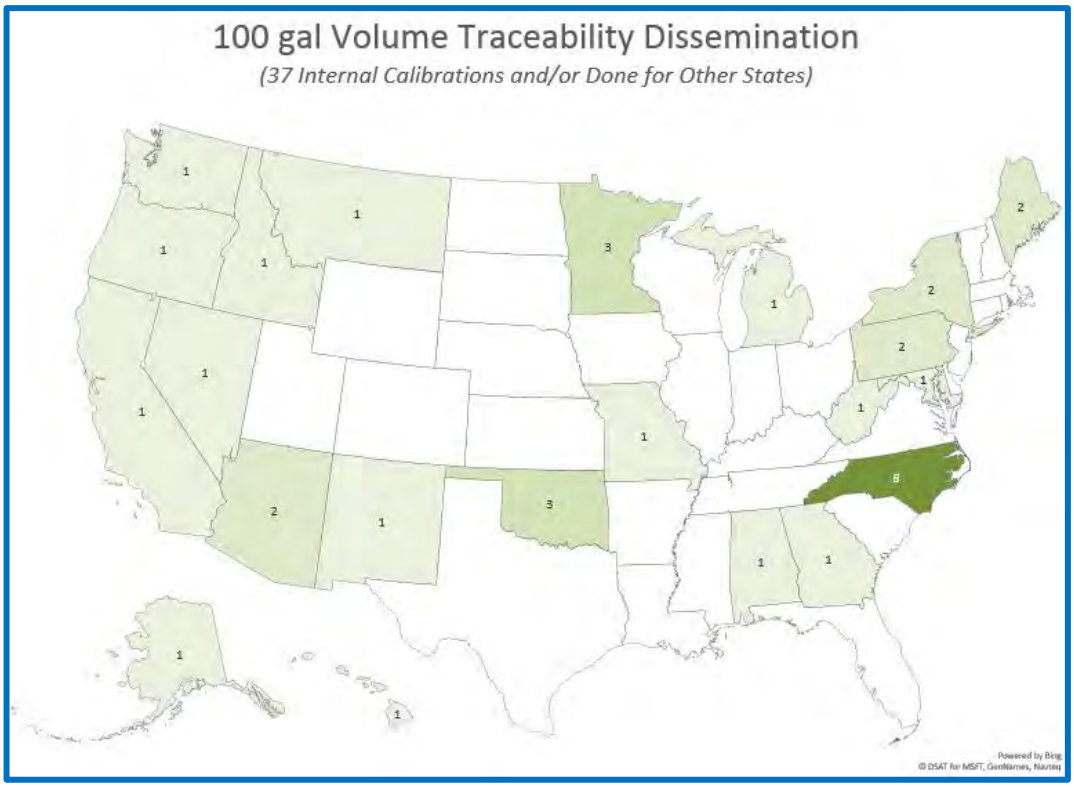
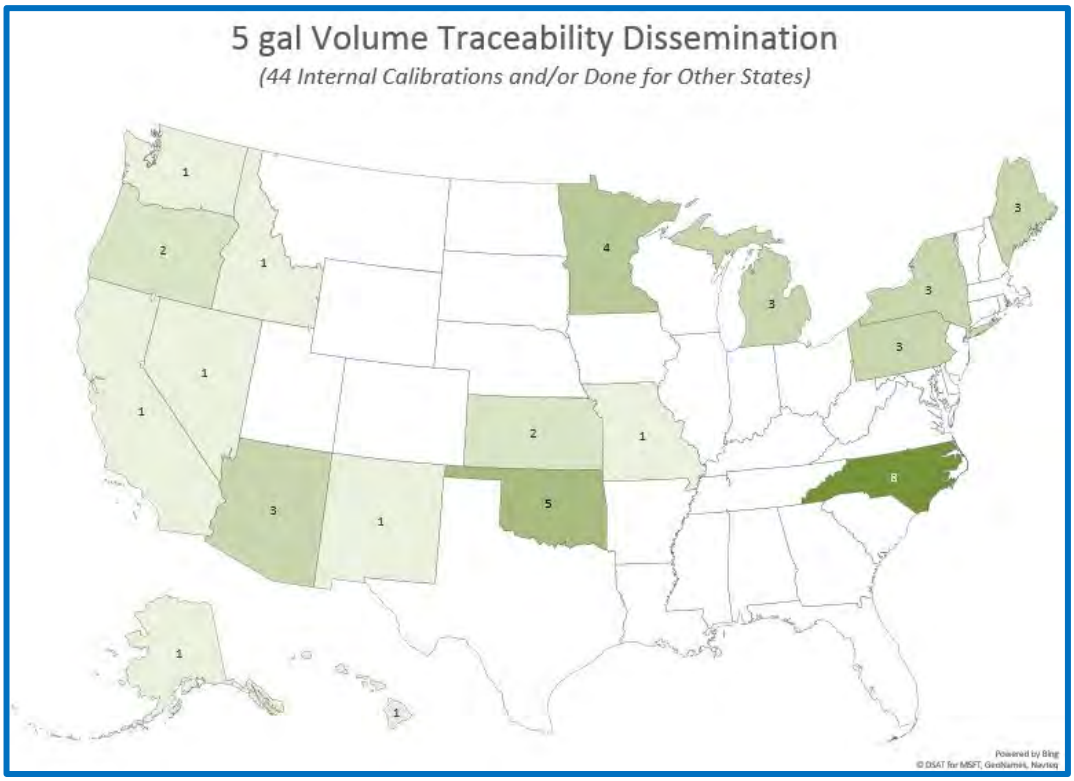




Metrological traceability and its assessment are required to comply with seven essential elements to ensure traceability to the International System of Units (SI) – typically, though not always through NIST. The

seven essential elements are 1) defining the measurand and realization of the measurements to the International System of Units (SI) 2) a documented unbroken chain of comparisons (calibrations), 3) documented and up to date calibration program, 4) documented and suitable measurement uncertainties, 5) use of documented and validated procedures, 6) demonstrated technical competence/proficiency, and 7) an acceptable measurement assurance system to ensure the validity of the measurement results. In addition, State laboratories are required to comply with State laws regarding traceability to the SI (or as stated, to National Institute of Standards and Technology) and through adoption of NIST publications like NIST Handbook 44: Specifications, Tolerances, and Other Technical Requirements for Weighing and Measuring Devices - Current Edition, and NIST Handbook 130: Uniform Laws and Regulations in the Areas of Legal Metrology and Engine Fuel Quality - Current Edition, they also must ensure compliance of measurement standards to appropriate/suitable specifications and tolerances for use in legal metrology.

Handbook 130 uniform laws allow for obtaining calibrations from suitable suppliers, as an alternative to direct NIST calibrations, when there is acceptable evidence of recognition and/or accreditation, suitable calibration and measurement capabilities (measurement, range, uncertainties) to ensure compliance with technical requirements of metrological traceability.

NIST Office of Weights and Measures (OWM)

Laboratory Metrology Program Overview

Note: This section was submitted by NIST OWM. Portions of this section were previously published as an article in the OWM W&M Newsletter and updated for the 2016 and 2018 workload survey.

There are often questions about what each program in the NIST Office of Weights and Measures (OWM) does and what the program responsibilities are. One of NIST's primary responsibilities is to ensure that uniform standards are available to support the nation's measurement infrastructure. State laboratories provide the foundation for over 450,000 calibrations as a critical part of the U.S. measurement infrastructure. Approximately half of these calibrations support commercial weights and measures with the remaining supporting measurements needed by industry and other government agencies. NIST will be successful if measurement results from State laboratories are accurate, traceable, defensible in support of enforcement actions, and widely accepted (both nationally and internationally.)

Four Interrelated Program Areas

There are four key areas of responsibility in the OWM Laboratory Metrology Program in support of ensuring the capability of laboratories to provide traceable measurement results: Laboratory Recognition, Proficiency Testing, Training, and Field Standards for Weights and Measures (Figure 1). Each functional area has a set of guiding documents as well as international documentary standards used for benchmarking to enhance program recognition and credibility.

All areas are interrelated with the other areas. For example, laboratories that are recognized often support the weights and measures program requirements to ensure that measurement results have demonstrated metrological traceability while the Handbook 105-series documentary standards are often required by the weights and measures program for enforcement applications. The laboratory recognition area is very narrow in scope and only supports weights and measures laboratories in the U.S. To be recognized, the laboratory must successfully complete both training and proficiency testing requirements, in addition to all other published requirements that follow the ISO/IEC 17025 standard for calibration laboratories. Training on both proficiency testing and laboratory recognition requirements is available. Then, proficiency testing is used not only to assess laboratory competency for recognition and accreditation, but assesses the level of impact and application of training concepts.

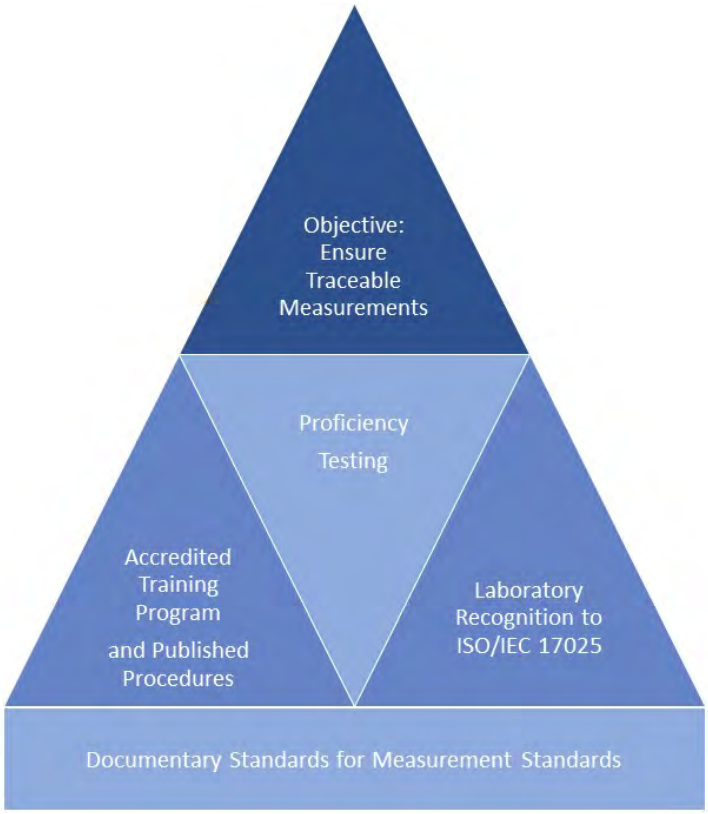


Figure 1: Laboratory Metrology Program Areas.

Program Measures:

Program measures for the four areas include the following items to assess ongoing program improvements (or declines and areas for needed focus). Graphic examples are included in each section to present the association measures.

1. Number of laboratories recognized by the Weights and Measures Division according to NIST Handbook 143, Program Handbook.
2. Laboratory Scoring Model measures changes in the national system over time with a key INDEX value according to elements of the Program Handbook.
3. Number of laboratories accredited by NVLAP (third-party independent assessment of compliance to ISO/IEC 17025 criteria) to NIST Handbook 150, NVLAP Program Handbook.
4. Number of staff completing training requirements as noted in NIST Handbook 143, Program Handbook.
5. Percentage of acceptable/passing proficiency test results and increasing percentage of effective follow up action (improvement, preventive, and corrective).
6. Updated publications.

Program Area Descriptions

Laboratory Recognition

Laboratory recognition is provided for the weights and measures laboratories to help demonstrate evidence of metrological traceability that is required in the States and local jurisdictions. Handbook 130, model weights and measures laws, as adopted in the jurisdictions, often states that weights and measures programs are required to ensure metrological traceability to NIST or the International System of Units (SI). The latest model laws indicate that laboratory recognition or accreditation provides the demonstrated evidence of metrological traceability. Some value-added impacts of the OWM laboratory recognition over accreditation alone is that we can target specific technical areas each year when and where problems have been identified as well as conduct national-level analysis to consider system-wide needs assessments. Annual assessments are conducted for all laboratories and periodic resources are posted on the NIST website related to annual assessments. Example technical assessments that have provided national level assessments in the past few years include: facility assessments, software verification and validation, succession planning, measurement assurance, uncertainties, and metrological traceability. Identified problems provide input into the training area.

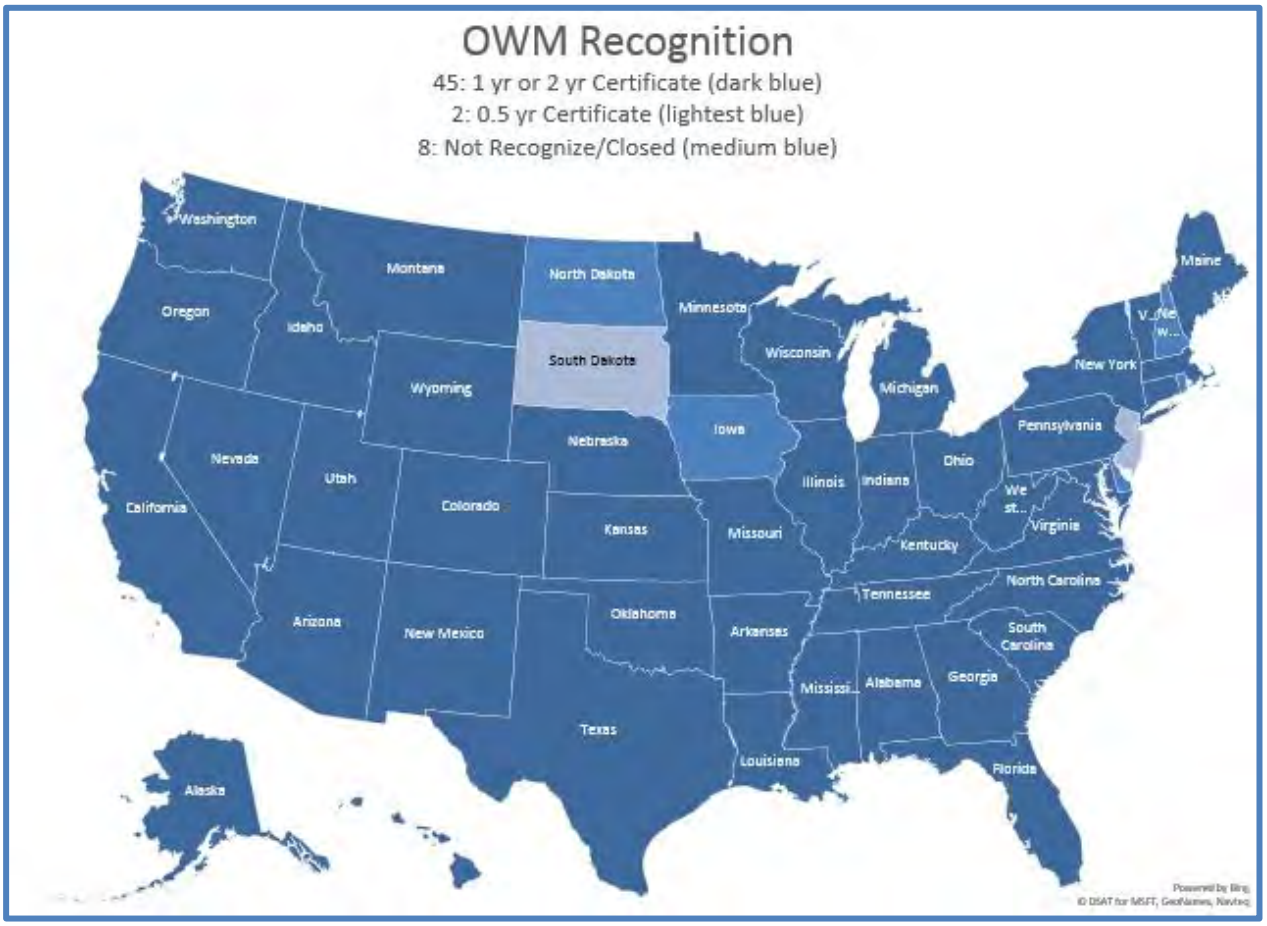


Figure 2. Laboratory Recognition by OWM (NIST Handbook 143, 2018 December).

Laboratory Scoring Model

A laboratory scoring model was developed in 2006 and is based on assigning numerical values to each laboratory in several categories that correspond to NIST Handbook 143. Points are awarded in the following categories to each laboratory:

• Quality Management System

• Administrative Procedures

• Facility

• Equipment

• Standards

• Staff

• Management Support

• Proficiency Tests (PTs)

• Extra Credit – Timely Submissions

• Multipliers (NVLAP accreditation with 2 year OWM recognition, 2.5; NVLAP accreditation with 1 year OWM recognition, 2.25; OWM, 2 year recognition, 2; OWM, 1 year recognition, 1.5; OWM, 1 year conditional recognition, 1; No recognition, 0.5; Lab Closed, 0).

The model is intended to provide a quality index to the overall laboratory program. The scoring model was updated in 2008 based on laboratory feedback and the first two years of use. The scoring model is used internally at NIST to identify where resources and efforts will be allocated. The current "top score" possible (success goal) is 275. Laboratories that are fully successful with OWM 2-year Recognition generally score between 140 and 220.

Scoring Model Trends

The OWM goal is to see the laboratory scores increase (or at least remain stable). Note: At this time, specific coding is not provided for identifying laboratories. In the latest assessment, we noted that several laboratories that were previously recognized and accredited have lost staff and not had adequate succession planning in place to keep laboratory recognition and/or accreditation in place or in place at the levels prior to staffing changes. In the 2017 to 2018 time frame several adjustments took place to update the scoring model consistent with the ISO/IEC 17025:2017 adoption at the end of 2017 as well as additional readiness assessments of laboratories for compliance with the new standard. The 2018 assessment during annual evaluations also assessed whether laboratory documentation and management reviews were updated to reflect risk assessments that are now part of the standard. Training was provided in 2016 in anticipation of the changes to the standard so that 40 out of 47 (85 %) active laboratories included the new Management Review documents that include risk assessments and 16 out of 47 (34 %) have already included updates to the laboratory quality documentation and procedures to reflect risk language. No laboratories were granted new 2 year recognitions at the end of 2018 due to the need for further evaluations for compliance to the new ISO/IEC 17025:2017 standard.

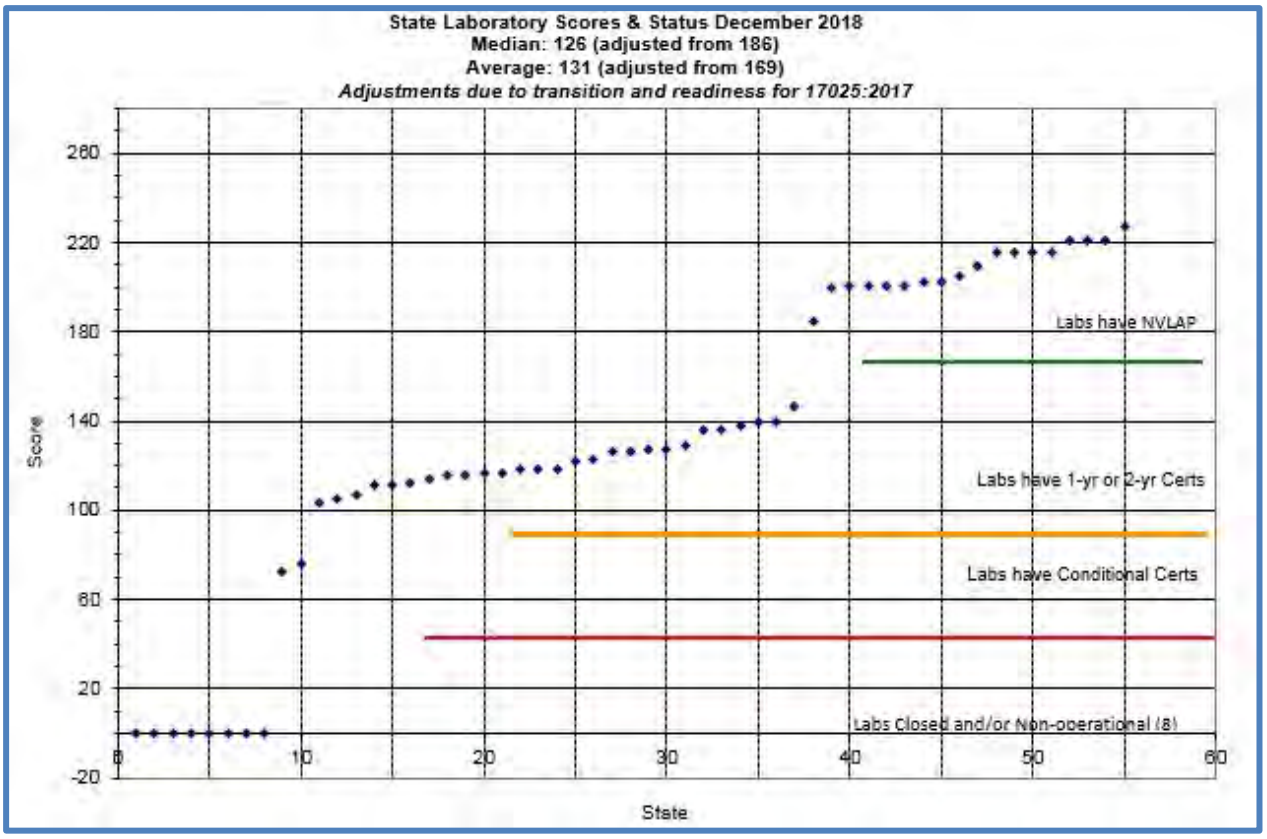


Figure 3. Laboratory Scoring Model (2018 December).

Table 2: Laboratory Scoring Model Trends.

Year	Median	Mean
Successful Goals	140 to 220	140 to 220
Accreditation Goals	220+	220+
2006	97.5	130
2007	140	140
2008	172	156
2009	172	156
2010	168	154
2012	168	156
2014 (end)	143	149
2016	186	169
2018[a]	126	131
[a] Major adjustment due to use of 1 year interval for all laboratories with transition to ISO/IEC 17025:2017.		

Laboratory Accreditation

The last measure of assessment in the recognition area that is presented here is the laboratory accreditation status through the NIST National Voluntary Laboratory Accreditation Program (NVLAP). The OWM Laboratory Metrology Program interfaces with NVLAP for those state laboratories that are accredited.

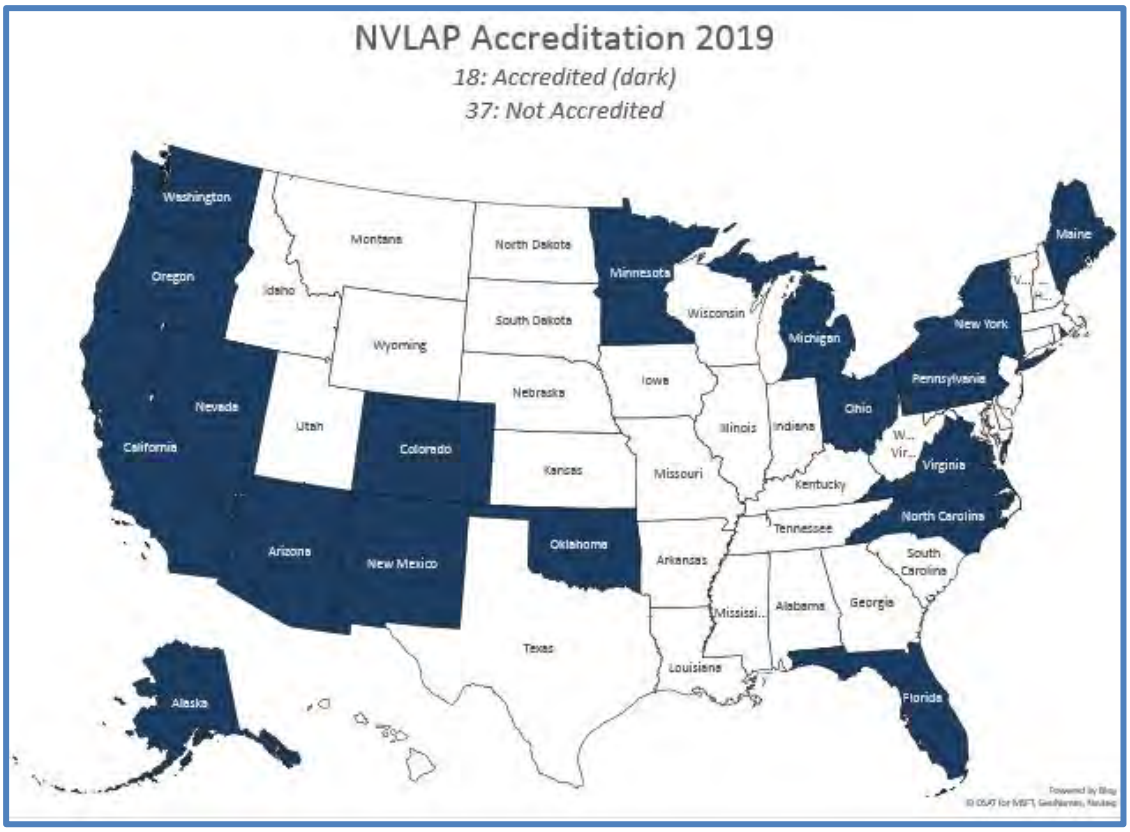


Figure 4. NVLAP Accreditation of State W&M Laboratories (2018 December for 2019)

Within NVLAP, the current primary contact for state laboratories is Titi Shodiya. The primary contact in OWM for this area is Georgia Harris.

Training

Training includes both courses that are taught at NIST in the OWM Demonstration and Training Laboratory as well as regionally at the Regional Measurement Assurance Program (RMAP) annual training sessions (Figure 5).

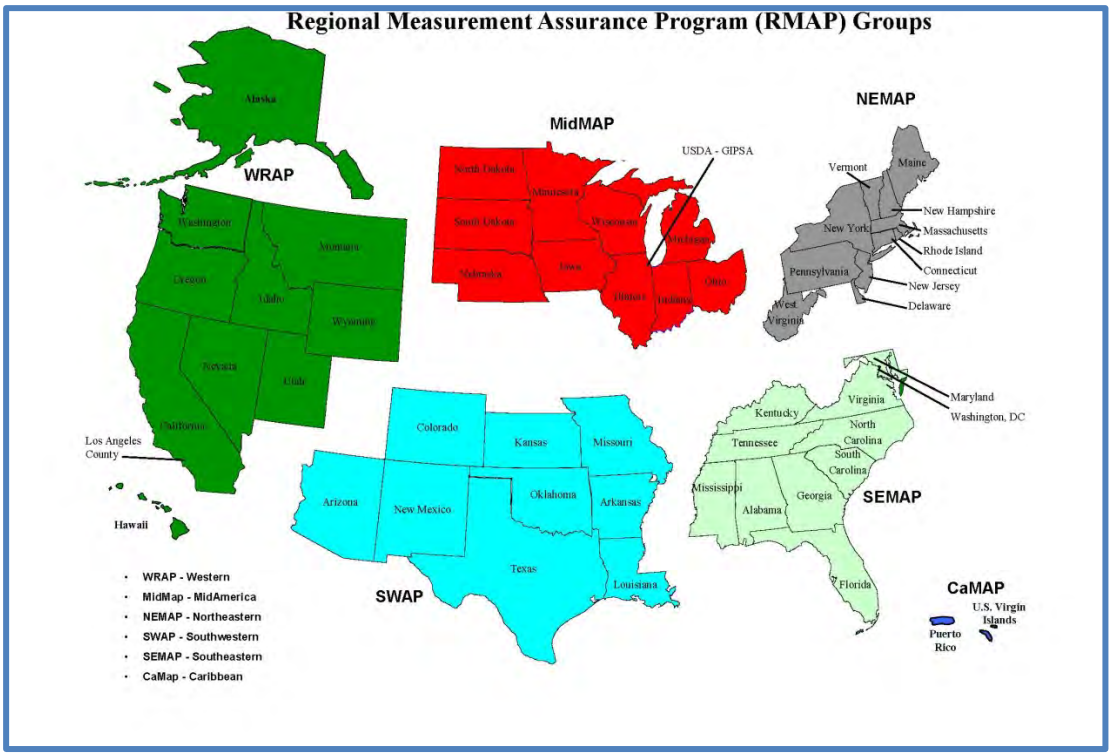


Figure 5. Regional Measurement Assurance Program (RMAP) Groups.

The current core laboratory metrology courses that are offered include: Fundamentals of Metrology, Mass Metrology, Volume Metrology, and Advanced Mass Metrology. These courses were developed and updated over the past five years as a part of a training redesign project to ensure that all training requirements needed by the laboratories are covered as well as to integrate more activities and adult learning concepts into the courses as a part of our goal in having an accredited training program. Previous courses (Basic Metrology for States, Intermediate Metrology) are no longer available. In addition to the traditional hands-on training courses, the OWM Laboratory Metrology Program has developed a series of 2 hour webinars on a variety of high interest topics. Webinar tuition is funded by the OWM and provided free to U.S. weights and measures officials and metrologists to enhance legal metrology uniformity.

Specific training and personnel competency requirements to support laboratory recognition are published in Handbook 143 with interim updates published on the NIST website. Training at the RMAP sessions is selected each year based on training needs assessments with input gathered through laboratory requests and inquiries, assessments of annual submissions from the laboratories, and through assessment of reasons for proficiency testing failures.

Numerous supplementary courses are taught throughout the year as webinars covering many topics related to implementing content from Handbook 143 or to address training needs between other seminars that are scheduled. Registration for all courses is done through the NIST OWM Contact Management System database with transcripts readily available to students. The primary contacts for this area are Georgia Harris and Val Miller from a program perspective, Yvonne Branden from an administrative perspective, and Isabel Chavez for the OWM database. Val Miller, Georgia Harris, and Elizabeth Gentry, plus contract instructors from working laboratories

who have completed training requirements provide course instruction at NIST and at the RMAP training sessions.

Training courses (seminars and webinars) for 2011 through 2018 in metrology are summarized in Figures 6 and 7. New in 2016 were the addition of "Laboratory Metrology Info Hour" (LMIH) sessions. These are short, 1-hour, recorded sessions, no pre-work, no post-work, no certificates, to provide updated news and current events. These are sessions for weights and measures staff only and can support up to 98 participants per session.

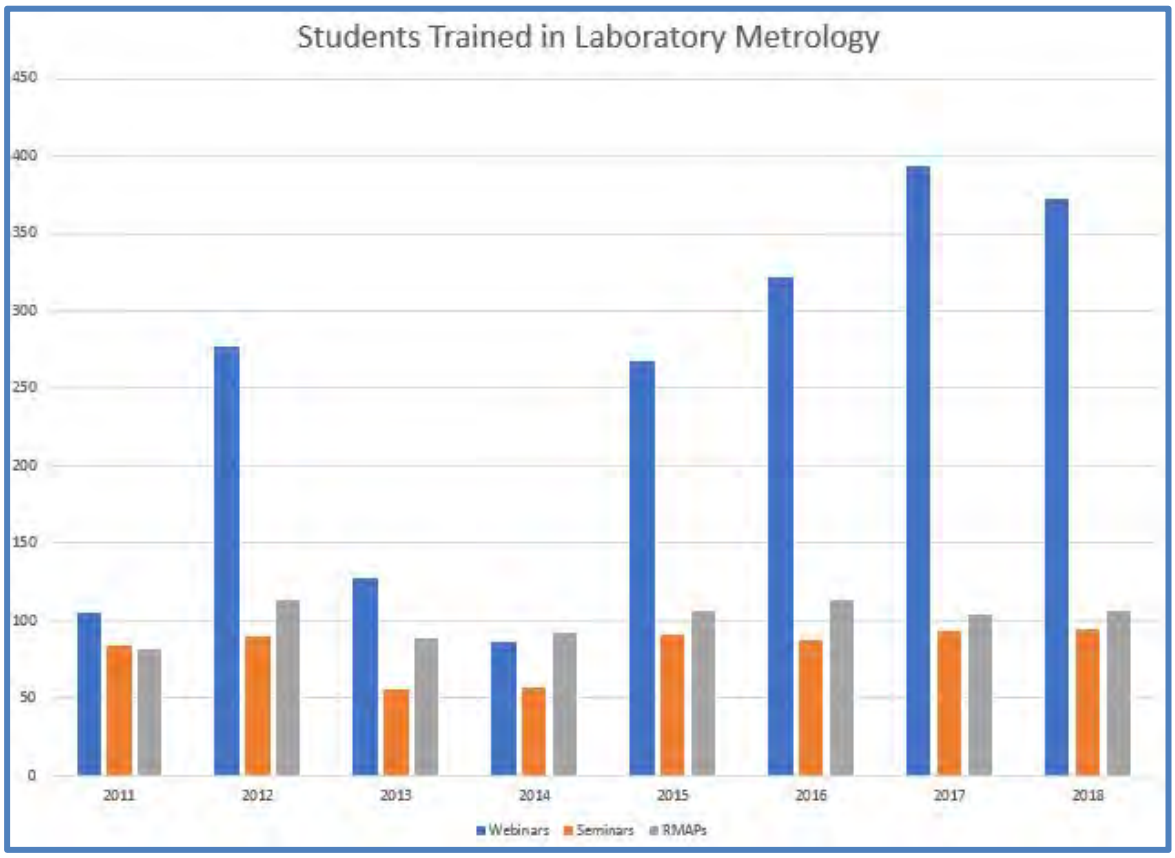


Figure 6. Laboratory Metrology Students Trained for 2011 through 2018.

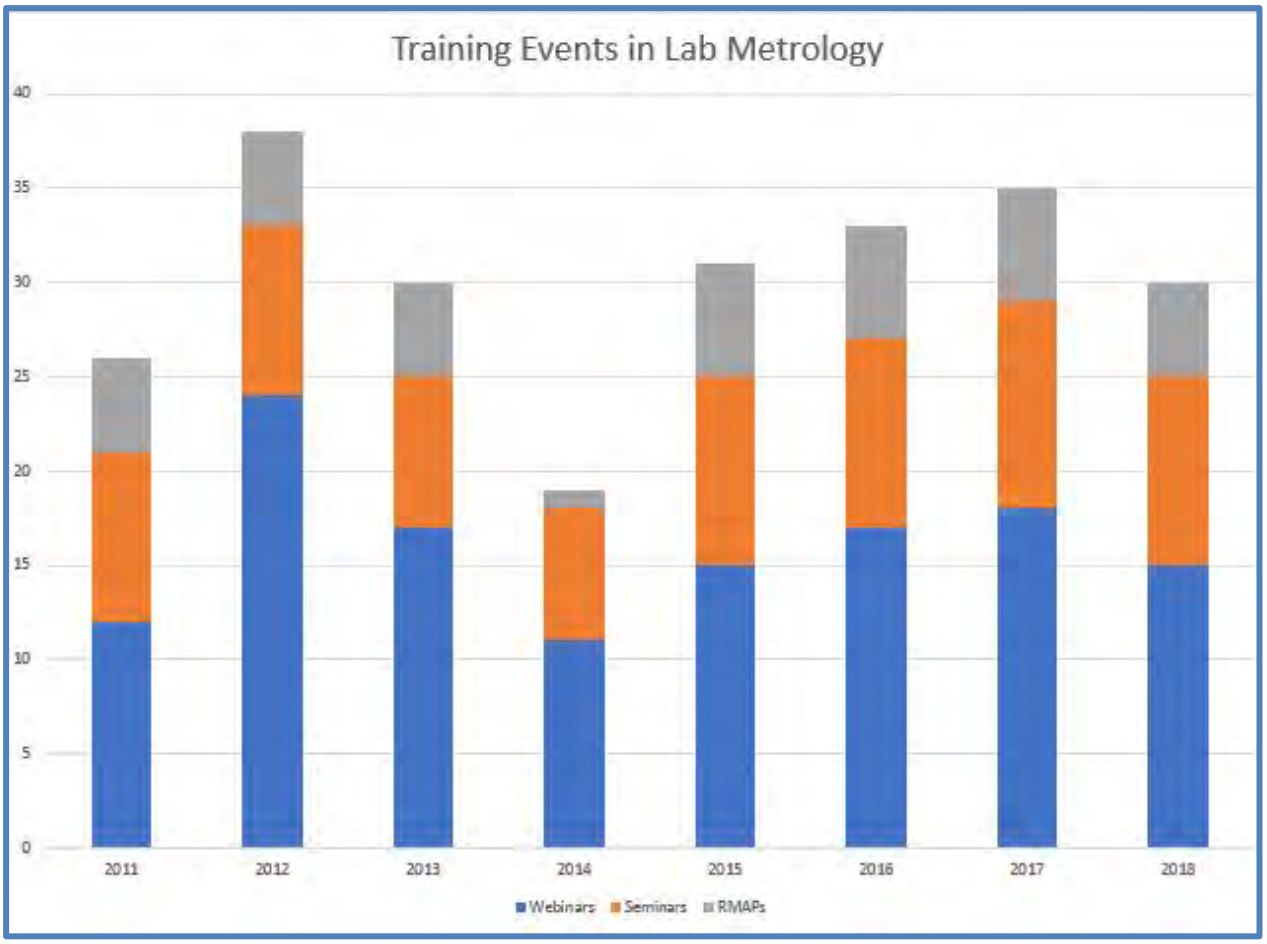
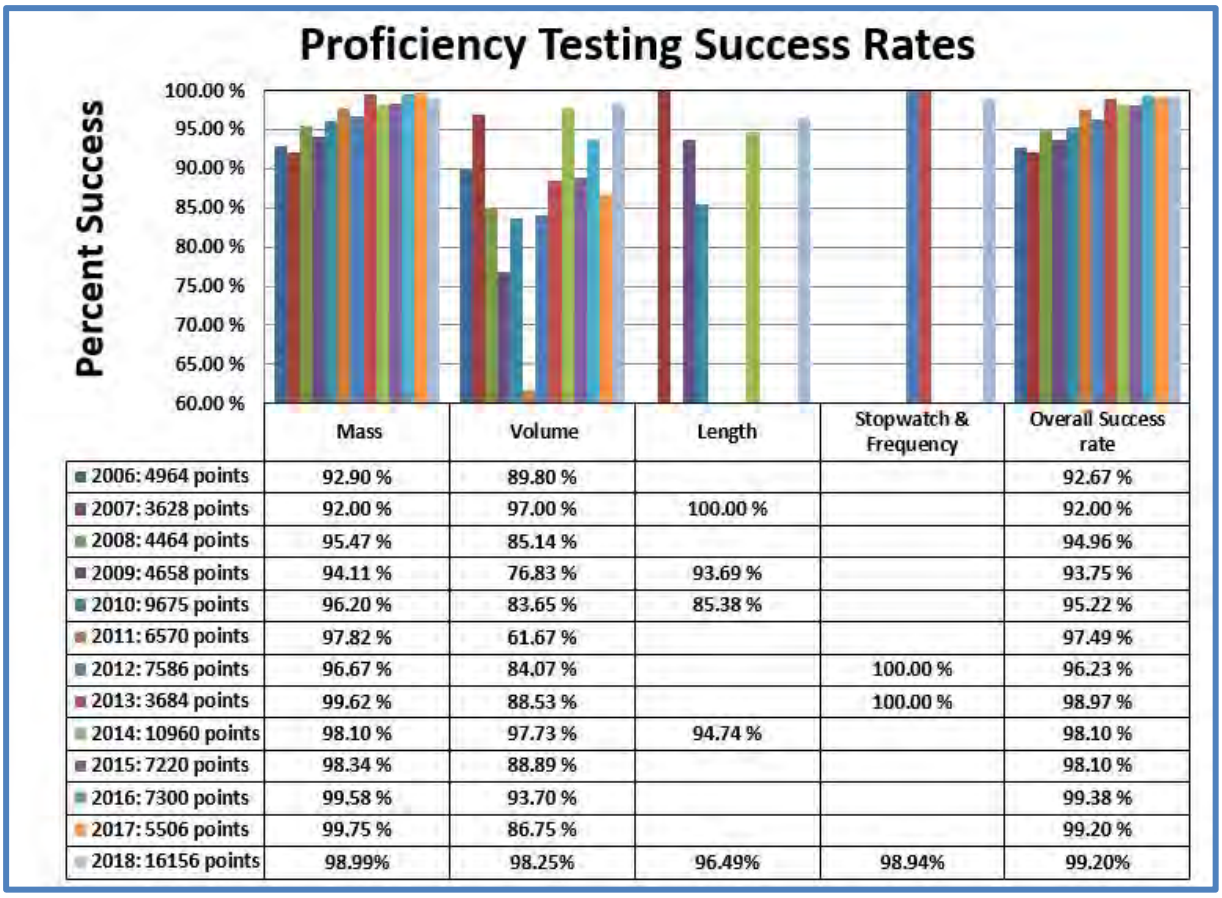


Figure 7. Laboratory Metrology Training Events for 2011 through 2018.

Proficiency Testing

The proficiency testing area is primarily coordinated through the annual RMAP training sessions. A 4-year plan is developed within each RMAP group to support the need for laboratories to have a 4-year plan and comply with recognition and accreditation policies. The planning, analysis, and reporting takes place at each meeting, where laboratories are given opportunities to help create the plan to meet the needs of their measurement scopes as well as providing an opportunity to minimize overall program costs through volunteering to coordinate and analyze data.



	Mass	Volume	Length	Stopwatch & Frequency	Overall Success rate
2006: 4964 points	92.90 %	89.80 %			92.67 %
2007: 3628 points	92.00 %	97.00 %	100.00 %		92.00 %
2008: 4464 points	95.47 %	85.14 %			94.96 %
2009: 4658 points	94.11 %	76.83 %	93.69 %		93.75 %
2010: 9675 points	96.20 %	83.65 %	85.38 %		95.22 %
2011: 6570 points	97.82 %	61.67 %			97.49 %
2012: 7586 points	96.67 %	84.07 %		100.00 %	96.23 %
2013: 3684 points	99.62 %	88.53 %		100.00 %	98.97 %
2014: 10960 points	98.10 %	97.73 %	94.74 %		98.10 %
2015: 7220 points	98.34 %	88.89 %			98.10 %
2016: 7300 points	99.58 %	93.70 %			99.38 %
2017: 5506 points	99.75 %	86.75 %			99.20 %
2018: 16156 points	98.99%	98.25%	96.49%	98.94%	99.20%

Figure 8. Proficiency Testing Success Rates (2006 to 2018).

Proficiency testing and interlaboratory comparisons (PTs/ILCs) have been conducted in the Regional Measurement Assurance Program (RMAP) regions since the early 1980's. NIST has captured the number and types of PTs/ILCs since that time. However, measures for evaluating proficiency testing results have been modified since 2006. Nearly 100,000 status points have been collected since pass/fail data has been collected. NIST began capturing pass/fail statistics for all PT/ILC results and compiling them by measurement parameter. This allows NIST to evaluate the effectiveness of training efforts and use of uniform calibration procedures among laboratories and to see improvements (or declines) over time. It also provides information on where to dedicate effort and resources in additional training and follow-up efforts.

Further assessments can be observed based on the data. For example, in the area of volume, special training efforts were conducted on gravimetric volume calibrations in 2005 and 2006 at the 5 gal level, reflecting overall improvements in the proficiency testing results. However, glass flasks were included for gravimetric calibrations in 2008, demonstrating the need for additional follow up for all gravimetric calibrations.

A four-year assessment of follow-up and corrective actions was conducted by NIST in 2007 and again in 2009 with a summary report circulated to all laboratories. The top 5 lab actions that were identified from periodic reviews in 2007 and 2009 included the need for:

1. Obtaining or calibrating standards
2. Obtaining updated equipment or service for existing equipment
3. Revising uncertainty analyses
4. Training on problem areas and review of procedures
5. Implementing better measurement assurance methods

Overall, based on the four-year assessment in 2007, laboratories completed a total of 245 follow-up actions from 85 PTs/ILCs. The success goals are 100 % passing rates and 100 % completed follow-up when needed. Examples of ongoing corrective action were incorporated into the training plan. Additional assessments were planned for this area in 2015. When the 2015 assessment was completed, it was followed by sharing of best practices from many laboratories and included an overview of the examples that were shared during a Laboratory Metrology Info Hour session.

Program planning, analysis and reporting tools used in this area are used by many other laboratories outside the program and outside the United States. Val Miller is the primary contact in this area.

Documentary Standards

Ideally, documentary standards would be reviewed at least every five years and updated as appropriate. This area of the program receives the least overall attention but standards are selected for updates when issues arise indicating a need. At this time, an update to NIST Handbook 105-1 field standard weights and Handbook 105-7 for small volume provers are in the development process. A new standard is being considered for master meters. Handbook 105-4, for LPG provers was updated in 2016. The program also participates with ASTM, USP, and OIML standards development. Val Miller is currently the primary contact for Handbook 105-1, ASTM, and USP updates and Georgia Harris with the volumetric standards. Handbooks 105-1 for mass standards and Handbook 105-8 for weight carts were both drafted for updates during 2018 and expected to be finalized early in 2019.

Program References

An intentional effort that has been made by the OWM Laboratory Metrology Program – at least since the 1980's – to adopt and use international standards and references to gain program credibility. For example, when NIST Handbook 143 was first published in 1986, it referenced ISO Guide 25 and Handbook 145 procedures referenced Mil-Std-45662A. Both ISO Guide 25 and Mil-Std-45662A were the internationally and nationally accepted standards at that time. Yet, full implementation of these and their current standard counterparts has taken time. The first documented guidance in the proficiency testing area followed ISO Guide 43, which has since become a formal standard rather than a guide with compliance to ISO/IEC 17043. Handbook 143, Program Handbook was drafted during 2018 and published in 2019 to adopt ISO/IEC 17025:2017.

Table 3: Program Area Reference Documents.

Program Area	Reference Documents
Laboratory Recognition	NIST Handbook 143, Program Handbook (based on ISO/IEC 17025:2017)
Training	ANSI/IACET Standard for Continuing Education and Training Laboratory Procedures: NBS Handbook 145 (length), NISTIR 5672 (mass dissemination), NISTIR 6969 (mass), NISTIR 7383 (volume), NISTIR 8028 (length)
Proficiency Testing	ISO/IEC 17043, ISO 13528 (applicable portions) NISTIR 7082, Proficiency Testing Policy NISTIR 7214, Proficiency Testing Quality Manual
Documentary Standards	NIST Handbooks 105-1 through 105-8 for field standards used in weights and measures

Internal Processes and Strategic Assessments

Each OWM Laboratory Metrology Program area has documented internal processes that are followed to ensure consistency on an ongoing basis. At a high level, OWM conducts annual strategic planning and selects specific strategic and operational objectives. The Laboratory Metrology Program conducts an annual SWOT analysis (identifying strengths, weaknesses, threats, and opportunities) within each program area. This method has also been used to gather input from metrologists at the annual RMAP training sessions to ensure customer input is considered and that program efforts are responsive to current and emerging national needs.

Measuring Results

As noted throughout this section, specific concepts are used to measure results in each Laboratory Metrology Program area. At one time, the majority of the measures were output measures. These included a count of how many laboratories were recognized, how many students attended training and how many courses were held, how many proficiency tests were conducted and in what measurement areas, along with the status of how many 105-series handbooks were published or in the process of being updated. Gradually, these measures have moved to include outcome measures where improvements are tracked, especially quality and impact. For example, the maps show how many laboratories are recognized by OWM and accredited by NVLAP. In addition, the scoring model shows the big picture assessment of all of the laboratories against standardized criteria to track whether or not improvements (or declines) are seen from year to year in the overall national quality of the laboratories. In the training area, OWM obtained IACET Accreditation in 2013, updated in 2018, and includes formal Kirkpatrick-type course evaluations to assess satisfaction with a training experience, learning, application, and impact. In the proficiency testing area, pass-fail statistics are tracked as well as a periodic evaluation of the resulting follow-up corrective actions made by the laboratories. In the

documentary standards area, the level of application and adoption within the weights and measures programs is considered.

If you have questions or comments about any of these program areas or the OWM Laboratory Metrology Program, please feel free to contact:

Georgia Harris at gharris@nist.gov[1],

Val Miller at val.miller@nist.gov, or

Douglas Olson at douglas.olson@nist.gov.

[1] Georgia Harris retired from NIST prior to the time of publication.

Participants

The SLP is comprised of 55 metrology laboratories. There are 50 state laboratories and 5 other government laboratories (Puerto Rico, Washington DC, Los Angeles County, USDA-GIPSA –identified as 'DA' in the survey–, and U.S.-Virgin Islands). Of these 55 laboratories, 6 are not operational. Washington DC, Delaware, U.S.-Virgin Islands, Rhode Island, North Dakota, and Iowa metrology laboratories were closed during the 2018 reporting period of the survey.

Notes and Comments:

- 45 metrology laboratories provided data for the 2018 State Program Workload Survey.
- Table 4 provides basic information summarizing the ages and sizes of the facilities in which the SLP conducts its work. It also summarizes the number of customers typically served by each laboratory.
- Office space is the overall size of the space in the laboratory devoted to administrative work. This includes space for workstations, filing, etc. In general, this category may include all of the space devoted to the laboratory not specifically dedicated to measurement work.
- Laboratory space is that space in the laboratory devoted to measurement work. This may include space where measurements are performed, space devoted to storing measurement standards and equipment, space used for material handling, space used for shipping and receiving of customer equipment, etc.
- Customers is a count of all distinct customers who received measurement services from the laboratory regardless of the reason or application.

SLP laboratories frequently provide measurement services for a fee regardless of whether the customer is regulated or not. This new category provides a measure of the number of customers using SLP laboratory services who are not otherwise required to do so.

SLP laboratories are frequently tasked with evaluating measurement equipment used by those service agents regulated by traditional Weights and Measures programs. These service agents provide calibration and repair services for measuring equipment used in commercial applications. They generally have a legal obligation to have their measure and test equipment periodically evaluated by one of the SLP member laboratories.

	Age (Years)	Office Space (Sq. Ft.)	Lab Space (Sq. Ft.)	Customers	Non-Service Agent Customers
Average	29	806	3,300	198	72
Minimum	1	0	0	2	0
Maximum	60	8,500	12,200	688	519

Table 4: Summary of lab space, age, and customers served.

(White Space)

Table 5: (beginning next page) Listing of the SLP laboratories including location, age[2], size, and total number of customers served as of the 2018 calendar year.

[2] Laboratory age is not indicative of laboratory condition. Many facilities have been significantly renovated in recent years.

Laboratory	Address	Contact	Website	Age (Years)	Office Space (sq. ft.)	Lab Space (sq. ft.)	Customers	Non-Service Agent Customers
State of Alaska Metrology Laboratory	12050 Industry Way Bldg. O #6, Anchorage, AK 99515	Phone: (907) 365-1233, Fax:	www.dot.state.ak.us/mscve	4	350	1740	53	48
Alabama Department of Agriculture	1445 Federal Dr, Montgomery, AL 36107	Phone: (334) 240-3729, Fax: (334) 240-7175	www.alabama.gov	46	314	588	200	0
Arkansas Bureau of Standards	4608 West 61st St., Little Rock, AR 72209	Phone: (501) 570-1159, Fax:	www.plantboard.arkansas.gov	52	400	1500	105	0
Arizona Dept Agriculture Weights and Measures Metrology Laboratory	4425 W Olive Ave Ste 134, Glendale, AZ 85302	Phone: (602) 771-4938, Fax: (623) 463-0440	agriculture.az.gov/	19	500	5500	206	69
California State Metrology Laboratory	6790 Florin Perkins Road, Suite 100, Sacramento, CA 95828	Phone: (916) 229-4858, Fax:	www.cdfa.ca.gov/dms/programs/metrology/metrology.html	15	309	3903	205	4
Colorado Metrology Laboratory	3125 Wyandot St, Denver, CO 80211	Phone: (303) 867-9244, Fax:	www.colorado.gov/pacific/aginspection/metrology-laboratory	45	1979	1927	199	150
Connecticut Metrology Lab	9 Windsor Avenue, Windsor, CT 06095	Phone: (860) 713-6165, Fax: (860) 706-1236	portal.ct.gov/DCP	6	130	1862	35	12
Florida Metrology Laboratory	3125 Conner Blvd Lab 2, Tallahassee, FL 32399	Phone: (850) 921-1580, Fax: (850) 921-1593	www.FreshFromFlorida.com	49	620	3500	119	17
Georgia Department of Agriculture Metrology Laboratory	3150 U.S. Highway 41 South, Tifton, GA 31794	Phone: (229) 386-3601, Fax: (229) 386-3365	agr.georgia.gov/weights-measures.aspx	9	0	0	212	177
Hawaii Measurement Standards Laboratory	1851 Auiki Street, Honolulu, HI 96819	Phone: (808) 832-0682, Fax: (808) 832-0683	hdoa.hawaii.gov/qad/measurement-standards	17	443	2602	50	22
Idaho State Department of Agriculture Metrology Laboratory	2216 Kellogg Lane, Boise, ID 83701	Phone: (208) 332-8691, Fax: (208) 334-2378	www.agri.idaho.gov	51	720	1900	72	53
Illinois Department of Agriculture Metrology Laboratory	801 Sangamon Avenue East, Springfield, IL 62702	Phone: (217) 785-8480, Fax: (217) 785-3136		41	1200	3220	166	25
Indiana Metrology Laboratory	2525 N Shadeland Ave Suite D3, Indianapolis, IN 46219	Phone: (317) 628-9028, Fax: (317) 351-2877	www.statehealth.in.gov	18	400	3600	256	92
Kansas Metrology Laboratory	6531 SE Forbes Ave, Ste B, Topeka, KS 66619	Phone: (785) 296-2938, Fax: (785) 296-8298	agriculture.ks.gov/divisions-programs/weight-measures/metrology-lab2	20	213	3574	156	82
Kentucky Department of Agriculture	107 Corporate Dr, Frankfort, KY 40601	Phone: (502) 573-0282, Fax: (502) 573-0303	kyagr.com	18	400	2395	62	13
LA Dept of Agriculture Metrology Laboratory	5825 Florida Blvd., Baton Rouge, LA 70806	Phone: (225) 922-1380, Fax: (225) 923-4877		25	300	1600	225	136
Los Angeles County	11012 Garfield Ave, South Gate, LAC 90280	Phone: (562) 622-0419, Fax: (562) 861-0278	www.acwm.lacounty.gov	44	168	2922	22	1

Laboratory	Address	Contact	Website	Age (Years)	Office Space (sq. ft.)	Lab Space (sq. ft.)	Customers	Non-Service Agent Customers
Massachusetts Division of Standards Metrology Laboratory	661 (Rear) Highland Avenue, Needham Heights, MA 02494	Phone: (781) 444-0219, Fax: (781) 444-0189	www.Mass.Gov/STANDARDS	7	160	2192	74	8
MD Dept of Agriculture, Weights & Measures Laboratory	50 Harry S Truman Pkwy, Annapolis, MD 20850	Phone: (410) 841-5790, Fax: (410) 841-2765	www.mda.maryland.gov	28	930	4870	2	0
Maine Metrology Laboratory	333 Cony Road, Augusta, ME 04330	Phone: (207) 287-7587, Fax:	www.maine.gov/dacf/qar/laboratory_testing/metrology.shtml	57	285	11500	150	15
State of Michigan E.C. Heffron Metrology Laboratory	940 Venture Lane, Williamston, MI 48895	Phone: (517) 655-8202, Fax: (517) 655-8303	www.michigan.gov/wminfo	22	2000	12200	161	77
Minnesota Weights and Measures	14305 Southcross Dr #150, Burnsville, MN 55306	Phone: (651) 539-1560, Fax: (952) 435-4040	mn.gov/commerce/industries/scales-meters/metrology-lab.jsp	12	1120	4706	264	179
Missouri Metrology Lab	1616 Missouri Blvd, Jefferson City, MO 65109	Phone: (573) 751-9487, Fax: (573) 751-0281	agriculture.mo.gov/	29	385	2433	547	25
MS Dept. of Agri. & Comm. Metrology Lab	1000 ASU Dr., Lorman, MS 39096	Phone: (601) 877-3802, Fax: (601) 877-3872		18	320	3752	150	0
State of Montana Bureau of Weights and Measures	2801 North Cooke Street, Helena, MT 59601	Phone: (406) 449-2582, Fax: (406) 443-8163	www.bsd.dli.mt.gov/weights-and-measures	40	2000	800	64	16
NCDA&CS Standards Laboratory	4040 District Drive, Raleigh, NC 27607	Phone: (919) 733-4411, Fax: (919) 733-8804	www.ncagr.gov/std	33	2700	4800	450	6
Nebraska Standards Laboratory	3721 West Cuming St., Lincoln, NE 68524	Phone: (402) 417-2087, Fax:		39	0	0	80	39
State of NJ, Office of Weights and Measures	1261 Routes 1 & 9 South, Avenel, NJ 07001	Phone: (732) 815-7821, Fax: (732) 382-5298	njconsumeraffairs.gov/OWM	29	200	2700	546	519
New Mexico Department of Agriculture	3190 S. Espina, Las Cruces, NM 88003	Phone: (575) 646-1551, Fax: (575) 646-2361	www.nmda.nmsu.edu/nmda/	45	153	2082	445	323
Nevada Metrology Laboratory	2150 Frazer Avenue, Sparks, NV 89431	Phone: (775) 353-3788, Fax: (775) 353-3798	agri.nv.gov	45	170	1044	181	31
New York State Metrology Laboratory	10B Airline Drive, Albany, NY 12235	Phone: (518) 457-4781, Fax: (518) 457-2552	www.agriculture.ny.gov/	7	975	4240	116	78
State of Ohio Metrology Laboratory	8995 E Main St, Bldg 5, Reynoldsburg, OH 43068	Phone: (614) 728-6290, Fax: (614) 728-6424	agri.ohio.gov/wps/portal/gov/oda/divisions/weights-and-measures	60	2500	3047	484	126
Oklahoma Bureau of Standards	2800 N. Lincoln Blvd., Oklahoma City, OK 73105	Phone: (405) 522-0567, Fax: (405) 522-5457	www.ag.ok.gov/lab/bos.htm	9	400	5807	162	123
Oregon Department of Agriculture	635 Capitol St NE, Salem, OR 97301	Phone: (503) 986-4669, Fax: (503) 986-4784	www.oregon.gov/ODA/programs/ISCP/Pages/Metrology.aspx	20	367	2038	101	33

Laboratory	Address	Contact	Website	Age (Years)	Office Space (sq. ft.)	Lab Space (sq. ft.)	Customers	Non-Service Agent Customers
Pennsylvania Standards Laboratory	2221 Forster Street, Room G-44A, Harrisburg, PA 17125	Phone: (717) 787-4707, Fax: (717) 705-0882	www.dgs.pa.gov	21	1568	3780	688	223
SCDA Metrology Laboratory	129 Ballard Court, West Columbia, SC 29172	Phone: (803) 253-4052, Fax:	agriculture.sc.gov/divisions/consumer-protection/metrology	1	8500	8000	350	100
South Dakota Metrology Laboratory	1500 N Garfield Ave, Pierre, SD 57501	Phone: (605) 773-3170, Fax:	dps.sd.gov/inspections/weights-measures/metrology-lab	45	0	525	62	20
Texas Department of Agriculture - Giddings Metrology Lab	PO Box 1518 / 1258 CR 226, Giddings, TX 78942	Phone: (979) 542-3231, Fax: (877) 205-7741	www.texasagriculture.gov/RegulatoryPrograms/WeightsandMeasures/MetrologyLab.aspx	16	1200	11077	226	45
Utah Metrology Lab	350 North Redwood Rd, Salt Lake City, UT 84014	Phone: (801) 538-7153, Fax:	ag.utah.gov	36	150	1350	62	44
VA Metrology Laboratory	600 North 4TH Street, Richmond, VA 23219	Phone: (804) 786-0479, Fax: (804) 371-0206		17	0	1840	148	110
State of Vermont Metrology Lab	322 Industrial Lane, Berlin, VT 05641	Phone: (802) 522-5415, Fax:	agriculture.vermont.gov	8	100	1500	71	23
WSDA Weights & Measures Metrology Laboratory	2747 29th Av SW; Tumwater, WA 98512	Phone: (360) 753-5042, Fax: (360) 586-4728	agr.wa.gov/Inspection/WeightsMeasures/metrologylab/metrologylab.aspx	41	230	2734	277	93
Wisconsin Weights and Measures Laboratory	3601 Galleon Run, Madison, WI 53718	Phone: (608) 224-4913, Fax: (608) 224-4912	datcp.wi.gov/Pages/Programs_Services/MetrologyLab.aspx	12	550	3700	382	0
WV Weights and Measures	570 MacCorkle Avenue, St. Albans, WV 25177	Phone: (304) 722-0602, Fax: (304) 722-0605	www.wvlabor.com	48	231	1769	282	56
Wyoming Department of Agriculture	6607 Campstool Rd, Cheyenne, WY 82002	Phone: (307) 777-7556, Fax: (307) 777-1943	agriculture.wy.gov	7	650	1660	40	6

Laboratory Survey Participation

Survey Participation Matrix														
Lab Code/Year	1996	1998	1999	2000	2002	2004	2005	2006	2008	2010	2012	2014	2016	2018
AK	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AL	Yes				Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
AR	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes
AZ	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CA	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CO	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CT	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
DE	(inactive)	(inactive)	(inactive)	(inactive)	(inactive)	(inactive)	(inactive)	(inactive)	(inactive)	(inactive)	(inactive)	(inactive)	(inactive)	(inactive)
FL	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
GA	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
HI	Yes	Yes	Yes	(inactive)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
IA	Yes	Yes	Yes		(inactive)	Yes	Yes	Yes	Yes	Yes	Yes	(inactive)	(inactive)	(inactive)
ID	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
IL	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
IN	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes
KS	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
KY	Yes	Yes	Yes	Yes	Yes	(inactive)	(inactive)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
LA	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
MA	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes
MD	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ME	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
MI	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
MN	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
MO	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
MS	Yes	Yes		(inactive)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
MT	Yes	Yes	Yes	Yes	Yes	Yes			Yes	Yes		Yes	Yes	Yes
NC	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ND	Yes	Yes	Yes	Yes	Yes	(inactive)	Yes	Yes	Yes		(inactive)	(inactive)	(inactive)	(inactive)

Lab Code/Year	1996	1998	1999	2000	2002	2004	2005	2006	2008	2010	2012	2014	2016	2018
NE	Yes	Yes			Yes	Yes	Yes	Yes			Yes	Yes	Yes	Yes
NH	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
NJ	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
NM	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
NV	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
NY	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
OH	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
OK	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
OR	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PA	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
RI	(inactive)	(inactive)	(inactive)	(inactive)	(inactive)	(inactive)	(inactive)	(inactive)	(inactive)	(inactive)	(inactive)	(inactive)	(inactive)	(inactive)
SC	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
SD	Yes	Yes			(inactive)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
TN	Yes	Yes	Yes	Yes	Yes	(inactive)	Yes	Yes	Yes		Yes	Yes	Yes	No
TX	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
UT	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
VA	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
VT	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WA	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WI	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WV	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
WY	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes
USDA-GIPSA	Yes					Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Wash. DC	(inactive)	(inactive)	(inactive)	(inactive)	(inactive)	(inactive)	(inactive)	(inactive)	(inactive)	(inactive)	(inactive)	(inactive)	(inactive)	(inactive)
Virgin Islands	(inactive)	(inactive)	(inactive)	(inactive)	(inactive)	(inactive)	(inactive)	(inactive)	(inactive)	(inactive)	(inactive)	(inactive)	(inactive)	(inactive)
Puerto Rico	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
LA County	Yes	Yes	Yes	Yes	Yes	(inactive)	(inactive)	(inactive)	Yes	Yes	Yes	Yes	Yes	Yes
TOTAL	51	46	45	44	48	47	46	49	50	47	48	49	49	45

Table 6: Listing of SLP member laboratories and their participation status in previous surveys (blanks indicate non-participation).

Grand Total

In order to give a very high-level overview of the measurement work performed by the SLP program the survey team added the number of measurements reported by all of the laboratories for each measurement procedure surveyed to come up with a grand total. This total does not factor in time or effort required in performing individual measurements. The reader is referred to the supplementary section of the 2014 edition of the SLP Workload Survey for data on the time required to complete individual measurements.

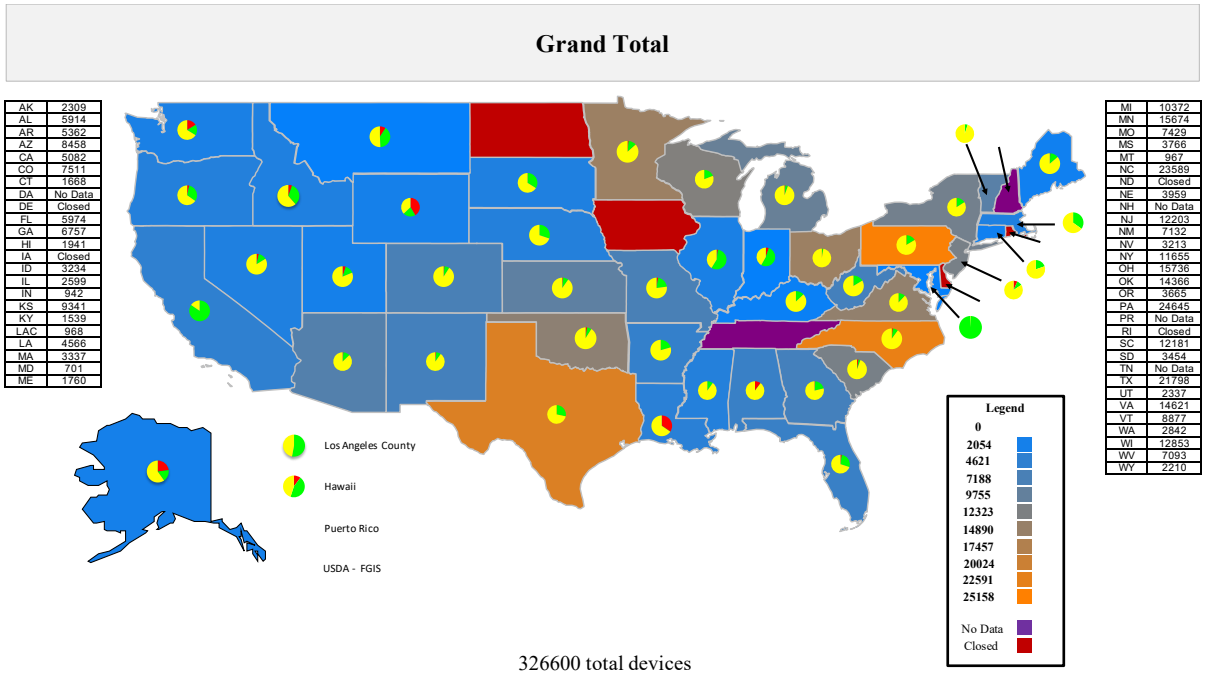
Survey	Labs	Total Devices	Lab Average
1996	51	322,472	6,323
1998	46	320,931	6,977
1999	45	352,274	7,828
2000	45	361,600	8,036
2002	48	375,411	7,821
2004	47	355,986	7,574
2005	46	361,054	7,849
2006	49	365,004	7,449
2008	50	367,336	7,347
2010	47	368,333	7,837
2012	47	305,728[3]	6,505
2014	49	336,858	6,875
2016	49	400,911[4]	8,182
2018	45	326,219[5]	7,244

Table 7: Summary of all measurements reported on prior surveys.

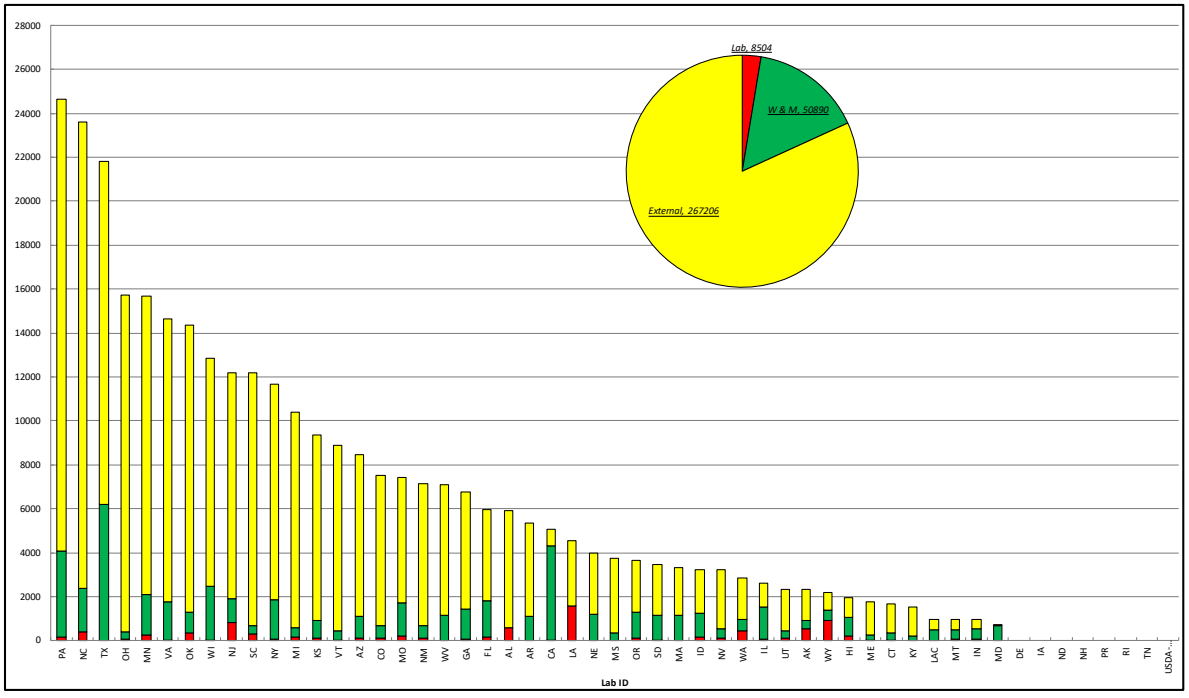
[3] The dip in SLP measurement production reported in 2012 is attributed in large part to the absence of a survey response from Puerto Rico. Puerto Rico routinely reports testing approximately 30,000 lottery balls

[4] In 2016 the metrology laboratory in Puerto Rico reported testing 69,800 lottery balls. This number is a little over double what has been historically reported by this laboratory. This accounts for a large portion of the increase in measurement production reported by the SLP this year.

[5] The dip in SLP measurement production reported in 2018 is attributed in large part to the absence of a survey response from Puerto Rico. Puerto Rico routinely reports testing approximately 30,000 lottery balls



326600 total devices
calibrated in 45 labs



Bar and pie chart color codes

- Laboratory
- Weights and Measures
- External

Figure 2: Total of all measurements reported.

Mass

Mass weighing procedures are broken into several categories based on measurement procedures and the category of mass standard measured for the purpose of this report.

Echelon I weighing procedures are those mass calibrations which use calibration designs, such as those detailed in the NIST SEMATECH Engineering Statistics Handbook and NIST Technical Note 952, that are solved using numerical least squares approximations, and correct for air buoyancy when inter-comparing weights of unequal volume. These calibrations are typically associated with, but are not limited to high precision weight standards such as those specified in ASTM E617 Class 0 or OIML E1. Masscode is the industry standard software used to analyze data collected for an echelon I calibration. Any calibration for which a laboratory used Masscode to analyze the primary data is considered to be an echelon I calibration for this survey.

Echelon II weighing procedures are typically used when high tolerance class calibrations are requested. These typically involve many redundant measurements in order to reduce the overall measurement uncertainty to an acceptable level. Unlike Echelon I, conventional mass corrections of the laboratory standards are typically used in lieu of performing air buoyancy corrections. Examples of echelon II mass calibration procedures may be found in NIST Internal Report 6969 (Harris, NIST IR 6969, "Selected Laboratory and Measurement Practices, and Procedures, to Support Basic Mass Calibrations", 2014), SOP 4 and SOP 7 (Harris, NIST IR 6969, "Selected Laboratory and Measurement Practices, and Procedures, to Support Basic Mass Calibrations", 2014).

Echelon III weighing procedures are essentially everything else with the exception of measurements performed on weight carts, railroad test cars, and railroad specific weight carts. A typical echelon III procedure is SOP 8 found in NIST Internal Report 6969 (Harris, NIST IR 6969, "Selected Laboratory and Measurement Practices, and Procedures, to Support Basic Mass Calibrations", 2014). Most mass standards tested in SLP metrology lab fall into this category (91%)[6]

Weight Carts are motorized carts used to transport a load of field test weights to facilitate the field testing of larger capacity scales. Weight carts are often subject to the specifications and tolerances found in NIST Handbook 105-8 (NIST Handbook 105-8 "Specifications and Tolerances for Field Standard Weight Carts", 2003) are typically tested using echelon III procedures. They are, never the less, treated separately herein as they are distinct from field test weights.

Railroad Test Cars are certified mass standards built for AAR interchange service used to facilitate the testing of railroad track scales. Specifications for these field standards are published by The Association of American Railroads (AAR Scale Handbook 2013 Edition, 2013). Certification of these mass standards is typically done using a master scale facility certified by the USDA Grain Inspection, Packers and Stockyard Association (GIPSA).

Railroad Specific Weight Carts are certified mass standards used to facilitate testing of railroad track scales. Unlike railroad test cars these devices by themselves are not suitable for AAR

[6] by count of mass standards tested only. The time required to complete a test is outside the scope of this survey.

interchange service. Unlike traditional weight carts these devices are designed transport 80,000 lb or more of test weight short distances on rail. Certification of these mass standards is typically done using a master scale facility certified by the USDA Grain Inspection, Packers and Stockyard Association (GIPSA) as these carts can weigh 10,000 lb or more. Additional weights loaded onto the cart are standard cast iron field test weights and are covered under Echelon III weighing procedures.

Mass Echelon I

Description

The graphs on the following page represent the total number of Mass Echelon I standards evaluated by the 45 reporting laboratories. The map graph illustrates a geographical distribution of the measurements. There are pie graphs located on the map for each individual lab and a larger pie graph that reflects the totals. The pie graphs provide a breakdown into the customer categories of Lab, W&M, and External. The bar graph at the bottom of the page shows the same breakdown along with the total number of devices tested by each laboratory.

- Lab – work done for the internal use of the metrology laboratory.
- W&M – work done for the weights and measures enforcement program.
- External – work done for customers who do not fall into any of the above categories.

Findings

Of the 45 reporting laboratories, 11 labs tested a total of 2,485 mass standards

Comparison of previous surveys

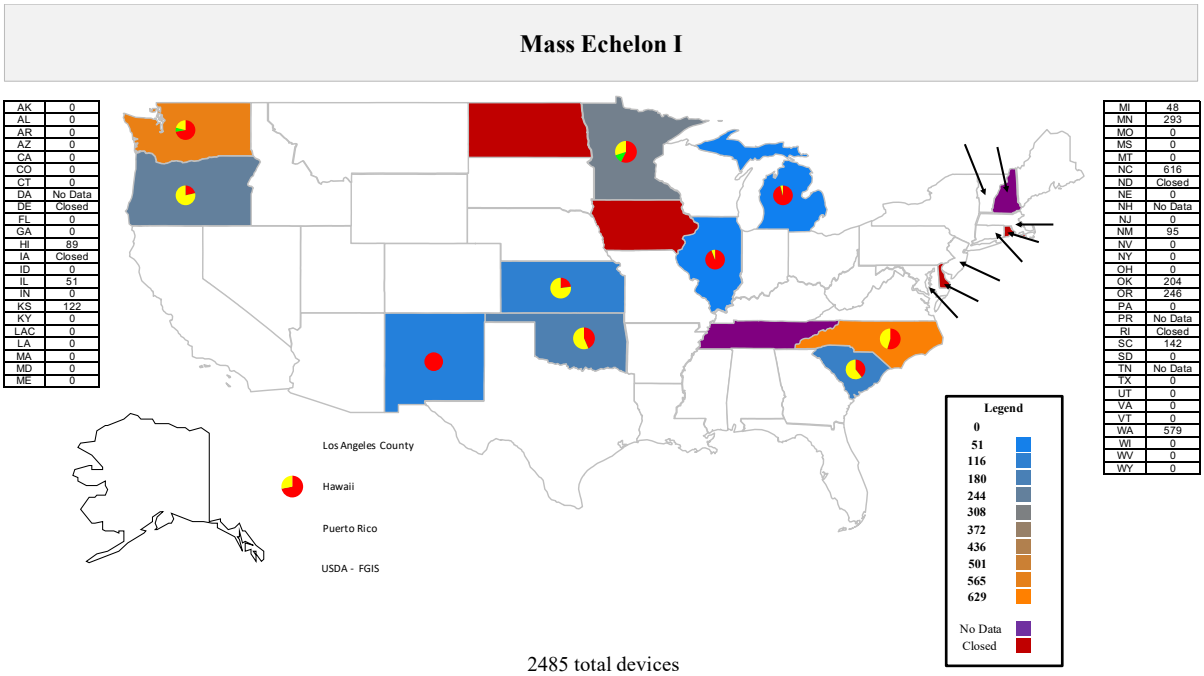
Year	# Labs	Total Devices
1998	10	2,667
1999	15	5,985
2000	16	5,227
2002	15	5,288
2004	14	3,707
2005	14	3,103
2006	14	3,025
2008	17	2,216
2010	19	2,309
2012	12	2,493
2014	13	2,980
2016	11	1,845
2018	11	2,485

Table 8: Summary of echelon I tests reported on previous surveys.

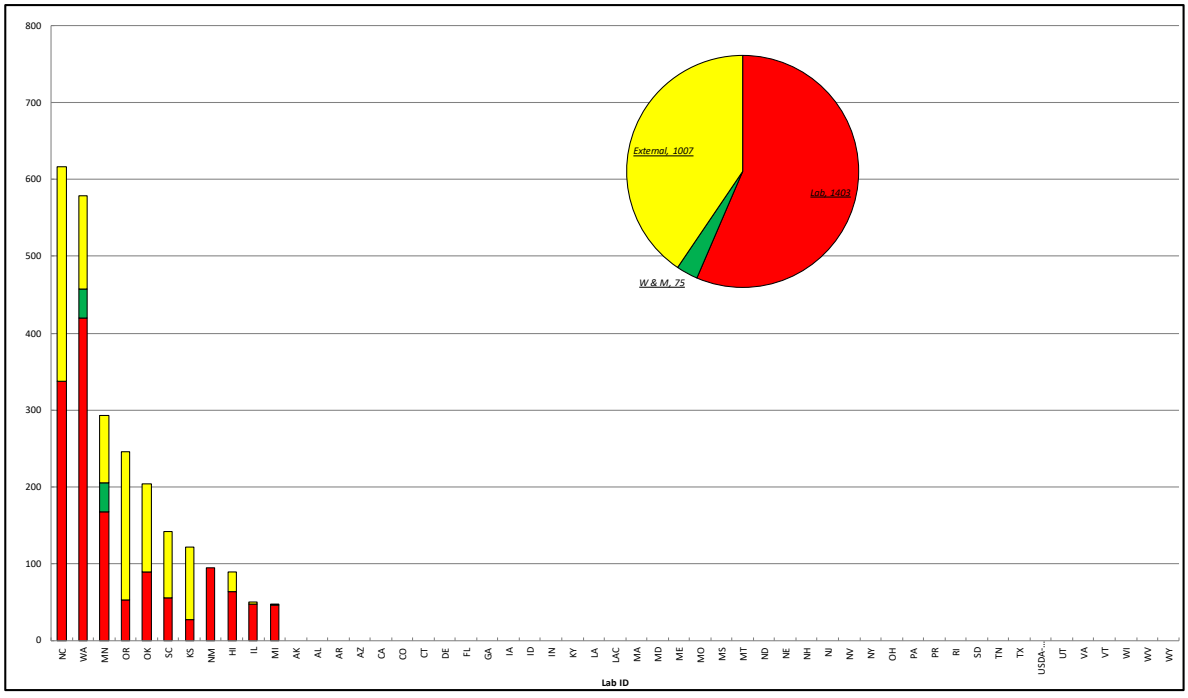
Results for Mass I cannot be compared to the 1996 survey as it did not use Mass Echelon I as a category. 'Precision Mass' was used as the category and it included both Mass Echelon I and Mass Echelon II calibrations.

Notes and Comments

- 56 % of all Mass I standards were calibrated for internal use by the laboratory.
- 3 % of all Mass I standards were calibrated for the weight and measures program.
- 41 % of all Mass I standards were calibrated for external customers.



2485 total devices
calibrated in 11 labs



Bar and pie chart color codes

- Laboratory
- Weights and Measures
- External

Figure 3: Mass Echelon I tests.

Mass Echelon II

Description

The graphs on the following page represent the total number of Mass Echelon II standards evaluated by the 45 reporting laboratories. The map graph illustrates a geographical distribution of the measurements. There are pie graphs located on the map for each individual lab and a larger pie graph that reflects the totals. The pie graphs provide a breakdown into the customer categories of Lab, W&M, and External. The bar graph at the bottom of the page shows the same breakdown along with the total number of devices tested by each laboratory.

- Lab – work done for the internal use of the metrology laboratory.
- W&M – work done for the weights and measures enforcement program.
- External – work done for customers who do not fall into any of the above categories.

Findings

Of the 45 reporting laboratories, 27 labs tested a total of 14,456 mass standards

Comparison of previous surveys

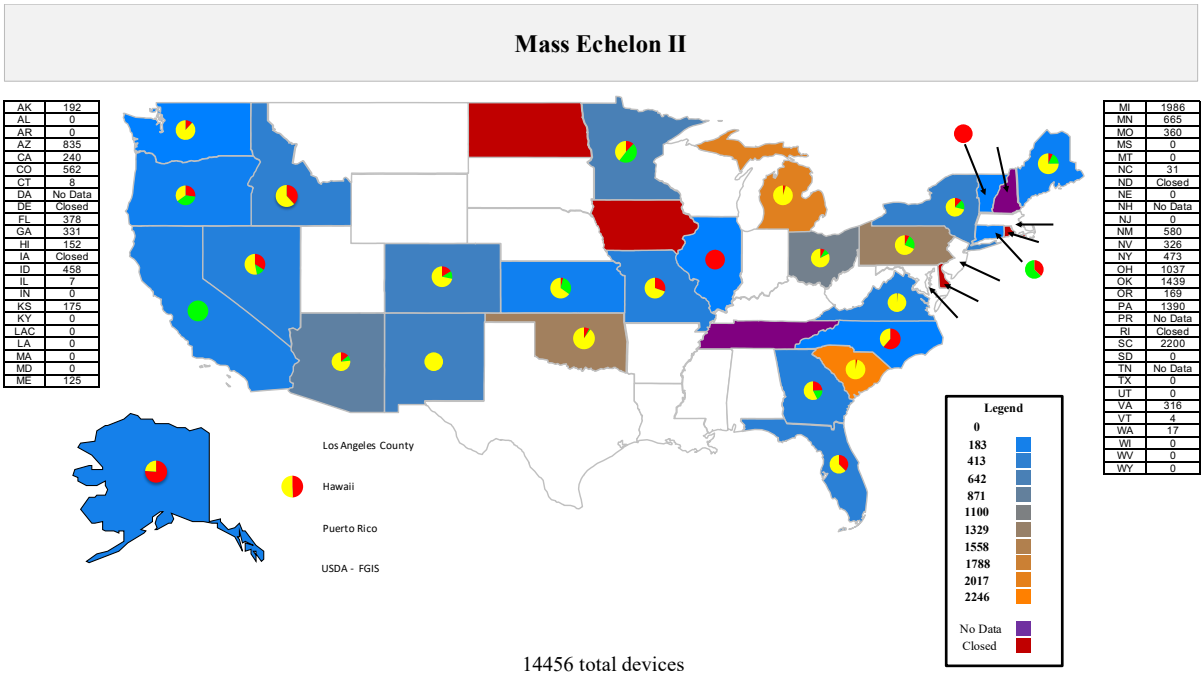
Year	# Labs	Total Devices
1996	38	37,662
1998	36	24,926
1999	35	25,807
2000	38	26,428
2002	37	25,847
2004	32	21,714
2005	32	20,541
2006	33	22,352
2008	32	25,371
2010	34	23,316
2012	30	18,222
2014	26	16,832
2016	27	11,723
2018	27	14,456

Table 9: Echelon II tests reported on previous surveys.

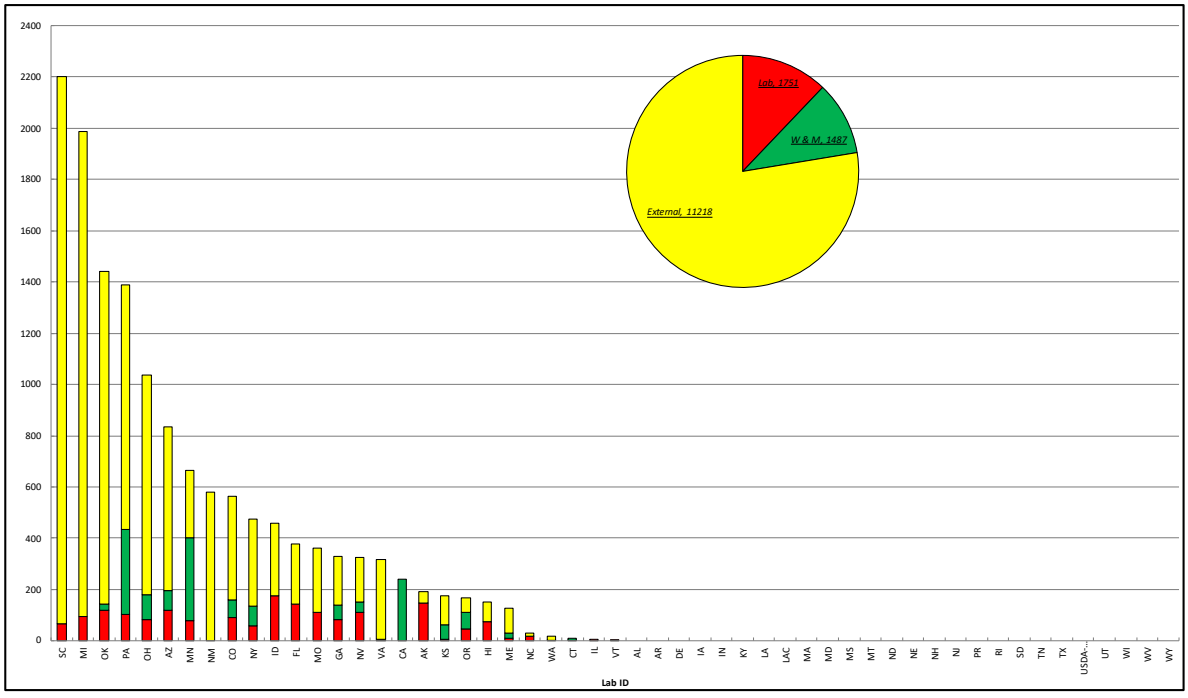
Results for Mass II cannot be compared to the 1996 survey as it did not use Mass Echelon II as a category. ‘Precision Mass’ was used as the category and it included both Mass Echelon I and Mass Echelon II calibrations.

Notes and Comments

- 12 % of all Mass II standards were calibrated for internal use by the laboratory.
- 10 % of all Mass II standards were calibrated for the weight and measures program.
- 78 % of all Mass II standards were calibrated for external customers.



14456 total devices
calibrated in 27 labs



Bar and pie chart color codes

- Laboratory
- Weights and Measures
- External

Figure 4: Mass Echelon II tests.

Mass Echelon III

Description

The graphs on the following page represent the total number of Mass Echelon III standards evaluated by the 45 reporting laboratories. The map graph illustrates a geographical distribution of the measurements. There are pie graphs located on the map for each individual lab and a larger pie graph that reflects the totals. The pie graphs provide a breakdown into the customer categories of Lab, W&M, and External. The bar graph at the bottom of the page shows the same breakdown along with the total number of devices tested by each laboratory.

- Lab – work done for the internal use of the metrology laboratory.
- W&M – work done for the weights and measures enforcement program.
- External – work done for customers who do not fall into any of the above categories.

Findings

Of the 45 reporting laboratories, 45 labs tested a total of 258,852 mass standards

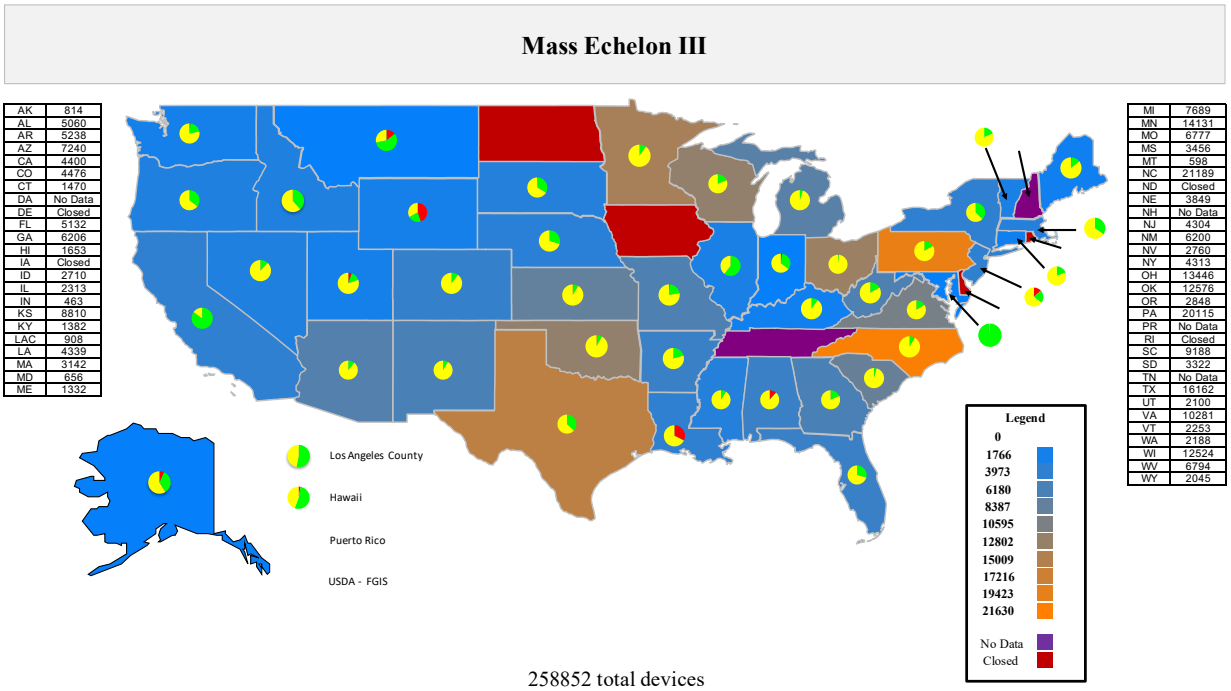
Comparison of previous surveys

Year	# Labs	Total Devices
1996	51	259,713
1998	46	259,166
1999	45	257,938
2000	45	260,072
2002	47	267,240
2004	47	248,117
2005	46	248,650
2006	49	256,844
2008	50	254,221
2010	47	256,094
2012	47	256,094
2014	47	244,985
2016	48	261,823
2018	45	258,852

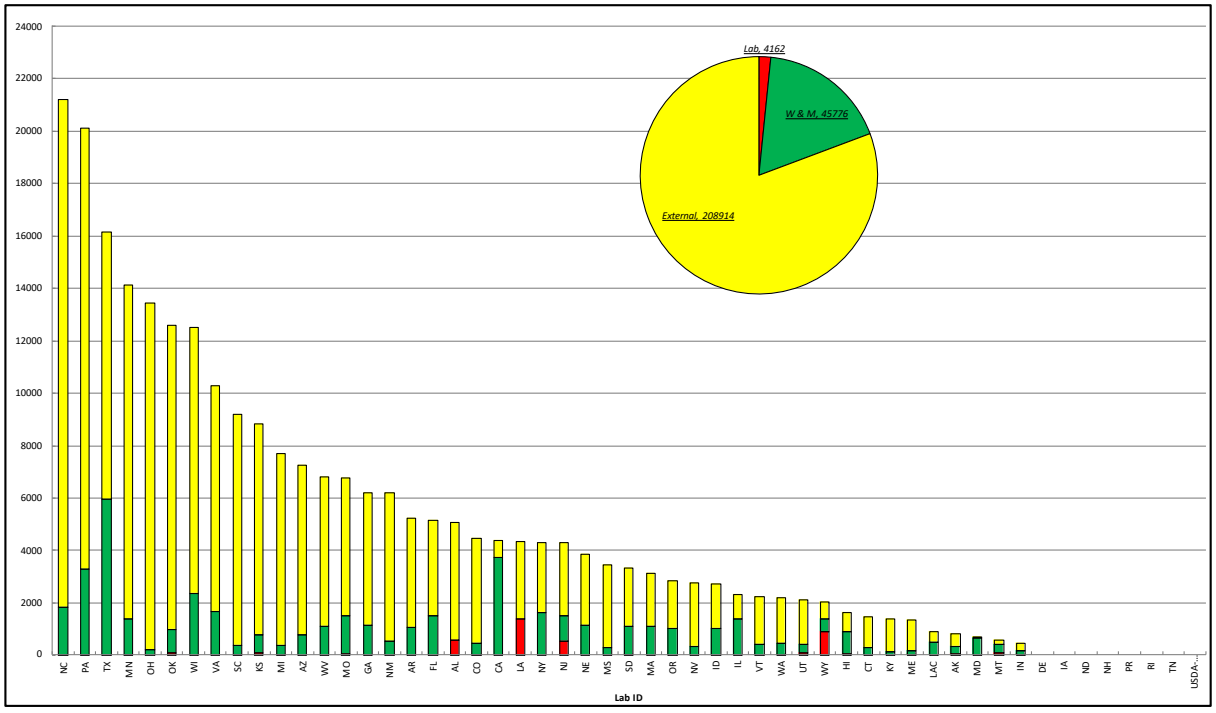
Table 10: Echelon III tests reported on previous surveys.

Notes and Comments

- 2 % of all Mass III standards were calibrated for internal use by the laboratory.
- 18 % of all Mass III standards were calibrated for the weight and measures program.
- 81 % of all Mass III standards were calibrated for external customers.



258852 total devices
calibrated in 45 labs



Bar and pie chart color codes

- Laboratory
- Weights and Measures
- External

Figure 5: Mass Echelon III tests.

Weight Carts

Description

The graphs on the following page represent the total number of weight carts evaluated by the 45 reporting laboratories. The map graph illustrates a geographical distribution of the measurements. There are pie graphs located on the map for each individual lab and a larger pie graph that reflects the totals. The pie graphs provide a breakdown into the customer categories of Lab, W&M, and External. The bar graph at the bottom of the page shows the same breakdown along with the total number of devices tested by each laboratory.

- Lab – work done for the internal use of the metrology laboratory.
- W&M – work done for the weights and measures enforcement program.
- External – work done for customers who do not fall into any of the above categories.

Findings

Of the 45 reporting laboratories, 30 labs tested a total of 585 weight carts

Comparison of previous surveys

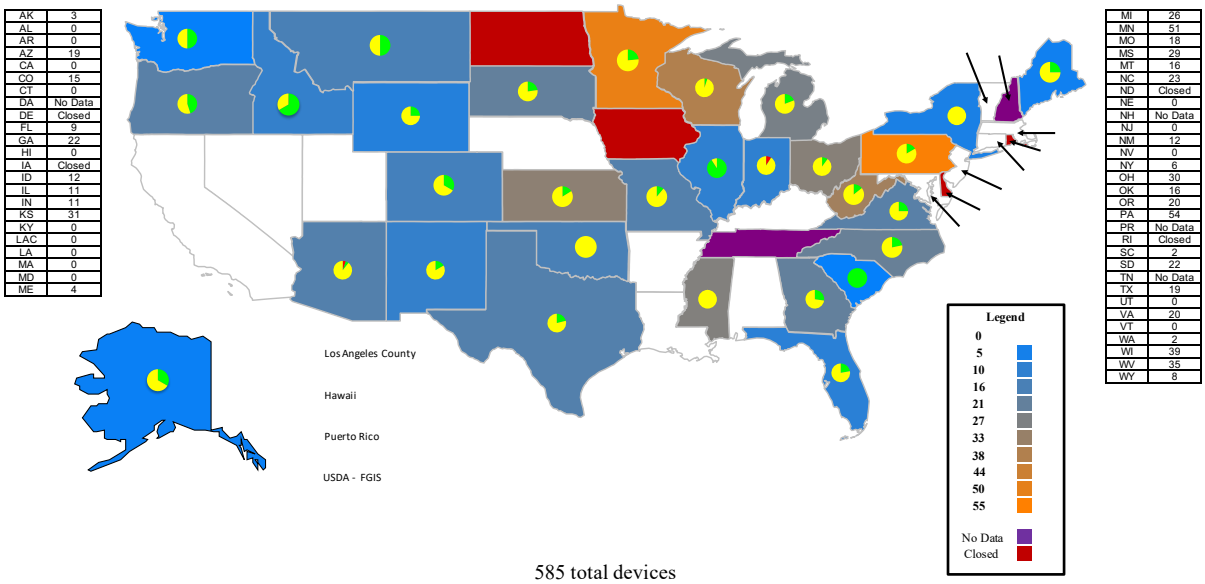
Year	# Labs	Total Devices
1998	30	297
2000	27	344
2002	29	388
2004	33	365
2005	30	410
2006	31	388
2008	32	445
2010	35	468
2012	31	433
2014	30	517
2016	31	572
2018	30	585

Table 11: Weight Cart tests reported on previous surveys.

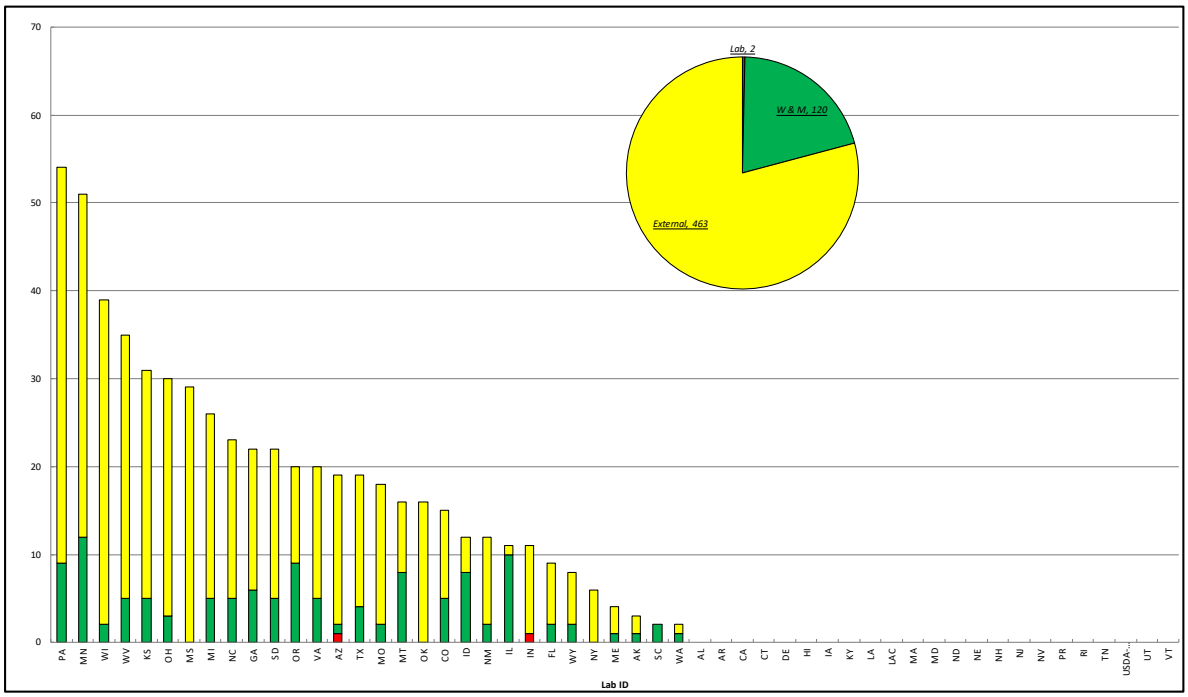
Notes and Comments

- <1 % of all weight carts were calibrated for internal use by the laboratory.
- 21 % of all weight carts were calibrated for the weight and measures program.
- 79 % of all weight carts were calibrated for external customers.

Weight Carts



585 total devices
calibrated in 30 labs



Bar and pie chart color codes

- Laboratory
- Weights and Measures
- External

Figure 6: Weight Cart tests.

Railroad Test Cars

Description

The graphs on the following page represent the total number of railroad test cars evaluated by the 45 reporting laboratories. The map graph illustrates a geographical distribution of the measurements. There are pie graphs located on the map for each individual lab and a larger pie graph that reflects the totals. The pie graphs provide a breakdown into the customer categories of Lab, W&M, and External. The bar graph at the bottom of the page shows the same breakdown along with the total number of devices tested by each laboratory.

- Lab – work done for the internal use of the metrology laboratory.
- W&M – work done for the weights and measures enforcement program.
- External – work done for customers who do not fall into any of the above categories.

Findings

Of the 45 reporting laboratories, 3 labs tested a total of 16 railroad test cars

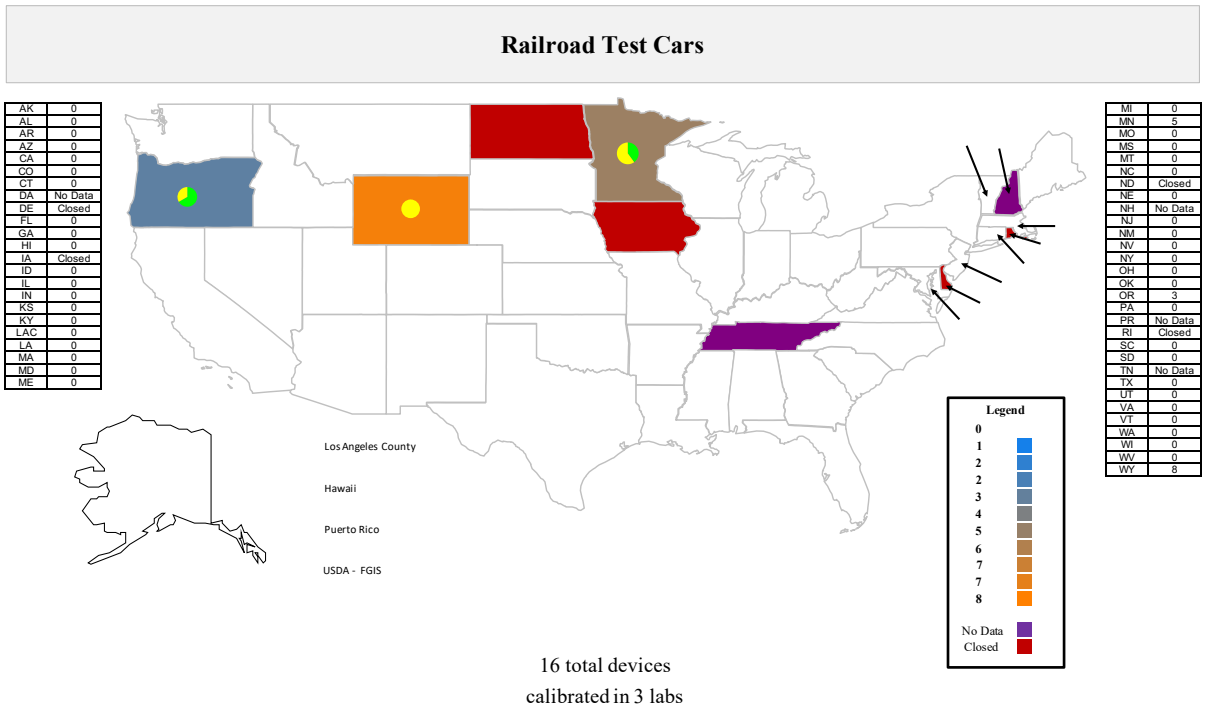
Comparison of previous surveys

Year	# Labs	Total Devices
2016	5	43
2018	3	16

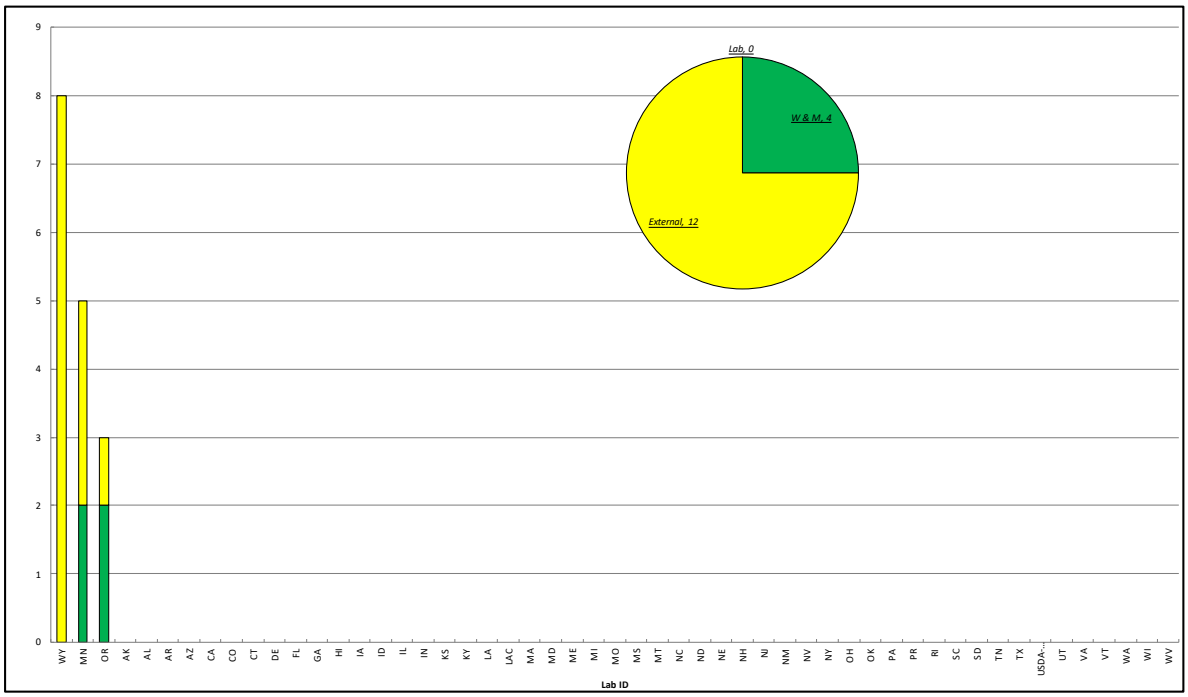
Table 12: Railroad Test Car tests reported on previous surveys.

Notes and Comments

- 0 % of all weight carts were calibrated for internal use by the laboratory.
- 25 % of all weight carts were calibrated for the weight and measures program.
- 75 % of all weight carts were calibrated for external customers.



16 total devices
calibrated in 3 labs



Bar and pie chart color codes

- Laboratory
- Weights and Measures
- External

Figure 7: Railroad Test Car tests.

Railroad Specific Weight Carts

Description

The graphs on the following page represent the total number of railroad specific weight carts evaluated by the 45 reporting laboratories. The map graph illustrates a geographical distribution of the measurements. There are pie graphs located on the map for each individual lab and a larger pie graph that reflects the totals. The pie graphs provide a breakdown into the customer categories of Lab, W&M, and External. The bar graph at the bottom of the page shows the same breakdown along with the total number of devices tested by each laboratory.

- Lab – work done for the internal use of the metrology laboratory.
- W&M – work done for the weights and measures enforcement program.
- External – work done for customers who do not fall into any of the above categories.

Findings

Of the 45 reporting laboratories, 7 labs tested a total of 33 railroad specific weight carts

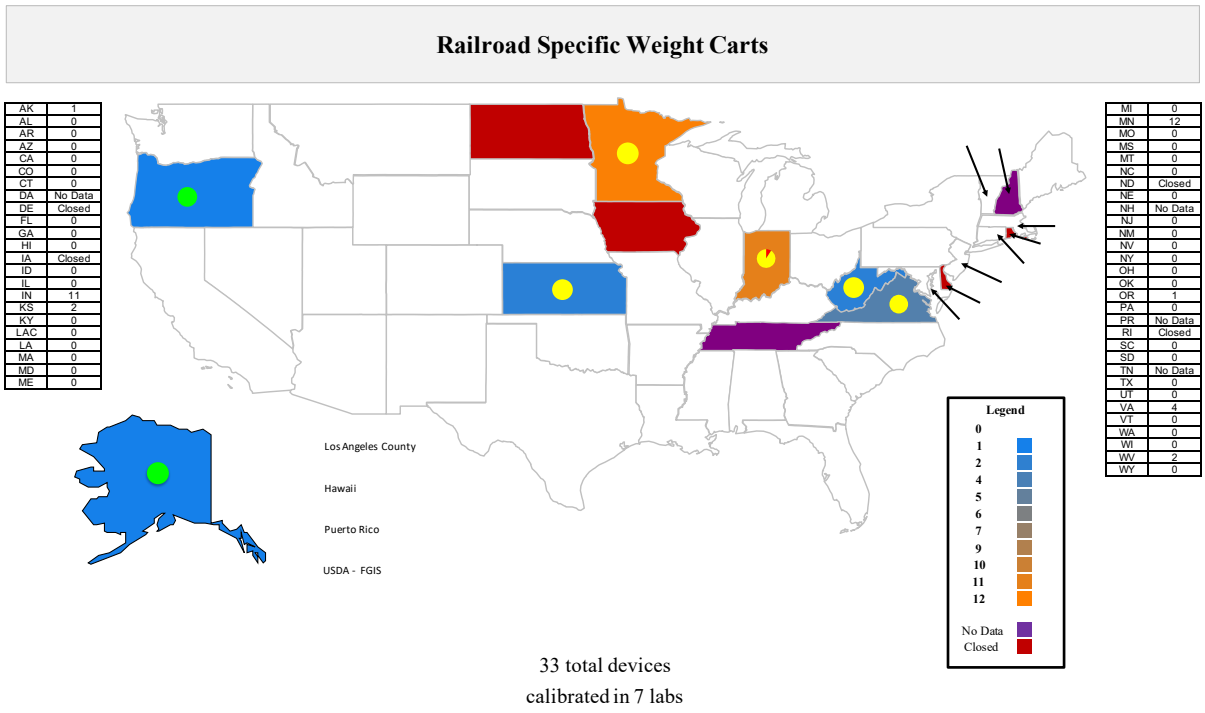
Comparison of previous surveys

Year	# Labs	Total Devices
2016	5	13
2018	7	33

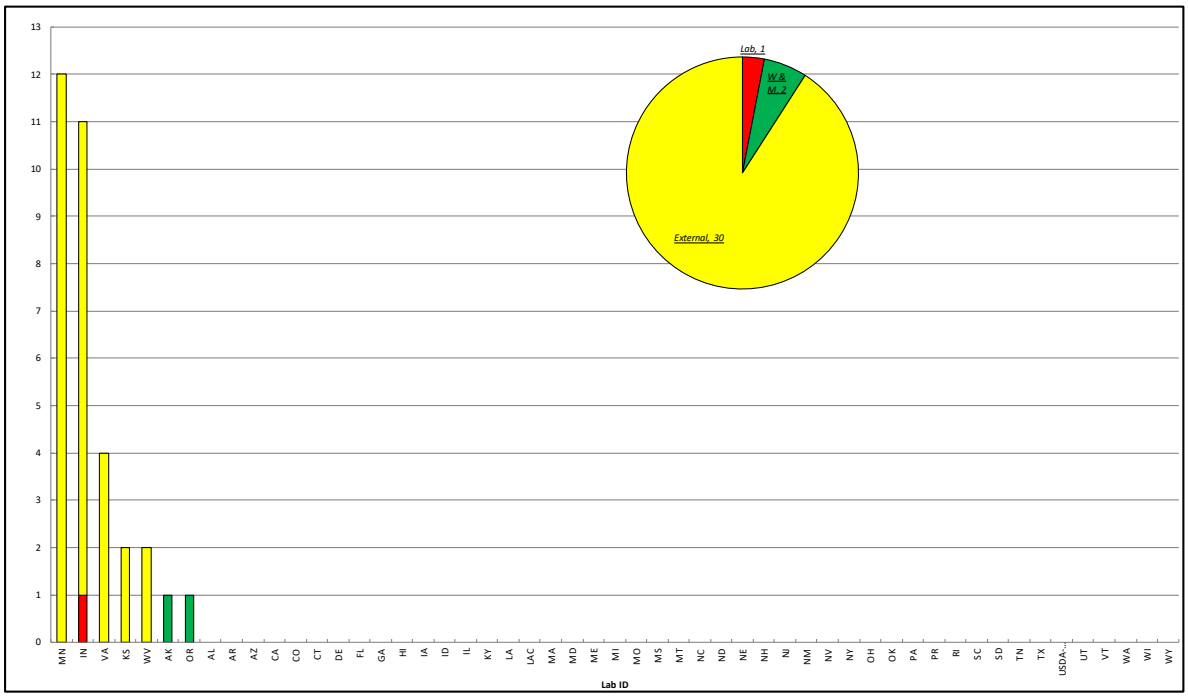
Table 13: Railroad Specific Weight Carts tests reported on previous surveys.

Notes and Comments

- 3 % of all weight carts were calibrated for internal use by the laboratory.
- 6 % of all weight carts were calibrated for the weight and measures program.
- 91 % of all weight carts were calibrated for external customers.



33 total devices
calibrated in 7 labs



Bar and pie chart color codes

- Laboratory
- Weights and Measures
- External

Figure 8: Railroad Specific Weight Cart tests.

Length

SLP Laboratories normally test two distinct classes of length standards, steel tape measures (surveyor's tapes or pi tapes for example) and rigid steel rules.

A typical measurement procedure for calibrating a rigid steel rule involves the side by side comparison of two rigid steel rules with the aid of a microscope. Two measurement procedures are commonly employed by the SLP laboratories to test steel tape measures. One involves the direct comparison of two flat steel tapes the other a direct comparison of a surveyor tape to a fixed length bench calibrated at 1 ft intervals out to 16 ft. Measurement procedures may be found in NISTIR 8028, 2014, *Selected Laboratory and Measurement Practices and Procedures for Length Calibrations, Jose A. Torres, Georgia L. Harris.*

Steel Tape Measures

Description

The graphs on the following page represent the total number of tape measures evaluated by the 45 reporting laboratories. The map graph illustrates a geographical distribution of the measurements. There are pie graphs located on the map for each individual lab and a larger pie graph that reflects the totals. The pie graphs provide a breakdown into the customer categories of Lab, W&M, and External. The bar graph at the bottom of the page shows the same breakdown along with the total number of devices tested by each laboratory.

- Lab – work done for the internal use of the metrology laboratory.
- W&M – work done for the weights and measures enforcement program.
- External – work done for customers who do not fall into any of the above categories.

Findings

Of the 45 reporting laboratories, 5 labs tested a total of 213 tape measures

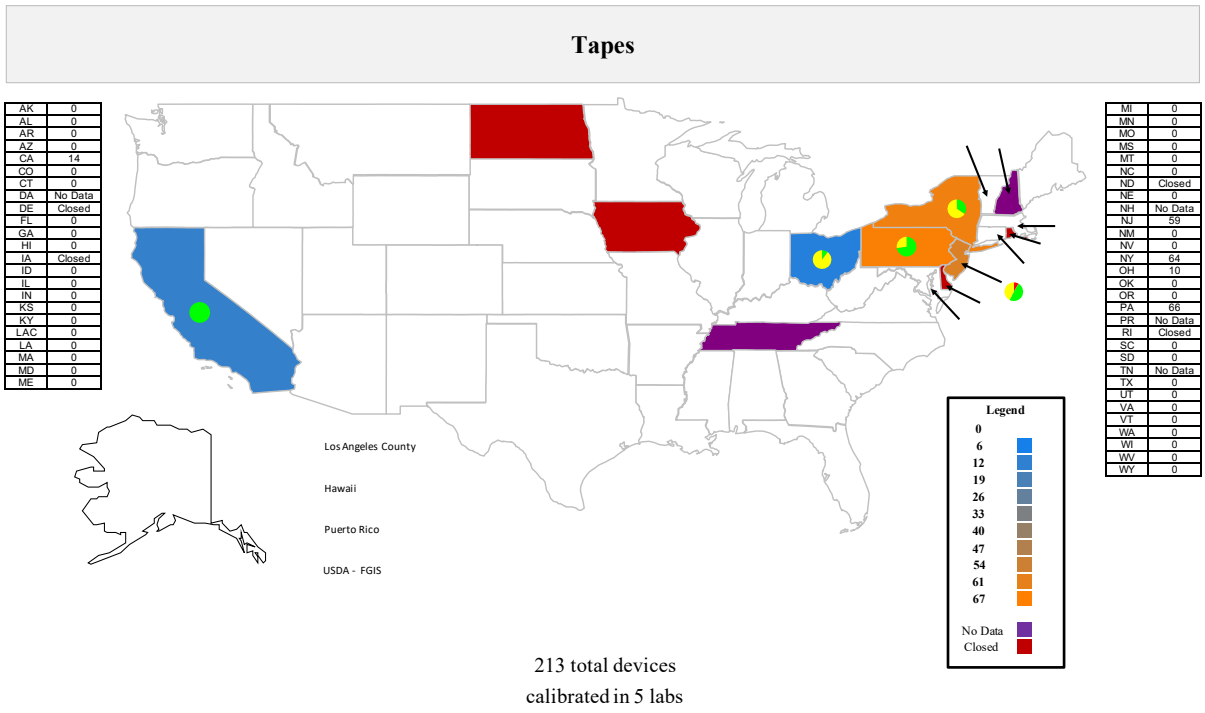
Comparison of previous surveys

Year	# Labs	Total Devices
1996	27	707
1998	29	537
1999	21	566
2000	22	487
2002	21	584
2004	21	319
2005	19	304
2006	18	339
2008	17	425
2010	15	310
2012	12	353
2014	9	323
2016	7	319
2018	5	213

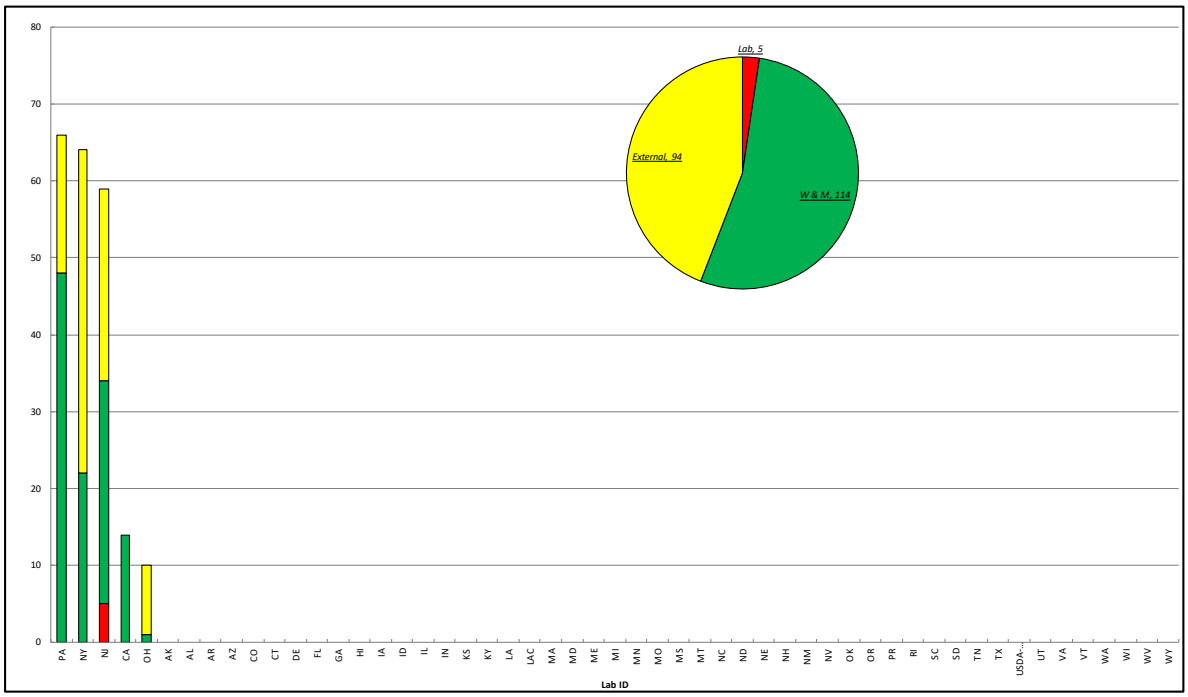
Table 14: Tape measure tests reported on previous surveys.

Notes and Comments

- 2 % of all tape measures were tested for internal use by the laboratory.
- 54 % of all tape measures were tested for the weight and measures program.
- 44 % of all tape measures were tested for external customers.



213 total devices
calibrated in 5 labs



Bar and pie chart color codes

- Laboratory
- Weights and Measures
- External

Figure 9: Tape Measure tests.

Rigid Rules

Description

The graphs on the following page represent the total number of rigid rules evaluated by the 45 reporting laboratories. The map graph illustrates a geographical distribution of the measurements. There are pie graphs located on the map for each individual lab and a larger pie graph that reflects the totals. The pie graphs provide a breakdown into the customer categories of Lab, W&M, and External. The bar graph at the bottom of the page shows the same breakdown along with the total number of devices tested by each laboratory.

- Lab – work done for the internal use of the metrology laboratory.
- W&M – work done for the weights and measures enforcement program.
- External – work done for customers who do not fall into any of the above categories.

Findings

Of the 45 reporting laboratories, 4 labs tested a total of 184 rigid rules.

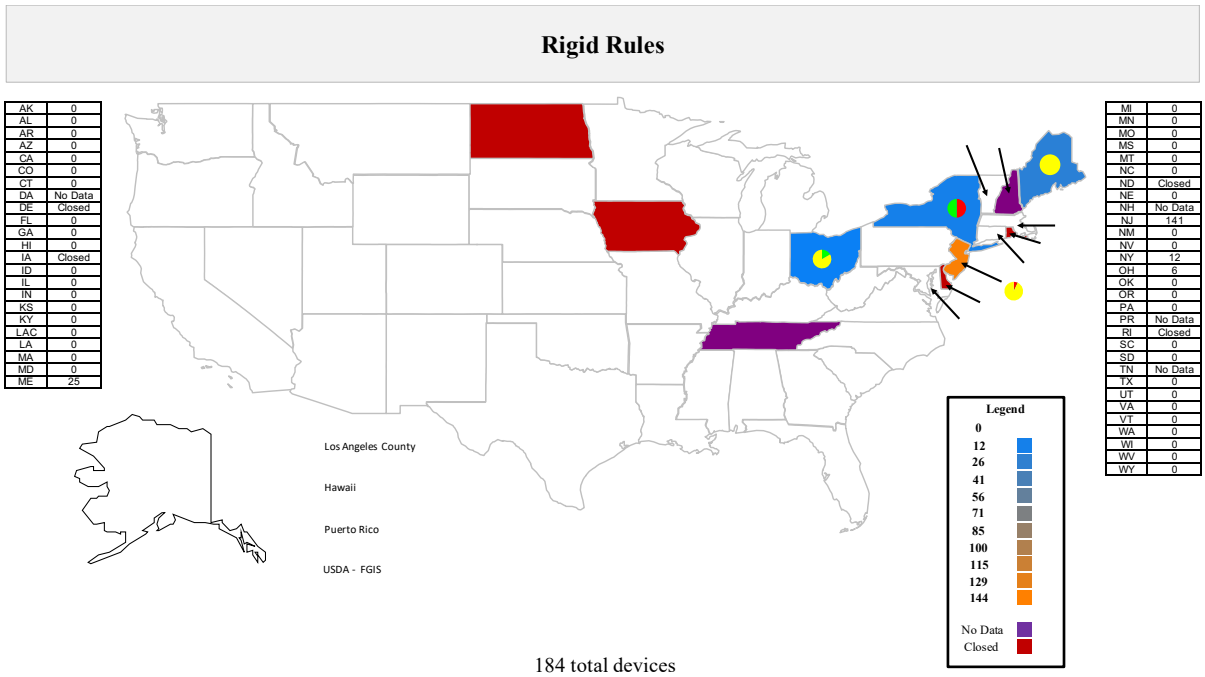
Comparison of previous surveys

Year	# Labs	Total Devices
1996	26	582
1998	29	269
1999	20	413
2000	16	169
2002	14	138
2004	12	98
2005	11	85
2006	11	122
2008	11	88
2010	8	89
2012	3	85
2014	3	54
2016	2	36
2018	4	184

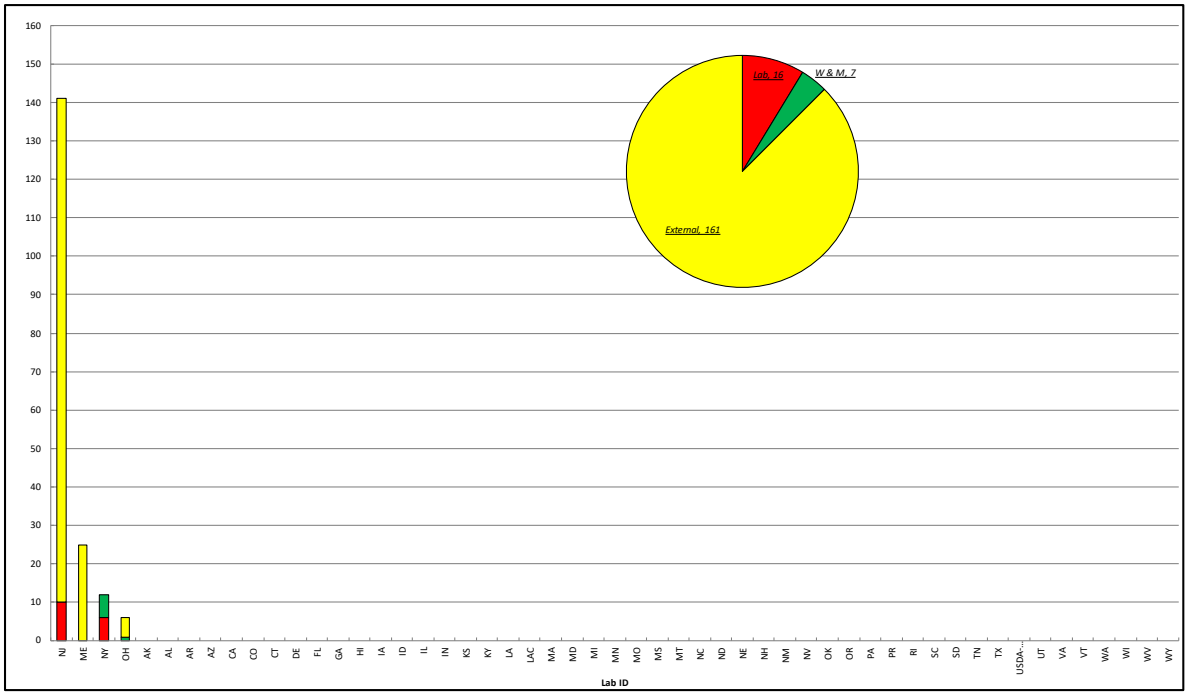
Table 15: Rigid rule tests reported in previous surveys.

Notes and Comments

- 9 % of all rigid rules were tested for internal use by the laboratory.
- 4 % of all rigid rules were tested for the weight and measures program.
- 88 % of all rigid rules were tested for external customers.



184 total devices
calibrated in 4 labs



Bar and pie chart color codes

- Laboratory
- Weights and Measures
- External

Figure 10: Rigid rule tests.

Volume

Volume measurement service are the 2nd most commonly performed by the SLP laboratories next to mass measurement. Volume measurement is broken down into distinct categories based upon the type of volumetric standard tested. The categories are glassware, volume test measures (≤ 5 gallons), medium volume provers (>5 gallons and ≤ 100 gallons), and large volume provers (> 100 gallons).

Examples of Volumetric Standards include but may not be limited to the following;

- laboratory glassware (see for example ASTM E288) and field measuring flasks (see NIST Handbook 105-2).
- steel graduated neck test measures as described in NIST Handbook 105-3 and in American Petroleum Institute's Manual of Petroleum Measurement Standards (Chapter 4). These include the steel 5 gallon capacity test measures commonly used by weights and measures officials to test retail motor fuel dispensers.
- pressurized Liquefied Petroleum Gas (LPG) Provers as described in NIST Handbook 105-4.
- slicker plate standards. These devices are similar to volumetric provers with the exception that they do not have a graduated neck. A slicker plate is used to skim off the meniscus formed at the top of the vessel when filled.

Volume measurements are further subdivided into two measurement categories. Volume standards are calibrated either by;

- transferring a known quantity of liquid (usually clean water) into them (See SOP's 16, 18, and 19 of NIST Internal Report 7383) –Volumetric Calibration–, or
- by filling it with a well characterized liquid (typically distilled water) and weighing it (See SOP 14 of NIST Internal Report 7383) –Gravimetric Calibration–.

Glassware

Description

The graphs on the next two pages represent the total number of volume measurements performed on glassware by the 45 reporting laboratories. Each map graph illustrates the geographical distribution of these measurements. The pie graphs located on each map for each individual lab and a larger pie graph that reflects the totals. The bar graph at the bottom of the page shows the same customer breakdown along with the total number of devices tested by each laboratory.

- Lab – work done for the internal use of the metrology laboratory.
- W&M – work done for the weights and measures enforcement program.
- External – work done for customers who do not fall into any of the above categories.

Findings

- Of the 45 reporting laboratories, 0 labs performed a total of 0 volume transfer tests.
- Of the 45 reporting laboratories, 9 labs performed a total of 104 gravimetric volume tests.

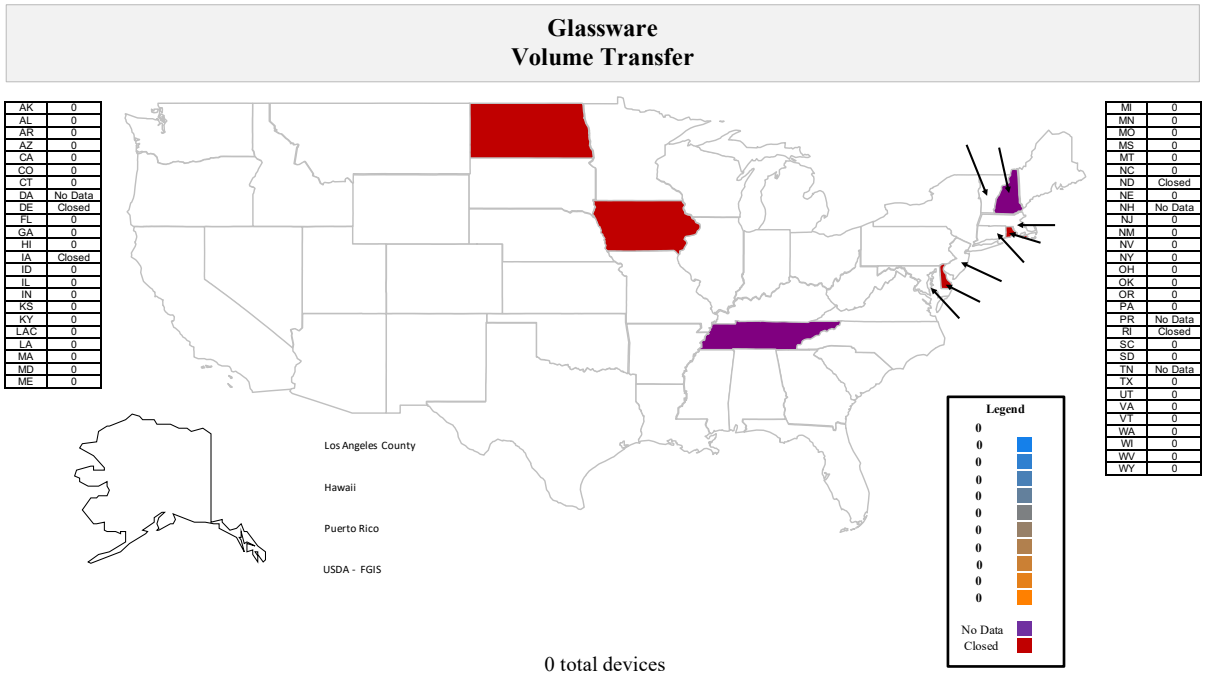
Comparison of previous surveys

Year	# Labs	Volume Transfer	Gravimetric	Total
1996	29			1,205
1998	24			844
1999	25			853
2000	27			668
2002	24			555
2004	17			332
2005	20	69	140	209
2006	18	82	172	254
2008	18	42	183	225
2010	16	43	288	331
2010	16	43	288	331
2012	8	170	78	248
2014	9	124	119	243
2016	10	6	75	81
2018	9	0	104	104

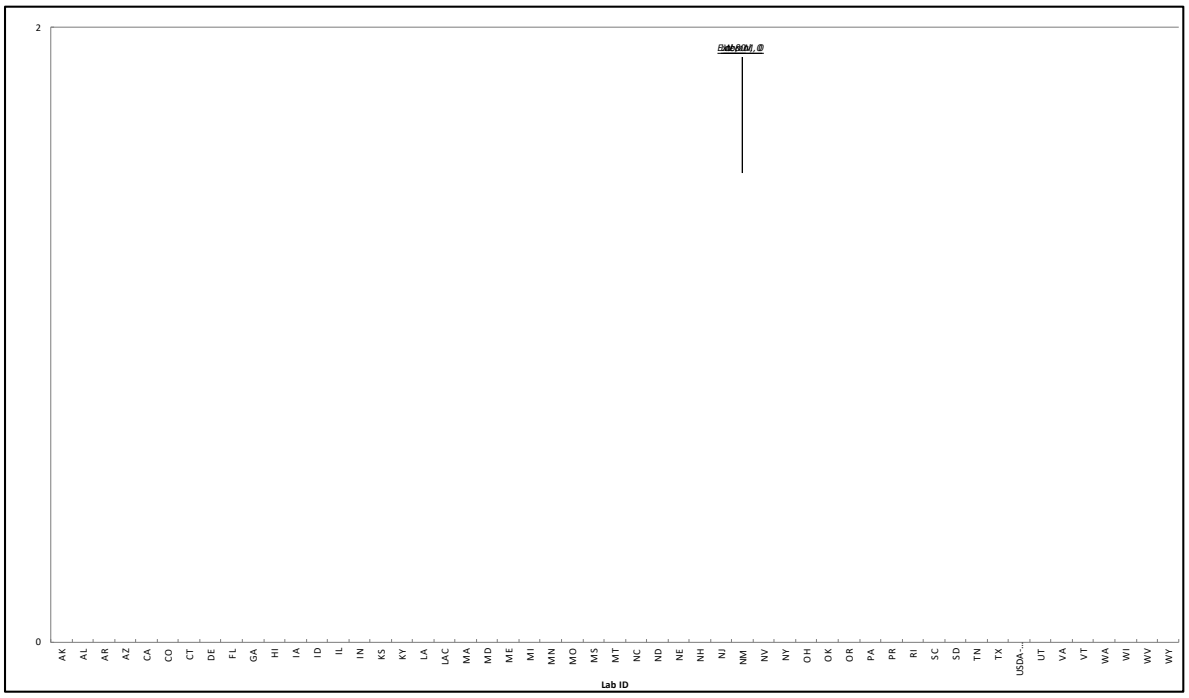
Table 16: Glassware calibrations from previous surveys.

Notes and Comments

- 6 % of all glassware standards were tested for the laboratory
- 37 % of all glassware standards were tested for Weights and Measures enforcement programs.
- 58 % of all glassware standards were tested for external customers.



0 total devices
calibrated in 0 labs

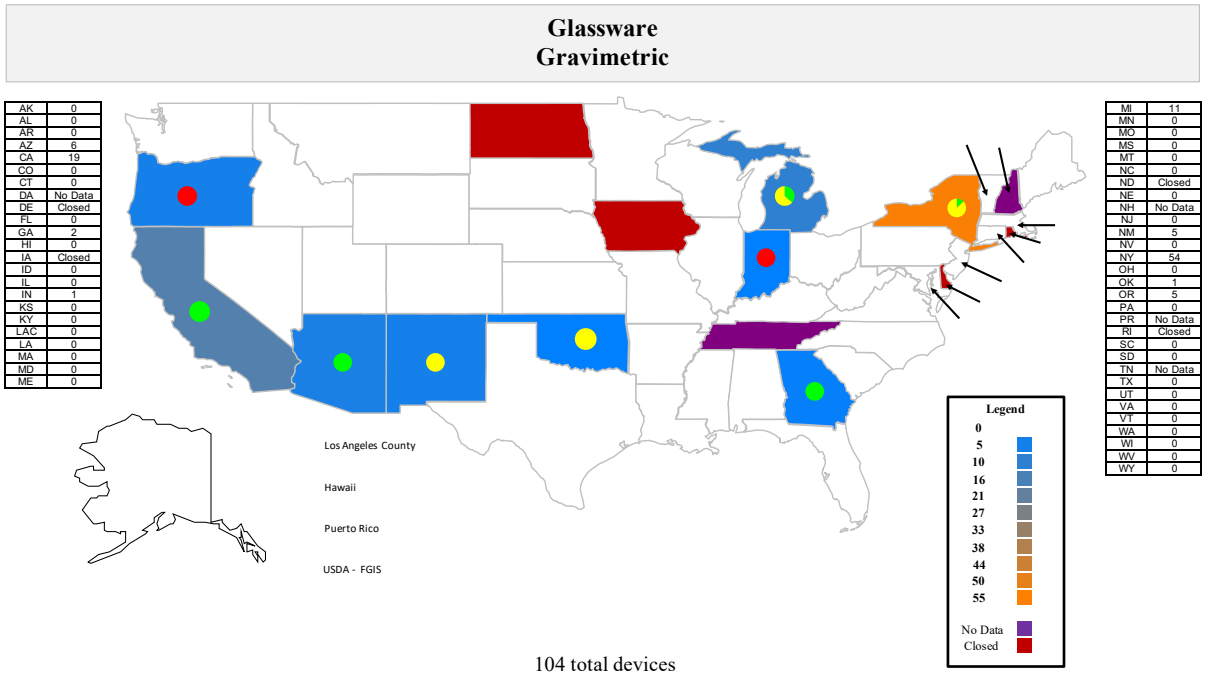


Bar and pie chart color codes

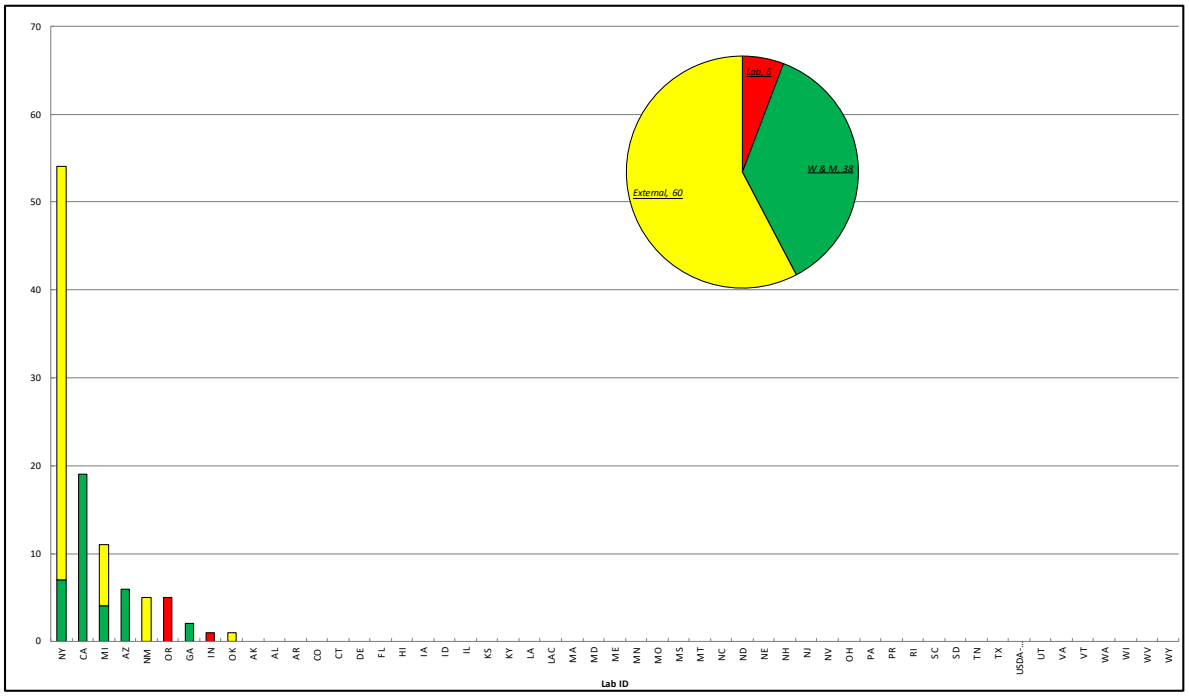
- Laboratory
- Weights and Measures
- External

Figure 11: Glassware calibrations, volume transfer method

Gravimetric



104 total devices
calibrated in 9 labs



Bar and pie chart color codes

Laboratory
Weights and Measures
External

Figure 12: Glassware calibrations, gravimetric method.

Test Measures (≤5 gallon)

Description

The graphs on the next two pages represent the total number of volume measurements performed on test measures by the 45 reporting laboratories. Each map graph illustrates the geographical distribution of these measurements. The pie graphs located on each map for each individual lab and a larger pie graph that reflects the totals. The bar graph at the bottom of the page shows the same customer breakdown along with the total number of devices tested by each laboratory.

- Lab – work done for the internal use of the metrology laboratory.
- W&M – work done for the weights and measures enforcement program.
- External – work done for customers who do not fall into any of the above categories.

Findings

- Of the 45 reporting laboratories, 44 labs performed a total of 8308 volume transfer tests.
- Of the 45 reporting laboratories, 16 labs performed a total of 74 gravimetric volume tests.

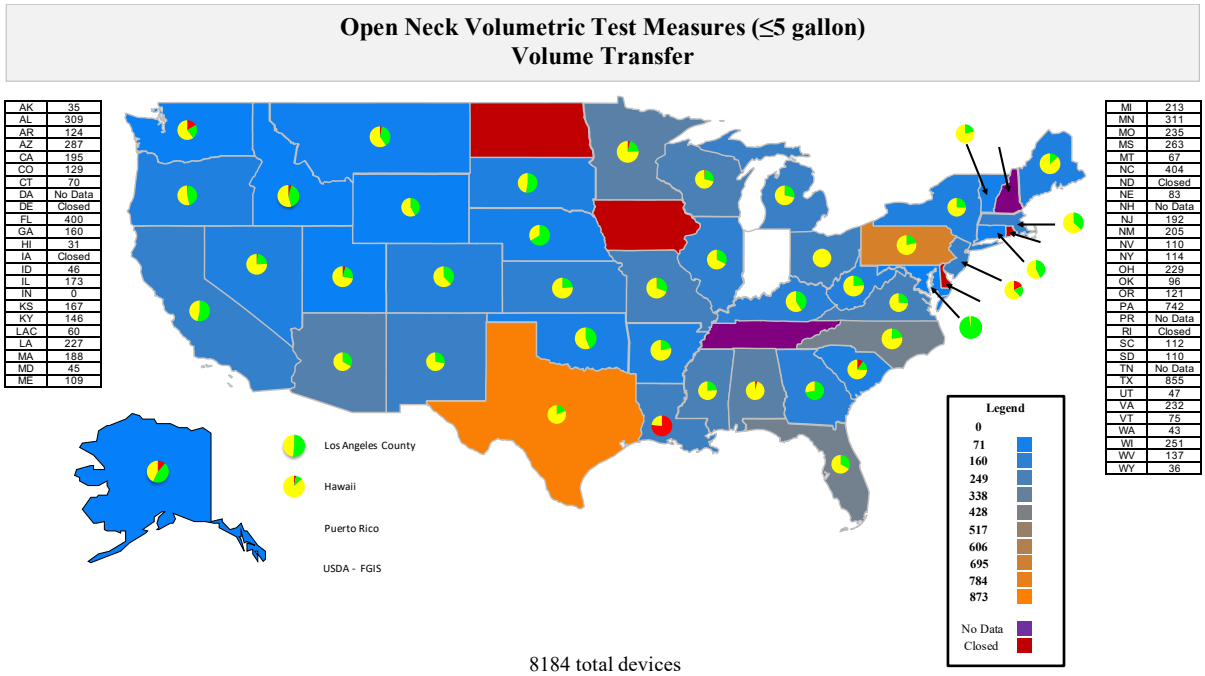
Comparison of previous surveys

Year	# Labs	Volume Transfer	Gravimetric	Total
1996	48	8290		8290
1998	46	6861		6861
1999	45	6986		6986
2000	45	7368		7368
2002	48	6966		6966
2004	46	6400		6400
2005	42	6925	75	7000
2006	46	7532	77	7609
2008	49	7321	69	7390
2010	45	8216	73	8289
2012	46	7533	93	7626
2014	46	7863	128	7991
2016	46	7926	84	8010
2018	44	8308	74	8341

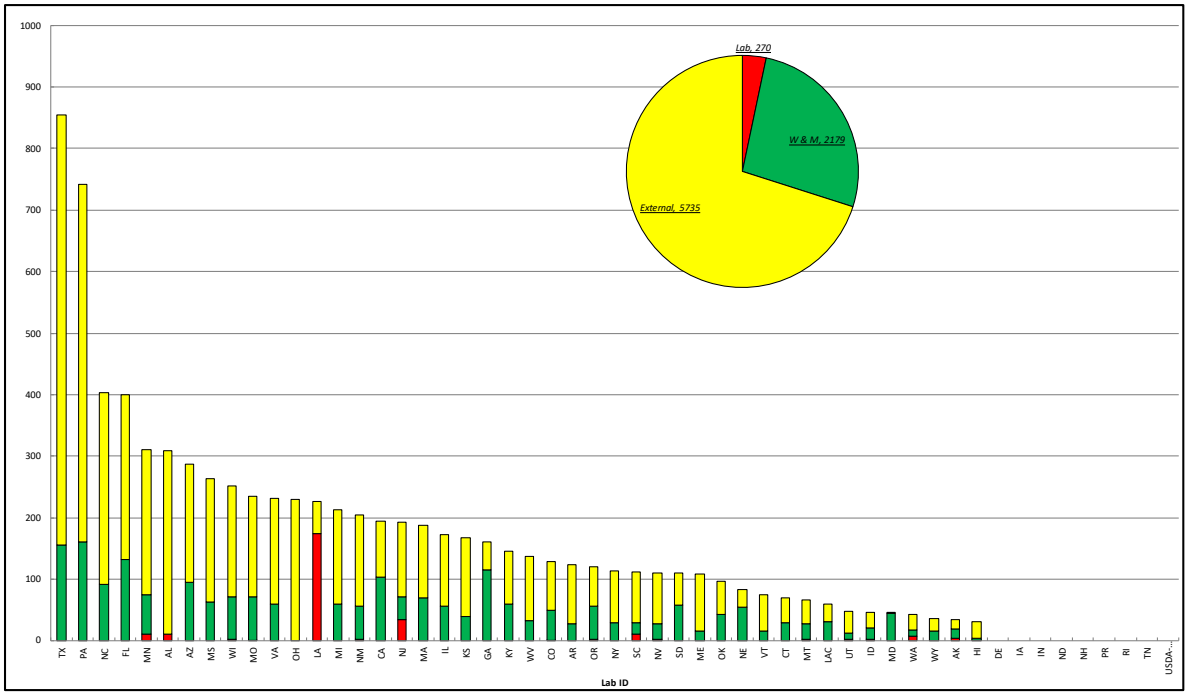
Table 17: Test Measure (5 ≤ gal.) volume tests from previous surveys.

Notes and Comments

- 4 % of all test measures were tested for the laboratory.
- 28 % of all test measures were tested for Weights and Measures enforcement programs.
- 68 % of all test measures were tested for external customers.



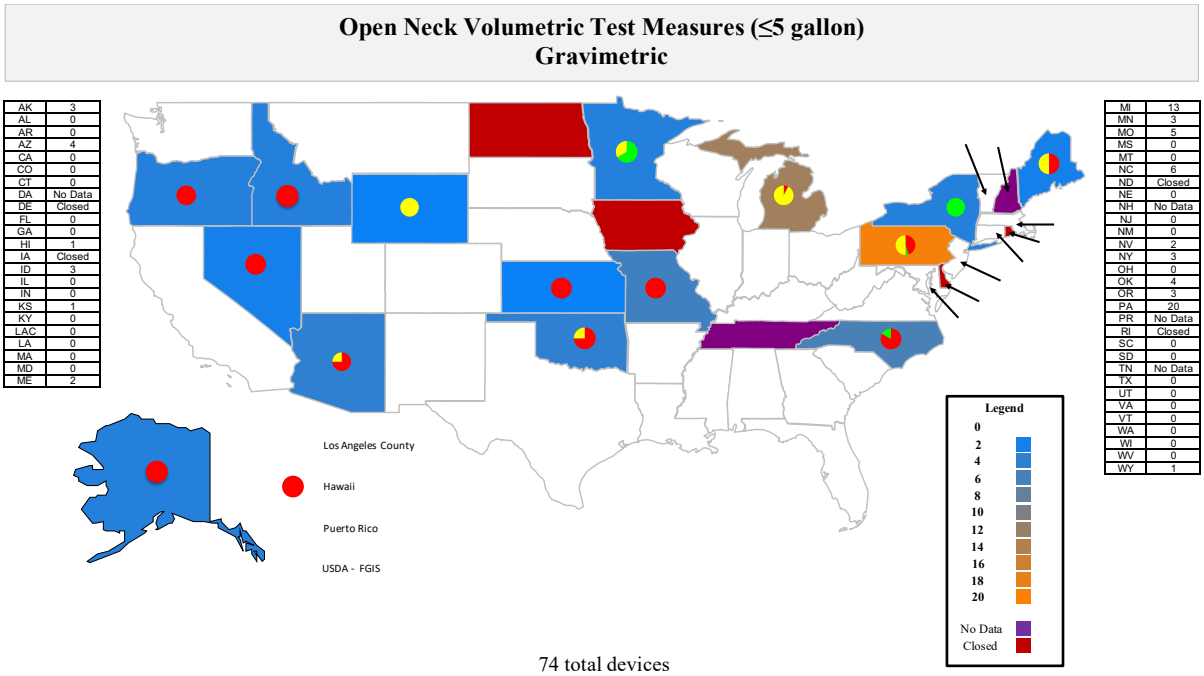
8184 total devices
calibrated in 44 labs



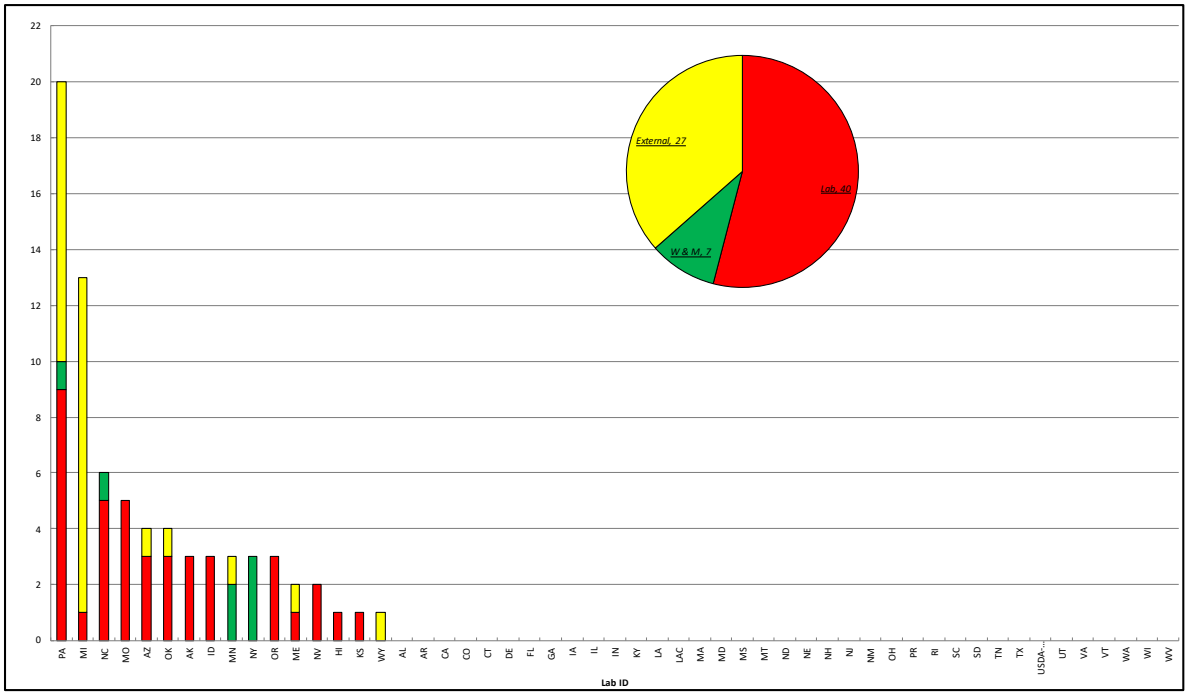
Bar and pie chart color codes

- Laboratory
- Weights and Measures
- External

Figure 13: Test Measure tests (≤5 gallon), volume transfer.



74 total devices
calibrated in 16 labs



Bar and pie chart color codes

- Laboratory
- Weights and Measures
- External

Figure 14: Test Measure tests (≤5 gallon), gravimetric.

Provers (> 5 gallon and ≤ 100 gallon)

Description

The graphs on the next two pages represent the total number of volume measurements performed on volumetric provers by the 45 reporting laboratories. Each map graph illustrates the geographical distribution of these measurements. The pie graphs located on each map for each individual lab and a larger pie graph that reflects the totals. The bar graph at the bottom of the page shows the same customer breakdown along with the total number of devices tested by each laboratory.

- Lab – work done for the internal use of the metrology laboratory.
- W&M – work done for the weights and measures enforcement program.
- External – work done for customers who do not fall into any of the above categories.

Findings

- Of the 45 reporting laboratories, 38 labs performed a total of 841 volume transfer tests.
- Of the 45 reporting laboratories, 8 labs performed a total of 61 gravimetric volume tests.

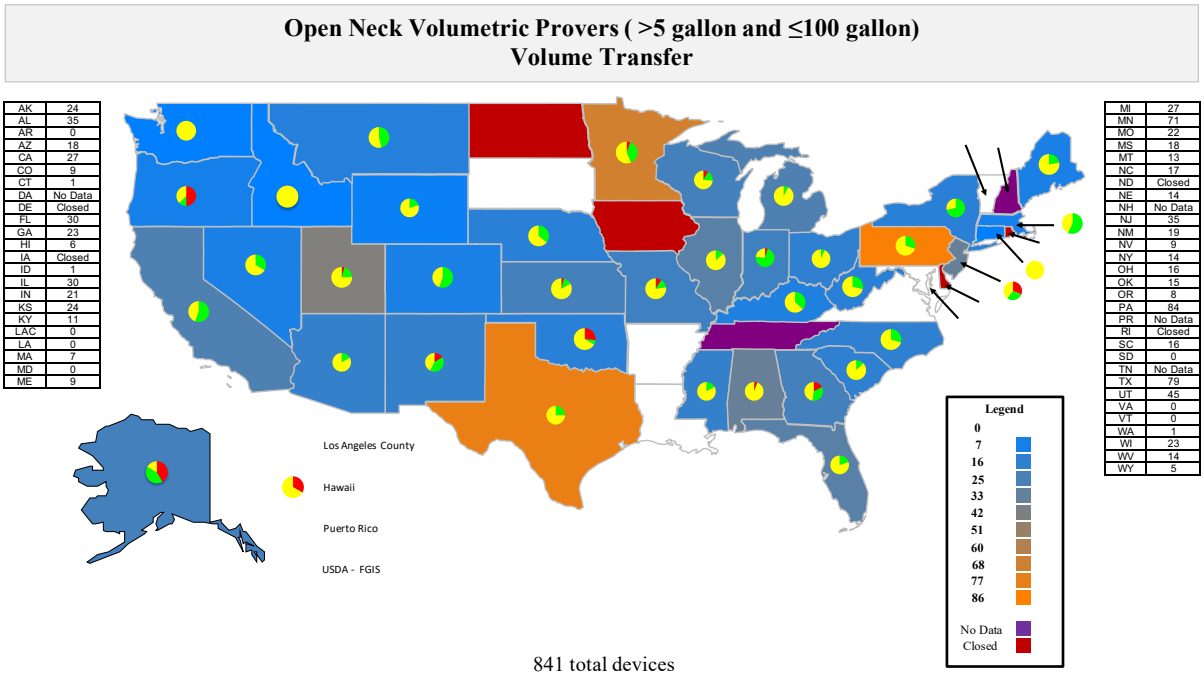
Comparison of previous surveys

Year	# Labs	Volume Transfer	Gravimetric	Total
2005		726	47	773
2006		760	81	841
2008		737	46	783
2010	41	711	49	760
2012	39	713	31	744
2014	37	828	57	885
2016	39	745	58	803
2018	38	841	61	902

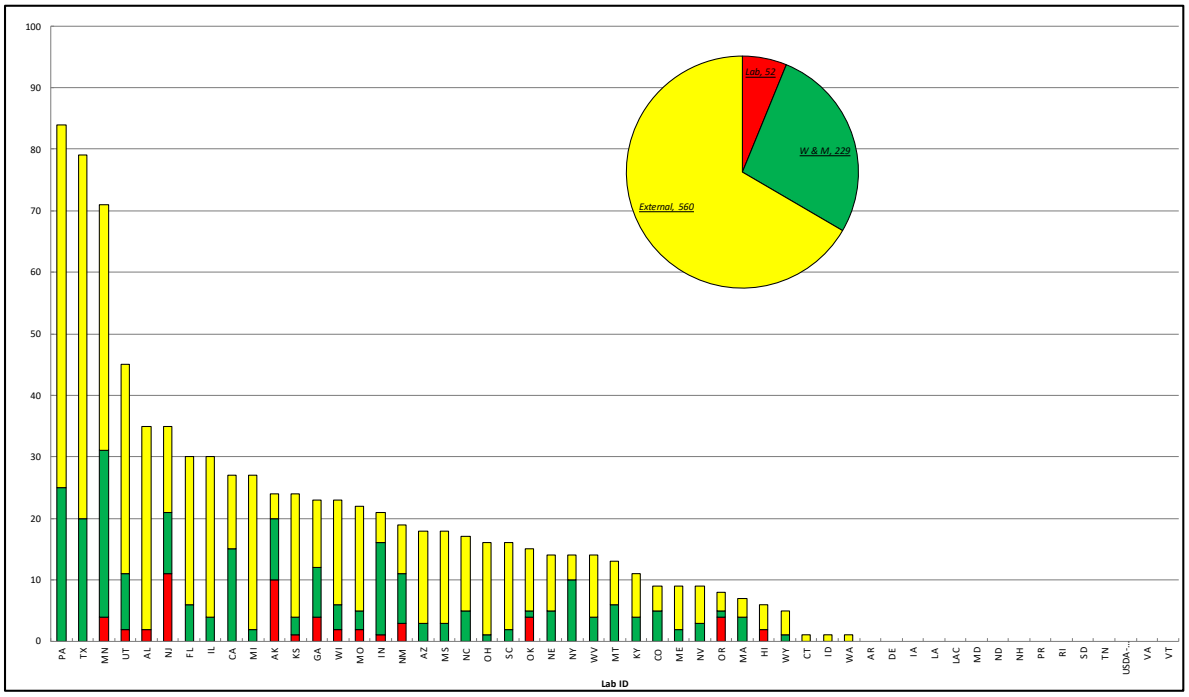
Table 18: Provers (>5 gal. and ≤ 100 gal.) volume tests from previous surveys.

Notes and Comments

- 8 % of all provers (> 5 gal. and ≤ 100 gal.) were tested for the laboratory
- 27 % of all provers (> 5 gal. and ≤ 100 gal.) were tested for Weights and Measures enforcement programs.
- 65 % of all provers (> 5 gal. and ≤ 100 gal.) were tested for external customers.



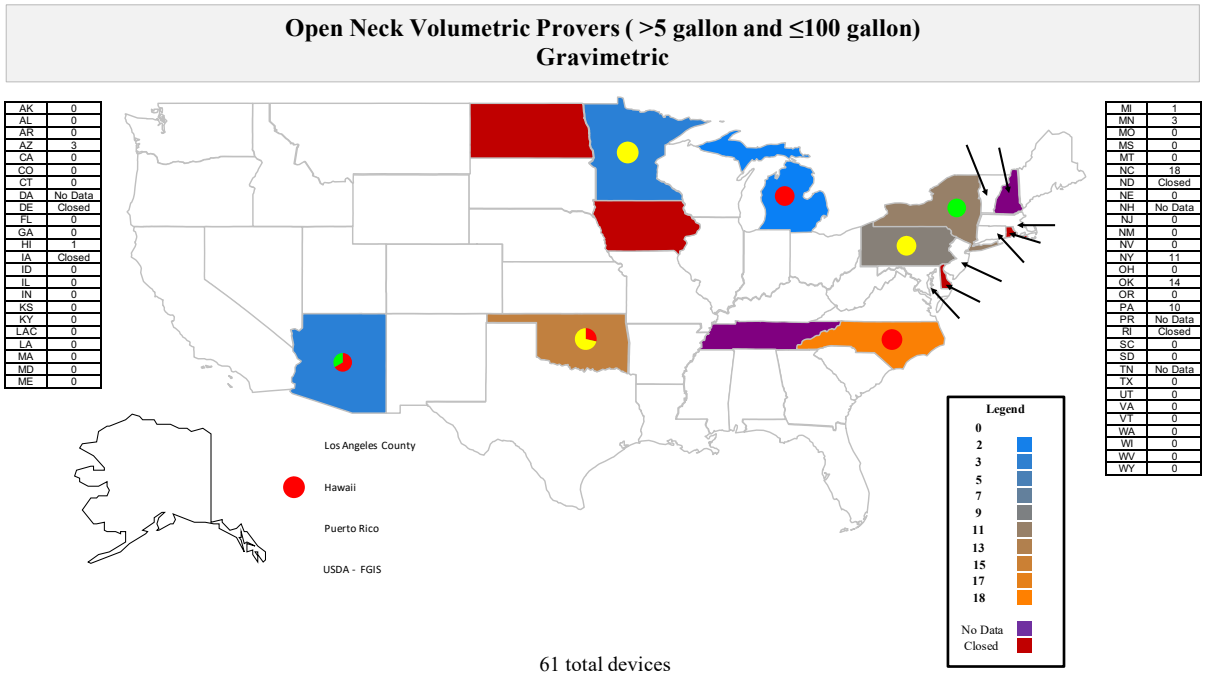
841 total devices
calibrated in 38 labs



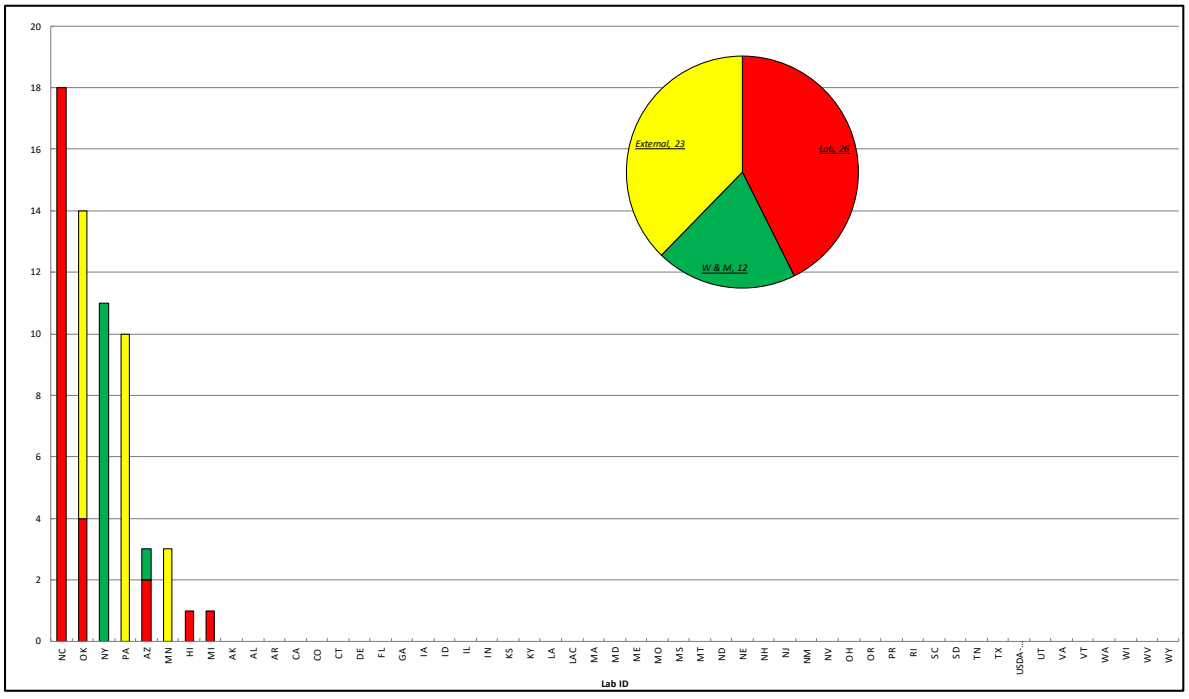
Bar and pie chart color codes

- Laboratory
- Weights and Measures
- External

Figure 15: Prover (≥5 gal. and < 100 gal.) tests, volume transfer.



61 total devices
calibrated in 8 labs



Bar and pie chart color codes

- Laboratory
- Weights and Measures
- External

Figure 16: Prover (≥5 gal. and < 100 gal.) tests, gravimetric.

Provers (> 100 gallon)

Description

The graphs on the next two pages represent the total number of volume measurements performed on volumetric provers by the 45 reporting laboratories. Each map graph illustrates the geographical distribution of these measurements. The pie graphs located on each map for each individual lab and a larger pie graph that reflects the totals. The bar graph at the bottom of the page shows the same customer breakdown along with the total number of devices tested by each laboratory.

- Lab – work done for the internal use of the metrology laboratory.
- W&M – work done for the weights and measures enforcement program.
- External – work done for customers who do not fall into any of the above categories.

Findings

- Of the 45 reporting laboratories, 28 labs performed a total of 259 volume transfer tests.
- Of the 45 reporting laboratories, 1 lab performed 1 gravimetric volume tests.

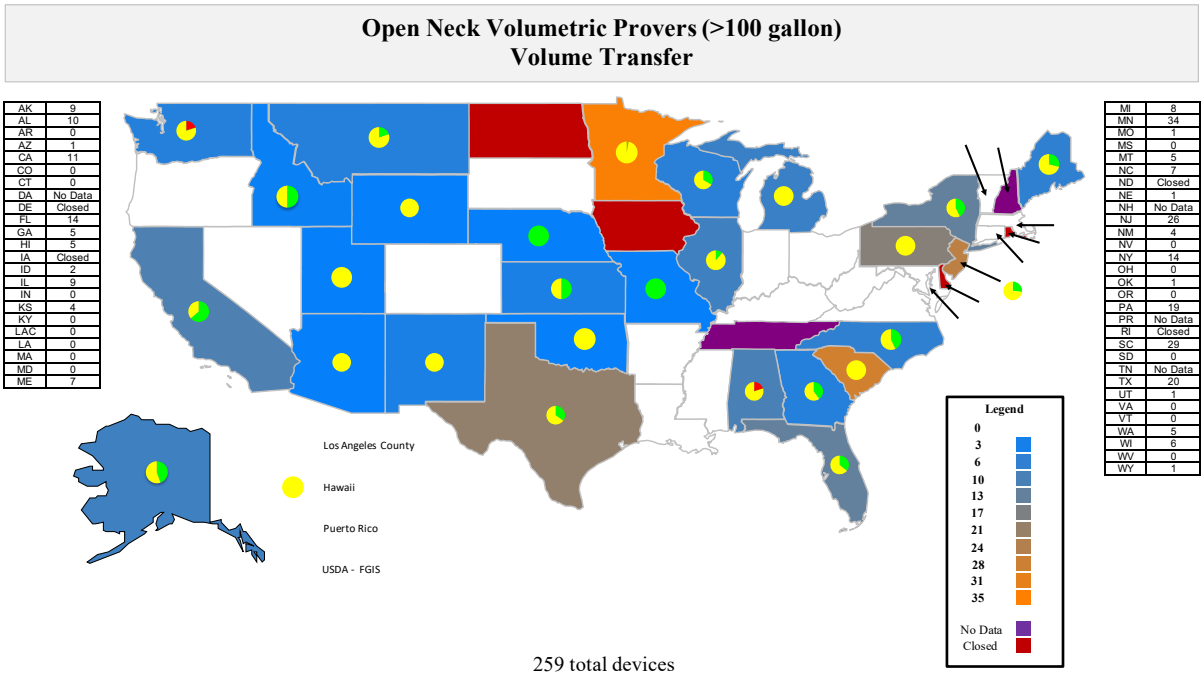
Comparison of previous surveys

Year	# Labs	Volume Transfer	Gravimetric	Total
2005		201	1	202
2006		202	0	202
2008	34	284	0	284
2010	33	287	0	287
2012	30	237	1	238
2014	30	239	1	240
2016	30	275	3	278
2018	28	259	1	260

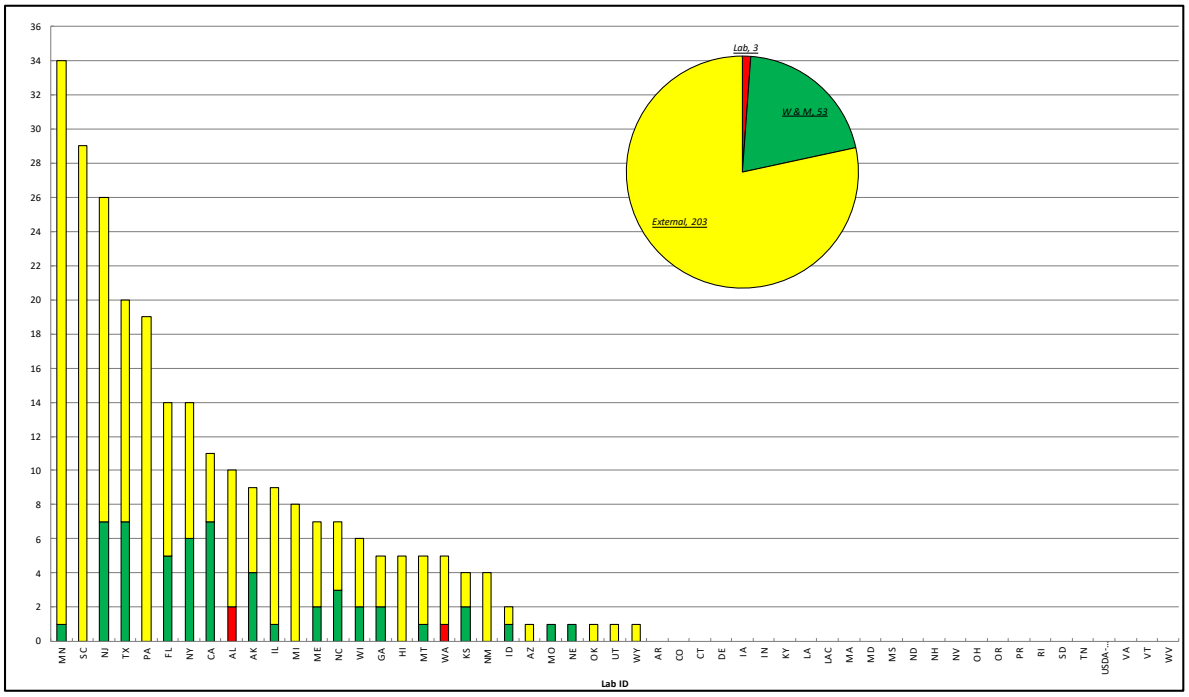
Table 19: Provers (> 100 gal.) tests from previous surveys.

Notes and Comments

- 1 % of all provers (> 100 gal.) were tested for the laboratory.
- 21 % of all provers (> 100 gal.) were tested for Weights and Measures enforcement programs.
- 78 % of all provers (> 100 gal.) were tested for external customers.



259 total devices
calibrated in 28 labs

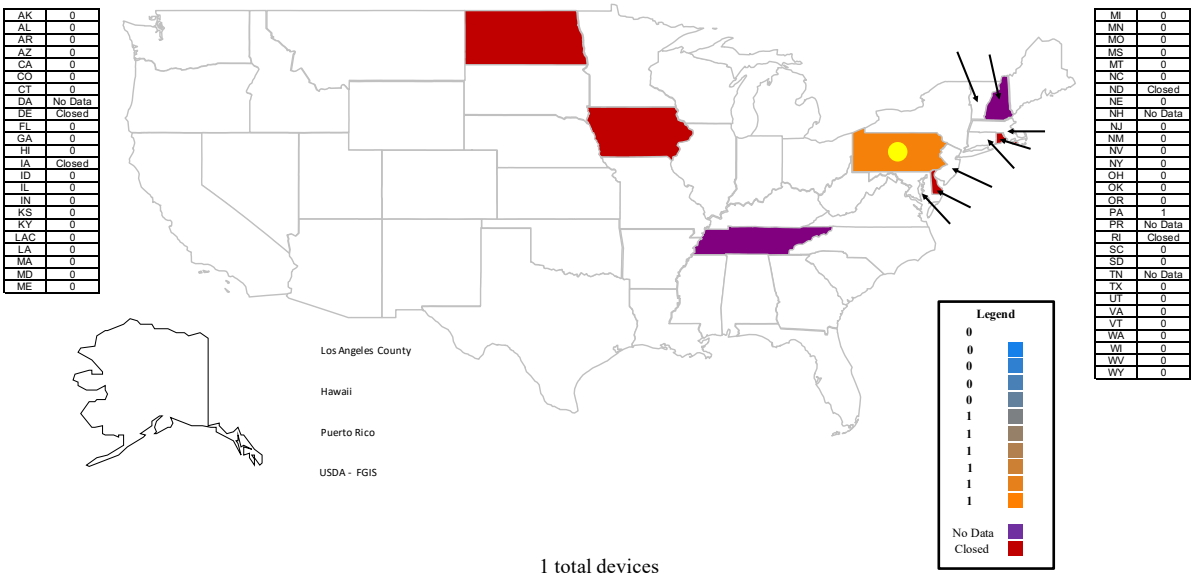


Bar and pie chart color codes

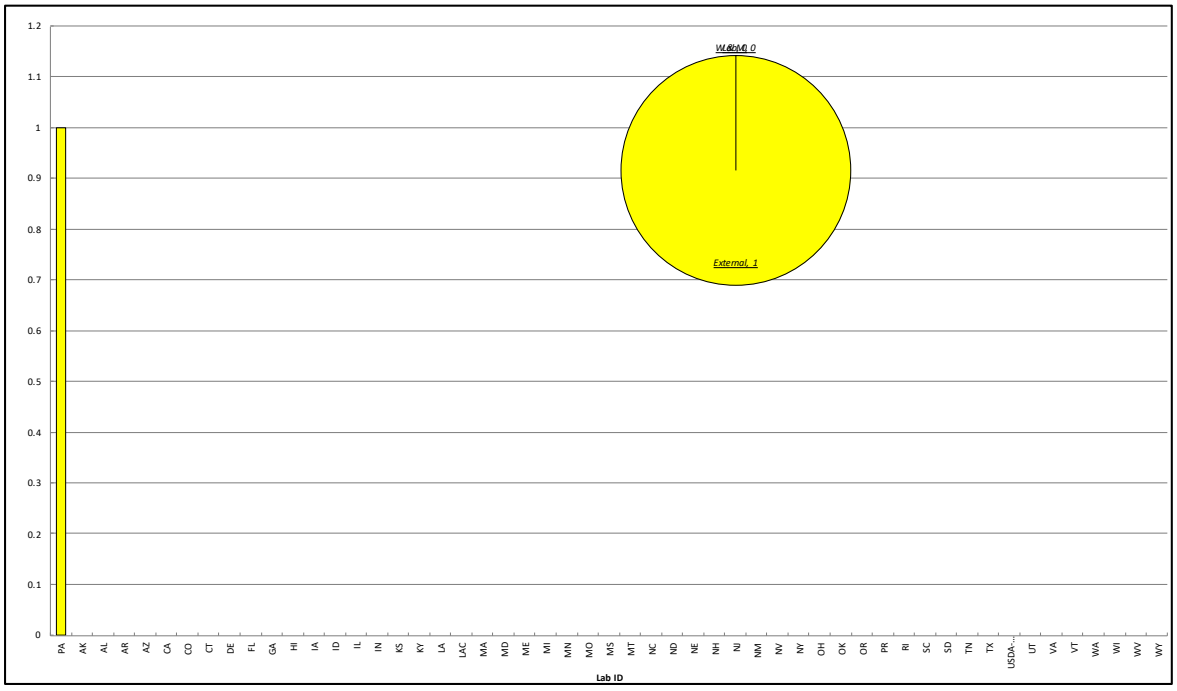
- Laboratory
- Weights and Measures
- External

Figure 17: Prover (>100 gal.) tests, volume transfer

Open Neck Volumetric Provers (>100 gallon)
Gravimetric



1 total devices
calibrated in 1 labs



Bar and pie chart color codes

- Laboratory
- Weights and Measures
- External

Figure 18: Prover (>100 gal.) tests, gravimetric

Liquefied Petroleum Gas (LPG) Provers

Description

The graphs on the next two pages represent the total number of measurements performed on LPG provers by the 45 reporting laboratories. Each map graph illustrates the geographical distribution of these measurements. The pie graphs located on each map for each individual lab and a larger pie graph that reflects the totals. The bar graph at the bottom of the page shows the same customer breakdown along with the total number of devices tested by each laboratory.

- Lab – work done for the internal use of the metrology laboratory.
- W&M – work done for the weights and measures enforcement program.
- External – work done for customers who do not fall into any of the above categories.

Findings

- Of the 45 reporting laboratories, 29 labs performed a total of 292 volume transfer tests.

Comparison of previous surveys

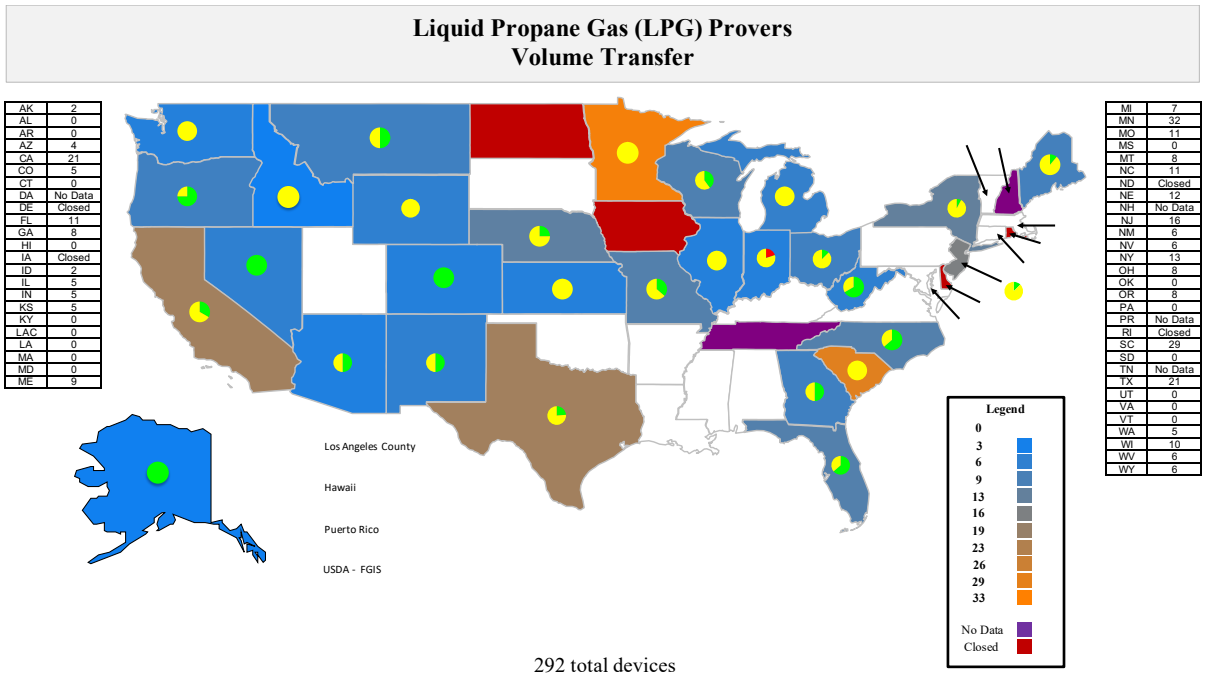
Year	# Labs	Volume Transfer
2005		226
2006		239
2008	27	249
2010	33	304
2012	24	228
2014	25	231
2016	25	253
2018	29	292

Table 20: LPG Prover volume tests from previous surveys[7].

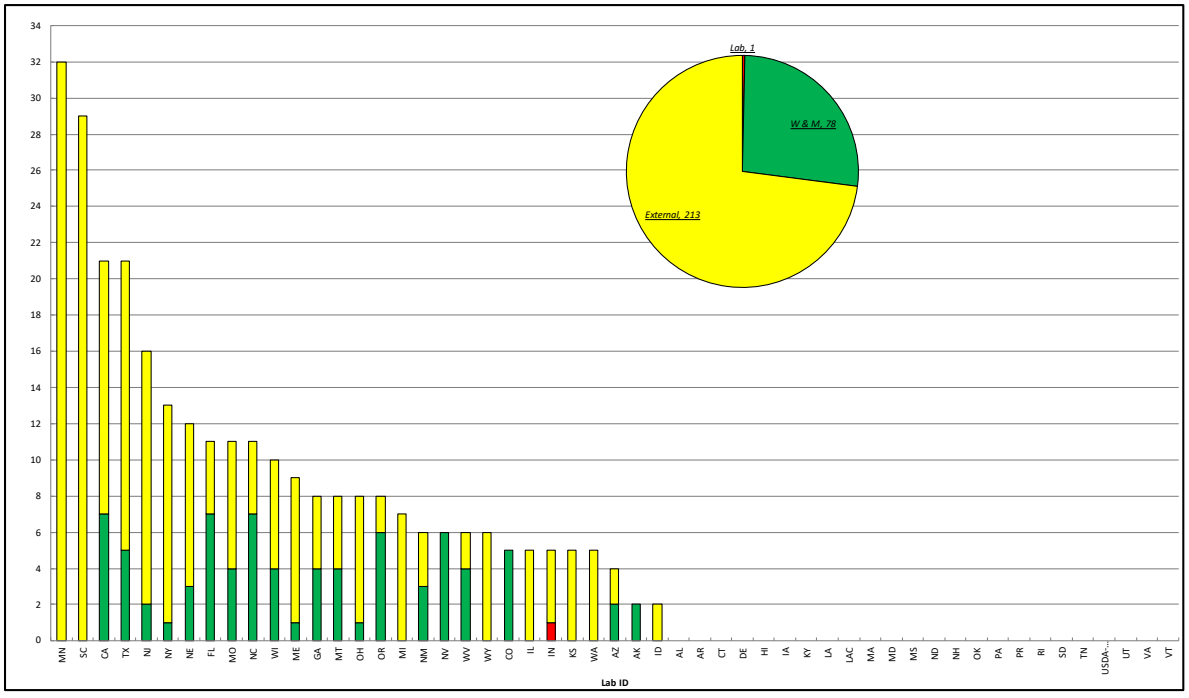
Notes and Comments

- <1 % of all LPG provers were tested for the laboratory.
- 27 % of all LPG provers were tested for Weights and Measures enforcement programs.
- 73 % of all LPG provers were tested for external customers.

[7] Prior editions of the survey included a survey of gravimetric testing of LPG style provers. This question was deleted in the 2016 edition. Laboratories have consistently reported performing no such measurements.



292 total devices
calibrated in 29 labs



Bar and pie chart color codes

- Laboratory
- Weights and Measures
- External

Figure 19: LPG Prover tests, volume transfer

Findings

(This section was deprecated in 2018 however prior history data has been retained in this report for convenience. See the new section titled "Small Volume Provers, Compact Displacement Provers, and Closed Loop Provers")

Year	# Labs	Gravimetric	Volume Transfer	Total
2005		11	0	11
2006		20	0	20
2008	3	16	11	27 [MI,NC,VT]
2010	2	30	0	30 [MI,NC]
2012	3	57	0	57
2014	4	32	3	35
2016	3	31	0	31[AZ,MI,NC]

Table 21: SVP tests from previous surveys.

Small Volume Provers, Compact Displacement Provers, and Closed Loop Provers

Description

The graphs on the next two pages represent the total number of measurements performed on small volume provers, compact displacement provers, and closed loop provers by the 45 reporting laboratories. Each map graph illustrates the geographical distribution of these measurements. The pie graphs located on each map for each individual lab and a larger pie graph that reflects the totals. The bar graph at the bottom of the page shows the same customer breakdown along with the total number of devices tested by each laboratory.

- Lab – work done for the internal use of the metrology laboratory.
- W&M – work done for the weights and measures enforcement program.
- External – work done for customers who do not fall into any of the above categories.

Findings

- Of the 45 reporting laboratories, 2 labs performed a total of 28 tests.

Comparison of previous surveys

Year	# Labs	Total Devices
2018	2	28

Table 22: Small Volume, Compact Displacement, and Closed Loop prover tests.

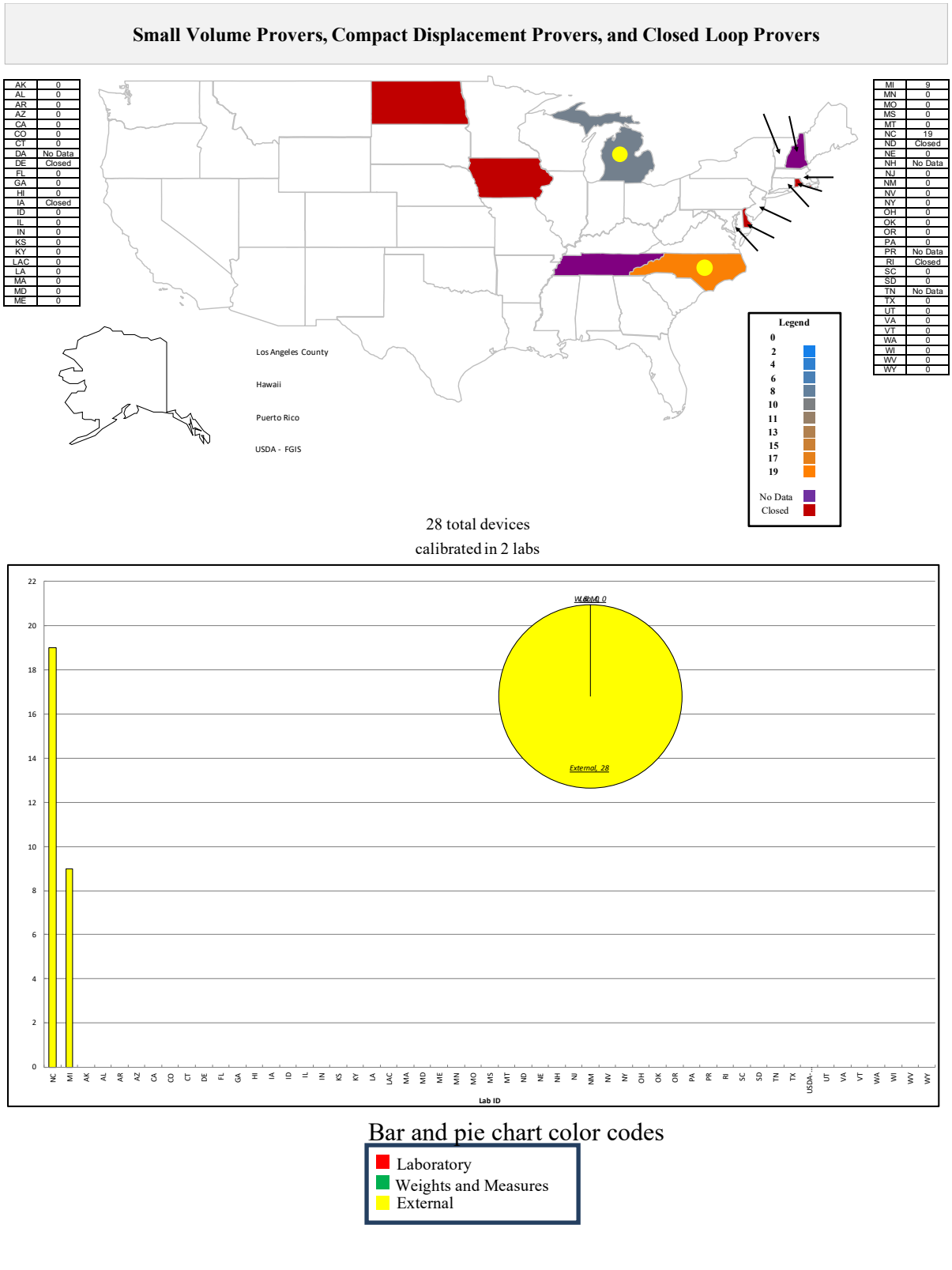


Figure 20: Small Volume, Compact Displacement, and Closed Loop prover tests

Temperature

Description

The graphs on the next page represent the total number of measurements performed on temperature sensing devices by the 45 reporting laboratories. Each map graph illustrates the geographical distribution of these measurements. The pie graphs located on each map for each individual lab and a larger pie graph that reflects the totals. The bar graph at the bottom of the page shows the same customer breakdown along with the total number of devices tested by each laboratory.

- Lab – work done for the internal use of the metrology laboratory.
- W&M – work done for the weights and measures enforcement program.
- External – work done for customers who do not fall into any of the above categories.

Findings

Of the 45 reporting laboratories, 5 labs tested a total of 216 temperature standards

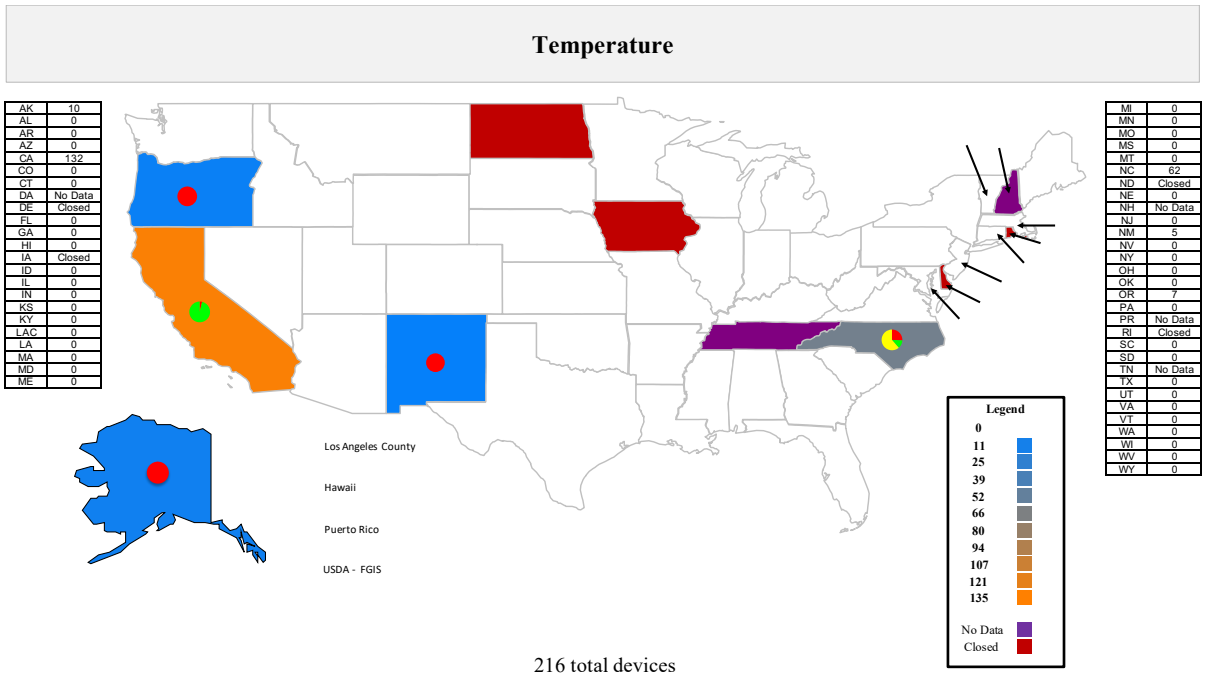
Comparison of previous surveys

Year	# Labs	Total Devices
1996	20	447
1998	11	378
1999	12	514
2000	16	460
2002	13	456
2004	12	315
2005	15	418
2006	12	281
2008	13	498
2010	11	465
2012	7	191
2014	6	192
2016	6	242
2018	5	216

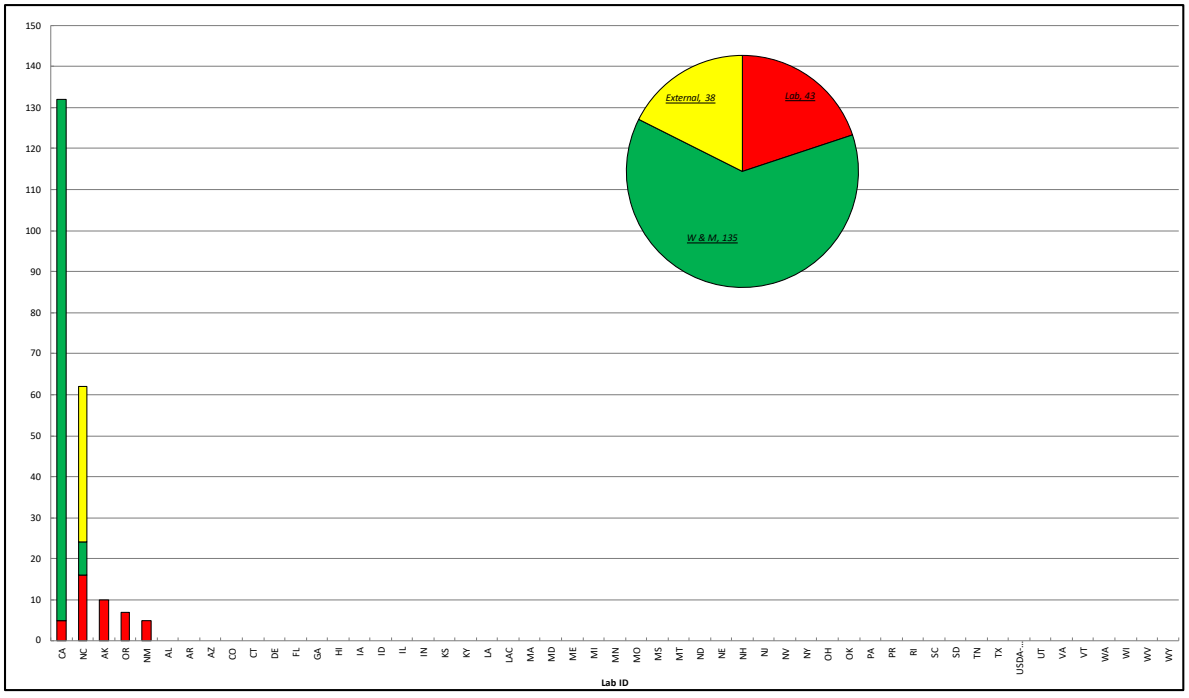
Table 23: Temperature standard tests from previous surveys.

Notes and Comments

- 20 % of all temperature standards were tested for internal use by the laboratory.
- 63 % of all temperature standards were tested for the weight and measures program.
- 18 % of all temperature standards were tested for external customers.



216 total devices
calibrated in 5 labs



Bar and pie chart color codes

- Laboratory
- Weights and Measures
- External

Figure 21: Temperature standard tests.

Frequency

Description

The graphs on the next page represent the total number of measurements performed on frequency standards by the 45 reporting laboratories. Each map graph illustrates the geographical distribution of these measurements. The pie graphs located on each map for each individual lab and a larger pie graph that reflects the totals. The bar graph at the bottom of the page shows the same customer breakdown along with the total number of devices tested by each laboratory.

- Lab – work done for the internal use of the metrology laboratory.
- W&M – work done for the weights and measures enforcement program.
- External – work done for customers who do not fall into any of the above categories.

Findings

Of the 45 reporting laboratories, 3 labs tested a total of 10,054 frequency standards

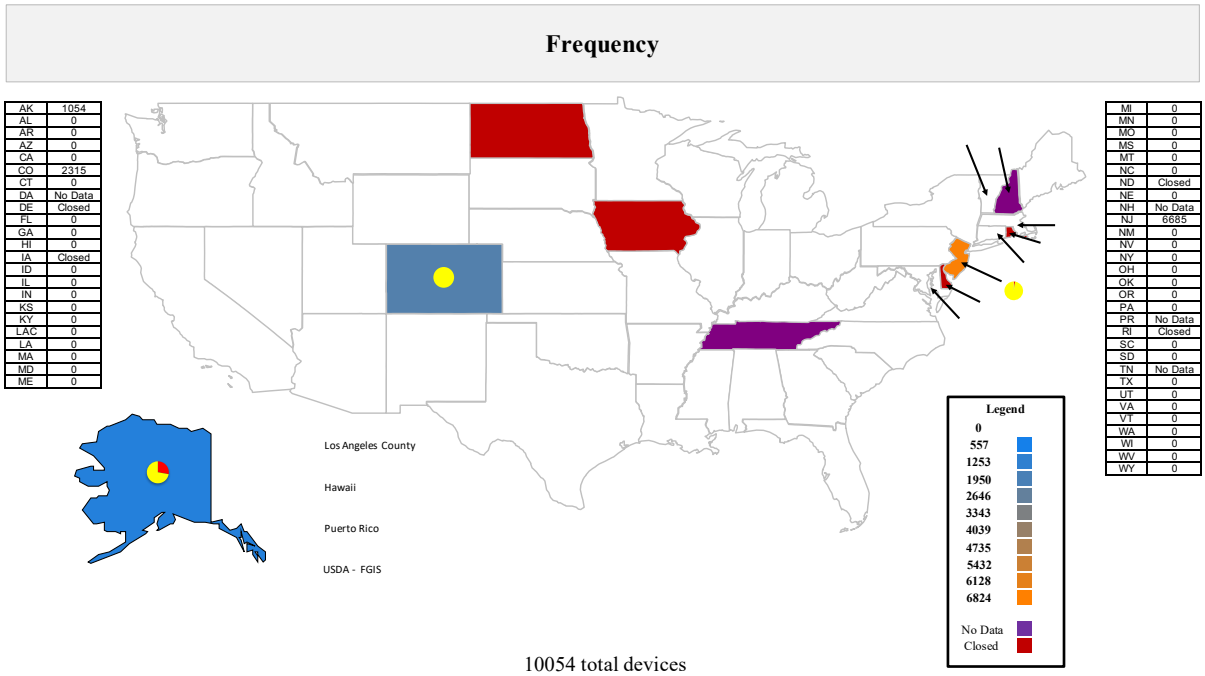
Comparison of previous surveys

Year	# Labs	Total Devices
1996	6	12,518
1998	4	11,561
1999	5	13,518
2000	7	14,670
2002	6	13,785
2004	3	14,772
2005	4	15,162
2006	4	14,832
2008	4	15,058
2010	4	17,580
2012	4	14,177
2014	4	13,282
2016	4	14,501
2018	3	10,054

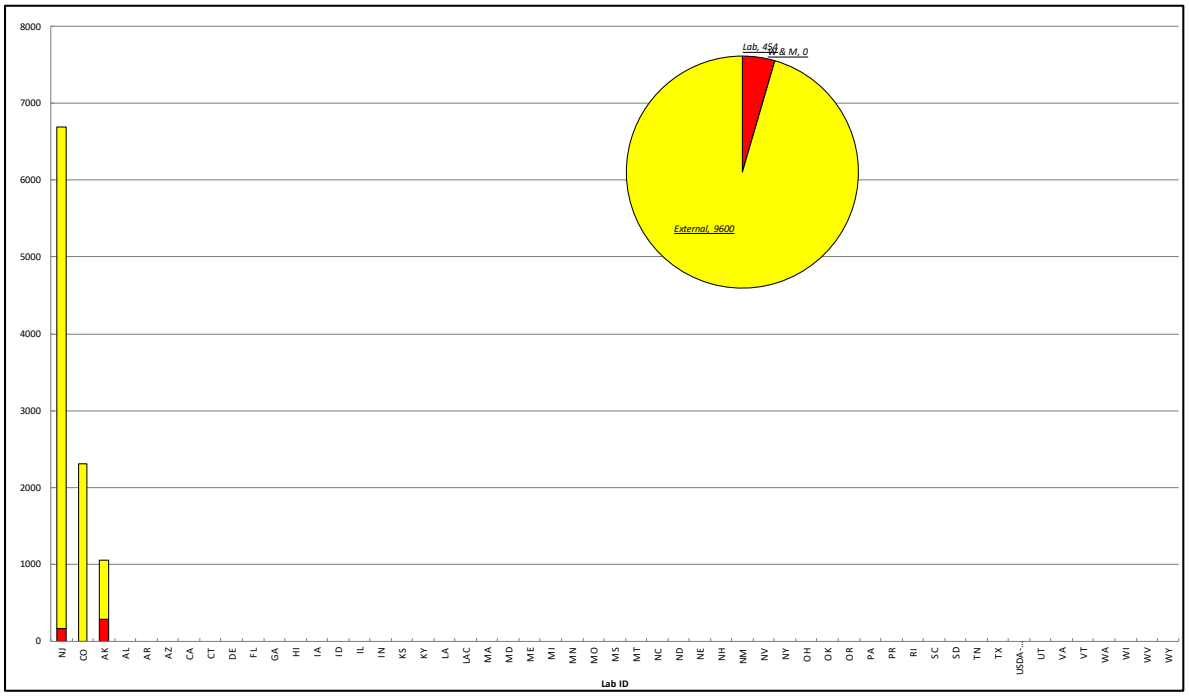
Table 24: Frequency standard tests from previous surveys.

Notes and Comments

- 5 % of all frequency standards were tested for internal use by the laboratory.
- 0 % of all frequency standards were tested for the weight and measures program.
- 95 % of all frequency standards were tested for external customers.



10054 total devices
calibrated in 3 labs



Bar and pie chart color codes

- Laboratory
- Weights and Measures
- External

Figure 22: Frequency standard tests

Timing Devices

Description

The graphs on the next page represent the total number of measurements performed on timing devices by the 45 reporting laboratories. Each map graph illustrates the geographical distribution of these measurements. The pie graphs located on each map for each individual lab and a larger pie graph that reflects the totals. The bar graph at the bottom of the page shows the same customer breakdown along with the total number of devices tested by each laboratory.

- Lab – work done for the internal use of the metrology laboratory.
- W&M – work done for the weights and measures enforcement program.
- External – work done for customers who do not fall into any of the above categories.

Findings

Of the 45 reporting laboratories, 9 labs tested a total of 4306 timing devices

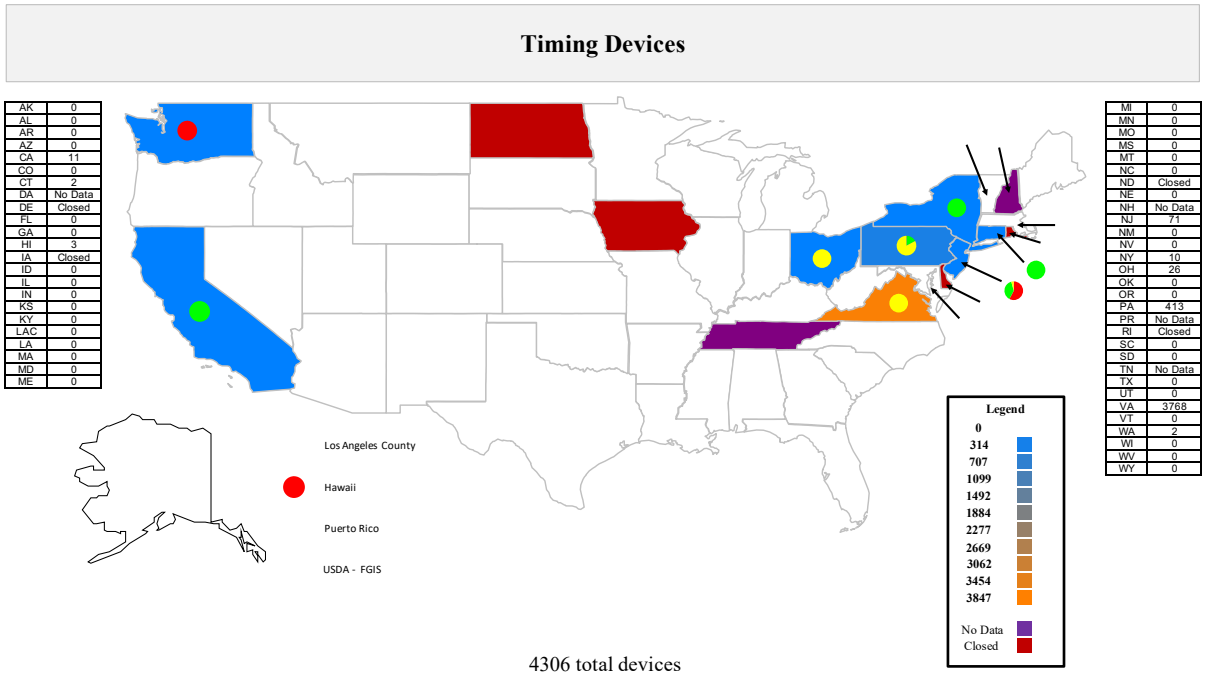
Comparison of previous surveys

Year	# Labs	Total Devices
1996	13	161
1998	11	380
1999	14	451
2000	13	554
2002	11	479
2004	9	951
2005	8	387
2006	11	365
2008	11	401
2010	9	339
2012	10	577
2014	7	600
2016	8	506
2018	9	4306

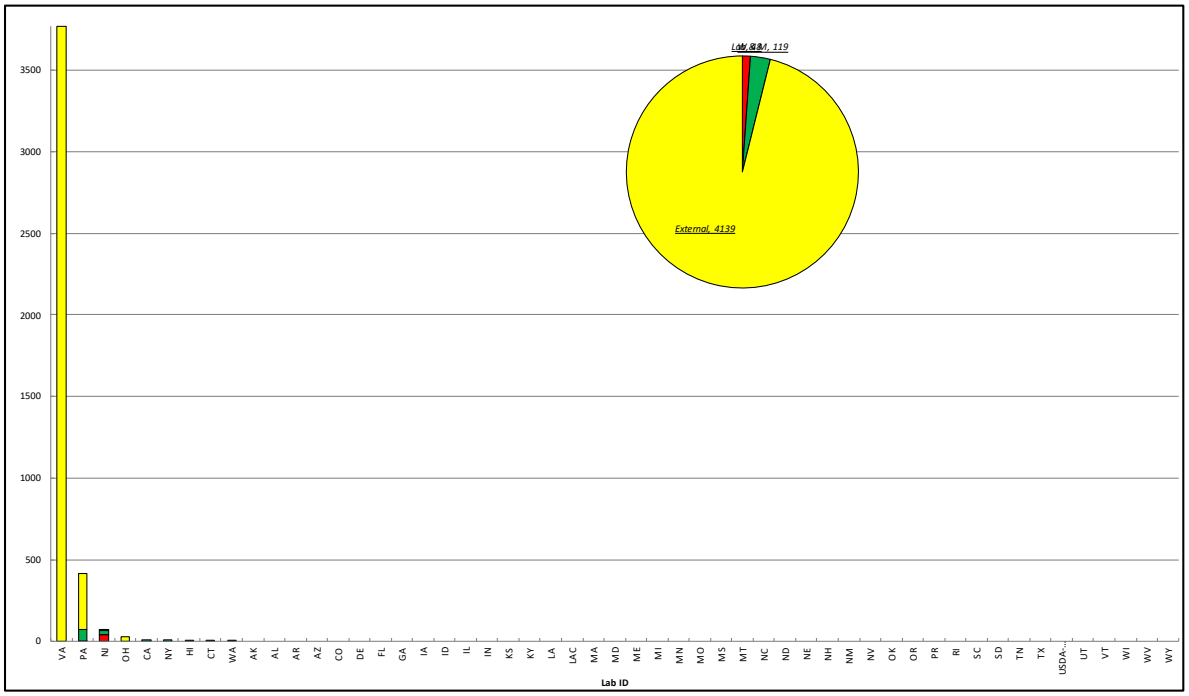
Table 25: Timing devices tests from previous surveys

Notes and Comments

- 1 % of all timing devices were tested for internal use by the laboratory.
- 3 % of all timing devices were tested for the weight and measures program.
- 96 % of all timing devices were tested for external customers.



4306 total devices
calibrated in 9 labs



Bar and pie chart color codes

- Laboratory
- Weights and Measures
- External

Figure 23: Timing device tests

Wheel Load Weighers

Description

The graphs on the next page represent the total number of measurements performed on wheel load weighers by the 45 reporting laboratories. Each map graph illustrates the geographical distribution of these measurements. The pie graphs located on each map for each individual lab and a larger pie graph that reflects the totals. The bar graph at the bottom of the page shows the same customer breakdown along with the total number of devices tested by each laboratory.

- Lab – work done for the internal use of the metrology laboratory.
- W&M – work done for the weights and measures enforcement program.
- External – work done for customers who do not fall into any of the above categories.

Findings

Of the 45 reporting laboratories, 15 labs tested a total of 6,476 wheel load weighers.

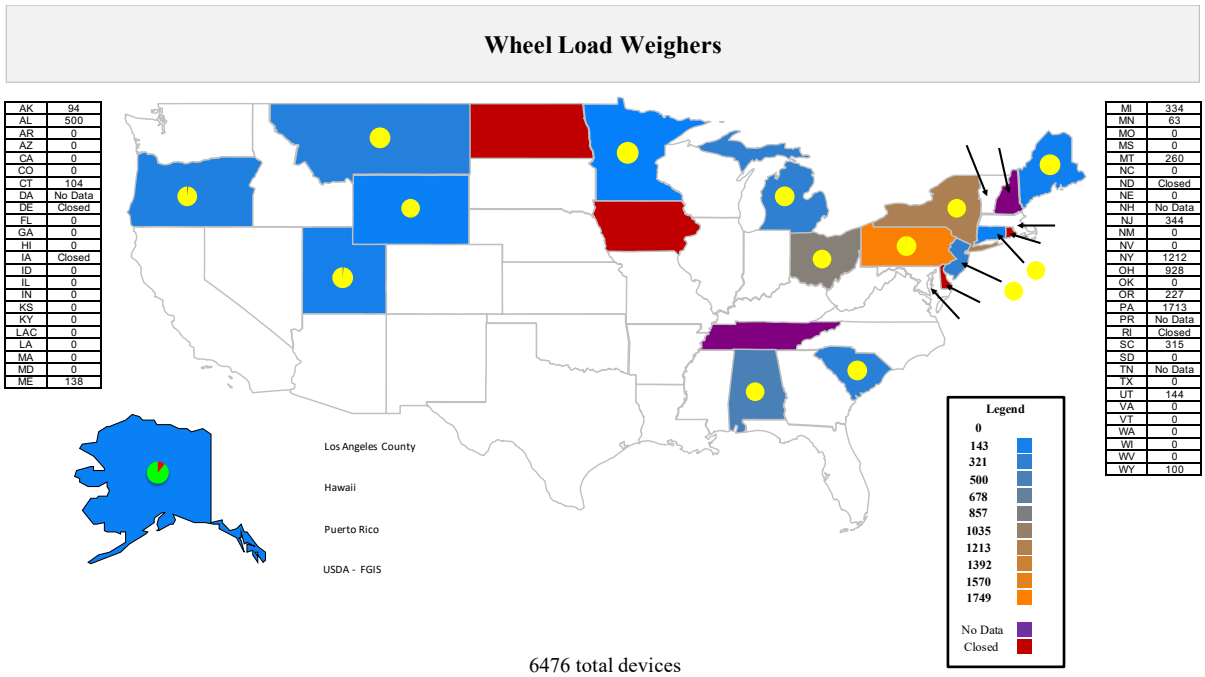
Comparison of previous surveys

Year	# Labs	Total Devices
1998	19	12,178
1999	20	12,781
2000	22	13,699
2002	23	10,350
2004	21	10,884
2005	19	9,748
2006	20	10,567
2008	22	10,191
2010	20	10,815
2012	17	7,050
2014	16	6,515
2016	14	6,541
2018	15	6,476

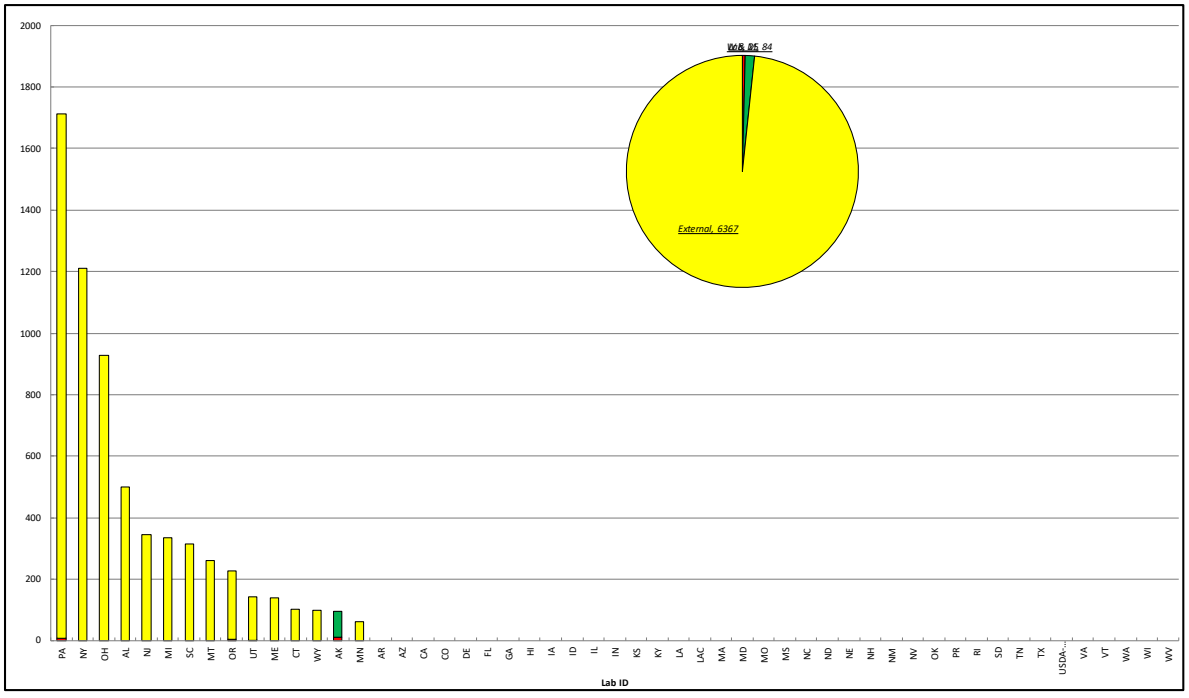
Table 26: Wheel load weigher tests from previous surveys

Notes and Comments

- < 1 % of all wheel load weighers were tested for internal use by the laboratory.
- 1 % of all wheel load weighers were tested for the weight and measures program.
- > 98 % of all wheel load weighers were tested for external customers.



6476 total devices
calibrated in 15 labs



Bar and pie chart color codes

- Laboratory
- Weights and Measures
- External

Figure 24: Wheel load weigher tests

Lottery Balls

Description

The graphs on the next page represent the total number of measurements performed on lottery balls by the 45 reporting laboratories. Each map graph illustrates the geographical distribution of these measurements. The pie graphs located on each map for each individual lab and a larger pie graph that reflects the totals. The bar graph at the bottom of the page shows the same customer breakdown along with the total number of devices tested by each laboratory.

- Lab – work done for the internal use of the metrology laboratory.
- W&M – work done for the weights and measures enforcement program.
- External – work done for customers who do not fall into any of the above categories.

Findings

Of the 45 reporting laboratories, 6 labs tested a total of 11,087 lottery balls

Comparison of previous surveys

Year	# Labs	Total Devices
1999	9	19,982
2000	13	24,702
2002	11	35,818
2004	11	40,939
2005	9	47,920
2006	9	41,068
2008	10	42,553
2010	8	46,515
2012	7	13,924[8]
2014	8	40,899
2016	6	80,946[9]
2018	4	11,087[10]

Table 27: Lottery balls tests from previous surveys

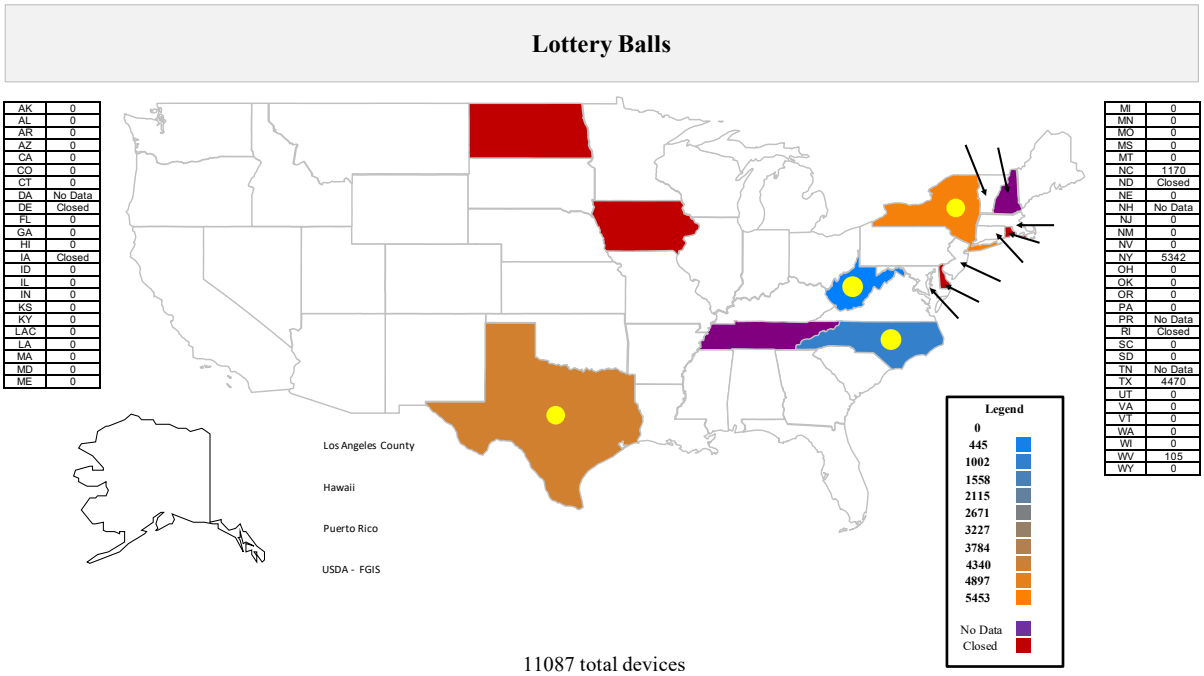
Notes and Comments

- 0 % of all lottery balls were tested for internal use by the laboratory.
- 0 % of all lottery balls were tested for the weight and measures program.
- 100 % of all lottery balls were tested for external customers.

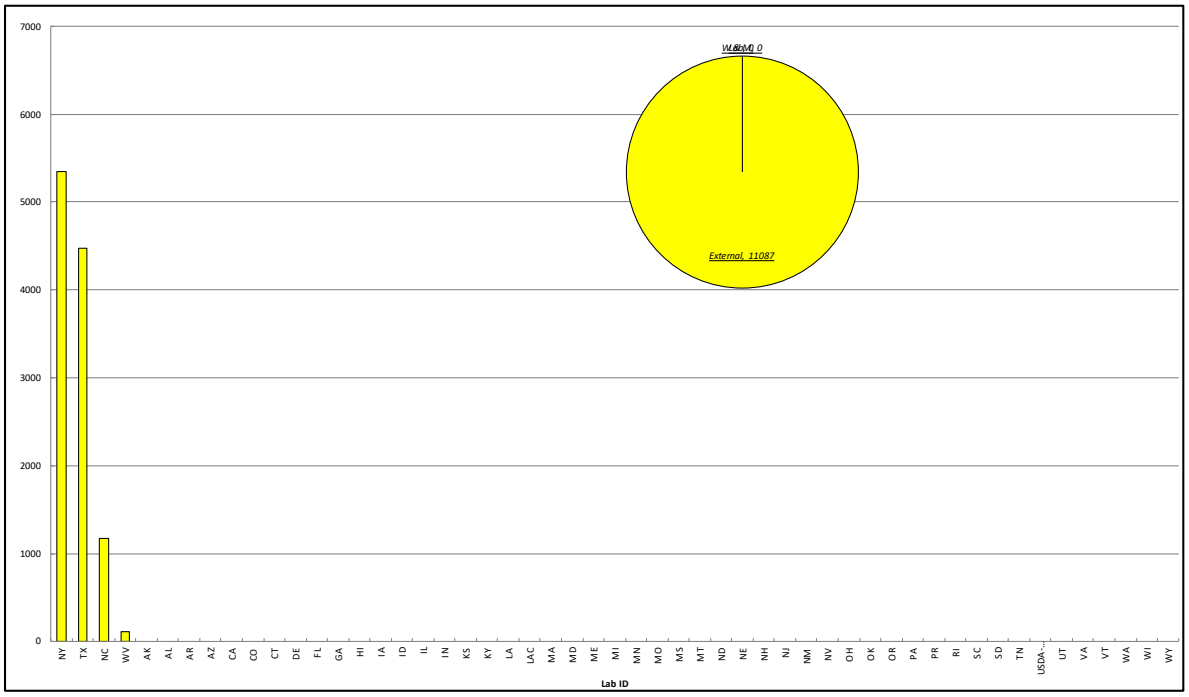
[8] The metrology laboratory in Puerto Rico, which normally performs approximately 30,000 of the total number of lottery balls tests, did not submit survey responses in 2012.

[9] The metrology laboratory in Puerto Rico, which performs approximately 30,000 of the total number of lottery balls tests, reported 69,800 in 2016.

[10] The metrology laboratory in Puerto Rico, which normally performs approximately 30,000 of the total number of lottery balls tests, did not submit survey responses in 2018.



11087 total devices
calibrated in 4 labs



Bar and pie chart color codes

- Laboratory
- Weights and Measures
- External

Figure 25: Lottery Ball tests

Summary Other Tests

The category of "Other Tests" is included to give each of the SLP laboratories an opportunity to report calibration work done on devices that did not fit into any of the other categories in the survey. This should not be considered to be an exhaustive list as it was up to each laboratory to determine which tests were worth including in the workload survey and survey allowed for only 3 additional responses per laboratory surveyed.

Test Description	Lab	W&M	Ext	Total
AK -- LIDAR for law enforcement speed detection	0	0	68	68
AK -- Witness testing of watt hour meters	0	0	0	0
AZ -- Master Meter	0	0	41	41
CA -- Watthour standards used to measure AC electrical energy	0	12	0	12
CT -- Scales: Type III scales used by W&M Inspectors and hanging scales used in fishing tournaments	0	5	6	11
CT -- Water meter provers for Water Departments	0	0	2	2
NC -- Special Test - Control Load Cell & Vaisala to Vaisala comparison	7	0	0	7
NC -- Special Test - Load Cells for our Highway Patrol Division	0	0	9	9
NJ -- Laser Devices	0	0	69	69
NJ -- Scales < 1,000 lb capacity	0	17	159	176
NJ -- Water Meter Bench Provers	2	0	83	85
PA -- Force Gauges ≤ 50 lbf	5	0	13	18
SC -- Grain Moisture	148	0	0	148
TX -- Neck Scale Plate Calibrations on New or Damaged Provers	0	5	167	172
VT -- Hyrdrometers	0	0	6,545	6,545

Table 28: Other tests reported by the participating laboratories

Laboratory Fees (2018)

Description

This information is provided as guidance for SLP member laboratories evaluating the fees they charge for measurement services as well as potential clients whom use their services.

The SLP laboratories charge fees for the calibration work they perform; when reviewing the fee estimates in this section consider;

- laboratories may provide an hourly rate and bill real time for all work done,
- laboratories may provide an hourly rate and bill based on the typical time to complete a calibration,
- laboratories may charge a fixed fee for routine calibration work,
- laboratories may charge additional fees for cleaning, repair, adjusting, packaging, etc. which are outside of that which is normally required for well cared for measurement standards.

The time it takes for any one laboratory to calibrate a particular item will vary significantly between laboratories because of differences in the staffing level, staff experience, the facility, the available weight handling equipment, and the available measurement equipment.

Laboratories were asked to quote the typical fee that they would charge for the various routine measurements instead of providing published hourly rates. This provides each lab with a similar set of assumptions when quoting fees for the survey enabling a more meaningful comparison of fee data between the individual SLP laboratories[11].

Additional Notes:

Only those labs responding to this section of the survey are represented. Labs responding with only a flat per hour service fee are not included, nor are any labs that did not respond to the survey, or are currently closed. No effort was made to extrapolate from previous surveys or to estimate calibration times for each requested service.

[11] Actual fees may differ from those indicated for a variety of reasons including but not limited to the number of required adjustments and the general condition of the equipment as delivered to the laboratory.

Fees for Out of State Customers

The fees quoted are based on in-state calibration work. Most of the member labs charge fees based solely on the measurement services provided, however, the following laboratories report charging higher rates for out-of- state customers;

- GA
- KS
- NC
- NV
- OK
- VT
- WY

Details on labs charging higher rates for out-of-state customers may be found in the comments for sections 8-31 published in this report beginning on page 166.

Fees for Local Government Weights and Measures Programs

Labs were asked if they charge local government for the calibration of W&M field test equipment used for regulatory purposes. The following labs indicated that they charge for calibrating city, county, township (political jurisdiction W&M) equipment and standards:

- AK
- AZ
- CA
- CO
- FL
- GA
- ID
- KY
- LA
- LAC
- MD
- ME
- MI
- MN
- MO
- MT
- NC
- NE
- NM
- NY
- OK
- OR
- SD
- UT
- VA
- VT
- WA

NOTE: Labs may not charge because they provide the service pro bono or because there is an absence of W&M programs operated at the county, city, or township level in the region.

Fees for in State Registered Service Companies

Labs were asked if they charge for the calibration of field test equipment used by registered placed in service agents where the agent is registered within the lab's jurisdiction. The following labs indicated that they charge for calibrating registered service company equipment and standards:

- AK
- AL
- AR
- AZ
- CA
- CO
- FL
- GA
- HI
- ID
- IN
- KS
- KY
- LA
- LAC
- MA
- MD
- ME
- MI
- MN
- MO
- MS
- MT
- NC
- NE
- NJ
- NM
- NV
- NY
- OH
- OK
- OR
- PA
- SC
- SD
- TX
- UT
- VA
- VT
- WA
- WI
- WY

NOTE: Not all states operate a service agent registration program.

Fees for "in Jurisdiction" Weights and Measures Programs

Labs were asked if they charge for the calibration of W&M field test equipment used by the W&M program within the lab's jurisdiction. Normally this question addresses W&M programs operated at the state government level. The following labs indicated that they charge for calibrating W&M field equipment and standards:

- CO
- LAC
- MN
- SC
- SD
- VA
- VT
- WA

Laboratory Fee Data Presentation

Fee data are plotted as box and whisker charts showing distribution of reported fees into quartiles delineated by boxes, the mean value, and whiskers intended to highlight both the mean and outliers.

Fees are also tabulated in order from highest to lowest. Each fee table includes the fee estimate provided by each responding laboratory, the estimated calibration time, and indicators which are meant to show whether the laboratory figures packing, equipment setup, certificate preparation, and maintenance of statistical controls explicitly as part of the calibration time estimate.

Historical average fees are reported with each section.

Minimum Laboratory Fees

Description

Labs may enforce a minimum charge to cover all the basic costs associated with performing small calibration jobs. Each laboratory was asked if a minimum calibration fee is assessed and the responses are provided in Figure 26 on page 98.

Minimum Lab Fee

Lab ID	Fee Total	Calibration Time	Includes Packing	Includes Setup	Includes Statistical Controls	Includes Certificates
CT	$ 150.00	1.0	+	+	+	+
WI	$ 128.10					
OR	$ 110.00	1.0	+	+	+	+
AK	$ 85.00	1.0	+	+	+	+
NE	$ 80.00	1.0				
MT	$ 75.00	1.0	+	+	+	+
NV	$ 75.00	0.5	+	+	+	+
MI	$ 72.50	0.5	+	+	+	+
VT	$ 60.00	1.0	+	+	+	+
GA	$ 55.00					
MN	$ 55.00	0.2	+	+	+	+
WA	$ 52.75	0.5	+	+	+	+
AZ	$ 50.00					
KS	$ 50.00					
MO	$ 50.00	0.5				
OH	$ 50.00	0.5	+	+	+	+
OK	$ 50.00	1.0	+	+	+	+
SD	$ 48.00	0.5	+	+	+	+
MA	$ 45.00		+	+	+	+
CO	$ 40.00					
ID	$ 40.00		+	+	+	+
ME	$ 40.00	0.5	+	+	+	+
IN	$ 35.00					
NM	$ 35.00	0.5	+	+	+	+
FL	$ 25.00					
NC	$ 25.00					
UT	$ 25.00	0.5	+	+	+	+
HI	$ 20.00	1.0	+	+	+	+
SC	$ 20.00		+	+	+	+
AL						
AR						
CA						
IL						
KY						
LA						
LAC						
MD						
MS						
NJ						
NY						
PA						
TX						
VA						
WV						
WY						

Labs Responding = 29 Average Fee = $56.77 Average Calibration Time = 0.7 hours

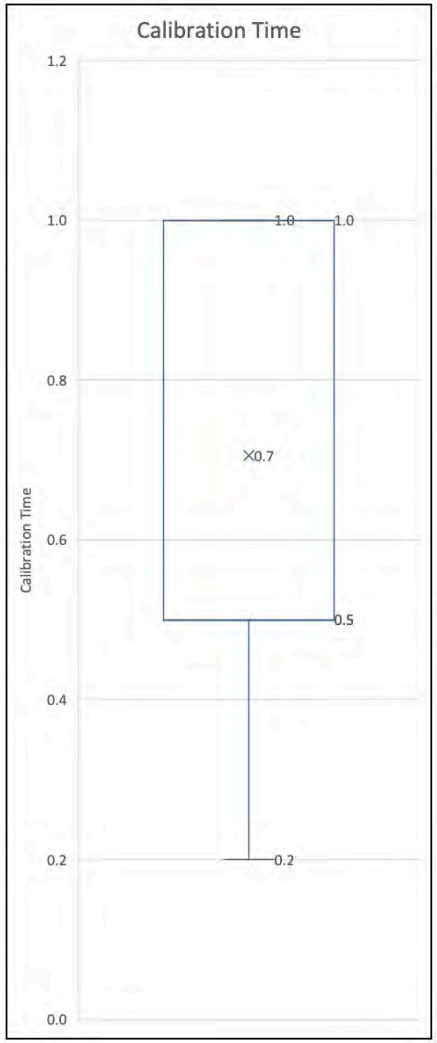


Figure 26: Minimum laboratory fees charged.

Mass Echelon I

Description

Each laboratory was asked to estimate the fee charged for testing a precision weight kit in good condition containing 21 pieces from 100 g to 1 mg to ASTM Class 0 tolerances using echelon I procedures. Laboratories were not asked to allow for cleaning or adjustments.

Comparison of Previous Surveys

Survey	Labs Reporting	Average Fee	%Change
2004	15	$617.87	--
2006	16	$758.75	+23 %
2008	14	$700.07	-8 %
2010	15	$780.83	+10 %
2012	14	$820.18	+5 %
2014	15	$870.90	<1 % Change
2016	13	$922.23	+6 %
2018	10	$933.07	+1%

Table 29: Average fee charged for echelon I mass testing from 2004 through 2018.

[Mass Echelon I] ASTM Class 0 Precision mass set - 100 g to 1 mg (21 weights) :

Lab ID	Fee Total	Calibration Time	Includes Packing	Includes Setup	Includes Statistical Controls	Includes Certificates
OR	$ 1,620.00	12.0	+	+	+	+
MI	$ 1,522.50	10.5	+	+	+	+
OK	$ 1,260.00	20.0	+	+	+	+
MN	$ 928.20	5.0	+	+	+	+
KS	$ 840.00	6.1	+	+	+	+
HI	$ 819.00	36.0	+	+	+	+
NC	$ 690.00					
GA	$ 630.00					
WA	$ 527.50	5.0	+	+	+	+
SC	$ 493.50	4.5	+	+	+	+
AK						
AL						
AR						
AZ						
CA						
CO						
CT						
FL						
ID						
IL						
IN						
KY						
LA						
LAC						
MA						
MD						
ME						
MO						
MS						
MT						
NE						
NJ						
NM						
NV						
NY						
OH						
PA						
SD						
TX						
UT						
VA						
VT						
WI						
WV						
WY						

Labs Responding = 10 Average Fee = 933.07 Average Calibration Time = 12.4 hours

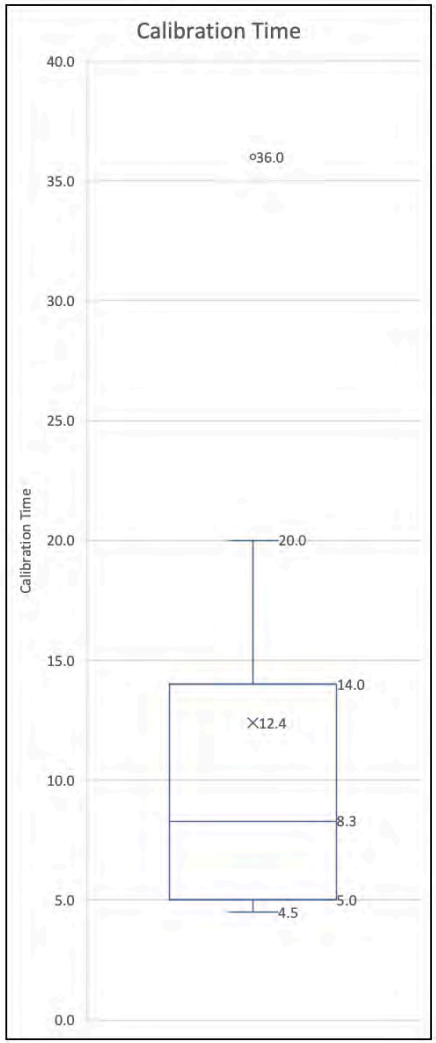


Figure 27: Fees charge for calibrating a precision weight kit containing 21 individual weights ranging from 100 g to 1 mg to ASTM Class 0 tolerances using echelon I testing techniques.

Mass Echelon II

Description

Each laboratory was asked to estimate the fee charged for testing a precision weight kit kit in good condition containing 21 pieces from 100g to 1mg to ASTM Class 2 tolerances using echelon II procedures. Laboratories were not asked to allow for cleaning or adjustments.

Comparison of Previous Surveys

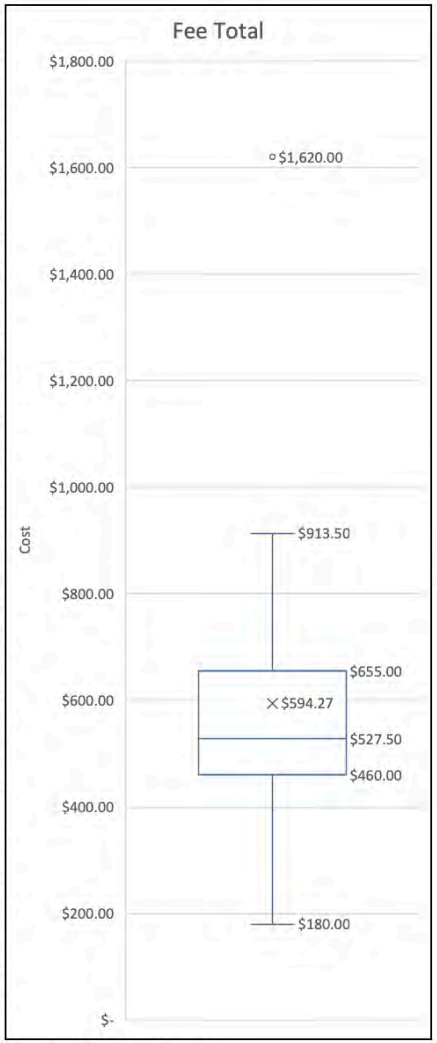
Survey	Labs Reporting	Average Fee	%Change
2000	33	$334.00	--
2002	39	$414.32	+24 %
2004	30	$431.43	+4 %
2006	31	$482.87	+12 %
2008	29	$496.18	+3 %
2010	29	$522.09	+5 %
2012	25	$636.25	+22 %
2014	27	$601.17	< 1 % Change
2016	26	$671.85	+12 %
2018	23	$594.27	-12%

Table 30: Average fee charged for echelon II mass testing from 2000 through 2018.

[Mass Echelon II] ASTM Class 2 Precision mass set - 100 g to 1 mg (21 weights) :

Lab ID	Fee Total	Calibration Time	Includes Packing	Includes Setup	Includes Statistical Controls	Includes Certificates
OR	$ 1,620.00	12.0	+	+	+	+
MI	$ 913.50	6.3	+	+	+	+
NV	$ 750.00	10.0	+	+	+	+
MN	$ 746.20	4.0	+	+	+	+
NC	$ 690.00					
AK	$ 680.00	8.0	+	+	+	+
GA	$ 630.00	15.0	+	+	+	+
HI	$ 630.00	22.0	+	+	+	+
PA	$ 630.00	7.5	+	+	+	+
MO	$ 600.00	6.0	+	+	+	+
VA	$ 588.00	20.0	+	+	+	+
WA	$ 527.50	5.0	+	+	+	+
OK	$ 525.00	7.0	+	+	+	+
NM	$ 504.00	6.0	+	+	+	+
OH	$ 500.00	5.0	+	+	+	+
ME	$ 480.00	6.0	+	+	+	+
NY	$ 480.00	3.5	+	+	+	+
AZ	$ 440.00					
FL	$ 420.00	16.0	+	+	+	+
KS	$ 420.00	5.4	+	+	+	+
SC	$ 378.00	3.0	+	+	+	+
ID	$ 336.00	6.0	+	+	+	+
CO	$ 180.00	4.5	+	+	+	+
AL						
AR						
CA						
CT						
IL						
IN						
KY						
LA						
LAC						
MA						
MD						
MS						
MT						
NE						
NJ						
SD						
TX						
UT						
VT						
WI						
WV						
WY						

Labs Responding = 23 Average Fee = 594.27 Average Calibration Time = 8.5 hours



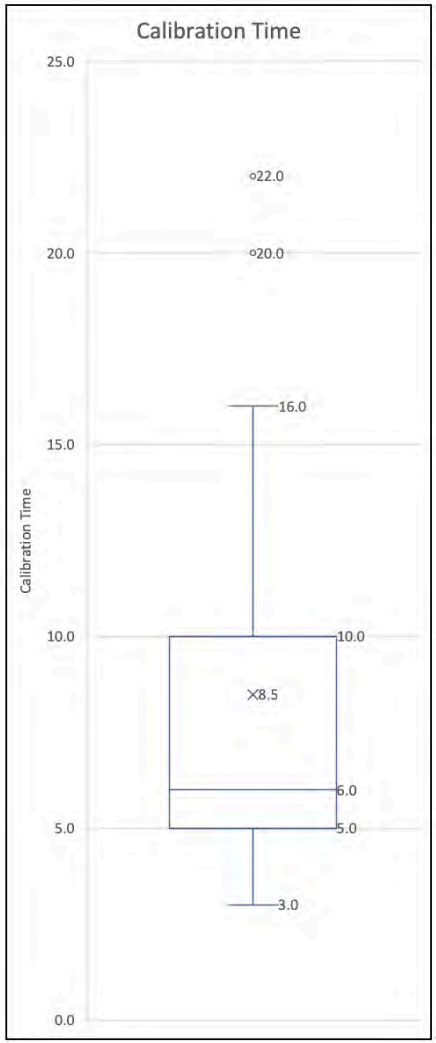


Figure 28: Fees charge for calibrating a precision weight kit containing 21 individual weights ranging from 100 g to 1 mg to ASTM Class 2 tolerances using echelon II testing techniques.

Mass Echelon III (31 lb kits)

Description

Each laboratory was asked to estimate the fee charged for testing a 31 lb weight kit containing 22 pieces to NIST Class F tolerances using echelon III procedures (NIST Handbook 105-1 "Specifications for Field Standard Test Weights (NIST Class F)", 1990). Laboratories were not asked to allow for cleaning or adjustments.

Comparison of Previous Surveys

Survey	Labs Reporting	Average Fee	%Change
2000	36	$77.00	--
2002	41	$94.99	+23 %
2004	38	$121.13	+28 %
2006	42	$135.64	+12 %
2008	44	$156.93	+15 %
2010	41	$179.30	+14 %
2012	43	$186.93	+4 %
2014	46	$187.56	> 1 % change
2016	47	$203.97	> 1 % change
2018	43	$201.28	-1%

Table 31: Average fee charged for echelon III mass testing from 2000 through 2018.

[Mass Echelon III] One - 31 lb Class F weight kit (22 weights) :

Lab ID	Fee Total	Calibration Time	Includes Packing	Includes Setup	Includes Statistical Controls	Includes Certificates
LAC	$ 1,078.96	8.0	+	+	+	+
HI	$ 440.00	12.0	+	+	+	+
NJ	$ 440.00	1.5	+	+	+	+
TX	$ 440.00	2.3	+	+	+	+
MT	$ 375.00	5.0	+	+	+	+
OR	$ 337.50	2.5	+	+	+	+
CA	$ 330.00	4.4	+	+	+	+
MI	$ 319.00	2.2	+	+	+	+
AK	$ 300.00	2.0	+	+	+	+
WA	$ 242.65	2.3	+	+	+	+
NV	$ 225.00	3.0	+	+	+	+
WI	$ 212.10	1.5	+	+	+	+
MN	$ 200.20	1.1	+	+	+	+
OH	$ 200.00	2.0	+	+	+	+
OK	$ 198.00	2.0	+	+	+	+
CT	$ 190.00	1.5	+	+	+	+
ID	$ 176.00	2.0	+	+	+	+
AZ	$ 165.00					
MA	$ 165.00		+	+	+	+
ME	$ 160.00	2.0	+	+	+	+
NE	$ 160.00	2.0	+	+	+	+
AR	$ 154.00		+	+	+	+
LA	$ 154.00	2.0	+	+	+	+
UT	$ 150.00	3.0	+	+	+	+
FL	$ 142.00	2.0	+	+	+	+
NM	$ 132.00	1.0	+	+	+	+
PA	$ 132.00	2.0	+	+	+	+
MD	$ 130.00	3.0	+	+	+	+
GA	$ 121.00	1.5	+	+	+	+
AL	$ 110.00	1.3				
KY	$ 110.00	3.0	+	+	+	+
MS	$ 110.00	1.5	+	+	+	+
NC	$ 110.00					
WV	$ 110.00					
CO	$ 104.00	2.6	+	+	+	+
MO	$ 100.00	1.0	+	+	+	+
NY	$ 92.50	1.5	+	+	+	+
SC	$ 77.00	0.3	+	+	+	+
VA	$ 77.00	1.5	+	+	+	+
VT	$ 60.00	1.0	+	+	+	+
WY	$ 50.00	2.5	+	+	+	+
IN	$ 40.00	2.0	+	+	+	+
KS	$ 35.00	1.3	+	+	+	+
IL						
SD						

Labs Responding = 43 Average Fee = 201.28 Average Calibration Time = 2.5 hours

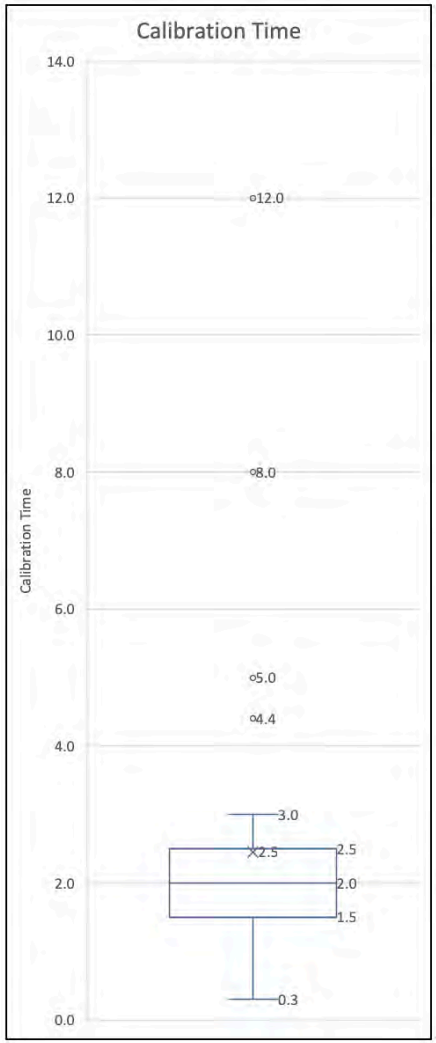


Figure 29: Fees charged for testing a 31 lb weight kit containing 22 pieces to NIST HB 105-1 Class F tolerances using mass echelon III procedures.

Mass Echelon III (50 lb Test Weights)

Description

Each laboratory was asked to estimate the fee charged for testing a set of 20 50 lb cast iron pipe-handle style test weights to NIST Class F tolerances using echelon III procedures (NIST Handbook 105-1 "Specifications for Field Standard Test Weights (NIST Class F)", 1990). Each lab was asked to provide an estimate assuming that 5 of the weights were adjusted.

Comparison of Previous Surveys

Survey	Labs Reporting	Average Fee	%Change
2014	47	$294.67	--
2016	47	$351.98	+19 %
2018	44	$336.72	-4%

Table 32: Average fee charged for testing 20 50 lb cast iron pipe-handle test weights in 2018.

20 - 50 lb weights (5 adjusted)

Lab ID	Fee Total	Calibration Time	Includes Packing	Includes Setup	Includes Statistical Controls	Includes Certificates
AK	$ 1,000.00	4.0	+	+	+	+
LAC	$ 944.09	7.0	+	+	+	+
NJ	$ 800.00	2.5	+	+	+	+
TX	$ 650.00	2.3	+	+	+	+
CA	$ 600.00	4.0	+	+	+	+
HI	$ 580.00	18.0	+	+	+	+
OH	$ 450.00	4.5	+	+	+	+
OK	$ 450.00	3.0	+	+	+	+
KY	$ 425.00	2.0	+	+	+	+
WI	$ 419.30	+	+	+	+	+
OR	$ 405.00	3.0	+	+	+	+
MI	$ 362.50	2.5	+	+	+	+
AR	$ 360.00		+	+	+	+
NM	$ 360.00	2.0	+	+	+	+
MA	$ 350.00		+	+	+	+
NY	$ 345.00	3.0	+	+	+	+
AZ	$ 330.00					
CT	$ 300.00	2.0	+	+	+	+
NV	$ 300.00	4.0	+	+	+	+
WV	$ 300.00					
WY	$ 300.00	1.5	+	+	+	+
MD	$ 280.00	36.0	+	+	+	+
MN	$ 273.00	1.5	+	+	+	+
GA	$ 250.00	3.0	+	+	+	+
LA	$ 250.00	4.0	+	+	+	+
MS	$ 250.00	3.0	+	+	+	+
NC	$ 250.00					
PA	$ 250.00	1.0	+	+	+	+
FL	$ 240.00	6.0	+	+	+	+
SD	$ 240.00	2.5	+	+	+	+
MT	$ 225.00	3.0	+	+	+	+
CO	$ 212.00	5.3	+	+	+	+
WA	$ 211.00	2.0	+	+	+	+
NE	$ 210.00	2.0	+	+	+	+
ID	$ 200.00	2.5	+	+	+	+
UT	$ 200.00	4.0	+	+	+	+
IN	$ 192.00	4.0	+	+	+	+
AL	$ 160.00	2.0				
ME	$ 160.00	2.0	+	+	+	+
SC	$ 130.00	1.5	+	+	+	+
KS	$ 105.00	2.8	+	+	+	+
MO	$ 100.00	1.0	+	+	+	+
VT	$ 60.00	1.0	+	+	+	+
IL						
VA						

Labs Responding = 43 Average Fee = $336.72 Average Calibration Time = 4.2 hours

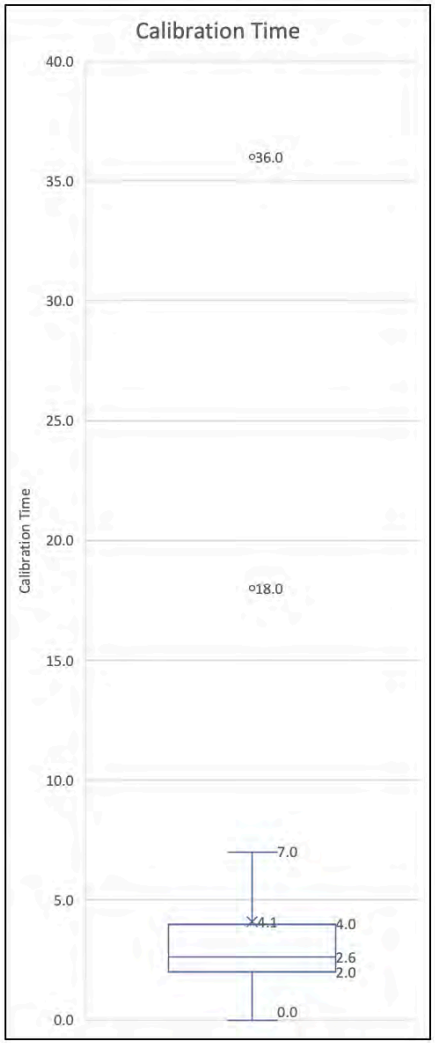


Figure 30: Fees charged for testing a set of 20 50 lb cast iron pipe-handle style test weights to NIST HB 105-1 Class F tolerances using mass echelon III procedures. 5 Adjustments were assumed.

Mass Echelon III (1000 lb Test Weights)

Description

Each laboratory was asked to estimate the fee charged for testing a set of 24 1,000 lb cast iron test weights according to NIST Class F tolerances using echelon III procedures (NIST Handbook 105-1 "Specifications for Field Standard Test Weights (NIST Class F)", 1990). Each lab was asked to provide an estimate assuming that 5 of the weights were adjusted.

Comparison of Previous Surveys

Survey	Labs Reporting	Average Fee	%Change
2014	46	$1,058.00	--
2016	47	$820.06	-22 %
2018	44	$857.66	5%

Table 33: Average fee charged for testing 24 1,000 lb cast iron test weights in 2018.

24 - 1000 lb weights (5 adjusted)

Lab ID	Fee Total	Calibration Time	Includes Packing	Includes Setup	Includes Statistical Controls	Includes Certificates
LAC	$ 6,810.94	50.5	+	+	+	+
AK	$ 1,800.00	6.0	+	+	+	+
TX	$ 1,540.00	5.0	+	+	+	+
HI	$ 1,416.00	28.0	+	+	+	+
MD	$ 1,200.00					
KY	$ 1,100.00	4.0	+	+	+	+
OR	$ 1,080.00	8.0	+	+	+	+
MN	$ 1,073.80	5.9	+	+	+	+
WI	$ 982.80	4.0	+	+	+	+
NJ	$ 960.00	5.0	+	+	+	+
NY	$ 960.00	11.0	+	+	+	+
MI	$ 942.50	6.5	+	+	+	+
SD	$ 912.00	9.5	+	+	+	+
ID	$ 864.00	8.0	+	+	+	+
VA	$ 858.00	6.0	+	+	+	+
WA	$ 844.00	8.0	+	+	+	+
WV	$ 820.00					
NM	$ 816.00	3.0	+	+	+	+
OK	$ 748.00	8.0	+	+	+	+
FL	$ 720.00	6.0	+	+	+	+
LA	$ 650.00	7.0	+	+	+	+
AR	$ 612.00		+	+	+	+
NE	$ 604.00	3.0	+	+	+	+
CT	$ 600.00	4.0	+	+	+	+
MT	$ 600.00	8.0	+	+	+	+
NV	$ 600.00	8.0	+	+	+	+
OH	$ 600.00	6.0	+	+	+	+
WY	$ 600.00	5.0	+	+	+	+
MS	$ 580.00	6.5	+	+	+	+
NC	$ 580.00					
PA	$ 580.00	3.0	+	+	+	+
MA	$ 540.00		+	+	+	+
UT	$ 500.00	10.0	+	+	+	+
ME	$ 480.00	6.0	+	+	+	+
CO	$ 468.00	11.7	+	+	+	+
VT	$ 450.00	6.0	+	+	+	+
GA	$ 396.00	4.0	+	+	+	+
SC	$ 384.00	3.5	+	+	+	+
AL	$ 360.00	8.0				
AZ	$ 330.00					
MO	$ 300.00	3.0	+	+	+	+
IN	$ 240.00	8.0	+	+	+	+
KS	$ 217.00	4.1	+	+	+	+
CA	$ 18.00	8.0	+	+	+	+
IL						

Labs Responding = 44 Average Fee = $857.66 Average Calibration Time = 8 hours

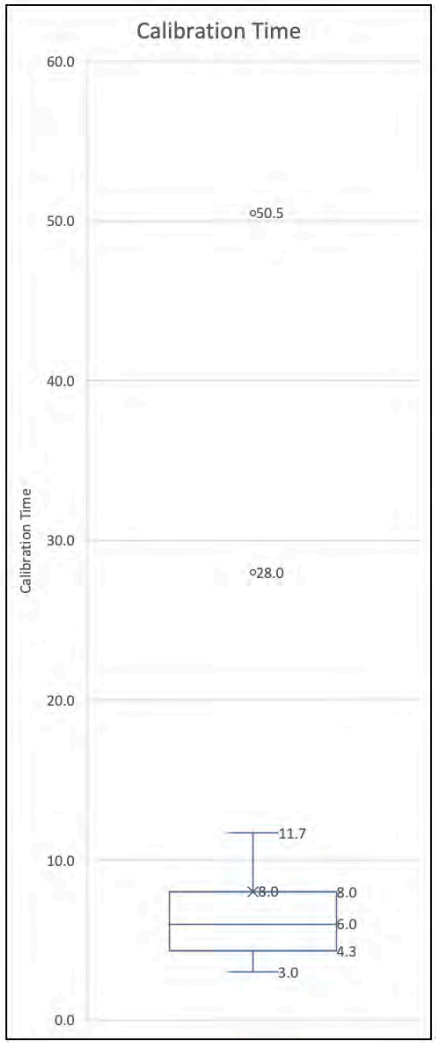


Figure 31: Fees charged for testing a set of 24 1,000 lb cast iron test weights to NIST HB 105-1 Class F tolerances using mass echelon III procedures. 5 Adjustments were assumed.

5,000 lb Weight Cart

Description

Each laboratory was asked to estimate the fee charged for testing a 5,000 lb weight cart according to NIST HB 105-8 tolerances using echelon III procedures (NIST Handbook 105-8 "Specifications and Tolerances for Field Standard Weight Carts", 2003). Laboratories were not asked to allow for cleaning or adjustments.

Comparison of Previous Surveys

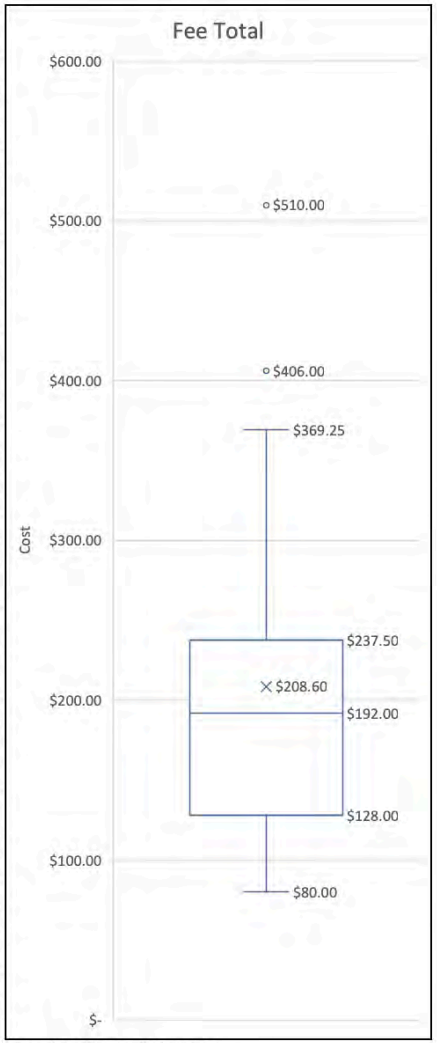
Survey	Labs Reporting	Average Fee	% Change
2004	28	$163.27	--
2006	31	$205.74	+23 %
2008	31	$185.80	+28 %
2010	34	$225.09	+21 %
2012	30	$201.65	-10 %
2014	31	$203.97	+1 %
2016	32	$205.01	< 1 % Change
2018	31	$208.60	2%

Table 34: Average fee charged for a 5,000 lb weight cart testing from 2004 through 2018.

[Mass Echelon III] 5,000 lb weight cart :

Lab ID	Fee Total	Calibration Time	Includes Packing	Includes Setup	Includes Statistical Controls	Includes Certificates
WI	$ 513.10	2.0	+	+	+	+
AK	$ 510.00	6.0	+	+	+	+
MI	$ 406.00	2.8	+	+	+	+
WA	$ 369.25	3.5	+	+	+	+
ME	$ 320.00	4.0	+	+	+	+
MN	$ 309.40	1.7	+	+	+	+
NY	$ 255.00	8.0	+	+	+	+
OK	$ 250.00	2.0	+	+	+	+
IN	$ 225.00	3.0	+	+	+	+
MT	$ 225.00	3.0	+	+	+	+
OR	$ 220.00	2.0	+	+	+	+
MO	$ 200.00	2.0	+	+	+	+
NE	$ 200.00	2.5	+	+	+	+
OH	$ 200.00	2.0	+	+	+	+
WV	$ 200.00					
SD	$ 192.00	2.0	+	+	+	+
PA	$ 180.00	1.5	+	+	+	+
MS	$ 150.00	1.5	+	+	+	+
NM	$ 145.00	2.0	+	+	+	+
MD	$ 140.00					
ID	$ 136.00	2.5	+	+	+	+
SC	$ 135.00	2.0	+	+	+	+
VA	$ 131.00	1.5	+	+	+	+
NC	$ 125.00					
CO	$ 120.00	3.0	+	+	+	+
AZ	$ 110.00					
GA	$ 110.00	2.5	+	+	+	+
TX	$ 110.00	2.8	+	+	+	+
FL	$ 100.00					
WY	$ 100.00	1.5	+	+	+	+
KS	$ 80.00	1.3	+	+	+	+
AL						
AR						
CA						
CT						
HI						
IL						
KY						
LA						
LAC						
MA						
NJ						
NV						
UT						
VT						

Labs Responding = 31 Average Fee = 208.6 Average Calibration Time = 2.6 hours



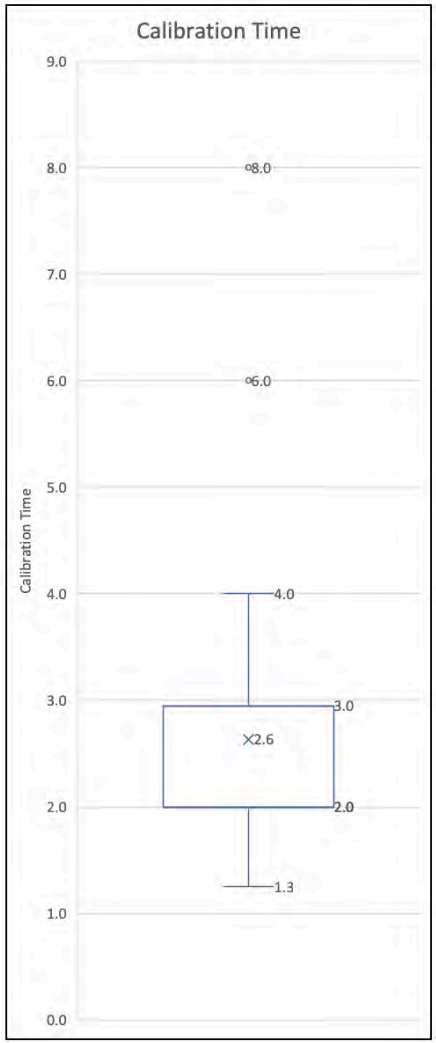


Figure 32: Fees charged for testing a 5,000 lb weight cart according to NIST HB 105-8 tolerances using mass echelon III procedures.

Scale Truck Calibration Class F

Description

Each laboratory was asked to estimate the fee charged for testing the measurement equipment contained in a single scale truck. The truck was assumed to carry 24 1,000 lb class F cast cube weights requiring 5 adjustments, 20 50 lb class F pipe-handle weights requiring 5 adjustments, and 2 31 lb weight kits containing 22 pieces each. Echelon III mass calibration procedures were requested for all measurements.

Comparison of Previous Surveys

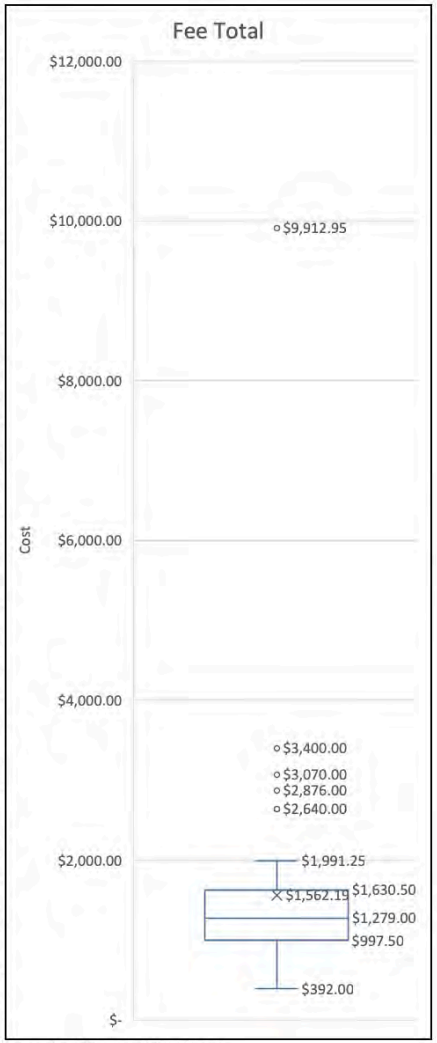
Survey	Labs Reporting	Average Fee	% Change
2004	39	$1,050.56	--
2006	43	$1,060.77	+23 %
2008	42	$1,300.30	+28 %
2010	44	$1,455.69	+12 %
2012	42	$1,520.41	+4 %
2014	45	$1,472.13	-3 %
2016	47	$1,529.57	+4 %
2018	44	$1562.19	2%

Table 35: Average fee charged for typical scale truck testing from 2004 through 2018.

Scale Test Truck Total

Lab ID	Fee Total	Calibration Time	Includes Packing	Includes Setup	Includes Statistical Controls	Includes Certificates
LAC	$ 9,912.95	73.5	+	+	+	+
AK	$ 3,400.00	14.0	+	+	+	+
TX	$ 3,070.00	10.8	+	+	+	+
HI	$ 2,876.00	70.0	+	+	+	+
NJ	$ 2,640.00	10.5	+	+	+	+
OR	$ 1,991.25	14.8	+	+	+	+
MI	$ 1,943.00	13.4	+	+	+	+
WI	$ 1,803.20	7.3	+	+	+	+
MN	$ 1,747.20	9.6	+	+	+	+
KY	$ 1,745.00	12.0	+	+	+	+
MD	$ 1,740.00	68.0	+	+	+	+
OK	$ 1,594.00	13.5	+	+	+	+
NY	$ 1,490.00	17.0	+	+	+	+
OH	$ 1,450.00	14.5	+	+	+	+
NM	$ 1,440.00	7.0	+	+	+	+
SD	$ 1,440.00	15.0	+	+	+	+
MT	$ 1,425.00	19.0	+	+	+	+
ID	$ 1,416.00	13.5	+	+	+	+
WV	$ 1,340.00					
WA	$ 1,318.75	15.5	+	+	+	+
AR	$ 1,280.00		+	+	+	+
CT	$ 1,280.00	9.0	+	+	+	+
CA	$ 1,278.00	20.0	+	+	+	+
FL	$ 1,244.00	16.0	+	+	+	+
LA	$ 1,208.00	14.0	+	+	+	+
NV	$ 1,200.00	16.0	+	+	+	+
MA	$ 1,140.00	0.0	+	+	+	+
PA	$ 1,094.00	6.5	+	+	+	+
NE	$ 1,054.00	8.0	+	+	+	+
MS	$ 1,050.00	12.5	+	+	+	+
NC	$ 1,050.00					
UT	$ 1,000.00	17.0	+	+	+	+
WY	$ 1,000.00	11.5	+	+	+	+
AZ	$ 990.00					
ME	$ 960.00	12.0	+	+	+	+
CO	$ 888.00	22.2	+	+	+	+
GA	$ 888.00	9.5	+	+	+	+
VA	$ 858.00	6.0	+	+	+	+
AL	$ 740.00	13.0				
SC	$ 668.00	6.0	+	+	+	+
MO	$ 600.00	6.0	+	+	+	+
VT	$ 600.00	8.5	+	+	+	+
IN	$ 492.00	16.0	+	+	+	+
KS	$ 392.00	9.5	+	+	+	+
IL						

Labs Responding = 44 Average Fee = $1562.19 Average Calibration Time = 16.4 hours



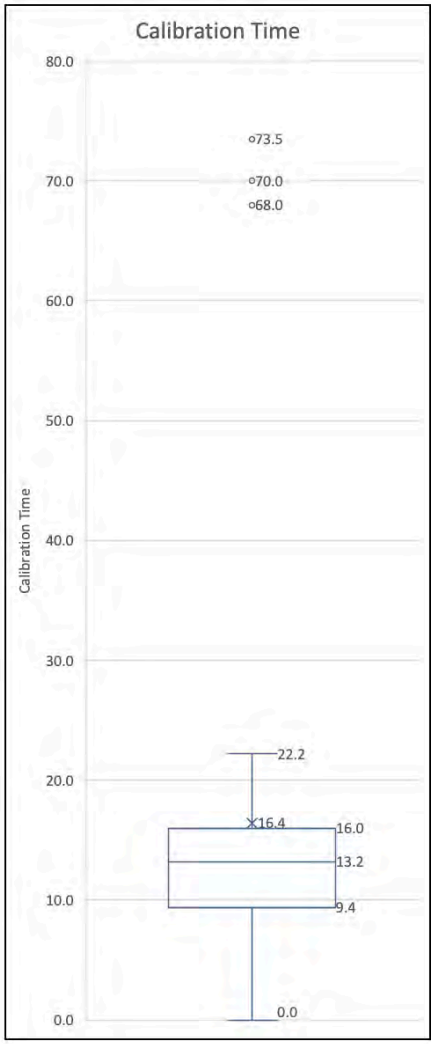


Figure 33: Fees charged for testing a typical scale truck according mass echelon III procedures.

Length 100 ft Steel Tape

Description

Each laboratory was asked to estimate the fee charged for 19 point testing of a 100 ft tape. Measurement points were requested at 1 ft intervals up to and including 10 ft then at 10 ft intervals up to and including 100 ft. It was left up to each lab to decide how best to test the steel tape, only the fee charged is reported here.

Comparison of Previous Surveys

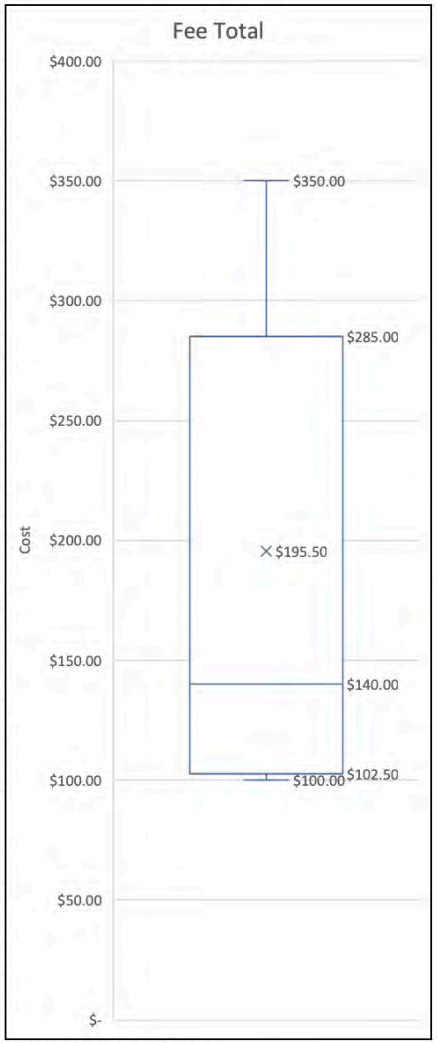
Survey	Labs Reporting	Average Fee	%Change
2000	33	$133.00	--
2002	36	$173.03	+30 %
2004	22	$250.89	+45 %
2006	22	$261.23	+4 %
2008	18	$244.86	-6 %
2010	16	$234.16	-4 %
2012	10	$246.00	+5 %
2014	9	$198.56	-19 %
2016	7	$200.71	+1 %
2018	5	$195.50	-3%

Table 36: Average fee charged for typical 19 point testing of a 100 ft steel tape from 2000 through 2018.

One - 100 foot tape with 19 points tested :

Lab ID	Fee Total	Calibration Time	Includes Packing	Includes Setup	Includes Statistical Controls	Includes Certificates
OH	$ 350.00	3.5	+	+	+	+
PA	$ 285.00	6.0	+	+	+	+
NJ	$ 140.00	6.0	+	+	+	+
NY	$ 102.50	2.0	+	+	+	+
GA	$ 100.00					
AK						
AL						
AR						
AZ						
CA		4.0	+	+	+	+
CO						
CT						
FL						
HI						
ID						
IL						
IN						
KS						
KY						
LA						
LAC						
MA						
MD						
ME						
MI						
MN						
MO						
MS						
MT						
NC						
NE						
NM						
NV						
OK						
OR						
SC						
SD						
TX						
UT						
VA						
VT						
WA						
WI						
WV						
WY						

Labs Responding = 5 Average Fee = 195.5 Average Calibration Time = 4.3 hours



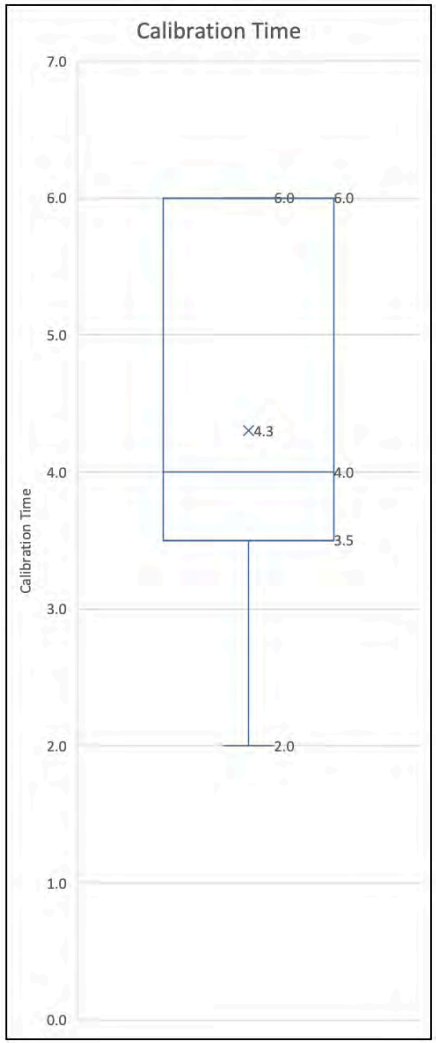


Figure 34: Fees charged for testing a steel 100 ft tape.

5 gallon test measures – Volume Transfer

Description

Each laboratory was asked to estimate the fee charged for testing a single 5 gallon field test measure according to NIST HB 105-3 (NIST Handbook 105-3, "Specifications and Tolerance Graduated Neck Type Volumetric Field Standards", 2010) tolerances using a volume transfer calibration technique (for example SOP No. 18 in (Harris, NIST Internal Report 7383, "Selected Procedures for Volumetric Calibrations", 2017)).

Comparison of Previous Surveys

Survey	Labs Reporting	Average Fee	% Change
2000	35	$35.00	--
2002	41	$41.46	+18 %
2004	39	$42.06	+1 %
2006	43	$43.93	+4 %
2008	43	$56.89	+30 %
2010	44	$64.44	+13 %
2012	44	$63.61	-1 %
2014	46	$62.52	-2 %
2016	48	$67.07	+7 %
2018	44	$70.24	5%

Table 37: Average fee charged for testing of a 5 gallon field test measure via volume transfer from 2000 through 2018.

One - 5 gallon test measure using volume transfer method :

Lab ID	Fee Total	Calibration Time	Includes Packing	Includes Setup	Includes Statistical Controls	Includes Certificates
LAC	$ 404.61	3.0	+	+	+	+
OR	$ 202.50	1.5	+	+	+	+
CA	$ 150.00	1.0	+	+	+	+
NV	$ 147.50	1.5	+	+	+	+
WI	$ 128.10	0.8	+	+	+	+
WA	$ 116.05	1.1	+	+	+	+
MI	$ 101.50	0.7	+	+	+	+
MO	$ 100.00	1.0	+	+	+	+
OH	$ 100.00	1.0	+	+	+	+
HI	$ 92.00	5.0	+	+	+	+
MN	$ 91.00	0.5	+	+	+	+
ME	$ 80.00	1.0	+	+	+	+
AK	$ 75.00	1.0	+	+	+	+
CT	$ 75.00	0.5	+	+	+	+
MT	$ 75.00	1.0	+	+	+	+
SD	$ 72.00	0.8	+	+	+	+
OK	$ 60.00	2.5	+	+	+	+
VT	$ 60.00	0.5	+	+	+	+
TX	$ 55.00	1.0	+	+	+	+
NE	$ 51.00		+	+	+	+
AZ	$ 50.00					
IN	$ 50.00	0.5	+	+	+	+
KS	$ 50.00	0.8	+	+	+	+
UT	$ 50.00	1.0	+	+	+	+
MA	$ 45.00		+	+	+	+
PA	$ 45.00	1.0	+	+	+	+
AR	$ 40.00		+	+	+	+
CO	$ 40.00	1.0	+	+	+	+
ID	$ 40.00	0.5	+	+	+	+
MS	$ 40.00	1.0	+	+	+	+
FL	$ 35.00	2.5	+	+	+	+
NM	$ 35.00	1.3	+	+	+	+
SC	$ 35.00	0.3	+	+	+	+
AL	$ 30.00					
GA	$ 30.00	1.0	+	+	+	+
LA	$ 30.00	1.5	+	+	+	+
MD	$ 30.00		+	+	+	+
NC	$ 30.00					
NJ	$ 30.00	0.8	+	+	+	+
WV	$ 30.00					
WY	$ 25.00	1.0	+	+	+	+
NY	$ 22.50	0.5	+	+	+	+
VA	$ 22.00	1.0	+	+	+	+
KY	$ 20.00	1.0	+	+	+	+
IL						

Labs Responding = 44 Average Fee = $70.24 Average Calibration Time = 1.2 hours

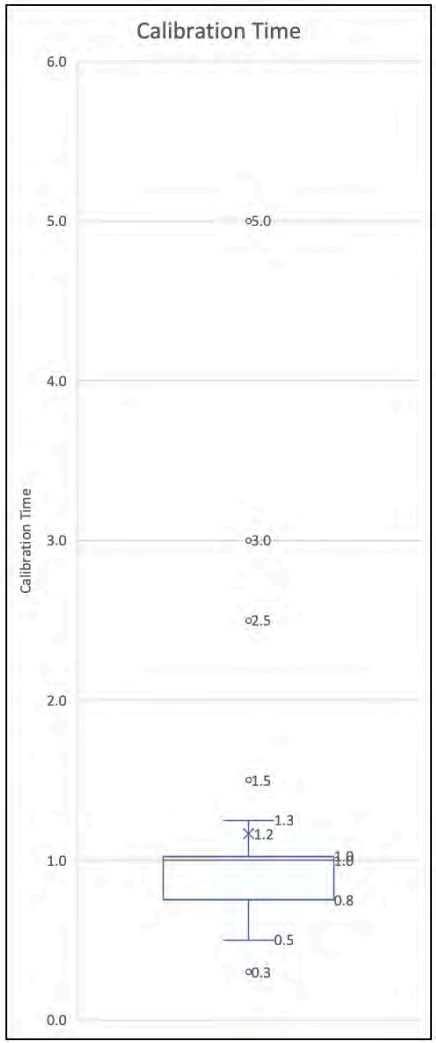


Figure 35: Fees charged for testing a 5 gallon test measure via volume transfer technique.

5 gallon test measure – Gravimetric

Description

Each laboratory was asked to estimate the fee charged for testing a single 5 gallon field standard test measure according to NIST HB 105-3 tolerances (NIST Handbook 105-3, "Specifications and Tolerance Graduated Neck Type Volumetric Field Standards", 2010) using a gravimetric measurement technique.

Comparison of Previous Surveys

Survey	Labs Reporting	Average Fee	% Change
2006	20	$177.95	--
2008	17	$173.65	+23 %
2010	21	$209.25	+21 %
2012	18	$215.24	+3 %
2014	22	$200.95	-7 %
2016	19	$241.26	+20 %
2018	18	$218.05	-10%

Table 38: Average fee charged for testing of a 5 gallon field test measure via gravimetric method from 2000 through 2018.

One - 5 gallon test measure using gravimetric method :

Lab ID	Fee Total	Calibration Time	Includes Packing	Includes Setup	Includes Statistical Controls	Includes Certificates
NV	$ 450.00	6.0	+	+	+	+
AZ	$ 440.00					
ID	$ 400.00	4.0	+	+	+	+
MN	$ 364.00	2.0	+	+	+	+
HI	$ 276.00	10.0	+	+	+	+
OR	$ 270.00	2.0	+	+	+	+
AK	$ 255.00	3.0	+	+	+	+
WA	$ 237.38	2.3	+	+	+	+
MI	$ 217.50	1.5	+	+	+	+
OK	$ 200.00	4.0	+	+	+	+
KS	$ 180.00	2.4	+	+	+	+
PA	$ 180.00	7.5	+	+	+	+
ME	$ 160.00	2.0	+	+	+	+
SC	$ 67.50	2.0	+	+	+	+
NY	$ 62.50	1.5	+	+	+	+
NC	$ 60.00					
GA	$ 55.00					
IN	$ 50.00	2.0	+	+	+	+
AL						
AR						
CA		1.5	+	+	+	+
CO						
CT						
FL						
IL						
KY						
LA						
LAC						
MA						
MD						
MO						
MS						
MT						
NE						
NJ						
NM						
OH						
SD						
TX						
UT						
VA						
VT						
WI						
WV						
WY						

Labs Responding = 18 Average Fee = $218.05 Average Calibration Time = 3.4 hours

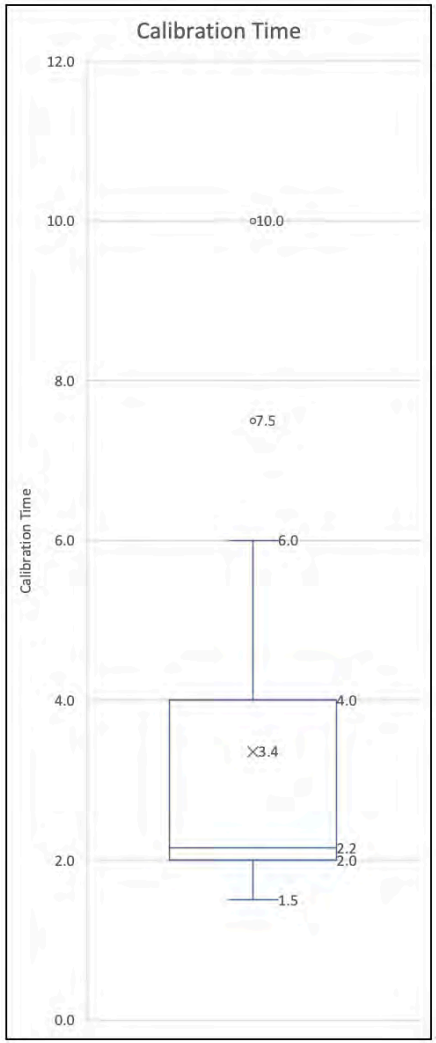


Figure 36: Fees charged for gravimetrically testing a 5 gallon field test measure.

100 gallon field standard prover – Volume Transfer

Description

Each laboratory was asked to estimate the fee charged for testing a 100 gallon field standard prover according to NIST HB 105-3 tolerances (NIST Handbook 105-3, "Specifications and Tolerance Graduated Neck Type Volumetric Field Standards", 2010) using a volume transfer calibration technique.

Comparison of Previous Surveys

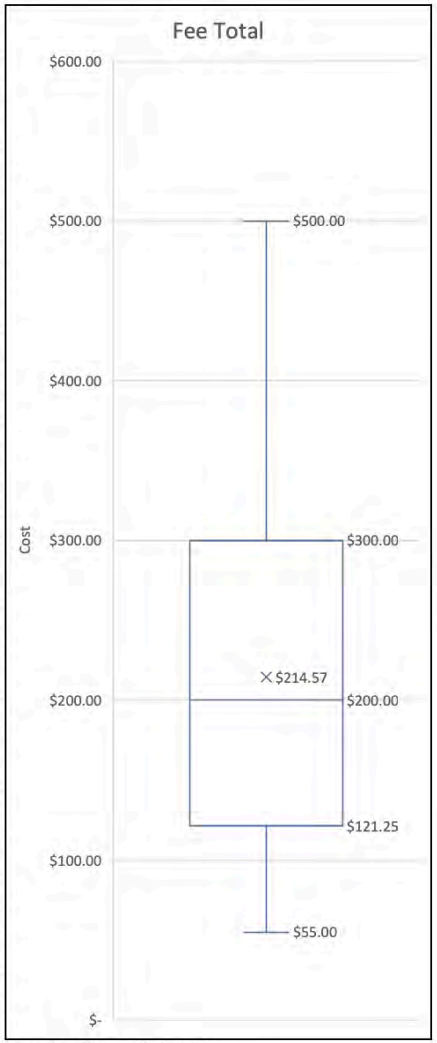
Survey	Labs Reporting	Average Fee	% Change
2000	35	$108.00	--
2002	40	$125.19	+16 %
2004	35	$138.73	+11 %
2006	37	$145.32	+5 %
2008	36	$191.83	+32 %
2010	38	$219.76	+15 %
2012	38	$206.35	-6 %
2014	40	$217.01	+5 %
2016	42	$224.16	+3 %
2018	38	$214.57	-4%

Table 39: Average fee charged for testing of a 100 gallon field standard prover via volume transfer from 2000 through 2018.

One - 100 gallon prover using volume transfer method :

Lab ID	Fee Total	Calibration Time	Includes Packing	Includes Setup	Includes Statistical Controls	Includes Certificates
OH	$ 500.00	5.0	+	+	+	+
CA	$ 450.00	3.0	+	+	+	+
OR	$ 391.50	2.9	+	+	+	+
NV	$ 375.00	5.0	+	+	+	+
HI	$ 368.00	12.0	+	+	+	+
MI	$ 362.50	2.5	+	+	+	+
MA	$ 360.00		+	+	+	+
ID	$ 320.00	3.0	+	+	+	+
CT	$ 300.00	2.0	+	+	+	+
MO	$ 300.00	3.0	+	+	+	+
MT	$ 300.00	4.0	+	+	+	+
OK	$ 300.00	4.0	+	+	+	+
WA	$ 253.20	2.4	+	+	+	+
WI	$ 247.10	3.0	+	+	+	+
AZ	$ 220.00					
MN	$ 218.40	1.2	+	+	+	+
AK	$ 200.00	2.0	+	+	+	+
NJ	$ 200.00	1.5	+	+	+	+
WV	$ 200.00					
WY	$ 200.00	2.0	+	+	+	+
ME	$ 160.00	2.0	+	+	+	+
NE	$ 160.00	2.0	+	+	+	+
TX	$ 160.00	3.0	+	+	+	+
NM	$ 150.00	3.0	+	+	+	+
PA	$ 150.00	2.5	+	+	+	+
UT	$ 150.00	3.0	+	+	+	+
SC	$ 135.00	2.0	+	+	+	+
IN	$ 125.00	3.0	+	+	+	+
CO	$ 120.00	3.0	+	+	+	+
MS	$ 111.25	2.0	+	+	+	+
MD	$ 110.00					
FL	$ 106.25	3.0	+	+	+	+
NY	$ 97.50	5.0	+	+	+	+
KS	$ 85.00	1.3	+	+	+	+
AL	$ 75.00					
KY	$ 70.00	3.0	+	+	+	+
NC	$ 68.00					
GA	$ 55.00	2.0	+	+	+	+
AR						
IL						
LA						
LAC						
SD						
VA						
VT						

Labs Responding = 38 Average Fee = $214.57 Average Calibration Time = 3.1 hours



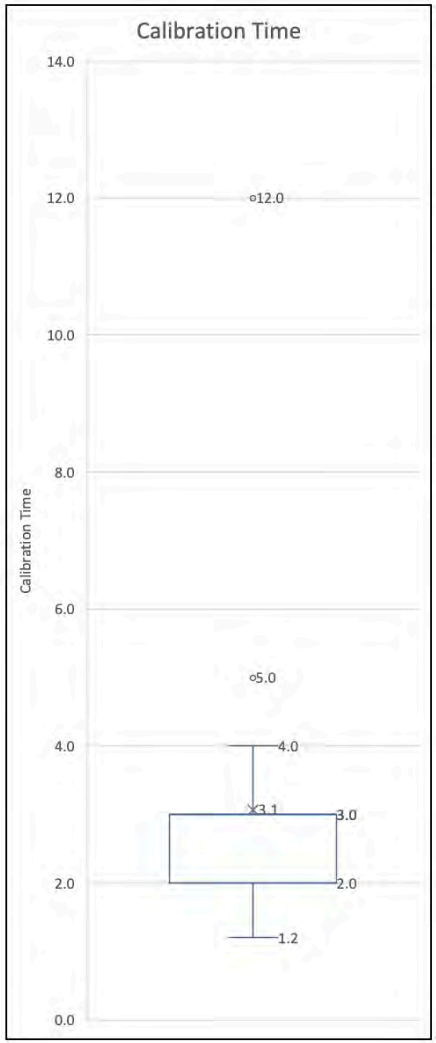


Figure 37: Fees charged for testing a 100 gallon field standard prover via volume transfer technique.

100 gallon field standard prover- Gravimetric

Description

Each laboratory was asked to estimate the fee charged for testing a 100 gallon field standard prover according to NIST HB 105-3 tolerances (NIST Handbook 105-3, "Specifications and Tolerance Graduated Neck Type Volumetric Field Standards", 2010) using a gravimetric calibration technique.

Comparison of Previous Surveys

Survey	Labs Reporting	Average Fee	% Change
2006	4	$265.00	+5 %
2008	7	$434.29	+64 %
2010	7	$597.14	+37 %
2012	7	$447.14	-25 %
2014	8	$670.63	+50 %
2016	7	$854.29	+27 %
2018	7	$702.29	-18%

Table 40: Average fee charged for testing of a 100 gallon field test standard prover via gravimetric method from 2006 through 2018.

One - 100 gallon prover using gravimetric method :

Lab ID	Fee Total	Calibration Time	Includes Packing	Includes Setup	Includes Statistical Controls	Includes Certificates
MN	$ 1,456.00	6.0	+	+	+	+
PA	$ 1,125.00	15.0	+	+	+	+
AZ	$ 660.00					
OK	$ 600.00	8.0	+	+	+	+
ME	$ 480.00	6.0	+	+	+	+
NY	$ 345.00	8.0	+	+	+	+
NC	$ 250.00					
AK						
AL						
AR						
CA						
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WA						
WI						
WV						
WY						

Labs Responding = 7 Average Fee = $702.29 Average Calibration Time = 8.6 hours

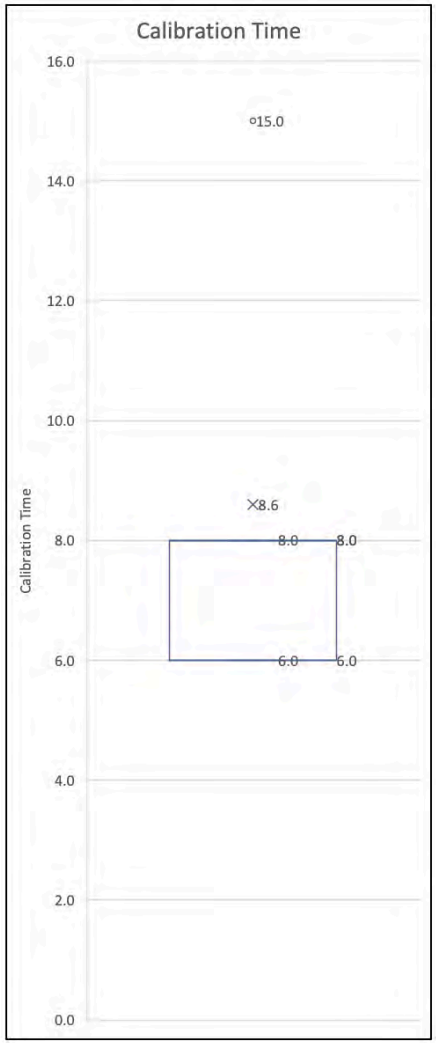


Figure 38: Fees charged for gravimetrically testing a 100 gallon field standard steel prover.

100 gallon field standard prover LPG – Volume Transfer

Description

Each laboratory was asked to estimate the fee charged for testing a 100 gallon liquefied petroleum gas (LPG) field standard prover according to NIST HB 105-4 tolerances (NIST Handbook 105-4, "Specifications and Tolerances for Liquified Petroleum Gas and Anhydrous Ammonia Liquid Volumetric Provers", 2010) using a volume transfer calibration technique.

Comparison of Previous Surveys

Survey	Labs Reporting	Average Fee	%Change
2006	32	$255.78	--
2008	31	$295.39	+23 %
2010	38	$219.75	-26 %
2012	29	$348.05	+58 %
2014	31	$347.05	< 1 % change
2016	30	$372.44	+7 %
2018	29	$389.74	5%

Table 41: Average fees charged for the testing of a 100 gallon LPG prover from via volume transfer from 2006 through 2018.

One - 100 gallon LPG prover :

Lab ID	Fee Total	Calibration Time	Includes Packing	Includes Setup	Includes Statistical Controls	Includes Certificates
CA	$ 750.00	5.0	+	+	+	+
MN	$ 728.00	4.0	+	+	+	+
OR	$ 671.00	6.1	+	+	+	+
WI	$ 618.10	4.0	+	+	+	+
NV	$ 600.00	8.0	+	+	+	+
OH	$ 600.00	6.0	+	+	+	+
MI	$ 580.00	4.0	+	+	+	+
WA	$ 527.50	5.0	+	+	+	+
OK	$ 500.00	8.0	+	+	+	+
WV	$ 500.00					
ID	$ 480.00	4.0	+	+	+	+
MT	$ 450.00	6.0	+	+	+	+
AZ	$ 440.00					
AK	$ 400.00	4.0	+	+	+	+
MO	$ 400.00	4.0	+	+	+	+
NY	$ 370.00	7.0	+	+	+	+
TX	$ 325.00	5.0	+	+	+	+
ME	$ 320.00	4.0	+	+	+	+
NM	$ 250.00	4.0	+	+	+	+
NE	$ 240.00	3.0	+	+	+	+
IN	$ 225.00	3.0	+	+	+	+
FL	$ 200.00	8.0	+	+	+	+
NJ	$ 200.00	2.0	+	+	+	+
WY	$ 200.00	3.0	+	+	+	+
SC	$ 195.00	2.5	+	+	+	+
KS	$ 170.00	1.8	+	+	+	+
CO	$ 160.00	4.0	+	+	+	+
GA	$ 135.00	3.0	+	+	+	+
NC	$ 68.00					
AL						
AR						
CT						
HI						
IL						
KY						
LA						
LAC						
MA						
MD						
MS						
PA						
SD			+	+	+	+
UT						
VA						
VT						

Labs Responding = 29 Average Fee = $389.74 Average Calibration Time = 4.6 hours

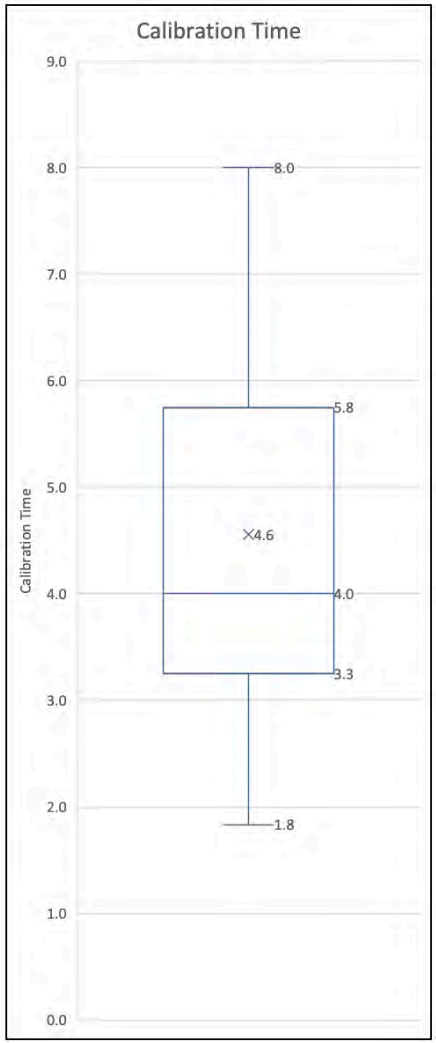


Figure 39: Fees charged for testing a 100 gallon LPG prover.

20 Gallon Dynamic Small Volume Prover (SVP) – Volume Transfer

Description

In previous surveys each lab was asked to estimate the fee for calibrating a 20 gallon SVP according to NIST HB 105- 7 tolerances (NIST Handbook 105-7, "Specifications and Tolerances for Dynamic Small Volume Provers", 1997). The question was deprecated in 2016 because only a very few labs calibrate these devices. The results are reprinted in this survey for convenient reference.

Comparison of Previous Surveys

Survey	Labs Reporting	Average Fee	% Change
2006	3	$113.33	--
2008	2	$123.75	+9 %
2010	1	$100.00	-19 %
2012	2	$200.00	+100 %
2014	4	$220.00	+10 %

Table 42: Average fee charged for testing a SVP via volume transfer from 2006 through 2014.

20 Gallon Dynamic Small Volume Prover (SVP) – Volume Gravimetric

Description

In previous surveys each lab was asked to estimate the fee for calibrating a 20 gallon SVP according to NIST HB 105- 7 tolerances (NIST Handbook 105-7, "Specifications and Tolerances for Dynamic Small Volume Provers", 1997). The question was deprecated in 2016 because only a very few labs calibrate these devices. The results are reprinted in this survey for convenient reference.

Comparison of Previous Surveys

Survey	Labs Reporting	Average Fee	% Change
2006	3	$470.00	--
2008	3	$470.00	0 %
2010	3	$593.33	+26 %
2012	3	$593.33	0 %
2014	5	$756.00	+27 %

Table 43: Average fee charged for testing a SVP gravimetrically from 2006 through 2014.

Metrology Positions/Title and Salaries

Each laboratory was asked to provide position titles and salary ranges for personnel employed by the lab. They were asked to categorize each position according to the metrology function performed.

Lab ID	Job Title	Standardized Title	Min Salary	Max Salary
AK	State Metrologist II	Laboratory Supervisor	$57,336.00	$85,764.00
AK	State Metrologist II	Metrology/Calibration Technician	$49,776.00	$75,060.00
AL	Laboratory Supervisior	Laboratory Supervisor	$32,287.20	$48,924.00
AL	Consumer W & M Protection Specialist	Metrology/Calibration Technician	$28,516.80	$47,757.60
AL	Labour	Support Staff	$9,000.00	$13,500.00
AR	Metrology Laboratory Manager	Supervisor	$43,200.00	$69,600.00
AR	Metrologist	Calibration Technician	$33,600.00	$55,200.00
AR	Agriculture Program Manager	Calibartion Technician	$36,000.00	$60,000.00
AZ	State Metrologist	Laboratory Supervisor	$46,593.60	$79,424.40
AZ	Assistant State metrologist	Metrology/Calibration Technician	$36,168.00	$67,982.40
CA	Principal State Metrologist	Laboratory Supervisor	$91,692.00	$104,136.00
CA	Measurement Standards Specialist III	Metrology/Calibration Engineer	$57,396.00	$71,832.00
CA	Measurement Standards Specialist II	Metrology/Calibration Technician	$45,696.00	$56,532.00
CA	Measurement Standards Specialist I	Metrology/Calibration Technician	$39,936.00	$49,248.00
CO	Metrologist I	Metrology/Calibration Engineer	$48,600.00	$68,616.00
CO	Metrologist II	Metrology/Calibration Engineer	$52,248.00	$73,752.00
CO	Metrologist III	Metrology/Calibration Engineer	$56,160.00	$79,260.00
CO	Laboratory Services Division Director	Laboratory Supervisor	$89,904.00	$145,704.00
CT	Metrologist	Metrology/Calibration Engineer	$54,764.04	$77,655.12
CT	W&M Inspector	Metrology/Calibration Engineer	$61,530.24	$77,704.20
FL	Laboratory Manager	Laboratory Supervisor	$42,813.36	$88,847.16
FL	Senior Metrologist	Metrology/Calibration Technician	$31,847.52	$55,310.16
FL	Metrologist	Metrology/Calibration Technician	$27,087.12	$44,530.80
FL	Laboratory Technician IV	Support Staff	$24,498.96	$42,010.56
GA	State Metrologist	Laboratory Supervisor	$39,038.04	$71,523.00
GA	Metrologist	Metrology/Calibration Engineer	$30,000.00	$78,000.00
HI	Metrologist I	Metrology/Calibration Engineer	$43,428.00	$64,284.00
HI	Metrologist II	Metrology/Calibration Engineer	$46,932.00	$69,540.00
HI	Metrologist III	Laboratory Supervisor	$50,772.00	$75,192.00
ID	Section Manager/Metrologist	Laboratory Supervisor	$58,177.56	$103,916.76
ID	Ag Program Specialist/Metrologist	Metrology/Calibration Technician	$48,588.84	$86,798.40
IL	Public Service Administrator		$55,344.00	$83,880.00
IL	Metrologist Associate		$45,504.00	$67,212.00
IL	Products & Standards Inspector		$45,408.00	$65,376.00
IN	Metrologist	Laboratory Supervisor	$40,680.00	$70,452.00
KS	Agricultural Inspector / Metrologist	Metrology/Calibration Technician	$35,424.00	$40,737.60
KS	Agricultural Inspector / State Metrologist	Laboratory Supervisor	$45,139.20	$51,910.08
KY	Program Coordinator	Metrology/Calibration Technician	$32,042.40	$53,270.40
KY	Agricultural Inspector I	Support Staff	$21,886.80	$36,102.48

Lab ID	Job Title	Standardized Title	Min Salary	Max Salary
KY	Metrology Lab Supervisor	Laboratory Supervisor	$38,770.08	$63,952.32
KY	Metrology Lab Technician I	Metrology/Calibration Technician	$24,072.96	$39,711.84
KY	Metrology Lab Technician II	Metrology/Calibration Engineer	$29,129.28	$48,048.00
LA	Asst. Division Director	Laboratory Supervisor	$67,368.00	$117,936.00
LA	Agriculture Specialist	Metrology/Calibration Technician	$36,600.00	$64,140.00
LAC	Senior Metrologist	Laboratory Supervisor	$61,064.76	$80,083.68
LAC	Metrologist	Metrology/Calibration Technician	$57,840.00	$75,860.76
LAC	Ag/Weights and Measures Inspector III	Laboratory Supervisor	$60,615.24	$79,495.68
LAC	Ag/Weights and Measures Inspector II	Metrology/Calibration Technician	$54,381.84	$71,326.92
LAC	Ag/Weights and Measures Inspector I	Metrology/Calibration Technician	$51,505.08	$63,996.00
LAC	Associate Weights and Measures Inspector	Metrology/Calibration Technician	$45,313.56	$45,313.56
MA	State Metrologist & Laboratory Manager		$54,000.00	$78,000.00
MD	Metrologist I	Metrology/Calibration Technician	$36,557.04	$57,807.96
MD	Metrologist II	Metrology/Calibration Technician	$38,880.00	$61,691.04
MD	Administrator I	Laboratory Supervisor	$44,016.96	$70,265.04
ME	Metrologist	Laboratory Supervisor	$46,716.84	$63,419.16
MI	Metrologist Manager - 14	Laboratory Supervisor	$61,006.44	$89,772.84
MI	Metrology Specialist - 13	Metrology/Calibration Engineer	$56,617.56	$83,116.80
MI	Metrologist - 12	Metrology/Calibration Engineer	$52,187.16	$76,065.60
MI	Metrologist - P11	Metrology/Calibration Engineer	$49,691.16	$69,971.16
MI	Metrologist - 10	Metrology/Calibration Engineer	$42,910.44	$60,528.00
MI	Metrologist - 9	Metrology/Calibration Engineer	$41,516.76	$59,238.36
MN	Metrologist	Metrology/Calibration Technician	$47,856.00	$70,200.00
MN	Lab Administrator/Tech. Mgr/Quality Mgr	Metrology/Calibration Engineer	$54,912.00	$80,916.00
MN	Lab Manager	Laboratory Supervisor	$72,972.00	$104,988.00
MO	Metrologist	Laboratory Supervisor	$36,480.00	$59,340.00
MO	Metrology Specialist	Metrology/Calibration Technician	$31,500.00	$44,472.00
MS	Lab Director	Laboratory Supervisor	$45,154.92	$79,021.08
MS	Metrologist	Metrology/Calibration Technician	$28,962.24	$50,683.92
MT	Metrologist	Laboratory Supervisor	$50,992.80	$52,723.20
NC	Laboratory Manager	Laboratory Supervisor	$46,203.00	$78,217.92
NC	Quality Assurance Manager	Metrology/Calibration Engineer	$36,677.04	$62,091.96
NC	Metrologist I	Metrology/Calibration Technician	$33,960.00	$57,492.96
NC	Grain Moisture Program Supervisor	Metrology/Calibration Engineer	$36,677.04	$62,091.96
NC	Administrative Associate II	Support Staff	$27,780.00	$44,091.00
NE	State Metrologist	Laboratory Supervisor	$42,000.00	$57,600.00
NJ	Sup. of Licensing, Metrololgy, and Reg.	Laboratory Supervisor	$77,604.00	$112,548.00
NJ	Weights and Measures Inspector 3	Metrology/Calibration Technician	$61,992.00	$91,248.00
NJ	Weights and Measures Inspector 3	Metrology/Calibration Technician	$53,544.00	$78,840.00
NJ	Agency Service Representative 3	Support Staff	$38,004.00	$53,304.00
NM	Regular Laboratory Manager,Metrology	Laboratory Supervisor	$48,000.00	$72,000.00
NM	Metrologist,Intermediate	Metrology/Calibration Engineer	$36,000.00	$54,000.00
NV	Metrologist III	Laboratory Supervisor	$45,643.68	$67,901.76
NV	Metrologist II	Metrology/Calibration Engineer	$41,843.52	$62,055.36

Lab ID	Job Title	Standardized Title	Min Salary	Max Salary
NV	Metrologist I	Metrology/Calibration Technician	$38,440.08	$56,751.84
NY	Specialist I	Metrology/Calibration Technician	$56,604.00	$71,979.96
NY	Specialist II (Lab Manager)	Laboratory Supervisor	$73,284.00	$92,693.04
NY	Director	Laboratory Supervisor	$99,414.96	$125,628.96
OH	Weights and Measures Supervisor	Laboratory Supervisor	$47,892.00	$60,480.00
OH	Weights and Measures Technologist	Metrology/Calibration Technician	$42,240.00	$54,960.00
OK	Metrologist I	Metrology/Calibration Technician	$26,502.12	$48,587.28
OK	Metrologist II	Metrology/Calibration Technician	$31,847.88	$58,587.72
OK	Metrologist III	Metrology/Calibration Engineer	$38,884.56	$71,288.40
OK	Metrologist IIII	Laboratory Supervisor	$43,162.68	$79,131.60
OR	Lead Metrologist	Metrology/Calibration Technician	$68,532.00	$100,296.00
OR	Metrologist	Metrology/Calibration Technician	$62,268.00	$91,200.00
PA	Laboratory Supervisor	Laboratory Supervisor	$56,058.96	$85,125.00
PA	Metrologist	Metrology/Calibration Technician	$52,421.04	$74,640.96
PA	Metrologist (PSL Basic Req.)	Metrology/Calibration Engineer	$54,846.00	$74,640.96
PA	Metrologist (PSL Intermediate Req.)	Metrology/Calibration Engineer	$57,233.04	$74,640.96
PA	Laboratory Adminstrative Assistant	Support Staff	$33,663.00	$50,229.96
SC	Laboratory Technologist I	Metrology/Calibration Technician	$29,120.00	$58,240.00
SC	Laboratory Technologist II	Metrology/Calibration Technician	$35,360.00	$66,560.00
SC	Program Coordinator II	Laboratory Supervisor	$41,600.00	$80,080.00
SD	State Inspector	Metrology/Calibration Engineer	$34,548.00	$54,168.00
TX	Manager For Metrology Laboratory	Laboratory Supervisor	$51,612.00	$84,480.00
TX	Inspector V	Metrology/Calibration Engineer	$36,972.00	$58,392.00
TX	Program Specialist III	Metrology/Calibration Engineer	$42,240.00	$68,952.00
TX	Administrative Assistant IV	Support Staff	$32,976.00	$52,044.00
UT	State Metrologist	Metrology/Calibration Engineer	$45,792.00	$72,648.00
VA	MANAGER		$42,000.00	$72,000.00
VA	METROLOGIST		$38,004.00	$51,996.00
VT	Weights and Measure Specialist	Laboratory Supervisor	$54,177.60	$85,152.00
VT	Consumer Protection Specialist	Metrology/Calibration Engineer	$51,072.00	$80,102.40
WA	State Metrologist	Laboratory Supervisor	$44,652.00	$60,012.00
WI	Laboratory Director	Laboratory Supervisor	$46,917.36	$107,907.84
WI	Chief Metrologist	Metrology/Calibration Technician	$46,845.36	$107,907.84
WI	Metrologist	Metrology/Calibration Technician	$46,845.36	$107,907.84
WI	Limited Term Employee (LTE)	Support Staff	$45,759.96	$45,759.96
WV	Program Specialist- Head Metrologist	Metrology/Calibration Technician	$32,496.00	$46,092.00
WY	Inspection Supervisor	Laboratory Supervisor	$59,172.00	$88,764.00
WY	Inspection Specialist	Metrology/Calibration Technician	$41,448.00	$62,184.00

Table 44: Metrologist position titles and salary ranges.

SLP Metrology Salaries – Standardized Title Comparison

A comparison of salary ranging reported across the SLP is made here using the standardized titled reported for each job title;

- Laboratory Supervisor
- Metrology/Calibration Engineer
- Metrology/Calibration Technician
- Support Staff

Salary comparisons were first compared using the data as reported by each laboratory without cost of living adjustments. Annual salaries for each position identified are plotted on a range from minimum to maximum and sorted on the highest possible compensation from high to low. Summary information for the entire program is provided showing minimum, maximum, and average values for the minimum salaries, maximum salaries, and salary ranges.

No adjustments have been made to these data to adjust for cost of living variations across the region.

Laboratory Supervisor

	Minimum	Maximum	Average
Minimum Salary	$32,278.20	$99,414.96	$65,851.08
Maximum Salary	$48,924.00	$145,704.00	$97,314.00
Salary Range	$16,636.80	$46,289.04	$31,462.92

Metrologist/Calibration Engineer

	Minimum	Maximum	Average
Minimum Salary	$29,129.28	$61,530.24	$45,329.76
Maximum Salary	$48,048.00	$83,116.80	$65,582.40
Salary Range	$18,918.72	$21,586.56	$65,582.40

Metrologist/Calibration Technician

	Minimum	Maximum	Average
Minimum Salary	$24,072.96	$68,532.00	$46,302.48
Maximum Salary	$39,711.84	$107,907.84	$73,809.84
Salary Range	$15,638.88	$39,375.84	$27,507.36

Support Staff

	Minimum	Maximum	Average
Minimum Salary	$9,000.00	$45,759.96	$27,379.98
Maximum Salary	$13,500.00	$53,304.00	$33,402.00
Salary Range	$4,500.00	$7,544.04	$6,022.02

Table 45: SLP metrologist compensation summary by standardized job titles.

Laboratory Supervisor

Lab ID	Min Salary	Max Salary
AL	$32,287.20	$48,924.00
AR	$33,600.00	$55,200.00
AR	$36,000.00	$60,000.00
MO	$36,480.00	$59,340.00
KY	$38,770.08	$63,952.32
GA	$39,038.04	$71,523.00
IN	$40,680.00	$70,452.00
SC	$41,600.00	$80,080.00
NE	$42,000.00	$57,600.00
FL	$42,813.36	$88,847.16
OK	$43,162.68	$79,131.60
AR	$43,200.00	$69,600.00
MD	$44,016.96	$70,265.04
WA	$44,652.00	$60,012.00
KS	$45,139.20	$51,910.08
MS	$45,154.92	$79,021.08
NV	$45,643.68	$67,901.76
NC	$46,203.00	$78,217.92
AZ	$46,593.60	$79,424.40
ME	$46,716.84	$63,419.16
WI	$46,917.36	$107,907.84
OH	$47,892.00	$60,480.00
NM	$48,000.00	$72,000.00
HI	$50,772.00	$75,192.00
MT	$50,992.80	$52,723.20
TX	$51,612.00	$84,480.00
VT	$54,177.60	$85,152.00
PA	$56,058.96	$85,125.00
AK	$57,336.00	$85,764.00
ID	$58,177.56	$103,916.76
WY	$59,172.00	$88,764.00
LAC	$60,615.24	$79,495.68
MI	$61,006.44	$89,772.84
LAC	$61,064.76	$80,083.68
LA	$67,368.00	$117,936.00
MN	$72,972.00	$104,988.00
NY	$73,284.00	$92,693.04
NJ	$77,604.00	$112,548.00
CO	$89,904.00	$145,704.00
CA	$91,692.00	$104,136.00
NY	$99,414.96	$125,628.96
Average	$52,921.59	$80,714.94
Median	$46,917.36	$79,131.60

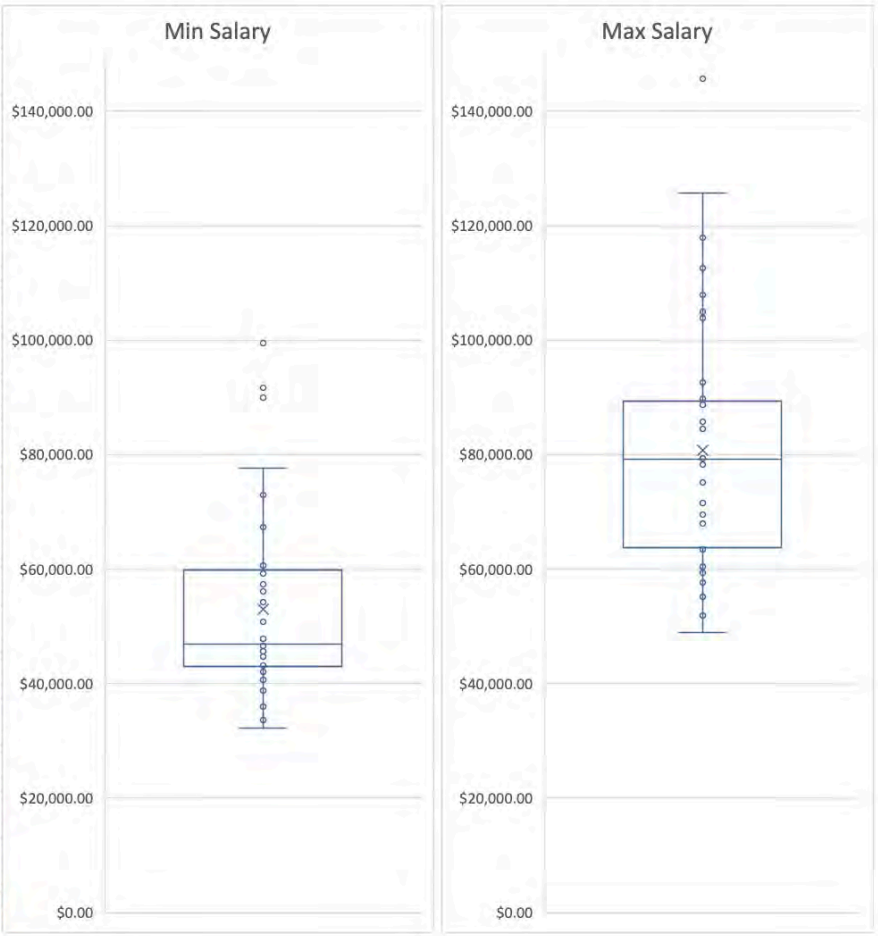


Figure 40: Salaries for Laboratory Supervisors

Metrology/Calibration Engineer

Lab ID	Min Salary	Max Salary
KY	$29,129.28	$48,048.00
GA	$30,000.00	$78,000.00
SD	$34,548.00	$54,168.00
NM	$36,000.00	$54,000.00
NC	$36,677.04	$62,091.96
NC	$36,677.04	$62,091.96
TX	$36,972.00	$58,392.00
OK	$38,884.56	$71,288.40
MI	$41,516.76	$59,238.36
NV	$41,843.52	$62,055.36
TX	$42,240.00	$68,952.00
MI	$42,910.44	$60,528.00
HI	$43,428.00	$64,284.00
UT	$45,792.00	$72,648.00
HI	$46,932.00	$69,540.00
CO	$48,600.00	$68,616.00
MI	$49,691.16	$69,971.16
VT	$51,072.00	$80,102.40
MI	$52,187.16	$76,065.60
CO	$52,248.00	$73,752.00
CT	$54,764.04	$77,655.12
PA	$54,846.00	$74,640.96
MN	$54,912.00	$80,916.00
CO	$56,160.00	$79,260.00
MI	$56,617.56	$83,116.80
PA	$57,233.04	$74,640.96
CA	$57,396.00	$71,832.00
CT	$61,530.24	$77,704.20
Average	$46,100.28	$69,057.12
Median	$46,362.00	$70,629.78

Figure 41: Salary ranges for Metrology/Calibration Engineers

Metrology/Calibration Technician

Lab ID	Min Salary	Max Salary
KY	$24,072.96	$39,711.84
OK	$26,502.12	$48,587.28
FL	$27,087.12	$44,530.80
AL	$28,516.80	$47,757.60
MS	$28,962.24	$50,683.92
SC	$29,120.00	$58,240.00
MO	$31,500.00	$44,472.00
FL	$31,847.52	$55,310.16
OK	$31,847.88	$58,587.72
KY	$32,042.40	$53,270.40
WV	$32,496.00	$46,092.00
NC	$33,960.00	$57,492.96
SC	$35,360.00	$66,560.00
KS	$35,424.00	$40,737.60
AZ	$36,168.00	$67,982.40
MD	$36,557.04	$57,807.96
LA	$36,600.00	$64,140.00
NV	$38,440.08	$56,751.84
MD	$38,880.00	$61,691.04
CA	$39,936.00	$49,248.00
WY	$41,448.00	$62,184.00
OH	$42,240.00	$54,960.00
LAC	$45,313.56	$45,313.56
CA	$45,696.00	$56,532.00
WI	$46,845.36	$107,907.84
WI	$46,845.36	$107,907.84
MN	$47,856.00	$70,200.00
ID	$48,588.84	$86,798.40
AK	$49,776.00	$75,060.00
LAC	$51,505.08	$63,996.00
PA	$52,421.04	$74,640.96
NJ	$53,544.00	$78,840.00
LAC	$54,381.84	$71,326.92
NY	$56,604.00	$71,979.96
LAC	$57,840.00	$75,860.76
NJ	$61,992.00	$91,248.00
OR	$62,268.00	$91,200.00
OR	$68,532.00	$100,296.00
AR	$36,000.00	$60,000.00
AR	$33,600.00	$55,200.00
Average	$41,465.43	$64,277.69
Median	$38,660.04	$59,293.86

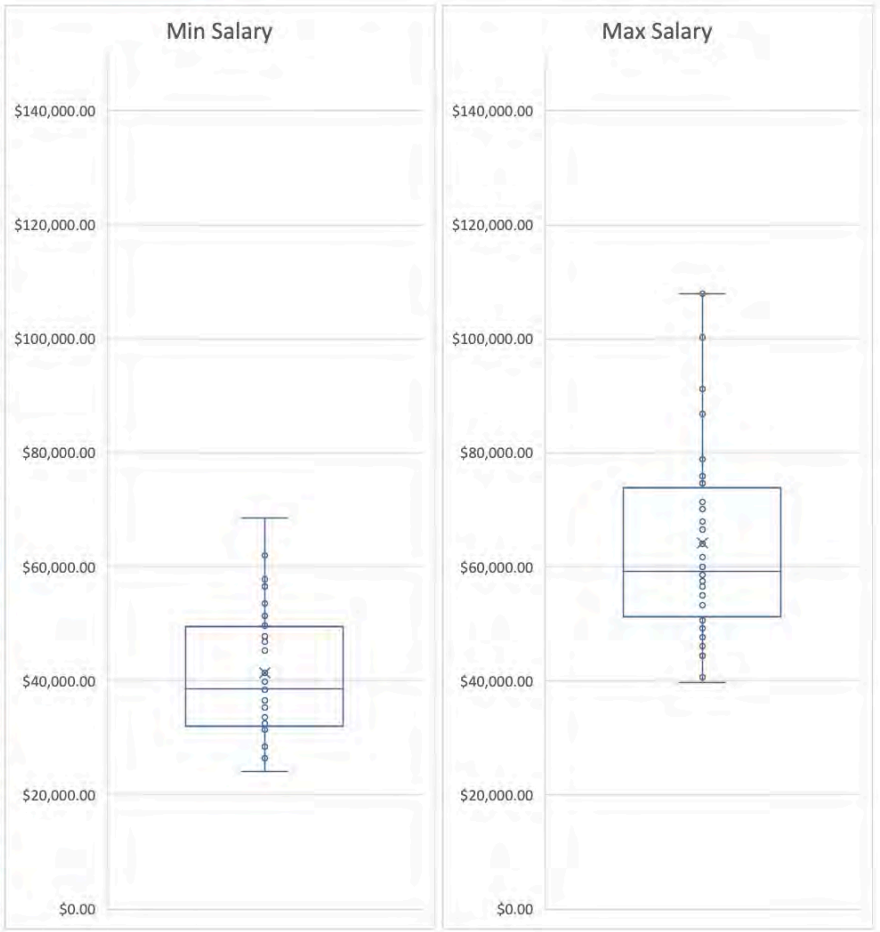


Figure 42: Salary ranges for Metrology/Calibration Technicians

Support Staff

Lab ID	Min Salary	Max Salary
AL	$9,000.00	$13,500.00
KY	$21,886.80	$36,102.48
FL	$24,498.96	$42,010.56
NC	$27,780.00	$44,091.00
TX	$32,976.00	$52,044.00
PA	$33,663.00	$50,229.96
NJ	$38,004.00	$53,304.00
WI	$45,759.96	$45,759.96
Average	$29,196.09	$42,130.25
Median	$30,378.00	$44,925.48

Figure 43: Salary ranges for Support Staff

2018 State Laboratory Program Metrologists

The survey requested specific data on each metrologists on staff in the SLP. These data include details on what measurements the metrologist is authorized to perform, his or her experience (in years) both in the SLP and outside of it, and the calendar year when he or she will be eligible for full retirement.

Lab ID	Name	Email	Mass I	Mass II	Mass III	Vol Trans	Vol Grav	Length	Time/Frequency	Temperature	Grain Moisture	What Year Eligible for Retirement?	State Lab Metrology	Other Metrology	Total Metrology Experience
AK	Roger Holland	roger.holland@alaska.gov	N	Y	Y	Y	Y	N	Y	N	N	2022	9		9
AK	Garret Brown	garret.brown@alaska.gov	N	Y	Y	Y	Y	N	Y	Y	N	2023	14	8	22
AL	Anthony Gallagher	anthony.gallagher@agi.alabama.gov			F	F						2041	3		3
AL	Michael Bridges	michael.bridges@agi.alabama.gov			F	F						2027	9		9
AR	Eva Ramirez	Eva.ramirez@agriculture.arkansas.gov			N	N					N		1		1
AR	Houston Naugher	Houston.naugher@agriculture.arkansas.gov			Y	N					N		1		1
AR	Nikhil Soman	Nikhil.soman@agriculture.arkansas.gov			Y	Y					N		7		7
AR	Randy Burns	Randy.burns@agriculture.arkansas.gov			N	N					Y		44		44
AZ	Eric Gaedert	egaedert@azda.gov		Y	Y	Y	Y					2037	4.1		4.1
AZ	Brian Sellers	bsellers@azda.gov		Y	Y	Y	Y					2024	14.5		14.5
CA	Toni Bulai	Toni.Bulai@cdfa.ca.gov		N	N	N	N	N	N	N		2039	3	9	12
CA	Tony Gruneisen	Anthony.Gruneisen@cdfa.ca.gov		Y	Y	Y	Y	Y	Y	Y		2032	17		17
CA	Greg Boers	Greg.Boers@cdfa.ca.gov		Y	Y	Y	Y	Y	Y	Y		2015	19	5	24
CO	Kate Smetana	kate.smetana@state.co.us	N	Y	Y	Y	Y	N	Y	N	Y	2038	6.5		6.5
CO	Diane Wise	diane.wise@state.co.us	N	Y	Y	Y	Y	Y	Y	N	Y	2012	25		25
CT	Ana Maria Feliciano	ana.feliciano@ct.gov	N	N	Y	Y	N	N	Y	N	N	2040	8		8
CT	Ion Daha	ion.daha@ct.gov	N	N	Y	Y	N	N	Y	N	N	2033	10		10
FL	Jesse Fields	Jesse.Fields@freshfromflorida.com	N	N	Y	N	N	N	N	N	N	2058	1.5		1.5
FL	Michael Kruse	Michael.Kruse@freshfromflorida.com	N	Y	Y	Y	N	N	N	N	N	2043	4.5		4.5
FL	Amy Smith	Amy.Smith@freshfromflorida.com	N	Y	Y	Y	N	N	N	N	N	2036	6		6
FL	Megan Money	Megan.Money@freshfromflorida.com	N	Y	Y	Y	N	N	N	N	N	2042	6		6
GA	Stan Diffie	stan.diffie@agr.georgia.gov	N	Y	Y	Y	N	N	N	N	N	2027	2		2
GA	Kontz Bennett	kontz.bennett@agr.georgia.gov	N	Y	Y	Y	Y	Y	N	N	N	2030	18		18
HI	Michael Tang	michael.tang@hawaii.gov	Y	Y	Y	Y	Y	N	Y	N	N	2019	18		18

Lab ID	Name	Email	Mass I	Mass II	Mass III	Vol Trans	Vol Grav	Length	Time/Frequency	Temperature	Grain Moisture	What Year Eligible for Retirement?	State Lab Metrology	Other Metrology	Total Metrology Experience
ID	Stacie Ybarra	stacie.ybarra@isda.idaho.gov	N	Y	Y	Y	Y	N	N	N	N	2034	7		7
ID	Kevin Merritt	kevin.merritt@isda.idaho.gov	N	Y	Y	Y	Y	N	N	N	N	2013	25		25
IL	John Satterlee	john.satterlee@illinois.gov										2046	0.8		0.8
IL	Karl Cunningham	karl.cunningham@illinois.gov			Y	Y						2025	14		14
IN	Howard Wickersham	hwickersham@ishd.in.gov	N	N	Y	Y	Y	N	N	N	N	2024	4		4
KS	Jake McCaffrey	jacob.mccaffrey@ks.gov	N	N	N	N	N	N	N	N	N	2050	1		1
KS	Kevin Uphoff	kevin.uphoff@ks.gov	Y	Y	Y	Y	Y	N	N	N	N	2036	7		7
KY	Zach Waller	zach.waller@ky.gov											2		2
KY	Bill Baker	bill.baker@ky.gov											11		11
KY	Chester Watson	Chester.watson@ky.gov			Y	Y							11		11
KY	Jason Glass	jason.glass@ky.gov			Y	Y						2027	15		15
LA	Whitney Corley	wcorley@ldaf.state.la.us			N	N						2049	0.5		0.5
LA	Richert Williams	richer_w@ldaf.state.la.us			Y	Y						2001	20		20
LAC	Jacky Cheng	Jcheng@acwm.lacounty.gov	N	N	N	N	N	N	N	N	N	2050	1		1
LAC	Rabih Abdullah	Rabdullah@acwm.lacounty.gov	N	N	N	N	N	N	N	N	N	2040	1		1
LAC	Lina Ng	LNg@acwm.lacounty.gov	N	N	Y	Y	N	N	N	N	N	2040	11		11
MA	Ray Costa	ray.costa@mass.gov	N	N	Y	Y	N	N	N	N	N	2002	7	36	43
MD	Tong Hsu	tong.hsu@maryland.gov	N	N	Y	Y	N	N	N	N	N	2043	3		3
MD	Zach Tripoulas	zacharias.tripoulas@maryland.gov	N	N	Y	Y	N	N	N	N	N	2040	4		4
MD	Elizabeth Koncki	elizabeth.koncki@maryland.gov	N	N	N	N	N	N	N	N	Y	2039	5		5
ME	Brad Bachelder	bradford.bachelder@maine.gov	N	Y	Y	Y	Y	Y	N	N	N	2053	7		7
MI	Nicole Byndas	byndasn@michigan.gov	N	N	N	N	N						1	3	4
MI	Steve Galvan	galvans@michigan.gov	N	N	N	N	N						3		3
MI	Nick Santini	santinin@michigan.gov	Y	Y	Y	Y	Y						8		8

Lab ID	Name	Email	Mass I	Mass II	Mass III	Vol Trans	Vol Grav	Length	Time/Frequency	Temperature	Grain Moisture	What Year Eligible for Retirement?	State Lab Metrology	Other Metrology	Total Metrology Experience
MI	Ryanne Hartman	hartmanr9@michigan.gov	N	Y	Y	Y	Y						8		8
MI	Scott Ferguson	fergusons9@michigan.gov	N	Y	Y	Y	Y						8		8
MI	Craig VanBuren	vanburenc9@michigan.gov	N	N	N	N	N						19		19
MI	Neil Jones	jonesn@michigan.gov	Y	Y	Y	Y	Y						19		19
MN	Anna Pierce	anna.pierce@state.mn.us	N	N	N	N	N	N	N	N	N	2055	1		1
MN	Erik Alfvin	erik.alfvin@state.mn.us	Y	Y	Y	Y	Y	N	N	N	N	2060	4		4
MN	Pete Whebbe		N	Y	Y	Y	Y	N	N	N	N	2018	4		4
MN	Benj FitzPatrick	benjamin.fitzpatrick@state.mn.us	Y	Y	Y	Y	Y	N	N	N	N	2047	5		5
MN	Heidi Jones	heidi.jones@state.mn.us	N	N	N	N	N	N	N	N	N	2023	19		19
MO	Kevin Hanson	Kevin.Hanson@mda.mo.gov	N	Y	Y	Y	Y	Y	N	N	Y	2021	17	4	21
MO	Tom Hughes	Tom.Hughes@mda.mo.gov	N	Y	Y	Y	Y	Y	N	N	Y	2022	18		18
MS	William Bell	WilliamBe@mdac.ms.gov			Y	Y						2030	14		14
MS	Mel Iasigi	Mel@mdac.ms.gov			Y	Y						2019	18		18
MT	David Fraser	dafraser@mt.gov	N	N	Y	Y	N	N	N	N	N	2030	5		5
NC	Joshua Hairston	joshua.hairston@ncagr.gov							N			2049	0		0
NC	Marina Paggen	marina.paggen@ncagr.gov							N			2048	1		1
NC	April Lee	april.lee@ncagr.gov							N		Y	2042	6.5		6.5
NC	Robert Rogers	robert.rogers@ncagr.gov			Y	Y	Y	Y	N	Y		2041	7.17	8	15.17
NC	Ashley Lessard	ashley.lessard@ncagr.gov	Y	Y	Y	Y	Y	Y	N			2041	7.75		7.75
NC	Spurgeon Van Hyder	van.hyder@ncagr.gov	Y	Y	Y	Y	Y	Y	N			2024	24.5		24.5
NC	Sharon Woodard	sharon.woodard@ncagr.gov	Y	Y	Y	Y	Y	Y	N	Y	Y	2022	26.5		26.5
NE	Joel P. Lavicky	joel.lavicky@nebraska.gov			Y	Y						2040	3		3
NJ	Kyle C. Pierson	PiersonK@dca.lps.state.nj.us	N	N	Y	Y	N	Y	Y	N	N	2035	3.5		3.5
NJ	Michael J. Cecere	CecereM@dca.lps.state.nj.us	N	N	Y	Y	N	Y	Y	N	N	2019	12		12

Lab ID	Name	Email	Mass I	Mass II	Mass III	Vol Trans	Vol Grav	Length	Time/Frequency	Temperature	Grain Moisture	What Year Eligible for Retirement?	State Lab Metrology	Other Metrology	Total Metrology Experience
NM	Ryan Rust	rrust@nmda.nmsu.edu	N	N	N	N	N	N	N	N	N	2042	1.5		1.5
NM	Clay Ivey	civey@nmda.nmsu.edu	N	Y	Y	Y	Y	N	N	N	N	2030	9		9
NV	Kiara Riske	kriske@agri.nv.gov		Y	Y	Y	Y					2048	1		1
NV	Jerome Plant	jplant@agri.nv.gov		Y	Y	Y	Y					2027	2		2
NV	James Kellames	jkellames@agri.nv.gov		Y	Y	Y	Y					2043	4		4
NY	Jonathan Fox	jonathan.fox@agriculture.ny.gov		Y	Y	Y	Y	Y	Y	N		2039	4		4
NY	Michael Lejeune	michael.lejeune@agriculture.ny.gov		Y	Y	Y	Y	Y	Y	N		2035	4		4
NY	Eric Morabito	eric.morabito@agriculture.ny.gov		Y	Y	Y	Y	Y	Y	N		2021	8		8
NY	Mike Sikula	mike.sikula@agriculture.ny.gov		N	N	N	N	N	N	N		2021	20	7	27
OH	Jeff Gibson	jeffrey.gibson@agri.ohio.gov	N	Y	Y	Y	Y	Y	Y	N	N	2030	3		3
OH	Tom Buck	tom.buck@agri.ohio.gov	N	Y	Y	Y	Y	Y	Y	N	N	2031	5		5
OH	Dan Walker	daniel.walker@agri.ohio.gov	N	Y	Y	Y	Y	Y	Y	N	N	2042	7	10	17
OH	Ken Johnson	ken.johnson@agri.ohio.gov	N	Y	Y	Y	Y	Y	Y	N	N	2020	29	6	35
OK	Tanner Foster	Tanner.Foster@ag.ok.gov	N	N	N	N	N	N	N	N	N	2049	0		0
OK	Jeremy Nading	Jeremy.Nading@ag.ok.gov	Y	Y	Y	Y	Y	N	N	Y	N	2037	12		12
OK	Richard Gonzales	Richard.Gonzales@ag.ok.gov	Y	Y	Y	Y	Y	N	N	Y	N	2012	32		32
OR	Ray Nekuda	rnekuda@oda.state.or.us	Y	Y	Y	Y	Y	N	N	N	N	2037	11		11
OR	Aaron Aydelotte	aaydelotte@oda.state.or.us	Y	Y	Y	Y	Y	N	N	Y	N	2029	18		18
PA	Dustin Claycomb	duclaycomb@pa.gov	N	Y	Y	Y	Y	Y	Y	N	N	2031	4.5	5	9.5
PA	David Welker	dawelker@pa.gov	N	Y	Y	Y	Y	Y	Y	N	N	2022	5.25		5.25
PA	Richard M. Radel, Jr.	riradel@pa.gov	N	Y	Y	Y	Y	Y	Y	N	N	2025	10.5		10.5
PA	Christopher J. Drupp	cdrupp@pa.gov	N	Y	Y	Y	Y	Y	Y	N	N	2034	11		11
PA	James P. Gownley	jgownley@pa.gov	N	Y	Y	Y	Y	Y	Y	N	N	2030	17		17
SC	Kristen Sherrick	ksherrick@scda.sc.gov	N	Y	Y	Y	Y	N	N	N	Y	2050	1		1

Lab ID	Name	Email	Mass I	Mass II	Mass III	Vol Trans	Vol Grav	Length	Time/Frequency	Temperature	Grain Moisture	What Year Eligible for Retirement?	State Lab Metrology	Other Metrology	Total Metrology Experience
SC	Antoine Montpeirous	Amontpeirous@scda.sc.gov	N	Y	Y	Y	Y	N	N	N	Y	2050	3	15	18
SC	Timothy Jones	tjones@scda.sc.gov	N	Y	Y	Y	Y	N	N	N	Y	2050	5		5
SD	Ron Peterson	ron.peterson@state.sd.us	N	N	Y	Y	N	N	N	N	N	2025	7		7
TX	Keri Schatte	keri.schatte@texasagriculture.gov	N	N	Y	N	N	N	N	N	N	2038	3		3
TX	Philip Lockwood	philip.lockwood@texasagriculture.gov	N	N	N	N	N	N	N	N	N	2005	3		3
TX	Lisa Corn	lisa.corn@texasagriculture.gov	N	Y	Y	Y	Y	N	N	N	N	2035	11		11
TX	Preston Adachi	preston.adachi@texasagriculture.gov	N	Y	Y	Y	Y	N	N	N	N	2015	13	30	43
TX	Daniel Gibbons	daniel.gibbons@texasagriculture.gov	N	Y	Y	Y	Y	N	N	N	N	2024	15		15
UT	Bill Rigby	brigby@utah.gov	N	N	Y	N	Y	N	N	N	N	2030	14		14
VA	WILLIAM Scott	WILLIAM.SCOTT@VDACS.VIRGINIA.GOV		Y	Y	Y			Y			2045	4	3	7
VA	WILLIAM LOVING	WILLIAM.LOVING@VDACS.VIRGINIA.GOV		Y	Y	Y			Y			2019	19		19
VT	Sumner Kuehne	sumner.kuehne@vermont.gov	N	N	N	N	N	N	N	N	N	2042	3		3
VT	Scott Dolan	scott.dolan@vermont.gov	N	N	Y	Y	Y	N	N	N	N	2041	8		8
VT	Michael Larose	michael.larose@vermont.gov	N	N	N	N	N	N	N	N	N	2025	12		12
VT	Marc Paquette	marc.paquette@vermont.gov	N	N	Y	Y	Y	N	N	N	N	2025	25		25
WA	Leslie German	lgerman@agr.wa.gov	N	Y	Y	Y	Y	N	Y	N	N	2024	2		2
WA	Dan Wright	dwright@agr.wa.gov	Y	Y	Y	Y	Y	Y	Y	N	N	2014	24	16	40
WI	Ronald DePouw	ronald.depouw@wisconsin.gov	N	N	N	N	N	N	N	N	N	2046	1		1
WI	Paul Masterson	paul.masterson@wisconsin.gov	N	N	Y	Y	N	N	N	N	N	2045	4		4
WI	Justin Lien	justin.lien@wisconsin.gov	N	N	Y	Y	N	N	N	N	N	2044	5		5
WV	Anthony O'Brien	anthony.p.obrien@wv.gov	N	N	Y	Y	N	N	N	N	N	2026	21		21
WY	Todd Stiles	todd.stiles@wyo.gov			Y	N						2032	3		3
WY	Robert Weidler	robert.weidler@wyo.gov			Y	Y						2029	10		10

Table 46: Listing of SLP metrologists as of 2018. Each metrologist was asked to indicate which of the listed calibrations they are authorized to perform ("F" = Full authority, "N" = Not authorized, "P" = partial or limited authority), provide what year they are eligible for retirement, and to provide a measure of their metrology experience.

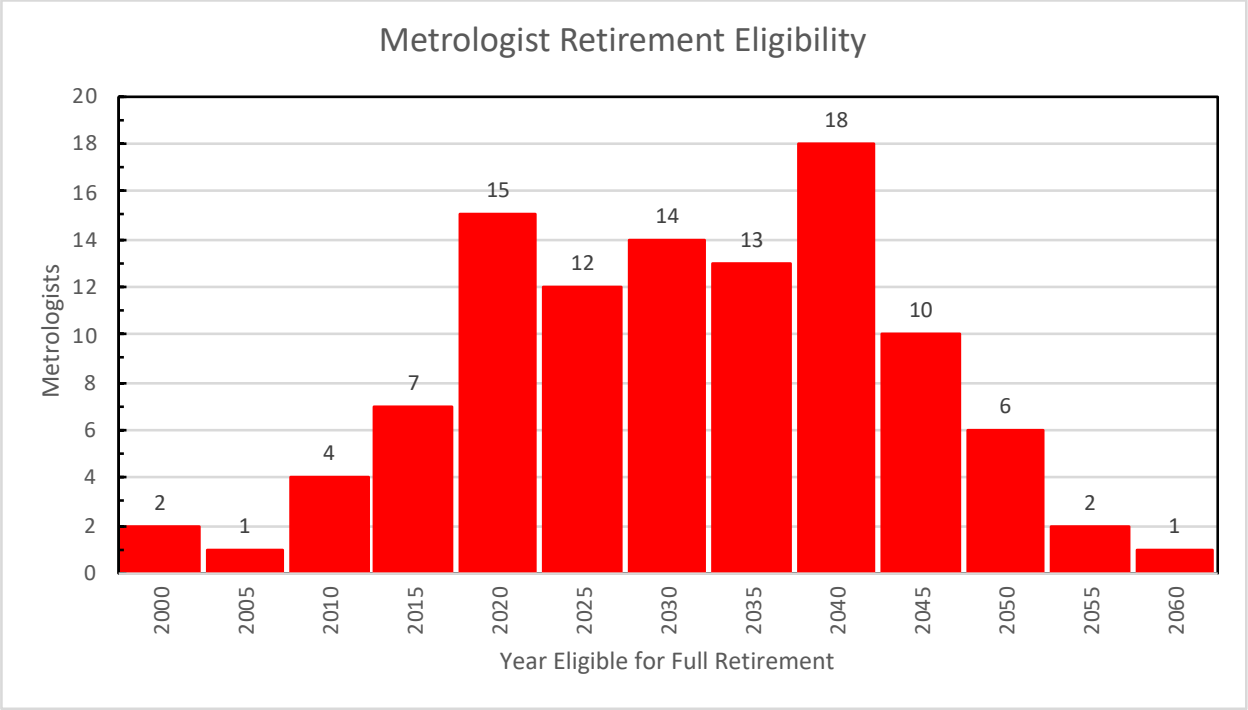


Figure 44: Retirement Eligibility Histogram. Of the 119 metrologists, 105 reported the year they would be eligible for full retirement. This may not reflect when any one person actually plans to leave the SLP.

Measurement Category	
Mass I	14
Mass II	60
Mass III	91
Vol Trans	86
Vol Grav	59
Length	26
Time/Frequency	27
Temperature	8
Grain Moisture	11

Table 47: 119 Metrologists reporting. Metrologists were asked to indicate which type of calibrations they are authorized to perform on behalf of their respective laboratories.

State Laboratory Program/Metrology Experience

Description

Total Metrology Experience:

Each metrologist was asked to report their metrology experience in years. The data was broken down into two categories, years of experience in the SLP, and years metrology experience outside the SLP.

Comparison of previous surveys

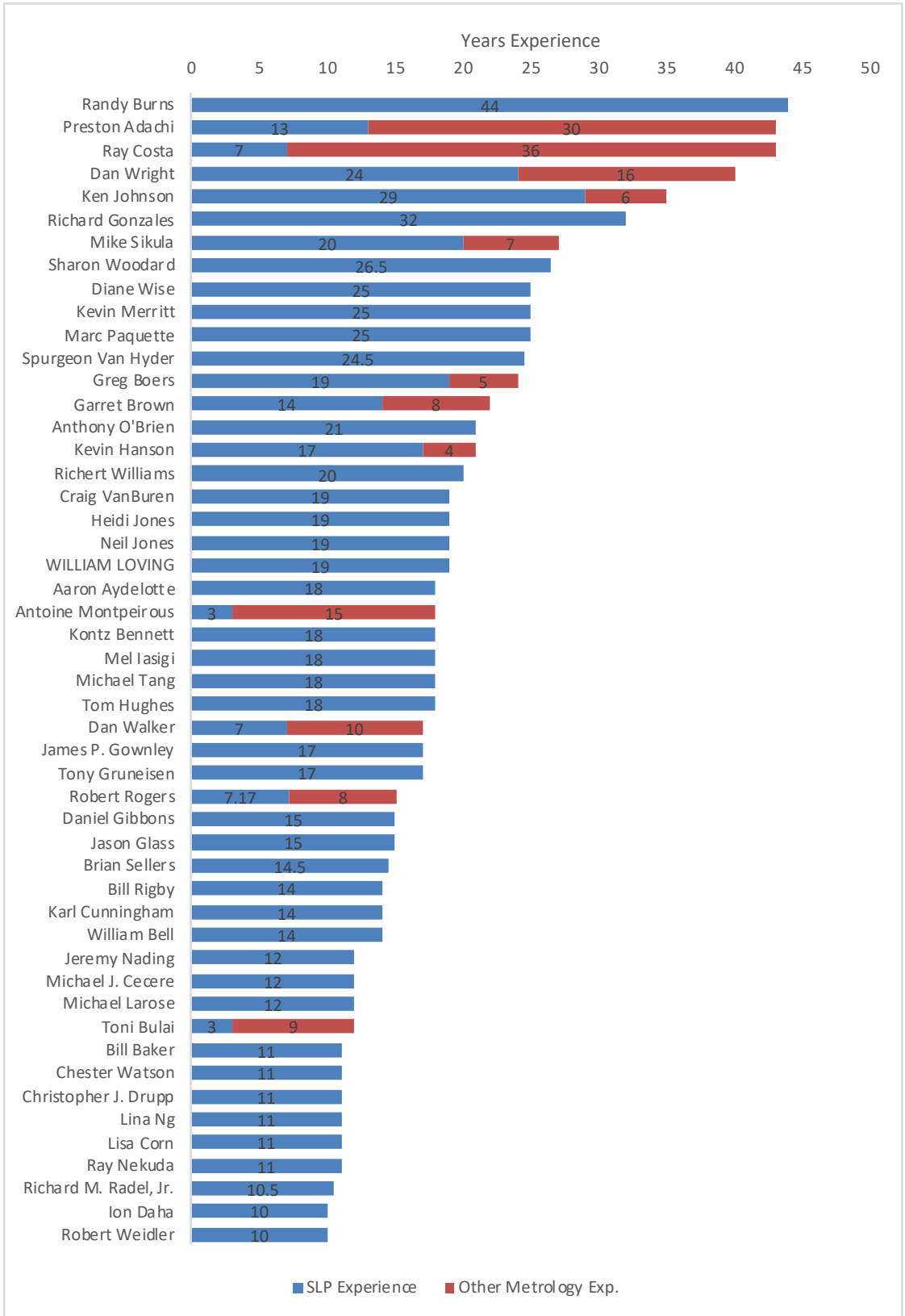
	Number of Metrologists	Average SLP Experience	Average Other Experience	Average Total Experience
2000	111	8.7	2.4	11.0
2002	113	9.1	2.1	11.2
2004	111	8.1	2.6	10.8
2006	112	8.3	3.1	11.4
2008	125	9.2	2.4	11.6
2010	121	9.5	1.9	11.4
2012	110	8.7	2.1	10.8
2014	118	9.2	1.7	10.9
2016	116	8.8	2.8	10.3
2018	119	9.3	1.4	10.7

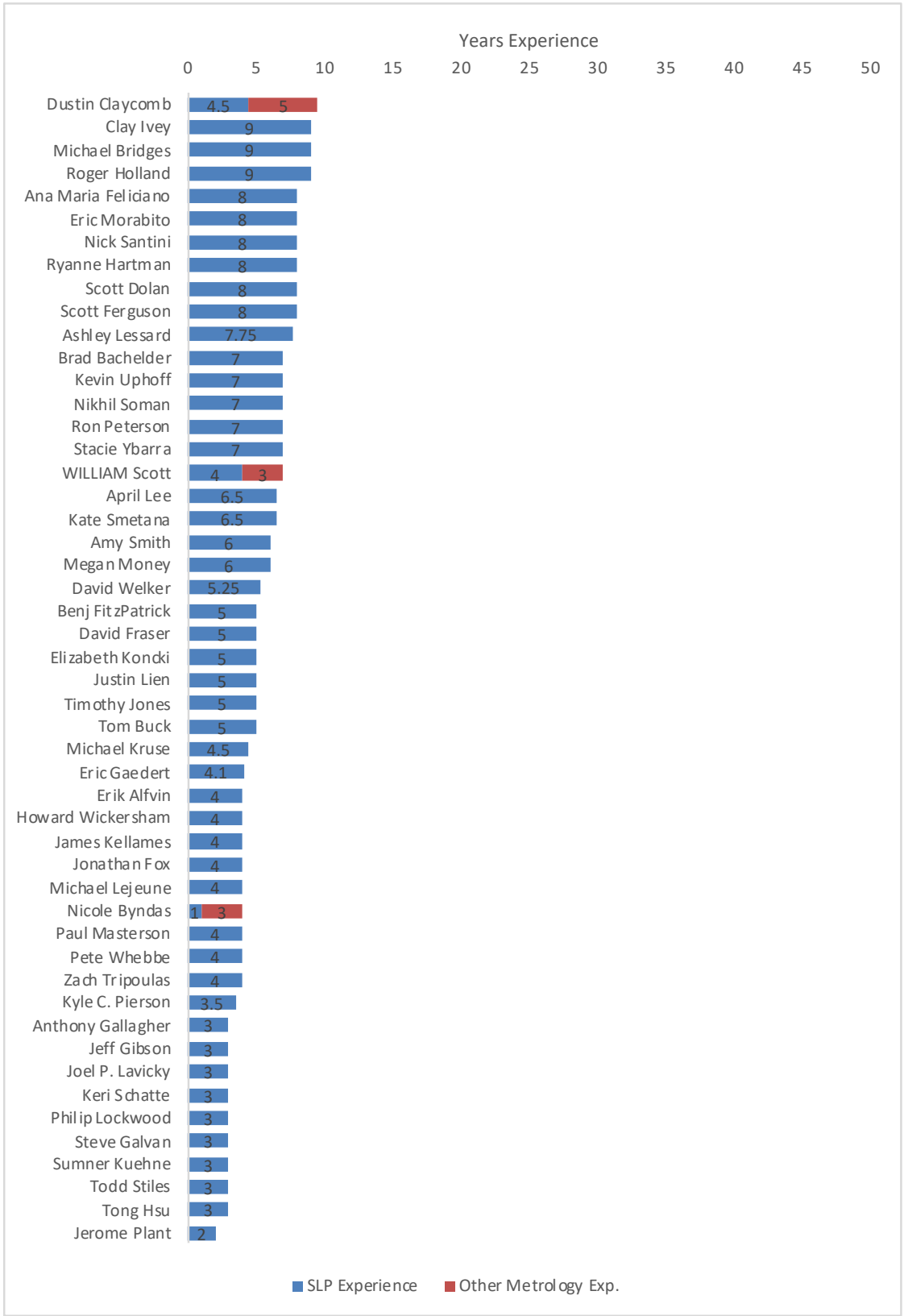
Table 48: Comparison matrix summarizing metrology experience reported by metrologists from 2000 to 2018.

Comments:

- Data was collected for 119 metrologist in the SLP from 45 laboratories.
- Each metrologist reports an average of 9.3 years the SLP experience each.
- Each metrologist reports an average of 1.4 years “other” experience each.
- Each of the 15 metrologist reporting “other” experience reports an average of 11 years other experience.
- Each metrologists report an average of 10.7 years total experience each.

NOTE: The survey team is aware some of the metrologists identified in this list are either full time weights and measures employees working part time in the laboratory due to promotions or transfers or are working as post retirement contractors to help maintain laboratory accreditation. These individuals tend to be more senior and thus skew the overall measures of experience and retirement risk high.


Years Experience
0 5 10 15 20 25 30 35 40 45 50
Randy Burns 44
Preston Adachi 13 30
Ray Costa 7 36
Dan Wright 24 16
Ken Johnson 29 6
Richard Gonzales 32
Mike Sikula 20 7
Sharon Woodard 26.5
Diane Wise 25
Kevin Merritt 25
Marc Paquette 25
Spurgeon Van Hyder 24.5
Greg Boers 19 5
Garret Brown 14 8
Anthony O'Brien 21
Kevin Hanson 17 4
Richert Williams 20
Craig VanBuren 19
Heidi Jones 19
Neil Jones 19
WILLIAM LOVING 19
Aaron Aydelotte 18
Antoine Montpeirous 3 15
Kontz Bennett 18
Mel Iasigi 18
Michael Tang 18
Tom Hughes 18
Dan Walker 7 10
James P. Gownley 17
Tony Gruneisen 17
Robert Rogers 7.17 8
Daniel Gibbons 15
Jason Glass 15
Brian Sellers 14.5
Bill Rigby 14
Karl Cunningham 14
William Bell 14
Jeremy Nading 12
Michael J. Cecere 12
Michael Larose 12
Toni Bulai 3 9
Bill Baker 11
Chester Watson 11
Christopher J. Drupp 11
Lina Ng 11
Lisa Corn 11
Ray Nekuda 11
Richard M. Radel, Jr. 10.5
Ion Daha 10
Robert Weidler 10
SLP Experience
Other Metrology Exp.


Years Experience
0
5
10
15
20
25
30
35
40
45
50
Dustin Claycomb 4.5 5
Clay Ivey 9
Michael Bridges 9
Roger Holland 9
Ana Maria Feliciano 8
Eric Morabito 8
Nick Santini 8
Ryanne Hartman 8
Scott Dolan 8
Scott Ferguson 8
Ashley Lessard 7.75
Brad Bachelder 7
Kevin Uphoff 7
Nikhil Soman 7
Ron Peterson 7
Stacie Ybarra 7
WILLIAM Scott 4 3
April Lee 6.5
Kate Smetana 6.5
Amy Smith 6
Megan Money 6
David Welker 5.25
Benj FitzPatrick 5
David Fraser 5
Elizabeth Koncki 5
Justin Lien 5
Timothy Jones 5
Tom Buck 5
Michael Kruse 4.5
Eric Gaedert 4.1
Erik Alfvin 4
Howard Wickersham 4
James Kellames 4
Jonathan Fox 4
Michael Lejeune 4
Nicole Byndas 1 3
Paul Masterson 4
Pete Whebbe 4
Zach Tripoulas 4
Kyle C. Pierson 3.5
Anthony Gallagher 3
Jeff Gibson 3
Joel P. Lavicky 3
Keri Schatte 3
Philip Lockwood 3
Steve Galvan 3
Sumner Kuehne 3
Todd Stiles 3
Tong Hsu 3
Jerome Plant 2
SLP Experience
Other Metrology Exp.

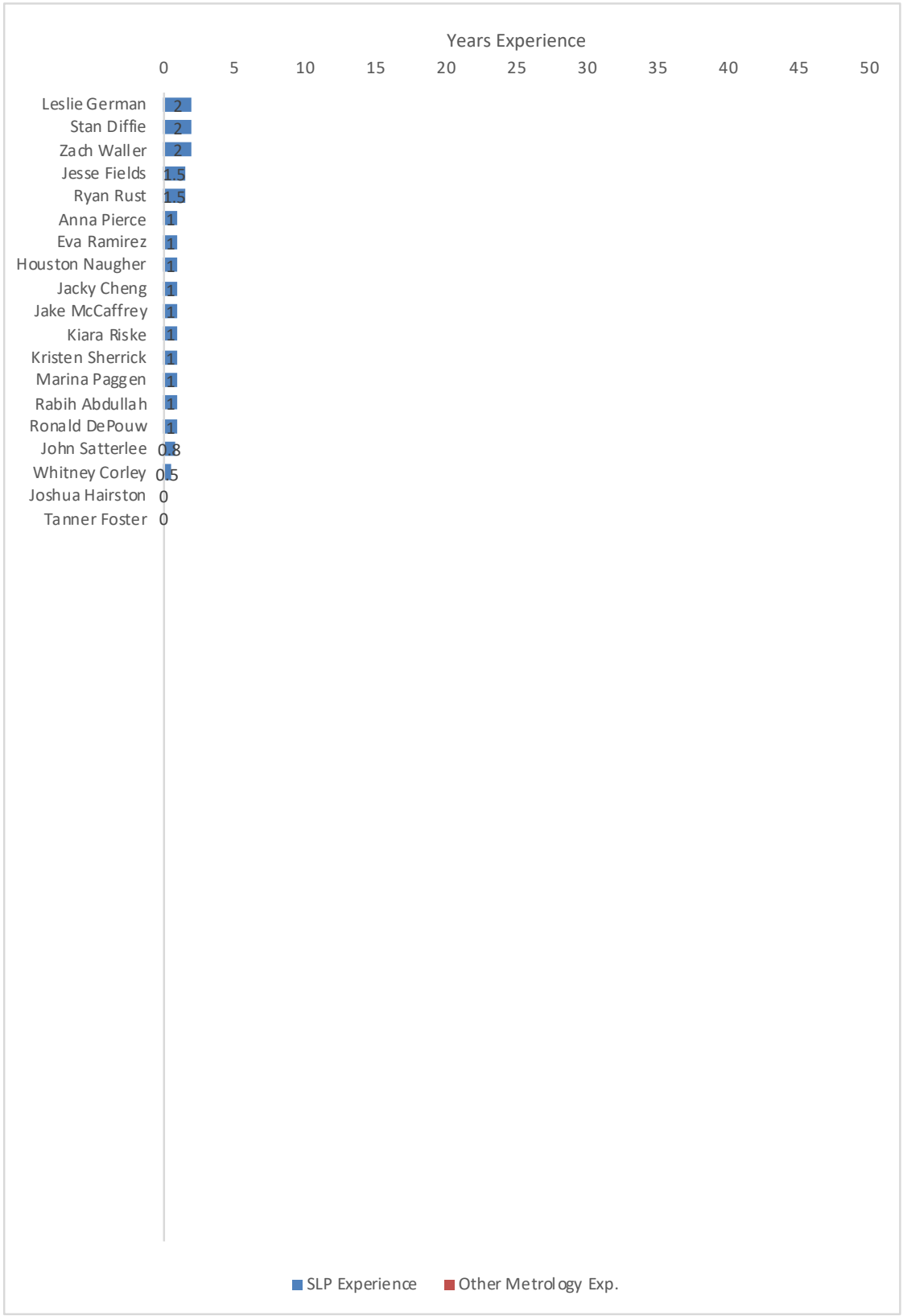


Figure 45: SLP metrologists ranked by years of experience (cont). Blue indicates experience in the SLP, Red indicates other metrology experience.

Acknowledgment of Calibration Certificates Matrix

Each member laboratory was asked to identify what laboratories it will accept calibration certificates from. The choices were:

- From your laboratory ONLY[12].
- Any of the SLP member labs.
- Any SLP member lab having NIST/OWM Recognition.
- Any NVLAP Accredited Lab.
- Any Weight Manufacturer regardless of accreditation status.
- Any laboratory accredited by an accreditation body that is an ILAC signatory.

Lab ID	Your State Lab Only	Any State Lab Regardless of Status	Any NIST/OWM Recognized Lab	Any NVLAP Accredited Lab	Any Weight Manufacturer Regardless of Accreditation Status	Any Company or Lab that is Accredited by an Accreditation Body that is an ILAC Signatory
AK	No	No	Yes	Yes	No	Yes
AL	No	No	Yes	No	No	No
AR	No	No	No	No	No	No
AZ	No	No	Yes	Yes	No	Yes
CA	No	No	Yes	Yes	No	Yes
CO	Yes	No	Yes	Yes	No	Yes
CT	No	No	No	No	No	No
FL	No	No	Yes	Yes	No	Yes
GA	No	No	No	No	No	No
IL	No	No	No	No	No	No
HI	Yes	No	Yes	Yes	No	No
ID	No	No	Yes	No	No	Yes
IL	No	No	No	No	No	No
IN	No	No	Yes	Yes	No	No
KS	No	No	Yes	Yes	No	Yes
KY	No	No	Yes	Yes	No	Yes
LA	No	No	Yes	Yes	No	No
CA	No	No	Yes	Yes	No	Yes
MA	No	No	Yes	Yes	No	Yes
MD	No	No	Yes	No	No	No
ME	No	No	No	Yes	No	Yes

[12] This choice should have been exclusive of the other options. Some respondents may have answered this question assuming that this meant they would accept their own certificates in addition to others as identified.

Lab ID	Your State Lab Only	Any State Lab Regardless of Status	Any NIST/OWM Recognized Lab	Any NVLAP Accredited Lab	Any Weight Manufacturer Regardless of Accreditation Status	Any Company or Lab that is Accredited by an Accreditation Body that is an ILAC Signatory
MI	No	No	Yes	Yes	No	No
MN	No	No	Yes	No	No	No
MO	No	No	Yes	Yes	No	Yes
MS	No	No	Yes	No	No	No
MT	No	Yes	Yes	Yes	No	Yes
NC	No	No	Yes	Yes	No	Yes
NE	No	No	Yes	Yes	No	No
NH	No	No	Yes	Yes	No	Yes
NJ	Yes	No	Yes	No	No	No
NM	No	No	Yes	Yes	No	Yes
NV	No	No	Yes	Yes	No	Yes
NY	No	No	Yes	Yes	No	Yes
OH	No	No	Yes	Yes	No	No
OK	Yes	No	Yes	Yes	No	Yes
OR	No	No	Yes	Yes	No	Yes
PA	No	No	Yes	No	No	No
PR	Yes	No	No	No	No	No
SC	No	No	No	No	No	No
SD	Yes	No	Yes	Yes	No	No
TN	No	No	Yes	No	No	No
TX	No	No	Yes	Yes	No	Yes
UT	No	No	Yes	Yes	No	No
VA	No	No	No	No	No	No
VT	No	No	No	No	No	No
WA	No	No	Yes	Yes	No	Yes
WI	No	No	Yes	Yes	No	Yes
WV	No	No	No	No	No	No
WY	No	No	Yes	Yes	No	Yes

Table 49: Calibration Certificate acceptance matrix.

NOTE: The question of calibration acceptance seems to be a bit vague. One could take it to mean acceptance of a calibration certificate from a service provider for the calibration of measure and testing equipment used by the laboratory to carry out its work. Another interpretation involves the acceptance of those calibration certificates submitted by service agents registered or licensed by the state or county weights and measures program. A third interpretation would look at any calibration certificate submitted to the laboratory regardless of reason. The survey team cannot infer how each respondent interpreted the question.

Supplementary Questions

Some biannual surveys include a section covering subjects of potential interest by NIST OWM and the SLP member laboratories. These supplementary questions are designed to require only a minimum of research time in order to answer and the answers themselves are generally limited to one word, multiple choice responses.

Historical Supplementary Questions

- 2003 – Miscellaneous questions
- 2010 – Use of national and international standards (HB 105 series, OIML, ASTM)
- 2014 – Who do you use for calibration services; Time to calibrate measure and test equipment.
- 2016 – Weight cleaning policy, Masscode revision in service, largest weight cart, relative metric workload, and service request tracking.
- 2018 – Acceptance criteria for MTE coming into the lab for calibration (cast iron and test measures). Calibration services requested by customers but not offered by the lab. What version of Excel are you using?

In 2018 a standardized format for including supplemental questions was introduced into the survey. Section 1 includes a bank of up to 10 yes or no questions. Section 2 includes a bank of up to 10 short answer questions.

Supplementary Questions Section 1

	Question:	Yes	No
1)	Do you require cleaning the unknown weights prior to accepting unpainted cast iron weights to be freshly painted prior to for calibration (whether you do it or they are delivered that way)?	30	13
2)	Does your laboratory routinely evaluate field test equipment submitted to the laboratory for compliance to nationally accepted documentary consensus standards (e.g., HB 105-1, 105-3, etc.) when the equipment is used for legal metrology?	38	6
3)	Is it your lab's policy to refuse to accept cast iron weights if they are not freshly cleaned and painted when submitted to the laboratory for calibration?	21	23
4)	Is it your lab's policy to refuse to accept test measures and provers if they are dirty or contain residual product in them when submitted to the laboratory for calibration?	30	14
5)	Note: Regarding question 3… If the weights are in wonderful condition looking as though they are not in need of painting because they have been taken care of, then they will be accepted without first having to have been painted.	0	0
6)	We do not accept test measures or provers that need to be cleaned but we will allow a customer to go clean them and bring them back if time permissible.	0	0
7)	We do not clean or paint weights at our facility but customers will be asked to do so if need.	0	0
8)	We will routinely inspect field standards if a problem is observed while equipment is being used in the field.	0	0
9)	Will you clean and paint cast iron weights submitted for calibration? (Answer "Yes" if you will regardless as to whether an additional fee is charged)	10	34
10)	Will you clean test measures and provers submitted for calibration? (Answer "Yes" if you will regardless as to whether an additional fee is charged)	17	27

Table 50: Summary of responses to supplementary questions in section 1.

1) Do you require cleaning the unknown weights prior to accepting unpainted cast iron weights to be freshly painted prior to for calibration (whether you do it or they are delivered that way)?

Lab Id	Response
AK	Yes
AL	Yes
AR	Yes
AZ	
CA	No
CO	Yes
CT	No
FL	Yes
GA	Yes
HI	Yes
ID	Yes
IL	Yes
IN	Yes
KS	No
KY	Yes
LA	Yes
LAC	No
MA	Yes
MD	Yes
ME	No
MI	No
MN	Yes
MO	Yes
MS	Yes
MT	Yes
NC	No
NE	Yes
NJ	Yes
NM	Yes
NV	Yes
NY	No
OH	Yes
OK	No
OR	No
PA	No
SC	Yes
SD	No
TX	Yes
UT	Yes
VA	Yes
VT	Yes
WA	
WI	Yes
WV	Yes
WY	No

Table 51: Responses to supplementary question #1 in section 1

2) Does your laboratory routinely evaluate field test equipment submitted to the laboratory for compliance to nationally accepted documentary consensus standards (e.g., HB 105-1, 105-3, etc.) when the equipment is used for legal metrology?

Lab ID	Response
AK	Yes
AL	Yes
AR	Yes
AZ	
CA	No
CO	Yes
CT	Yes
FL	Yes
GA	Yes
HI	Yes
ID	Yes
IL	Yes
IN	Yes
KS	Yes
KY	Yes
LA	Yes
LAC	Yes
MA	Yes
MD	Yes
ME	Yes
MI	No
MN	Yes
MO	Yes
MS	Yes
MT	Yes
NC	No
NE	Yes
NJ	Yes
NM	No
NV	Yes
NY	Yes
OH	Yes
OK	Yes
OR	No
PA	Yes
SC	Yes
SD	Yes
TX	Yes
UT	Yes
VA	Yes
VT	No
WA	Yes
WI	Yes
WV	Yes
WY	Yes

Table 52: Responses to supplementary question #2 in section 1

3) Is it your lab's policy to refuse to accept cast iron weights if they are not freshly cleaned and painted when submitted to the laboratory for calibration?

Lab ID	Response
AK	No
AL	Yes
AR	No
AZ	
CA	No
CO	Yes
CT	No
FL	Yes
GA	Yes
HI	No
ID	Yes
IL	Yes
IN	Yes
KS	No
KY	Yes
LA	Yes
LAC	Yes
MA	No
MD	No
ME	No
MI	No
MN	No
MO	Yes
MS	Yes
MT	Yes
NC	No
NE	Yes
NJ	Yes
NM	Yes
NV	No
NY	No
OH	Yes
OK	No
OR	No
PA	No
SC	Yes
SD	No
TX	No
UT	Yes
VA	Yes
VT	No
WA	No
WI	No
WV	Yes
WY	No

Table 53: Responses to supplementary question #3 in section 1

4) Is it your lab's policy to refuse to accept test measures and provers if they are dirty or contain residual product in them when submitted to the laboratory for calibration?

Lab ID	Response
AK	Yes
AL	No
AR	No
AZ	
CA	No
CO	Yes
CT	Yes
FL	Yes
GA	Yes
HI	Yes
ID	Yes
IL	No
IN	Yes
KS	No
KY	Yes
LA	Yes
LAC	Yes
MA	Yes
MD	No
ME	No
MI	Yes
MN	No
MO	Yes
MS	Yes
MT	Yes
NC	Yes
NE	Yes
NJ	Yes
NM	Yes
NV	Yes
NY	Yes
OH	Yes
OK	Yes
OR	No
PA	No
SC	Yes
SD	No
TX	Yes
UT	Yes
VA	Yes
VT	Yes
WA	Yes
WI	No
WV	No
WY	No

Table 54: Responses to supplementary question #4 in section 1

5) Note: Regarding question 3… If the weights are in wonderful condition looking as though they are not in need of painting because they have been taken care of, then they will be accepted without first having to have been painted.

Lab ID	Response
AK	
AL	
AR	
AZ	
CA	
CO	
CT	
FL	
GA	
HI	
ID	
IL	
IN	
KS	
KY	
LA	
LAC	
MA	
MD	
ME	
MI	
MN	
MO	
MS	
MT	
NC	
NE	
NJ	
NM	
NV	
NY	
OH	
OK	
OR	
PA	
SC	
SD	
TX	
UT	
VA	
VT	
WA	
WI	
WV	
WY	

Table 55: Responses to supplementary question #5 in section 1

6) We do not accept test measures or provers that need to be cleaned but we will allow a customer to go clean them and bring them back if time permissible.

Lab ID	Response
AK	
AL	
AR	
AZ	
CA	
CO	
CT	
FL	
GA	
HI	
ID	
IL	
IN	
KS	
KY	
LA	
LAC	
MA	
MD	
ME	
MI	
MN	
MO	
MS	
MT	
NC	
NE	
NJ	
NM	
NV	
NY	
OH	
OK	
OR	
PA	
SC	
SD	
TX	
UT	
VA	
VT	
WA	
WI	
WV	
WY	

Table 56: Responses to supplementary question #6 in section 1

7) We do not clean or paint weights at our facility but customers will be asked to do so if need.

Lab ID	Response
AK	
AL	
AR	
AZ	
CA	
CO	
CT	
FL	
GA	
HI	
ID	
IL	
IN	
KS	
KY	
LA	
LAC	
MA	
MD	
ME	
MI	
MN	
MO	
MS	
MT	
NC	
NE	
NJ	
NM	
NV	
NY	
OH	
OK	
OR	
PA	
SC	
SD	
TX	
UT	
VA	
VT	
WA	
WI	
WV	
WY	

Table 57: Responses to supplementary question #7 in section 1

8) We will routinely inspect field standards if a problem is observed while equipment is being used in the field.

Lab ID	Response
AK	
AL	
AR	
AZ	
CA	
CO	
CT	
FL	
GA	
HI	
ID	
IL	
IN	
KS	
KY	
LA	
LAC	
MA	
MD	
ME	
MI	
MN	
MO	
MS	
MT	
NC	
NE	
NJ	
NM	
NV	
NY	
OH	
OK	
OR	
PA	
SC	
SD	
TX	
UT	
VA	
VT	
WA	
WI	
WV	
WY	

Table 58: Responses to supplementary question #8 in section 1

9) Will you clean and paint cast iron weights submitted for calibration? (Answer "Yes" if you will regardless as to whether an additional fee is charged)

Lab ID	Response
AK	No
AL	No
AR	No
AZ	
CA	No
CO	No
CT	No
FL	Yes
GA	No
HI	Yes
ID	No
IL	No
IN	No
KS	Yes
KY	No
LA	No
LAC	No
MA	No
MD	Yes
ME	No
MI	No
MN	Yes
MO	No
MS	No
MT	No
NC	No
NE	No
NJ	No
NM	No
NV	No
NY	No
OH	No
OK	No
OR	Yes
PA	No
SC	No
SD	Yes
TX	No
UT	No
VA	No
VT	Yes
WA	No
WI	Yes
WV	No
WY	Yes

Table 59: Responses to supplementary question #9 in section 1

10) Will you clean test measures and provers submitted for calibration? (Answer "Yes" if you will regardless as to whether an additional fee is charged)

Lab ID	Response
AK	No
AL	No
AR	No
AZ	
CA	No
CO	No
CT	No
FL	Yes
GA	No
HI	Yes
ID	No
IL	Yes
IN	Yes
KS	Yes
KY	No
LA	No
LAC	No
MA	No
MD	Yes
ME	No
MI	No
MN	Yes
MO	Yes
MS	No
MT	No
NC	No
NE	No
NJ	No
NM	No
NV	Yes
NY	No
OH	No
OK	No
OR	Yes
PA	Yes
SC	No
SD	Yes
TX	No
UT	No
VA	Yes
VT	No
WA	Yes
WI	Yes
WV	Yes
WY	Yes

Table 60: Responses to supplementary question #10 in section 1

Supplementary Questions Section 2

Laboratories were asked to list up to 10 requests for calibration services that they are currently unable to provide. Responses are listed here alphabetically.

AK - Captive Displacement Provers
AK - Flow
AK - Higher Echelon (lower uncertainty) thermometry
AK - Master meters
AL - Customers wanting a higher class than we can calibrate
AL - customers wanting to get weight carts calibrated
AR - Mass Echelon I- customer called in, told them it was not on our scope and referred them to state labs located near our state.
AR - Vol Transfer 100 gal prover- Referred to other state labs near us
CA - calipers
CT - Mass Echelon I - Personnel without Mass Echelon I training yet.
CT - Mass Echelon II - Personnel with Mass Echelon II training (Metrologist) but no process in place yet (need to get measurement control data).
CT - Tapes - Personnel with training but not enough requests that justify time to be spent to have process in place (recalibrate length bench and get measurement control data).
CT - Thermometry - No equipment in the lab to be able to perform tests (equipment is expensive) and personnel without thermometry training.
FL - 2500 lb
FL - ASTM Class 1, 0
GA - 6000 lb weight carts
GA - Test weights 2000 lb and over
HI - pressure measurement devices
HI - thermometers
ID - Mass 1
ID - Pressure Gauges
ID - Thermometry
IN - Electric meters
IN - 1250 lb
IN - 2500 lb
IN - Force calibrations
KY - LPG provers
KY - weight carts
LAC - Echelon I (ASTM Class 2 and I)
LAC - Echelon II (ASTM Class 2)
LAC - Large volume transfer.
MA - The occasional 1000 to 1500 gallon static provers
MA - Weight carts
MD - Request 1000 lb cast iron calibration, outside of lab scope
MD - Request F-1 (Echelon II) weight kit, outside of lab scope
MD - Request large volume prover (>100 gallon) volume transfer method, outside of lab scope
MD - Request tape measures (25 ft), outside of lab scope
MD - Request Weight Cart calibration, outside of lab scope
ME - Mass Echelon I
ME - Temperature
MI - Lottery balls
MN - Calibration of 10000 lb cast iron NIST class F weights
MN - Calibration of rail carts (8000 lb and 10000 lb) to NIST class F tolerances
MN - Calibration of temperature probes used in balances
MN - Echelon I calibration of ounce weights (8 oz to 1/32 oz)
MN - Echelon II calibration of 25 kg and 30 kg weights
MO - ASTM 1 calibrations, we are not a Mass I lab
MO - SVP calibrations
MS - 300 gallon volume prover (1 request)
MT - Calibration of non-conforming weights. (Asked to weld wieght on, or shave weight off non adjustable weights.
MT - Calibrations outside of the Lab's scope.
NC - Gauge Blocks
NC - Pressure Gauges
NE - Echelon II mass calibrations
NE - kg mass > 30 kg
NJ - Gravimetric, 1 and 2 gallon Test Measures

NJ - Thermometry
NJ - Window tint measurning equipment
NM - Echelon 1 mass standards
NM - Length
NV - Pippettes
NV - Thermometers
NY - 300 ft Tape
NY - 300 gal LPG
NY - 7000 lb Weight Cart
NY - Laser Range Finder
NY - Length Measurement Wheel (walk behind)
NY - Mass over 500 lb (due to equipment out of service)
NY - PSI Gauge
NY - Thermometry
OK - Gauge Blocks
OK - Length Calibrations
OK - Temperature calibrations
PA - Mass Echelon I
PA - Thermometers
SC - Echelon I calibrations, ASTM Class 0, not on scope at this time.
UT - Mass II and Mass I precision calibration
VA - LARGE PROVERS
VT - Class 2 Weight Kits
VT - Large Volume Provers
VT - LPG Provers
VT - Weight Carts
WI - an occasional request to calibrate Class 1 or 2 standards.
WI - calibration of newton weights. Our database is not set up to calculate these artifacts.
WI - calibration of troy ounce weights. Our database is not set up to calculate these artifacts.
WV - 2000 to 2500 lb weights
WV - weight carts over 6000 lb
WY - Echelon I or II mass
WY - Manufactured weight carts(dollies) - we are able but will not perform calibration.

Table 61: Responses to supplementary questions #1-#10 in section 2

Laboratories were asked to identify which version of Excel they are currently using. Responses are listed here alphabetically.

Response
AK – 2013
AL - 2016
AR - Excel 2010
AZ -
CA - Excel for Microsoft Office 365 ProPlus
CO - 2016
CT - 2010
FL - 2016
GA - 2016 (running 2003 compatability mode)
HI - 97-2003, 2007, 2016
ID - Excel 2010
IL - 2016
IN - Excel 7
KS - Microsoft Excel for Office 365, Version 1808 (Build 10730.20264 Click-to-Run)
KY - 2016
LA - 2010
LAC - 2016
MA - Microsoft Office Professional Plus 2013
MD - 2007
ME - 2016
MI - Office 365 ProPlus
MN - Excel 2016
MO - Office Professional Plus 2016
MS - 2010
MT - 2016
NC - 2016
NE - 2016
NJ - 2013
NM - 13 and 16
NV - Excel for Office 365
NY - Excel 2016
OH - Excel for Office 365
OK - Excel 2010
OR - Mac Excel 14 and 16 versions.
PA - Microsoft Office 365 ProPlus version 1811
SC - Version 1808
SD - 2010
TX - 2000
UT - 2010
VA – LATEST (NOTE: at the time of publication the latest desktop version of Excel is 2016)
VT - Office 365
WA - Excel 2013, Part of Microsoft Office Professional 2013
WI - 2016
WY - 2010

Table 62: Excel versions used by laboratories.

Comments – Survey Section 1 to 6

Sections 1 through 6 of the survey included questions covering

- the laboratory,
- job titles and salary ranges,
- laboratory customers, and
- acceptance of calibration certificates

Comments provided by individual SLP laboratories are listed in Table 63.

Lab ID	Comments Survey Sections 1-6
AK	Cell F29, Laboratory customers: This is only a count of the customers served during the reporting period, not a complete count of all lab customers. Section 6, Cell G35: The laboratory's measurement scope and associated uncertainty is considered/evaluated. Section 6, Cell G36: The laboratory's measurement scope and associated uncertainty is considered/evaluated. Section 6, Cell G38: The laboratory's measurement scope and associated uncertainty is considered/evaluated.
CT	The job description selected for Consumer Protection W&M Inspector has been chosen as Metrology/Calibration Engineer because the inspector that helps in the lab has trainning in Metrology (Basic Metrology Seminar), have been participating in PTs for the last 3 years and his background is Engineering.
FL	We served several of the same customers throughout the year, but only counted them once. If we counted all appointments for all customers are total was 259 customers with 22 not W&M offlicials
GA	State of Georgia accepts certificates from any NIST/OWM Recognized state lab. Private lab and manufacturer lab certificates are not accecpted for Georgia licensing.
MA	Field number three indicating "Any NIST/WMD" recognized lab should be corrected to read NIST/OWM. WMD is no longer the appropriate term for the NIST Office of Weights and Measures.
MN	For section 6: MN accepts calibration certificates from ISO 17025 accredited manufacturers initially, when new weights are purchased.
NC	I do not have an adequate way to determine which companies are NOT W&M officials or Service Companies. I provided a guesstimation.
NE	The Nebraska Statue says we may accept certificates from "a labortatory that is accredited or recognized by NIST". Since NIST does not accredited and because of the relationship between NVLAP and NIST, we may accept certs from a NVLAP lab.
NV	I have listed our Sparks locations address. We also have a lab in the Southern Part of the State in Las Vegas. I have included the calibration numbers from that location in this report.
SC	The section where it states Number of Laboratory Customers served… we go by amount of weights. From July 2017 through June 2018 we did 12,004 different calbrations.
SD	Section 6 Yes answer also requires a satisfactory supplier evaluation.
WI	Regarding the question in section 5 "number of the above that are not W&M officials or service companies": we do not have a tracker for this statistic. However, a best guess may be in the neighborhood of 15 % we have a number of private companies that bring weights for calibration. We are unsure as to their application.

Table 63: Comments provided by respondents regarding sections 1 through 6 of the survey.

Section 7 Comments

Section 7 of the survey includes questions regarding individual metrologists working in the SLP. Comments provided by individual SLP laboratories are listed in Table 64.

Lab ID	Comments Survey Sections 7
AK	Thermometry as of 01/01/2019
CT	The year eligible for retirement has been calculated when personnel reach the age of 67 which is the year for full (normal) retirement age for the personnel listed in Section 7. Years of Metrology experience of Ion Daha (W&M inspector) has been counting since he attended the Basic Metrology Seminar (in 2008) even he doesn't work full time in the lab (he has been helping the Metrologist in the lab and the last 5 years have been participating in PTs).
MD	Grain is not on Scope. State regulator use only.
MI	Santini, Ferguson, Galvan are approved signatores for Wheel Load Weighers
MN	Weight carts, Rail test cars and carts (master scale), wheel load scales
NJ	Wheel Load Weighters 20 000 lb to 2 500 lb
NM	We are recognized for LPG and Weight Carts.
NY	We are also recognized for lottery ball weight and lottery ball diameter calibrations.
PA	We are also recognized for force 0 to 50 lbf
VT	Hydrometry
WI	We anticipate that Ronald DePouw will becomes an Approved Signatory in August 2019 upon completion of the NIST Volume Seminar. He has already completed his Fundaments, Mass Metrology, and LAP Problems. …..eligibility year of retirement is considered 30 years in service.

Table 64: Comments provided by respondents regarding section 7 of the survey.

Comments – Survey Sections 8 to 31

Sections 8 through 31 of the survey cover the production of measurements by the SLP laboratories and the fees charged for measurement services. Comments provided by individual SLP laboratories are listed in Table 65.

Lab ID	Comments Survey Sections 8-31
CT	There is no charge for CT State Agencies and CT City Sealers. Fees are charged to industry's companies. For companies/individuals who uses erquipment for W&M aplications such as dealers and repairmen (registered service companies) there is no charge if the following 3 conditions are met: the company is based in Connecticut or have a place of bussiness in CT, they have a Repairmen or Dealer license from CT, and the technician that use the equipment leaves in CT. If one of the conditions is not met the lab will charge for the service. Number of standards/equipment tested in 2018 is smaller than previous years because the lab was closed in January, February and March 2018 (no tests have been performed in these 3 months).
GA	Out-of-state customers that are both located out-of-state and perform no work in Georgia are charged double the normal fees. Customers that are located out-of-state but perform work in Georgia are not considered to be out-of-state customers, and are therfore not charged double the normal fees. Also, out-of-state fees will not be charged to out-of-state customers that do not have an available NIST traceable laboratory in their state.
KS	• Adjustment fees range anywhere from $5.00 to $50.00 per piece and are the same for in-state and out-of-state customers. • Calibration costs are determined on a per piece basis and range anywhere from $4.00 to $30.00 per piece more for out-of-state customers. • Calibration costs, also, vary on the quantity of items per order for certain items. Ten to ninety-nine items will be cheaper per piece than items in the single digit range and 100 or more items will be cheaper than the ten to ninety-nine quantity. • The Kansas Metrology Laboratory does not have any in-state city, county,or township standards that come to the lab. • The calibration times listed above do not account for everyday laboratory operations (only time per category if a calibration was performed non-stop until complete). • Measurement control time in the above table only refers to obtaining and analyzing data for the immediate measurement being performed. It does not account for extensive analysis.
LAC	Section 31, we do not charge fees for calibration of Los Angeles County Weights and Measures equipment and standards. Other Counties and jurisdictions are charged.
MA	All calibrations performed in the laboratory are calculated based upon a $45.00/hour rate and dollar figures indicated above are what an average fee would be for taking the average time to perform the work from initial setup to completion of the certificate. We do not have flat fees and with a new Director who came on board late December 2018, I am working with him in the attempt to institute flat fees which makes it so much easier to quote prices to customers who are interested in submitting their equipment for calibration. Also it is very difficult to keep accurate time performing testing with so many interruptions, drop-offs, pick-ups, State Inspectors stopping by for documents, forms used by them in the field and seals etc. And the phone calls from sealers in the field with questions or problems needing assistance never stop. All difficult issues in a one-person laboratory.
NC	Section 26: We test both characteristics - mass & diameter of lottery balls Section 31: Fees are doubled for standards used primarily outside of North Carolina. We do not charge an additional fee to handle standards. There are some set up fees for various calibrations - Gravimetric Caibrations, SLPs and Thermometry
NV	State Registered Service Agents are charged a rate of $75/hr regardless if they are in or out of state. Private industry and non-registered service agents are charge a rate of $95/hr.
OR	Our laboratory charges fees to customers that are not part of our internal Weights and Measures Program. We do not charge our Weights and Measures program for calibrations.
VT	We charge for loading an unloading of large weights (500 lb & 1000 lb). We charge $2.75 or $4.00 per hydrometer depending on range of test.
WI	Section 10: for this survey we are stating zero Mass III internal standards performed. In previous workload surveys, we had incorrectly reported the number of times check standards had been performed. we do not perform calibrations of our own standards. Section 30: in previous workload surveys, our facility did not include all charges relating to the items. Example, in 2016 a 22 piece kit was listed at 154.00. However, this year we are approaching it from the standpoint that if someone wanted a kit calibrated, that kit will cost a total of $212.10 (154.00 for the artifacts, 35.00 cert fee, 23.10 admin fee). all values presented in this section includes the certificate fee as well as administrative fee. Section 31: invoices are generated for W&M officials, however, we do not pay ourselves for these calibrations. Starting April 1, 2019, we are no longer charging for calibration of City Sealers.
WY	Railroad test cars are no longer calibrated in Wyoming due to closure of Master Scale. Fees listed are for in-state customers, out of state customers are charged double the rate listed.

Table 65: Comments provided by respondents regarding section 8 through 31 of the survey.

General Survey Comments

At the end of the workload survey the responding laboratory has an opportunity to provide any general comments about the entire survey. These comments are listed in

Lab ID	Comment
AK	Section 32, Question 32: Weights need to be clean, but not necessarily freshly painted to meet acceptence criteria. About 80% of weights accepted by the lab are freshly painted.
FL	Comment for question #2 on Section 32 - the lab rejects registered service agents artifacts if not properly coated. If we don't regulate the customer we will notate condition upon receipt. For question #5 on Section 32 we won't clean provers larger than 5 gallons.
KS	Clarification for the "Supplementary Questions 1." section: • The laboratory does not require cast iron weights or low-carbon steel volume items to be freshly painted. The items only need to be touch-up painted if there are areas that require correction for being rusty or having flaking paint. • The laboratory will not paint weights or volume items but will clean them. • The laboratory continually informs customers that items should be clean and painted as required, which nearly eliminates the instances where the laboratory has to clean items.
LAC	Clarification explanation for Supplementary Questions 1 Tab. Weights not required to be freshly painted upon arrival. However, cleanliness standards are evaluated at the time of arrival and customer advised.
MA	Supplementary Questions Section 32 Questions 1 through 8. There should be a drop down box or something to add comments because not all answers are simply a yes or a no. There may be special circumstances when an explanation may be necessary as I attempted to do in the lower section. Perhaps for next survey in 2020 that can be added.
MD	Section 7 lists four personnel who perform metrology measurements/functions in the lab, but all are not full-time in the metrology lab. One is 10% time to metrology (mainly PT and administrative work), one is 10% time to metrology (mainly PT, most time focus on NTEP evaluation), one is full time in metrology lab.
NJ	RE: Supplementary Q1: Painting of Cast Iron Test Weights - a fresh coat of paint OR clean and rust free. Slight scratches can occur at any time, including right after painting.
OK	Supplementary question 1: What? This question is not clear as to the information being requested, I think I finally figured it out after reading it a few times but I am still not sure.
OR	Some of the survey questions need "it depends" or "sometimes" as a selection rather than just yes or no.
PA	The Pennsylvania Standards Laboratory uses the results of this survey to evaluate fees, staffing and overall workload. The work that goes into getting this information compiled and published is greatly appreciated.
SD	Section 7: What year eligible for retirement. Since there are many different ways to define eligibility, it might be better to simply ask what year do you plan to retire.
WA	In Section 32: Supplementary Questions 1, question 1 doesn't make sense to me. Question 3, I might clean them up a little, but I won't paint them. Finally, 4 and 5 also conflict for me. I will turn away a prover on a trailer with fuel, but if a test measure is sent in and has a fuel residue I won't send it back, but I'd clean it and give the sender a call to remind them to clean in the future.
WY	No spot for comments in Supplementary Question 1. WDA lab asks that cast iron are clean and repainted (if necessary) prior to delivery. However, if the weights are in good condition (i.e. decent paint, little rust) we will calibrate. Generally we do not have to do other cleaning other than wiping the weights down prior to calibration but we have had a couple of customers who delivered weights in poor condition and we cleaned and repainted for a fee (only 2 customers in 10 years).

Table 66.

Lab ID	Comment
AK	Section 32, Question 32: Weights need to be clean, but not necessarily freshly painted to meet acceptence criteria. About 80% of weights accepted by the lab are freshly painted.
FL	Comment for question #2 on Section 32 - the lab rejects registered service agents artifacts if not properly coated. If we don't regulate the customer we will notate condition upon receipt. For question #5 on Section 32 we won't clean provers larger than 5 gallons.
KS	Clarification for the "Supplementary Questions 1." section: • The laboratory does not require cast iron weights or low-carbon steel volume items to be freshly painted. The items only need to be touch-up painted if there are areas that require correction for being rusty or having flaking paint. • The laboratory will not paint weights or volume items but will clean them.

	• The laboratory continually informs customers that items should be clean and painted as required, which nearly eliminates the instances where the laboratory has to clean items.
LAC	Clarification explanation for Supplementary Questions 1 Tab. Weights not required to be freshly painted upon arrival. However, cleanliness standards are evaluated at the time of arrival and customer advised.
MA	Supplementary Questions Section 32 Questions 1 through 8. There should be a drop down box or something to add comments because not all answers are simply a yes or a no. There may be special circumstances when an explanation may be necessary as I attempted to do in the lower section. Perhaps for next survey in 2020 that can be added.
MD	Section 7 lists four personnel who perform metrology measurements/functions in the lab, but all are not full-time in the metrology lab. One is 10% time to metrology (mainly PT and administrative work), one is 10% time to metrology (mainly PT, most time focus on NTEP evaluation), one is full time in metrology lab.
NJ	RE: Supplementary Q1: Painting of Cast Iron Test Weights - a fresh coat of paint OR clean and rust free. Slight scratches can occur at any time, including right after painting.
OK	Supplementary question 1: What? This question is not clear as to the information being requested, I think I finally figured it out after reading it a few times but I am still not sure.
OR	Some of the survey questions need "it depends" or "sometimes" as a selection rather than just yes or no.
PA	The Pennsylvania Standards Laboratory uses the results of this survey to evaluate fees, staffing and overall workload. The work that goes into getting this information compiled and published is greatly appreciated.
SD	Section 7: What year eligible for retirement. Since there are many different ways to define eligibility, it might be better to simply ask what year do you plan to retire.
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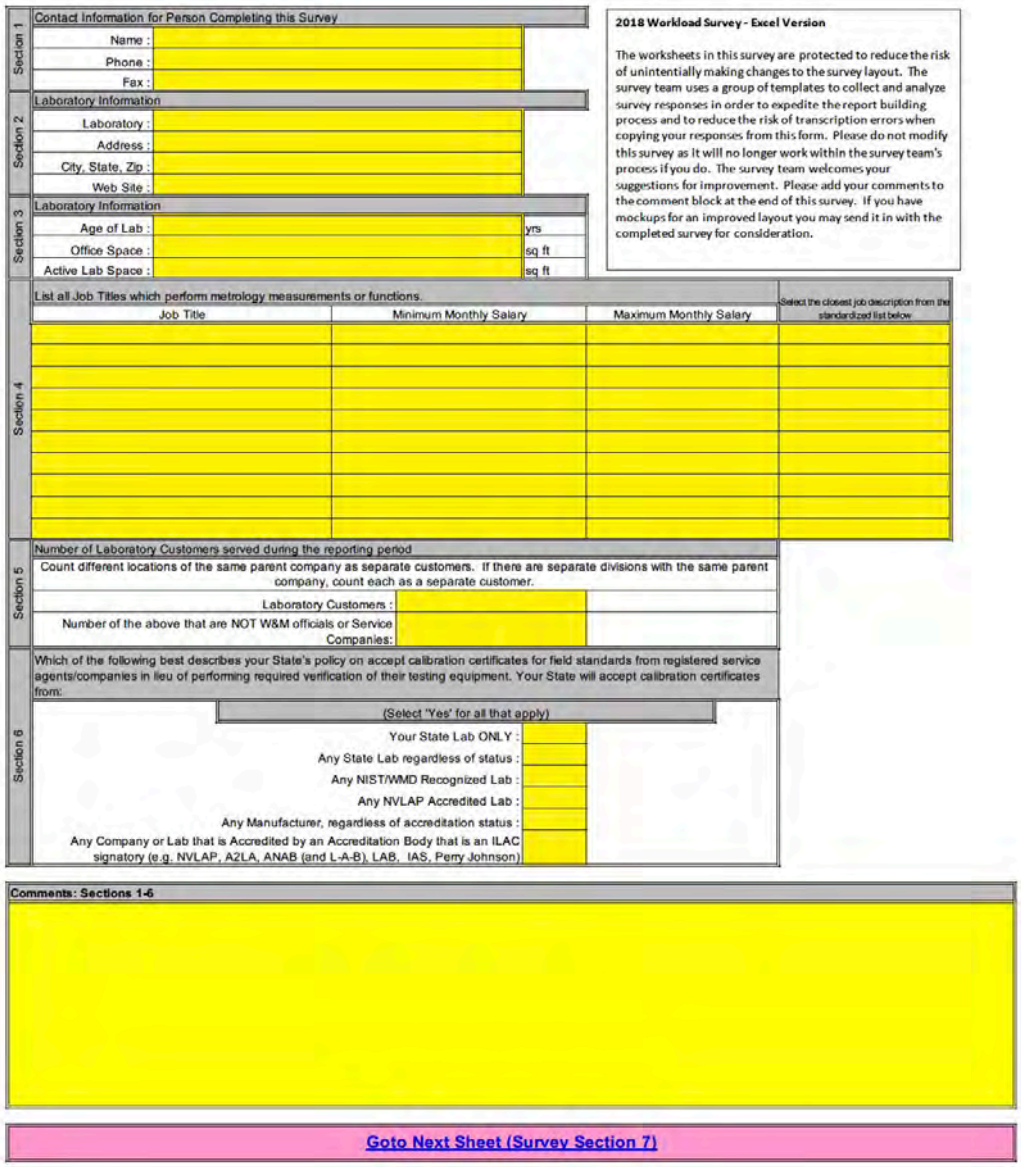
WY	No spot for comments in Supplementary Question 1. WDA lab asks that cast iron are clean and repainted (if necessary) prior to delivery. However, if the weights are in good condition (i.e. decent paint, little rust) we will calibrate. Generally we do not have to do other cleaning other than wiping the weights down prior to calibration but we have had a couple of customers who delivered weights in poor condition and we cleaned and repainted for a fee (only 2 customers in 10 years).

Table 66: General comments provided by respondents of the workload survey.

2018 Survey Form

Survey Page 1



Section 1 — Contact Information for Person Completing this Survey

Name :	
Phone :	
Fax :	

Section 2 — Laboratory Information

Laboratory :	
Address :	
City, State, Zip :	
Web Site :	

Section 3 — Laboratory Information

Age of Lab :		yrs
Office Space :		sq ft
Active Lab Space :		sq ft

2018 Workload Survey - Excel Version

The worksheets in this survey are protected to reduce the risk of unintentionally making changes to the survey layout. The survey team uses a group of templates to collect and analyze survey responses in order to expedite the report building process and to reduce the risk of transcription errors when copying your responses from this form. Please do not modify this survey as it will no longer work within the survey team's process if you do. The survey team welcomes your suggestions for improvement. Please add your comments to the comment block at the end of this survey. If you have mockups for an improved layout you may send it in with the completed survey for consideration.

Section 4 — List all Job Titles which perform metrology measurements or functions.

Job Title	Minimum Monthly Salary	Maximum Monthly Salary	Select the closest job description from the standardized list below

Section 5 — Number of Laboratory Customers served during the reporting period

Count different locations of the same parent company as separate customers. If there are separate divisions with the same parent company, count each as a separate customer.

Laboratory Customers :		
Number of the above that are NOT W&M officials or Service Companies:		

Section 6 — Which of the following best describes your State's policy on accept calibration certificates for field standards from registered service agents/companies in lieu of performing required verification of their testing equipment. Your State will accept calibration certificates from:

(Select 'Yes' for all that apply)

Your State Lab ONLY :	
Any State Lab regardless of status :	
Any NIST/WMD Recognized Lab :	
Any NVLAP Accredited Lab :	
Any Manufacturer, regardless of accreditation status :	
Any Company or Lab that is Accredited by an Accreditation Body that is an ILAC signatory (e.g. NVLAP, A2LA, ANAB (and L-A-B), LAB, IAS, Perry Johnson)	

Comments: Sections 1-6

Goto Next Sheet (Survey Section 7)

Section 7

1. Please list all current personnel who perform metrology measurements or functions in the laboratory (match with your Scope).

Name	email	Check Approved Signatory Status (yes or no)									What Year Eligible for Retirement?	#Yrs Metrology Experience		
		Mass I	Mass II	Mass III	Vol Trans	Vol Grav	Length	Time/Frequency	Temperature	Grain Moisture		State Lab Metrology	Other Metrology	Total Metrology Experience

Comments: Sections 7 (include additional items on your scope which are not listed above.)

Go To Next Sheet (Survey Sections 8-29)

Go to Previous Sheet (Survey Sections 1 - 6)

Section 8	**Mass Echelon I** (Match with Handbook 143 and Lab Scope)		
	Number of mass standards calibrated using Advanced Weighing Designs and Mass Code Data Reduction. Regardless of Class. And, ASTM 1 or better, OIML E2 or better.	Lab (Internal)	
		W&M Program[1]	
		External Customers[2]	
		TOTAL	0
Section 9	**Mass Echelon II** (Match with Handbook 143 and Lab Scope)		
	Number of mass standards. ASTM Class 2, 3 OIML Class F1, F2	Lab (Internal)	
		W&M Program[1]	
		External Customers[2]	
		TOTAL	0
Section 10	**Mass Echelon III** (Match with Handbook 143 and Lab Scope)		
	Number of mass standards (except weight carts). ASTM Class 4, 5, 6, 7 OIML Class M1, M2, M3 NIST Class F	Lab (Internal)	
		W&M Program[1]	
		External Customers[2]	
		TOTAL	0
Section 11	**Weight Carts**		
	Number of weight carts calibrated.	Lab (Internal)	
		W&M Program[1]	
		External Customers[2]	
		TOTAL	0
Section 12	**Railroad Test Cars (Master Scale)**		
	Number of cars calibrated.	Lab (Internal)	
		W&M Program[1]	
		External Customers[2]	
		TOTAL	0
Section 13	**Railroad Specific Weight Carts**		
	Number of weight carts calibrated.	Lab (Internal)	
		W&M Program[1]	
		External Customers[2]	
		TOTAL	0

Footnotes: Section 8 - Section 29

1. Count State or Local Jurisdiction owned Weights and Measures Testing Equipment used by State Weights and Measures Program Staff only.

2. External customers includes registered service companies, industry, city/county standards, and standards that do not belong to State officials.

			Vol-Transfer	Gravimetric
Section 14	**Volume - Glassware**			
	Number of individual pieces of volumetric glassware calibrated. Note: Indicate number of Volume Transfer and/or Gravimetric tests.	Lab (Internal)		
		W&M Program[1]		
		External Customers[2]		
		TOTAL	0	0
Section 15	**15. Volume - SVP (Small Volume Provers, Compact Displacement Provers) and CLP (Closed Loop Provers)**			
	Number of small volume provers and closed loop provers calibrated.	Lab (Internal)		
		W&M Program[1]		
		External Customers[2]		
		TOTAL	0	
Section 16	**Volume - LPG**			
	Number of individual LPG provers calibrated.	Lab (Internal)		
		W&M Program[1]		
		External Customers[2]		
		TOTAL	0	
Section 17	**Volume - Non-Pressurized Small Metal Standards (≤5 gallon)**			
	Number of metal volumetric standards (20 liter / 5 gallon and smaller). Note: Indicate number of Volume Transfer (Volume II) and/or Gravimetric (Volume I) tests.	Lab (Internal)		
		W&M Program[1]		
		External Customers[2]		
		TOTAL	0	0
Section 18	**Volume - Non-Pressurized Medium Metal Standards (>5 gallon and ≤100 gallon)**			
	Number of metal volumetric standards (larger than 20 liter / 5 gallon and less than or equal to 400 liter / 100 gallon). Note: Indicate number of Volume Transfer (Volume II) and/or Gravimetric (Volume I) tests.	Lab (Internal)		
		W&M Program[1]		
		External Customers[2]		
		TOTAL	0	0
Section 19	**Volume - Non-Pressurized Large Metal Standards (>100 gallon)**			
	Number of metal volumetric standards (greater than 400 liter / 100 gallon). Note: Indicate number of Volume Transfer (Volume II) and/or Gravimetric (Volume I) tests.	Lab (Internal)		
		W&M Program[1]		
		External Customers[2]		
		TOTAL	0	0
Section 20	**Length - Tapes**			
	Number of individual tapes (metal, fiberglass, woven fiberglass, cloth, etc.). Please enter #devices tested, NOT number of points tested.	Lab (Internal)		
		W&M Program[1]		
		External Customers[2]		
		TOTAL	0	
	Length - Rigid Rules			

Section 21	Number of individual rigid rules tested. Please enter #devices tested, NOT number of points tested.	Lab (Internal)	
		W&M Program[1]	
		External Customers[2]	
		TOTAL	0
Section 22	**Thermometry**		
	Number of thermometers tested (mechanical, liquid-in-glass, thermocouples, thermistors, PRT, and SPRT).	Lab (Internal)	
		W&M Program[1]	
		External Customers[2]	
		TOTAL	0
Section 23	**Frequency**		
	Number of frequency standards tested (includes tuning forks).	Lab (Internal)	
		W&M Program[1]	
		External Customers[2]	
		TOTAL	0
Section 24	**Timing Devices**		
	Number of timing devices tested (stopwatches).	Lab (Internal)	
		W&M Program[1]	
		External Customers[2]	
		TOTAL	0
Section 25	**Wheel Load Weighers**		
	Number of wheel load weighers tested.	Lab (Internal)	
		W&M Program[1]	
		External Customers[2]	
		TOTAL	0
Section 26	**Lottery Balls**		
	Number of lottery balls tested.	Lab (Internal)	
		W&M Program[1]	
		External Customers[2]	
		TOTAL	0
Section 27	**(A) Other Types of Measurements not covered in this survey**		
	Describe type of measurement:	Lab (Internal)	
		W&M Program[1]	
		External Customers[2]	
		TOTAL	0
Section 28	**(B) Other Types of Measurements not covered in this survey**		
	Describe type of measurement:	Lab (Internal)	
		W&M Program[1]	
		External Customers[2]	
		TOTAL	0
Section 29	**(C) Other Types of Measurements not covered in this survey**		
	Describe type of measurement:	Lab (Internal)	
		W&M Program[1]	
		External Customers[2]	
		TOTAL	0

Section 30 Instructions:

Fee: This is the fee estimate that you would provide a customer in a calibration service quotation.

Average Time: This is the time estimated to complete the calibration work specified in decimal hours.

Includes Unpacking/Packing Standards: Select "Yes" if your time estimate includes receiving equipment for calibration (i.e. unpacking, logging, storing, etc) and prepping equipment for shipment (i.e. palletizing, packing, coordinating pick up, etc)

Includes pre-measurement setup time: Select "Yes" if your time estimate includes time setting up the measurement area (i.e. setting up measurement statndards, instrument warm up time, staging customer equipment, etc.)

Includes measurement control related work: Select "Yes" if your time estimate includes time spent obtaining and analyzing measurement control data.

Includes certificate preparation time: Select "Yes" if your time estimate includes time spent preparing and error checking the calibration certificate.

Section 30	In this section please estimate the typical fees charged for each of the described examples and enter the average time required for each item.		Fee	Average Time (enter time in decimal hours)	Includes Unpacking/Packing Standards	Includes pre measurement setup time	Includes measurement control related work	Includes certificate preparation time
	If you have a minimum fee for a test, what is it?							
	[Mass Echelon I] ASTM Class 0 Precision mass set - 100 g to 1 mg (21 weights) :							
	[Mass Echelon II] ASTM Class 2 Precision mass set - 100 g to 1 mg (21 weights) :							
	[Mass Echelon III] One - 31 lb Class F weight kit (22 weights) :							
	[Mass Echelon III] 5,000 lb weight cart :							
	Mass Echelon III Large Scale Test Truck	24 - 1000 lb weights (5 adjusted) :						
		20 - 50 lb weights (5 adjusted) :						
		2 - 31 lb weight kits (22 weights each) :						
		Scale Test Truck Total :	$ -	0.0				
	One - 5 gallon test measure using volume transfer method :							
	One - 5 gallon test measure using gravimetric method :							
	One - 100 gallon prover using volume transfer method :							
	One - 100 gallon prover using gravimetric method :							
	One - 100 gallon LPG prover :							
	One - 100 foot tape with 19 points tested :							

31	**Do you charge:**	
	Do you charge out of state customers higher fees than in state customers?	

Section		
	Do you charge for calibrating W&M field equipment and standards?	
	Do you charge for calibrating city, county, township (political jurisdiction W&M) equipment and standards?	
	Do you charge for calibrating registered service company equipment and standards?	

Comments: Sections 8-31

Go to Supplimentary Questions 1.

Go To Previous Sheet (Survey Section 7)

Section 32: *Supplementary Questions 1. (Yes/No)*		
1	Do you require cleaning the unknown weights prior to accepting unpainted cast iron weights to be freshly painted prior to for calibration (whether you do it or they are delivered that way)?	
2	Is it your lab's policy to refuse to accept cast iron weights if they are not freshly cleaned and painted when submitted to the laboratory for calibration?	
3	Will you clean and paint cast iron weights submitted for calibration? (Answer "Yes" if you will regardless as to whether an additional fee is charged)	
4	Is it your lab's policy to refuse to accept test measures and provers if they are dirty or contain residual product in them when submitted to the laboratory for calibration?	
5	Will you clean test measures and provers submitted for calibration? (Answer "Yes" if you will regardless as to whether an additional fee is charged)	
6	Does your laboratory routinely evaluate field test equipment submitted to the laboratory for compliance to nationally accepted documentary consensus standards (e.g., HB 105-1, 105-3, etc.) when the equipment is used for legal metrology?	
7		
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9		
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Go To Supplementary Questions 2.

Go to Previous (Sections 8 - 30)

Section 33: *Supplementary Questions 2. Short Answer*		
1	In #1 - #10 identifiy some requests for calibration services that you are currently unable to provide.	(Give a brief description)
2	#1	
3	#2	
4	#3	
5	#4	
6	#5	
7	#6	
8	#7	
9	#8	
10	#9	
11	#10	
12	Which version of Excel are you using?	
13		
14		
15		
16		
17		
18		
19		
20		

Go to Survey Comments

Back to Supplementary Questions 1.

Section 34	Comments on Survey

Goto Prevous Sheet (Supplementary Questions 2.)

End of Survey