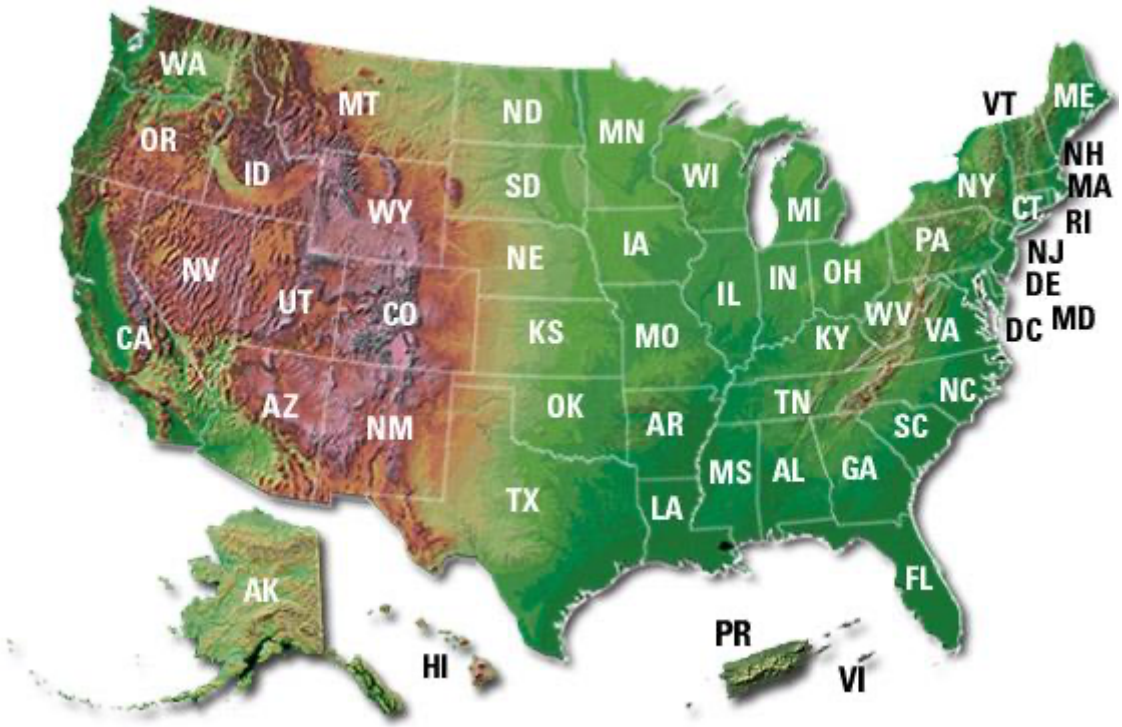
2022

State Laboratory Program Workload Survey



Published by the NCSL International Legal Metrology Committee

Foreword

Greetings from North Carolina!

We are gearing up to publish the next State Lab survey, and I asked Steven if I could write the foreword for it.

Steven and I worked together for years to produce this biennial survey, which we feel is very beneficial to the State Laboratory Program. We have solicited help (and thank you to all who responded!) but haven't done as well as we would have liked in accepting the offers. That is on us, and we promise to improve in that area. Nonetheless, we are proud of the survey and excited to see how this next version will be used. In the past, Metrologists have used it for raises, fee increases, budget expansion, and scope expansion.

I started in the NC Standards Laboratory in June 1993 (when I was just a toddler, keep in mind). I have been around for all of the previous 14 surveys, and in that time have also seen some of the greatest minds in the field retire and pass the mantle on to the next generation. I have also seen the field grow and improve with the help of NIST OWM training, collaboration between RMAPs, and the technical capabilities of our equipment.

This, the 15th, is my final survey. I plan to retire in early 2024, and although I will miss working directly with you on the survey and other metrology efforts, I am excited Lisa Corn of Texas has been nominated for the Legal Metrology Chairman of Committee 156 in the Industrial Programs of NCSLI. Lisa is smart, great to work with, very active on a national level, and I am grateful she will keep the survey alive.

But wait- you can't get rid of me that easily! I plan on keeping up with the field of legal metrology, and you all know I don't shy away from talking! If I can ever be of any assistance, please message me on my personal cell phone. I plan to spend time between the ocean and mountains (and DeAnn's Honey Do List), so it may take a minute for me to respond, but I will do my best to get back with you.

Well, I've got a heavy scale truck arriving shortly, so I'm off to smile at my balances. Enjoy the rest of your week and thank you in advance for your time on this and other surveys moving forward!

Sincerely and all the best,

Van Hyder

(919) 656-6898

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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 2022 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
2020 State Laboratory Program Workload Survey	2020
2022 State Laboratory Program Workload Survey	2022

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 completed survey forms into a master workbook for analysis. The copy process is automated using Excel macros 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 15.
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 33. 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/owm
4. Each laboratory's prior survey participation in previous surveys is reported beginning on page 38.
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 41, Length on page 55, Volume on page 60, and all other tests on page 78.

6. A report of fees charged for the various services provided by each member lab begins on page 91. 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 124. 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 142. 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 144.
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 156.
11. A reprint of the 2022 survey begins on page 160.

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 records for State laboratories were obtained from the NIST Measurement Services from 2000 through 2022. 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.

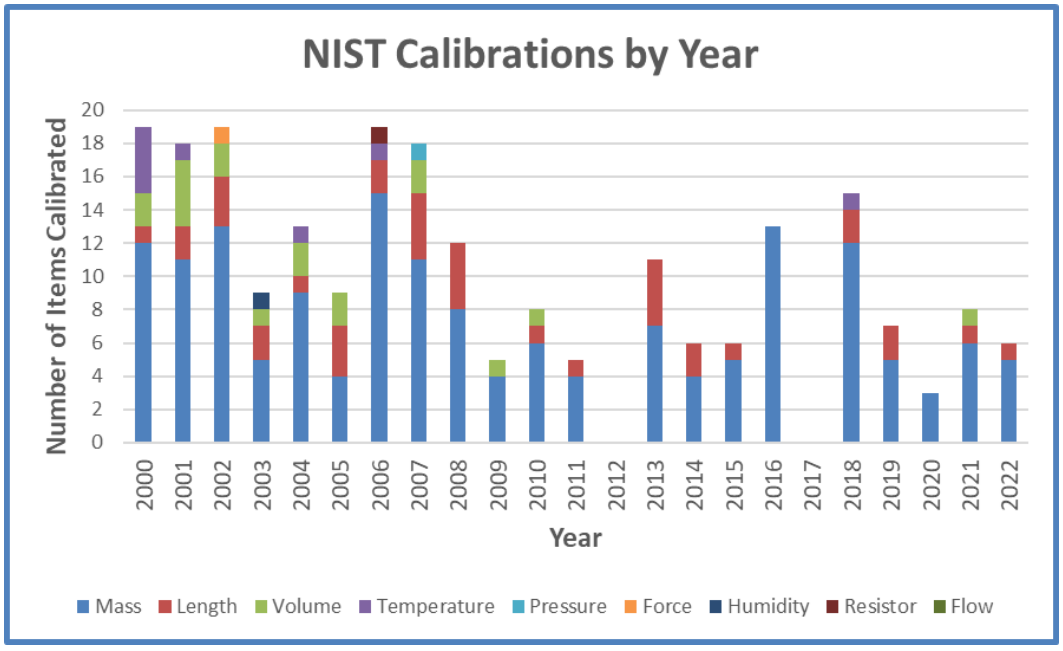


Figure 1. NIST total calibrations of State laboratories artifacts by year

Data in Figure 1 includes measurements and calibrations performed at NIST in traditional and non-traditional measurement areas (i.e., 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 $25.46 trillion (2022) 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.

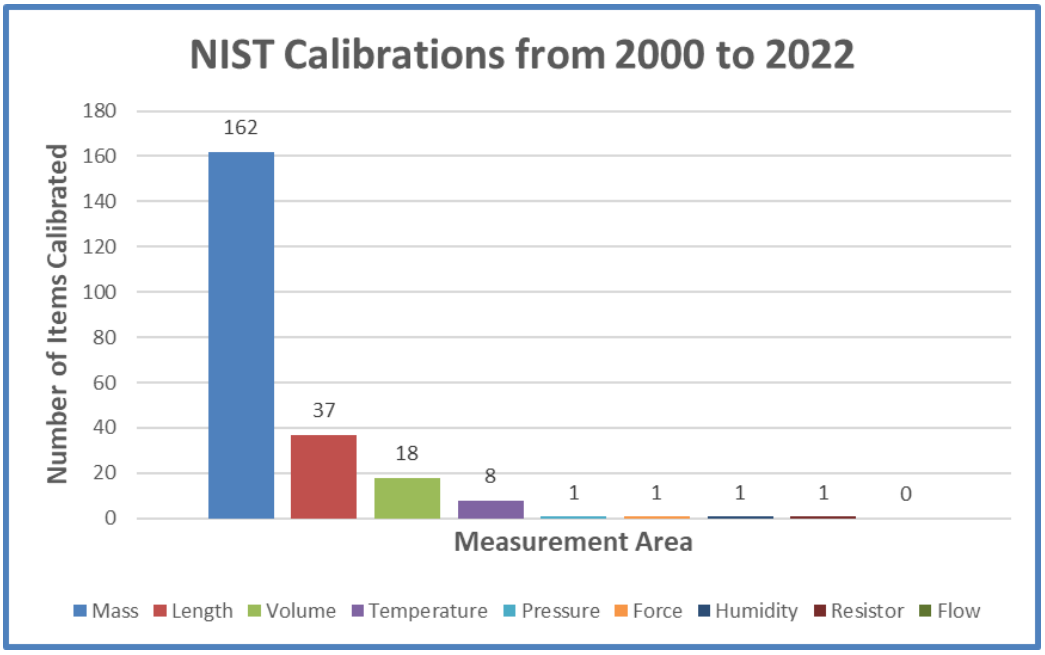


Figure 2. NIST total calibrations of State laboratories artifacts by measurement area

One question that might be asked in looking at Figure 2 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.

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

One of NIST's primary responsibilities is to ensure that uniform standards are available to support the nation's measurement infrastructure. As documented in the last edition of the workload survey, State laboratories provide the foundation for over 305,000 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 and the U.S. economy depend on the accuracy, traceability, and defensibility of these measurement results for State programs enforcement purposes and to ensure fair trade.

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 documentary standards (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.

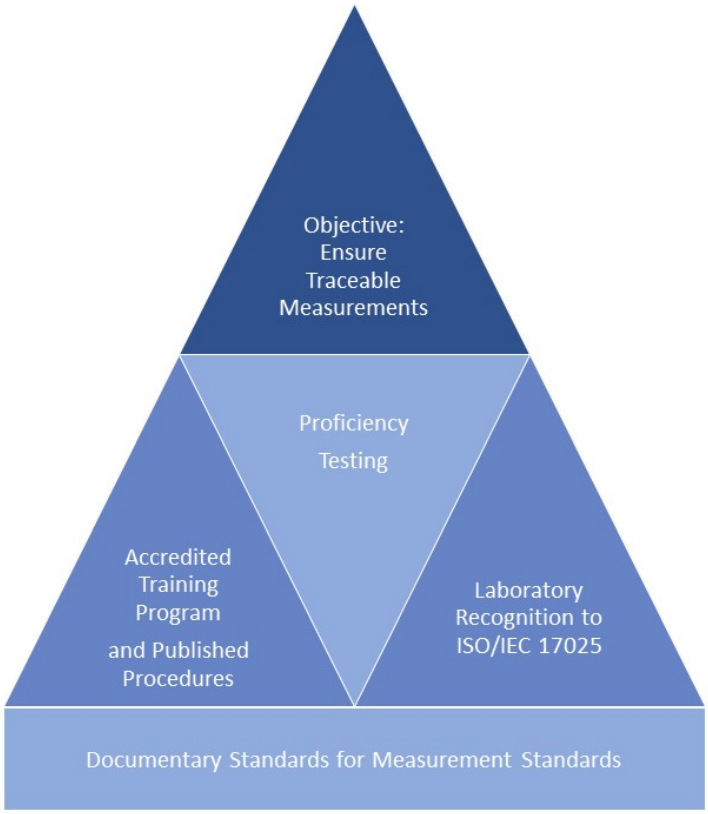


Figure 3. Laboratory Metrology Program Areas.

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. 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.

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 complying with 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, NIST Handbook 143.
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, states that weights and measures programs are required to ensure metrological traceability to the International System of Units (SI) normally through NIST. The latest model law indicates 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 OWM can target specific technical areas each year when and where problems have been identified, as well as conduct national-level analysis to assess and consider system-wide needs. 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. The laboratory

recognition program required all states to meet the requirements of the latest ISO/IEC 17025 standard by the end of 2020.

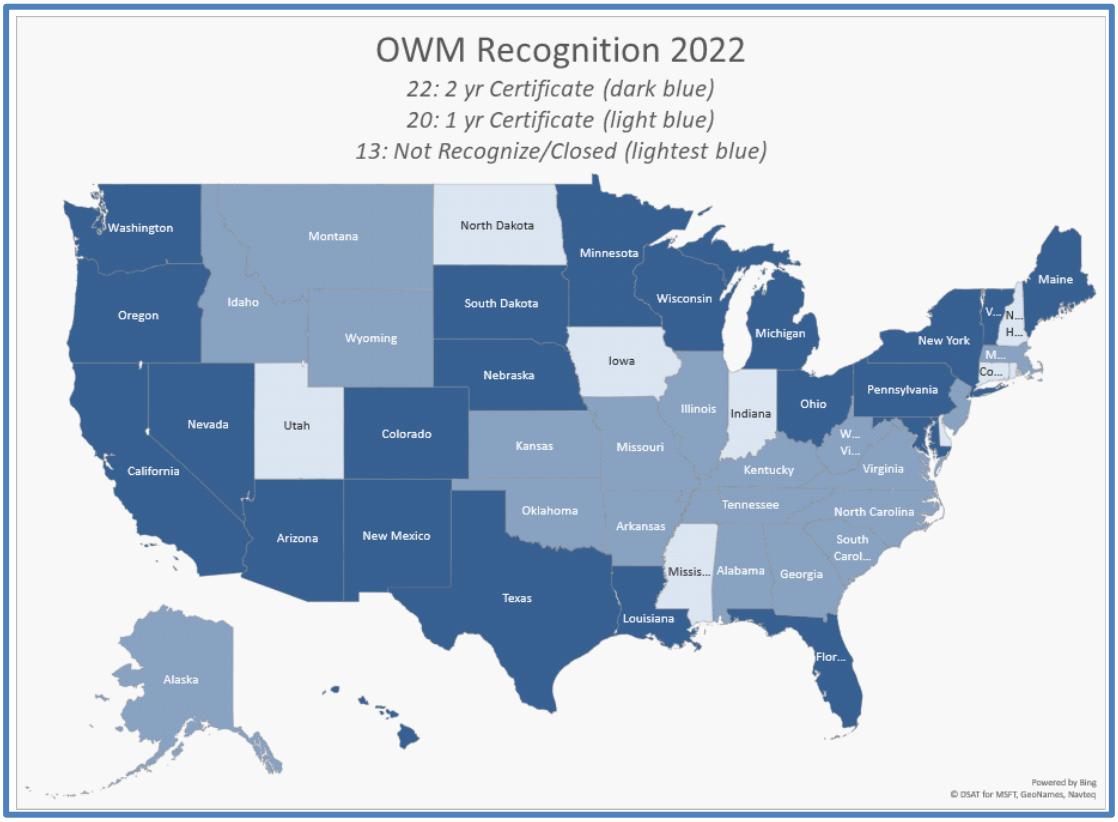


Figure 4. Laboratory Recognition by OWM (2022 December).

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.

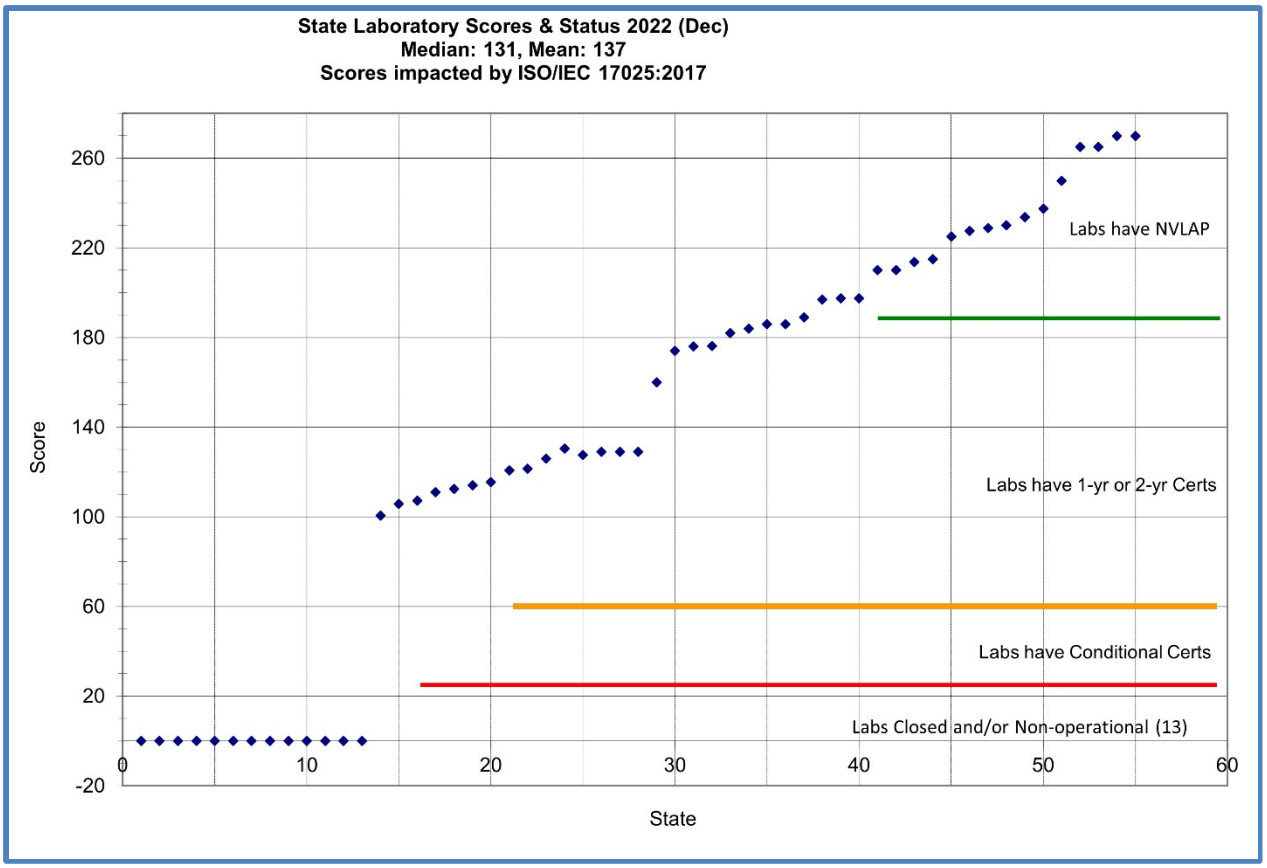


Figure 5. Laboratory Scoring Model (2022 December).

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 2021 to 2022 time frame the effects of the COVID-19 pandemic continued to plague and impact laboratories plans to relocate to a new or renovated laboratory and their ability to succession planning. In addition, after the 2020, all laboratories had to demonstrate compliance with ISO/IEC 17025. Training on the new ISO/IEC 17025 standard has been provided since 2016 and is ongoing. All laboratories are required to demonstrate continued compliance with the standard.

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
2020	138	139
2022	131	137
[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.

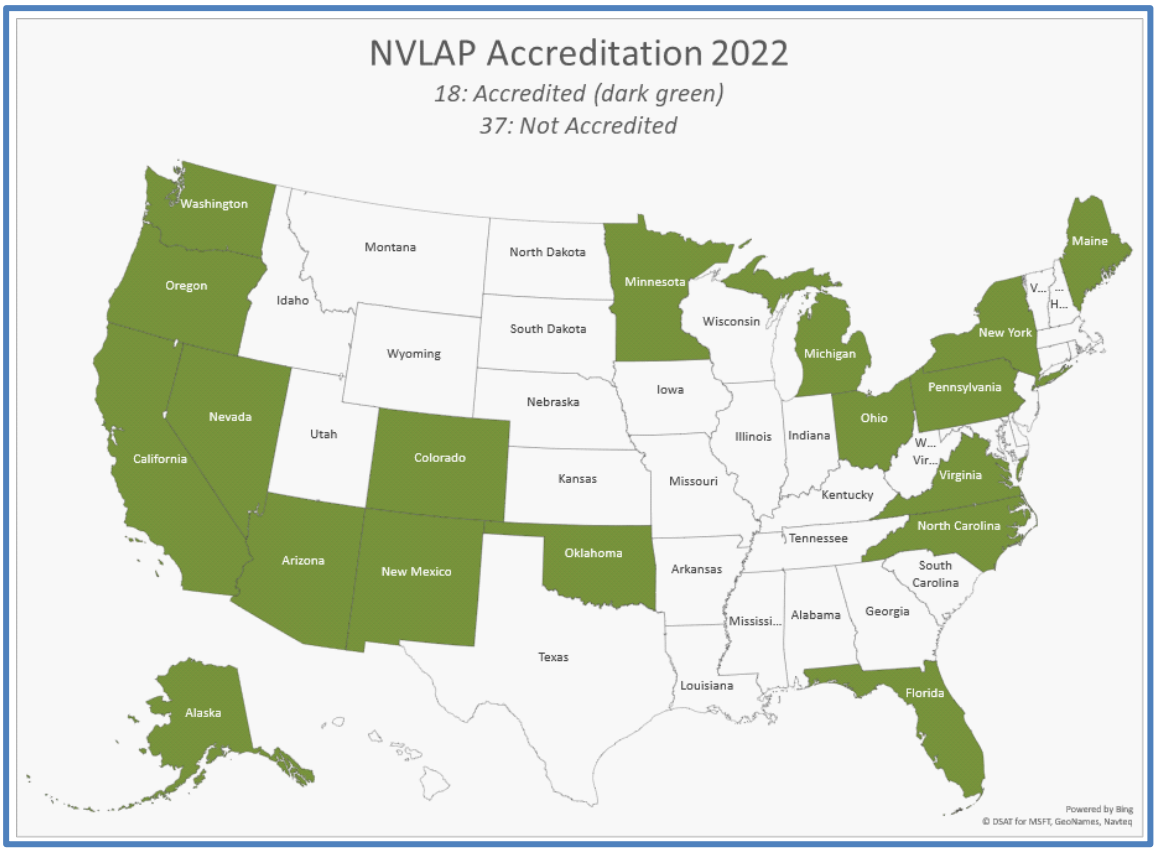


Figure 6. NVLAP Accreditation of State W&M Laboratories

Within NVLAP, the current primary contact for state laboratories is Robert Knake. The primary contact in OWM for OWM Accreditation and Recognition is Micheal Hicks.

Training

Training includes courses that are taught at NIST in the OWM Training Laboratory, regionally at the Regional Measurement Assurance Program (RMAP) annual training sessions (Figure 5), and online as a webinar, workshop, and info-hours.

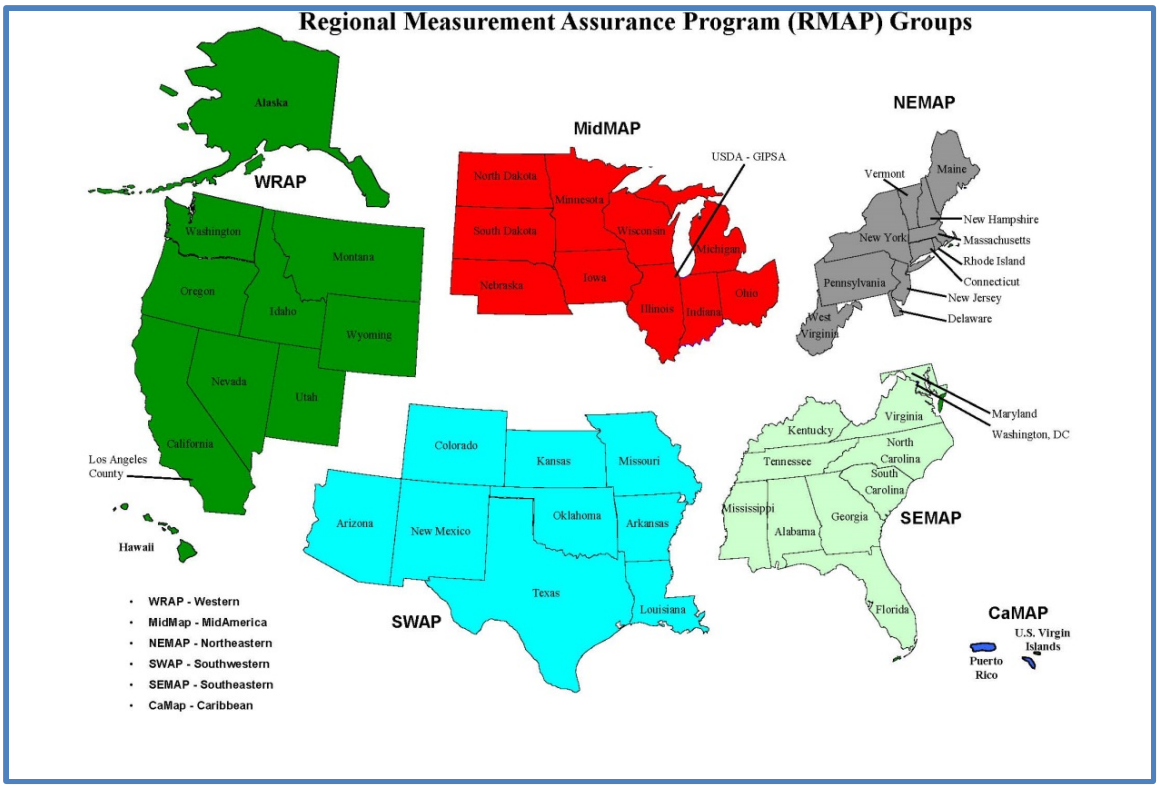


Figure 7. Regional Measurement Assurance Program (RMAP) Groups.

The core laboratory metrology courses/seminars that are offered by OWM at NIST include: Fundamentals of Metrology, Mass Metrology, Volume Metrology, and Advanced Mass Metrology. These courses were developed and updated 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 the goal of maintaining an accredited training program. Previous courses (Basic Metrology for States, Intermediate Metrology) are no longer available and have evolved into the current courses. 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. The seminar and webinar tuition are funded by the OWM for 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 OWM 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.

The COVID-19 pandemic resulted in NIST OWM canceling all in-person training starting March 2020 through February 2022. RMAP training delivery was modified to an online method for 2020 and 2021. All NIST OWM core training seminars were suspended pending the reopening of the NIST campus. The impact of the suspension of the core training in 2020 and 2021 can be seen in the relatively low scoring model average for the 2022 Recognition Reviews. To partially compensate for the suspension of the training seminars, NIST OWM developed an interim online workshop titled Fundamentals and Laboratory Auditing Program (LAP) Problems Preparation in

2020. This online course covered the principles taught in the Fundamentals of Metrology, with content from one Mass Metrology procedure and one Volume Metrology Seminar procedure. The main objective for this temporary/interim course was geared toward giving new staff the fundamentals and knowledge base needed to operate with confidence in Metrology at the lower echelon levels of Mass and Volume. This interim course was offered online and relied on an approved qualified mentor at the lab of the participant for hands on activities, as this course was not at the same level as Fundamental of Metrology at NIST. OWM designed, developed and delivered an abbreviated Fundamentals of Metrology training for metrologist who completed the online Interim course, discussed above, in 2022 so they could achieve and be recorded as receiving equivalent training to the full Fundamentals of Metrology Seminar. The abbreviated course was taught after the end of the 2022 RMAP training at the various regional locations. This course and the online interim course are no longer offered since the seminar courses have resumed on NIST campus. Additionally, the Laboratory Administration Workshop, a 5 day in-person course, was redesigned to an eight session online course during the pandemic. The online and in-person version of the Laboratory Administration Workshop will continue to be offered. OWM Laboratory Metrology Program has been dealing with staff changes throughout the pandemic and currently has a staff of three with all less than three years of experience and activity in the OWM Laboratory Metrology program. The use of contractors, including experienced staff from state laboratories, to help instruct the training courses has greatly helped to steady the program.

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 contact and administrator of this system is Yvonne Branden.

Training courses (seminars and webinars) for 2012 through 2022 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. The primary contact for the laboratory training program is Isabel Chavez Baucom.

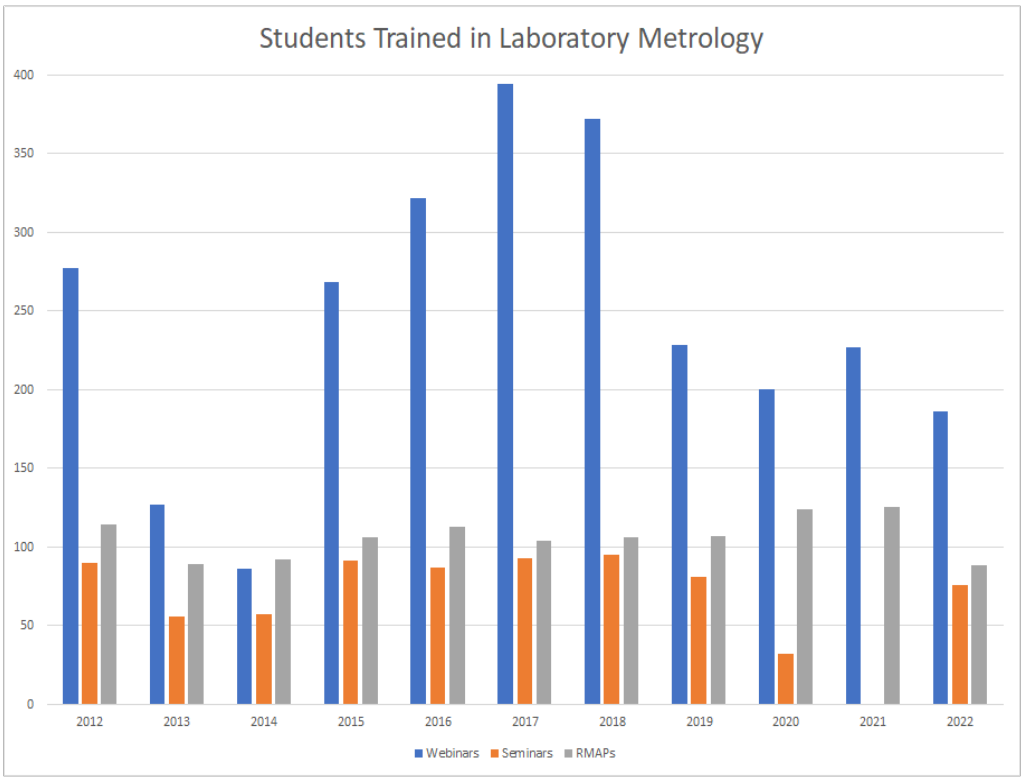


Figure 8 Laboratory Metrology Students Trained for 2012 through 2022.

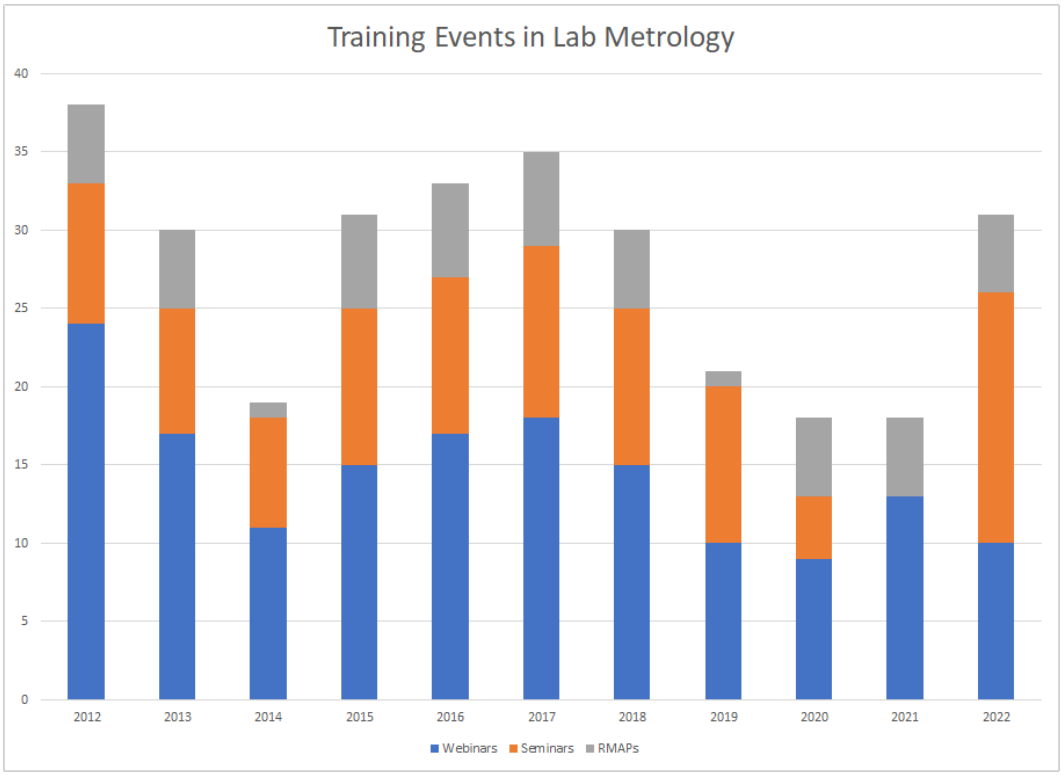
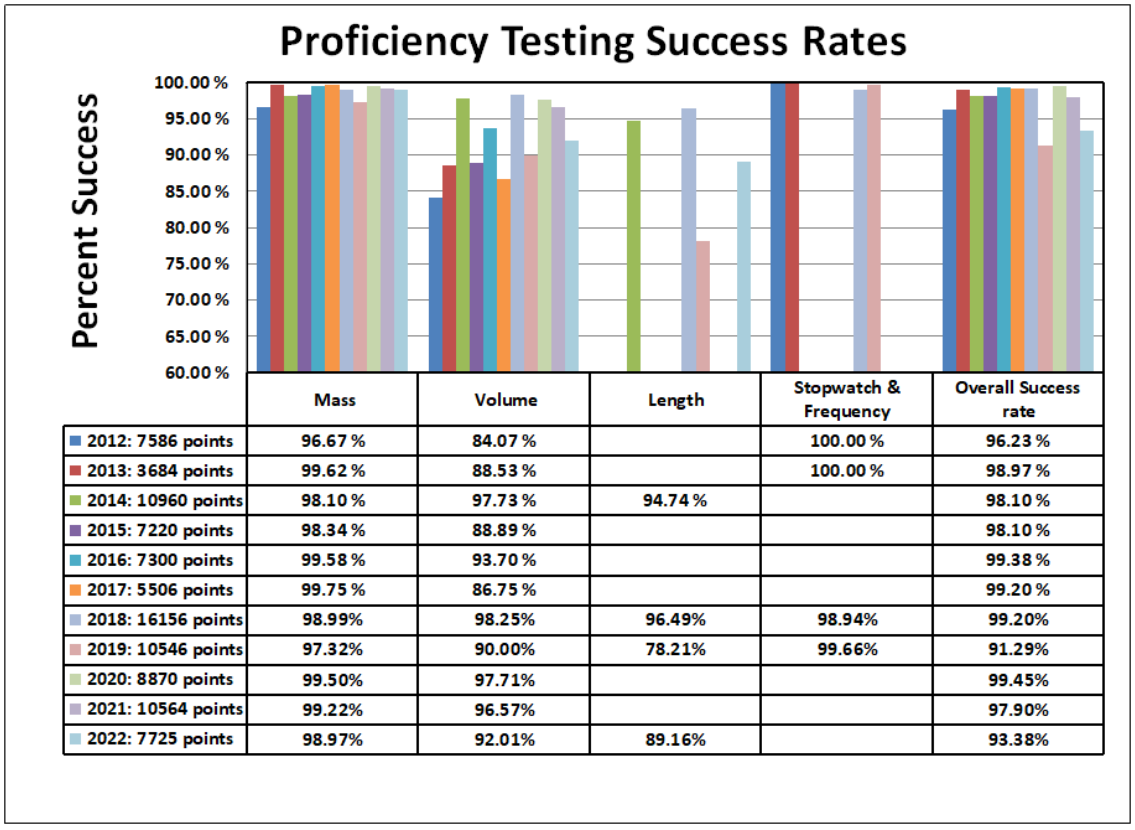


Figure 9. Laboratory Metrology Training Events for 2012 through 2022.

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
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%
2019: 10546 points	97.32%	90.00%	78.21%	99.66%	91.29%
2020: 8870 points	99.50%	97.71%			99.45%
2021: 10564 points	99.22%	96.57%			97.90%
2022: 7725 points	98.97%	92.01%	89.16%		93.38%

Figure 10. Proficiency Testing Success Rates (2012 to 2022).

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. Over 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.

Overall, based on the 10-year of PT assessments above, over 95,000 evaluation points of normalized error (E_n) and normalized precision (P_n) have been assessed in the listed measurement areas. Laboratories are making good progress towards reaching the success goal of

100 % passing rate and 100 % completed follow-up when needed. Program planning, analysis and reporting tools used in the PT program are used by many other laboratories outside the program and outside the United States. Micheal Hicks is the primary contact for OWM Proficiency Testing program.

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 due to limited resources, but standards are selected for updates when issues arise indicating a need. Currently, an update to NIST Handbook 105-7 for small volume provers is in the development process. A new standard is being considered for master meters along with an update to 105-2 for field standard measuring flasks being published in 2021. Handbook 105-1 for field standard weights and Handbook 105-8 for weight carts were both updated in 2019. Handbook 105-4 for LPG provers was updated in 2016. The program also participates with ASTM, USP, and OIML standards development. Micheal Hicks is currently the primary contact for Handbook 105-1, and ASTM updates and Georgia Harris for the volumetric standards.

Program References

An intentional effort 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. An update to Handbook 143 will be published in 2023.

Table 3. Program Area Reference Documents.

Topic	Publication Type and Number	Title	Latest Revision Date
Recognition	Handbook 143[i]	State Weights and Measures Laboratories Program Handbook	2019
Accreditation	Handbook 150-2[ii]	NVLAP Calibration Laboratories	2019
Accreditation	Handbook 150-2, Annex A	Annex A: ANSI/NCSL Z540-1-1994, Part I (normative)	2019
Accreditation	Handbook 150-2, Annex B	Annex B: Dimensional measurements (normative)	2019
Accreditation	Handbook 150-2, Annex C	Annex C: Time and frequency measurements (normative)	2019

Topic	Publication Type and Number	Title	Latest Revision Date
Accreditation	Handbook 150-2, Annex D1	Annex D: Mechanical measurements (normative), D1 Force Calibrations	2019
Accreditation	Handbook 150-2, Annex D2	Annex D: Mechanical measurements (normative), D2 Mass calibrations	2019
Accreditation	Handbook 150-2, Annex D3	Annex D: Mechanical measurements (normative), D3 Volume calibrations	2019
Accreditation	Handbook 150-2, Annex E	Annex E: Requirements for NVLAP-accredited legal metrology laboratories	2019
Mass Calibration Lab Procedures	NISTIR 5672	Advanced Mass Calibrations and Measurements Assurance Program for the State Calibration Laboratories	2019
Mass Calibration Lab Procedures	NISTIR 6969	Selected Laboratory and Measurement Practices, and Procedures to Support Basic Mass Calibrations	2019
Volume Calibration Lab Procedures	NISTIR 7383	Selected Procedures for Volumetric Calibrations	2019
Length Calibration Lab Procedures	NISTIR 8028	Selected Laboratory and Measurement Practices and Procedures for Length Calibrations	2014
Weights and Measures Lab Procedures	NISTIR 8250[iii]	Calibration Procedures for Weights and Measures Laboratories	2019
Proficiency Testing	NISTIR 7082	Proficiency Test Policy Plan	2018
Proficiency Testing	NISTIR 7214[iv]	Weights and Measures Division Quality Manual for Proficiency Testing and Interlaboratory Comparisons	2005
Field Standards	Handbook 105-1	Specifications and Tolerances for Field Standard Weights, (NIST Class F) (available for Historical purposes)	1990
Field Standards	Handbook 105-1	Specifications and Tolerances for Field Standard Weights, (Ref OIML R111 and ASTM E617)	2019
Field Standards	Handbook 105-2[v]	Specifications and Tolerances for Field Standard Measuring Flasks	2021

Topic	Publication Type and Number	Title	Latest Revision Date
Field Standards	Handbook 105-3	Specifications and Tolerances for Graduated Neck Type Volumetric Field Standards	2010
Field Standards	Handbook 105-4	Specifications and Tolerances for Liquefied Petroleum Gas and Anhydrous Ammonia Liquid Volumetric Provers	2016
Field Standards	Handbook 105-5	Specifications and Tolerances for Field Standard Stopwatches	1997
Field Standards	Handbook 105-6	Specifications and Tolerances for Thermometers	1997
Field Standards	Handbook 105-7[vi]	Specifications and Tolerances for Dynamic Small Volume Provers	1997
Field Standards	Handbook 105-8[vii]	Specifications and Tolerances for Field Standard Weight Carts	2019
Notes	[i] Handbook 143, Table 2 was updated in 2021. Additional updates are anticipated due to incomplete references in the NVLAP Handbook Annexes regarding Echelon categories. Additional annexes may be referenced as they are developed (e.g., for thermometry and thermodynamic measurements). [ii] NVLAP Handbook 150-2 for Calibration Laboratories and all Annexes are referenced in Handbook 143 as requirements for Weights and Measures Laboratories. Technical criteria were published as duplicates prior to the 2019 versions. For the 2019 publications, Handbook 143 explicitly references the NVLAP technical criteria. Associated checklists are applicable for internal auditing and assessor evaluations as well. OWM staff contribute to technical and editorial review of the applicable NVLAP annexes. [iii] Additional procedures available in draft form to be formatted, validated, and published as part of this NISTIR in the future. See the table of contents for works to be completed in the future. [iv] Updates expected to ensure compliance with ISO/IEC 17043 upon next revision (to ensure compliance and consistency with ISO/IEC 17025.) [v] Decision rule criteria to be updated in this publication. Currently specified as uncertainty required to be less than one-third applicable tolerances (maximum permissible errors). Updates will specify uncertainty to be less than the tolerances only. [vi] Comments received to update this publication. Updates are pending work of national working group analysis and efforts related to metering and meter calibrations. [vii] Updates expected to correct tolerance tables for correct rounding formatting.	

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, most 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 the laboratories against standardized criteria to track whether 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 Micheal Hicks (micheal.hicks@nist.gov).

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, 11 are not operational. Connecticut, Delaware, Iowa, Los Angeles County, Mississippi, North Dakota, New Hampshire, Puerto Rico, Rhode Island, Washington D.C., and the U.S. Virgin Islands,

Notes and Comments:

- 42 metrology laboratories provided data.
- Figure 11 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.

	Age (Years)	Office Space (Sq. Ft.)	Lab Space (Sq. Ft.)	Customers	Non-Service Agent Customers
Average	28	696	3,629	184	61
Maximum	92	2,500	12,200	1,195	646

Figure 11: Historical survey titles and the year represented by each.

(White Space)

Table 4: (beginning next page) Listing of the SLP laboratories including location, age[1], size, and total number of customers served as of the 2022 calendar year.

[1] 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 Ste. 6 Anchorage, AK 99515	Phone: 907-365-1233	dot.alaska.gov/mscve/pages/metrology	8	350	1,740	76	68
Alabama Weights and Measures Laboratory	1445 Federal Drive Montgomery, AL 36107	Phone: 205-617-8068 Fax: 334-240-7175	agi.alabama.gov	49	374	588	260	-
Arkansas State Standards Laboratory	4608 W. 61st St. Little Rock, AR 72209	Phone: 501-219-6334	www.agriculture.arkansas.gov/plant-industries/bureau-of-standards/state-mass-volume-lab/	56	400	1,500	200	15
Arizona Dept Agriculture Weights and Measures Metrology Laboratory	4425 W Olive Ave Ste 134 Glendale, AZ 85302	Phone: 602-771-4938	agriculture.az.gov/	23	500	5,500	182	55
California State Metrology Laboratory	6790 Florin Perkins Road, Suite 100 Sacramento, CA 95828	Phone: 916-229-4858	www.cdfa.ca.gov/dms/programs/metrology/metrology.html	19	296	3,747	111	4
Colorado Department of Agriculture, Metrology	300 S. Technology Ct. Broomfield, CO 80021	Phone: 303-869-9240	ag.colorado.gov/labs/metrology-laboratory	4	500	2,900	255	33
Florida Metrology Laboratory	3125 Conner Blvd Lab 2 Tallahassee, FL 32399	Phone: 850-921-1572	www.fdacs.gov	53	620	3,500	201	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/laboratories	13	994	6,818	125	-
USDA Master Scale	5800 W. 69th Street Chicago, USDA-GIPSA o, IL	Phone: 312-919-7665	www.ams.usda.gov/services/fgis/master-scale-program	92	1,200	3,000	5	5
Hawaii Measurement Standards Laboratory	1851 Auiki Steet Honolulu, HI 96819	Phone: 808-832-0682 Fax: 808-832-0683	hdoa.hawaii.gov/qad/measurement-standards	21	443	2,602	48	19
Idaho Metrology Laboratory	2216 Kellogg Ln Boise, ID 83712	Phone: 208-332-8692	www.agri.idaho.gov	53	720	1,900	65	45
Illinois Department of Agriculture Metrology Laboratory	801 Sangamon Avenue East Springfield, IL 62702	Phone: 217-785-8480	agr.illinois.gov/consumers/weightsmeasures.html	45	1,200	3,220	115	32
Kansas Metrology Laboratory	2004 Research Park Circle Manhattan, KS 66502	Phone: 785-564-7477 Fax: 745-564-6777	agriculture.ks.gov/divisions-programs/ag-lab/metrology-lab2	2	237	3,751	125	52
Kentucky Department of Agriculture	107 Corporate Dr Frankfort, KY 40601	Phone: 502-573-0282 Fax: 502-573-0303	www.kyagr.com	22	40	2,395	-	-
Louisiana State Metrology Laboratory	5825 Florida Blvd Baton, LA 70806	Phone: 225-922-1381 Fax: 225-923-4877	www.ldaf.state.la.us	40	342	1,568	135	67
Massachusetts Div of Standards Metrology Laboratory	250 Eliot Street ~ Suite 10-D Ashland, MA 01721	Phone: 508-532-1200	www.mass.gov/orgs/division-of-standards	1	324	4,676	69	1
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	32	930	4,870	13	-
Maine Metrology Laboratory	333 Cony Rd Augusta, ME 04330	Phone: 207-287-7587	www.maine.gov/dacf/qar/laboratory_testing/metrology.shtml	57	432	2,600	105	-
Michigan Department of Agriculture and Rural Development	940 Venture Lane Williamston, MI 48895	Phone: 517-655-7229 Fax: 517-655-8303	www.michigan.gov/mdard/lab	26	2,000	12,200	152	78
State of MN Metrology Lab	14305 South Cross Drive W Suite 150 Burnsville, MN 55306	Phone: 651-539-1567 Fax: 952-435-4040	mn.gov/commerce/business/weights-measures/scales-meters/metrology.jsp	16	1,120	4,706	236	74
Missouri Metrology Laboratory	1616 Missouri Blvd Jefferson City, MO 65109	Phone: 573-751-3440 Fax: 573-751-0281	agriculture.mo.gov/	30	385	2,433	68	1

Laboratory	Address	Contact	Website	Age (Years)	Office Space (sq ft)	Lab Space (sq ft)	Customers	Non-Service Agent Customers
Montana Bureau of Weigfhts and Measures	3806 US HWY 12/287 East Helena, MT 59635	Phone: 406-461-4168	www.bsd.dli.mt.gov/weights-and-measures/metrology-lab	2	500	1,000	71	15
NCDA&CS Metrology Laboratory	4400 Reedy Creek Road Raleigh, NC 27607	Phone: 984-236-4800 Fax: 919-831-1303	www.ncagr.gov/standard	2	2,483	6,902	165	3
Nebraska Standards Lab	3721 West Cuming St. Lincoln, NE 68524	Phone: 402-471-2087		44	580	1,800	159	61
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	33	200	2,700	422	399
New Mexico Department of Agriculture	3190 S. Espina Las Cruces, NM 88003	Phone: 575-646-1551	nmdeptag.nmsu.edu	49	281	2,335	139	93
Nevada Metrology Laboratory	405 S. 21st Street Sparks, NV 89431	Phone: 775-353-3794 Fax: 775-353-3798	agri.nv.gov/Protection/Weights_and_Measures/Metrology_Lab/	49	170	10,044	106	61
New York State Metrology Laboratory	10B Airline Dr Albany, NY 12235	Phone: 518-457-4781 Fax: 518-457-2552	www.agriculture.ny.gov	10	975	4,240	108	37
Ohio Department of Agriculture	8995 East Main St. Bldg. #5 Reynoldsburg, OH 43068	Phone: 614-728-6290 Fax: 614-728-6424	agri.ohio.gov/divisions/weights-and-measures	53	2,500	3,047	413	68
Oregon Department of Agriculture	635 Capitol St NE, Suite 100 Salem, OR 97301	Phone: 503-986-4669 Fax: 503-986-4784	www.oregon.gov/oda/programs/MarketAccess/Pages/Metrology.aspx	24	367	2,038	91	44
Pennsylvania Standards Laboratory	2221 Forster Street, Room G-44A Harrisburg, PA 17125	Phone: 717-787-4707 Fax: 717-705-0882	www.dgs.pa.gov	25	1,568	3,780	556	209
SC Department of Agriculture Metrology Laboratory	129 Ballard Court West Columbia, SC 29172	Phone: 803-253-4052	agriculture.sc.gov/divisions/consumer-protection/metrology	4	835	8,000	360	-
SD State Metrology Laboratory	1100 Otter Rd, Bldg D Sturgis, SD 57785	Phone: 605-280-4572	dps.sd.gov/inspections/weights-measures/metrology-lab	2	300	2,800	97	33
Julius Johnson Metrology Lab (Tennessee Lab)	5203 Marchant Dr. Nashville, TN 37211	Phone: 615-253-4426	www.tn.gov/agriculture/consumers/standards/metrology.html	6	-	-	144	-
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	20	1,200	11,077	191	18
Utah Metrology Lab	350 North Redwood Rd Salt Lake City, UT 84116	Phone: 801-982-2267	ag.utah.gov	37	150	1,350	64	43
Virginia Department of Agriculture and Consumer Services	600 North 5th Street Richmond, VA 23219	Phone: 804-786-0479 Fax: 804-371-0206	www.vdacs.virginia.gov/standards/service	21	-	3,637	156	57
Vermont State Metrology Laboratory	163 Admin Drive Randolph Center, VT 05061	Phone: 802-522-5415	agriculture.vermont.gov	4	500	1,500	124	62
WA St. Dept. of Agriculture Metrology Laboratory	PO Box 42560 Olympia, WA 98504	Phone: 360-764-0199	agr.wa.gov/Inspection/WeightsMeasures/metrologylab/metrologylab.aspx	45	230	2,734	201	74
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	16	550	3,700	384	67
West Virginia Weights & Measures Metrology Lab	570 MacCorkle Ave SW St. Albans, WV 25177	Phone: 304-722-0602 Fax: 304-722-0605	www.labor.wv.gov	60	1,780	1,855	1,195	646
Wyoming Department of Agriculture	6607 Campstool Rd Cheyenne, WY 82002	Phone: 307-777-7556 Fax: 307-777-1943	agriculture.wy.gov	11	650	1,660	35	7

Laboratory Survey Participation

Lab ID																
Lab Code/Year	1996	1998	1999	2000	2002	2004	2005	2006	2008	2010	2012	2014	2016	2018	2020	2022
AK	Yes		Yes	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	Yes	Yes
AR	Yes	Yes	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	Yes	Yes
CA	Yes	Yes	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	Yes	Yes
CT	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
DE	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**
FL	Yes	Yes	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	Yes	Yes
HI	Yes	Yes	Yes	**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
IA	Yes	Yes	Yes		**	Yes	Yes	Yes	Yes	Yes	Yes	**	**	**	**	**
ID	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
IL	Yes	Yes	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	Yes	
KS	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
KY	Yes	Yes	Yes	Yes	Yes	**	**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
LA	Yes	Yes	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	Yes	Yes
MD	Yes	Yes	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	Yes	Yes
MI	Yes	Yes	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	Yes	Yes
MO	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
MS	Yes	Yes		**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	**
MT	Yes	Yes	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	Yes	Yes
ND	Yes	Yes	Yes	Yes	Yes	**	Yes	Yes	Yes		**	**	**	**	**	**
NE	Yes	Yes			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	Yes	Yes
NM	Yes	Yes	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	Yes	Yes
NY	Yes	Yes	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	Yes	Yes
OK	Yes	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	Yes	Yes
PA	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
RI	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**
SC	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Lab Code/Year	1996	1998	1999	2000	2002	2004	2005	2006	2008	2010	2012	2014	2016	2018	2020	2022
SD	Yes	Yes			**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
TN	Yes	Yes	Yes	Yes	Yes	**	Yes	Yes	Yes		Yes	Yes	Yes	No	Yes	Yes
TX	Yes	Yes	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	Yes	Yes
VA	Yes	Yes	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	Yes	Yes
WA	Yes	Yes	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	Yes	Yes
WV	Yes	Yes	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	Yes	Yes
USDA-GIPSA	Yes					Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
Wash. DC	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**
Virgin Islands	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**
Puerto Rico	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	**	**
LA County	Yes	Yes	Yes	Yes	Yes	**	**	**	Yes	Yes	Yes	Yes	Yes	Yes	No	**
TOTAL	51	46	45	44	48	47	46	49	50	47	48	49	49	45	47	42

Table 5: Listing of SLP member laboratories and their participation status in previous surveys (blanks indicate non-participation). ** indicates an inactive lab, empty cells indicates no response to the survey..

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[2]	6,505
2014	49	336,858	6,875
2016	49	400,911[3]	8,182
2018	45	326,219[4]	7,244
2020	44	306,860[5]	7,064
2022	42	306,660	7,301

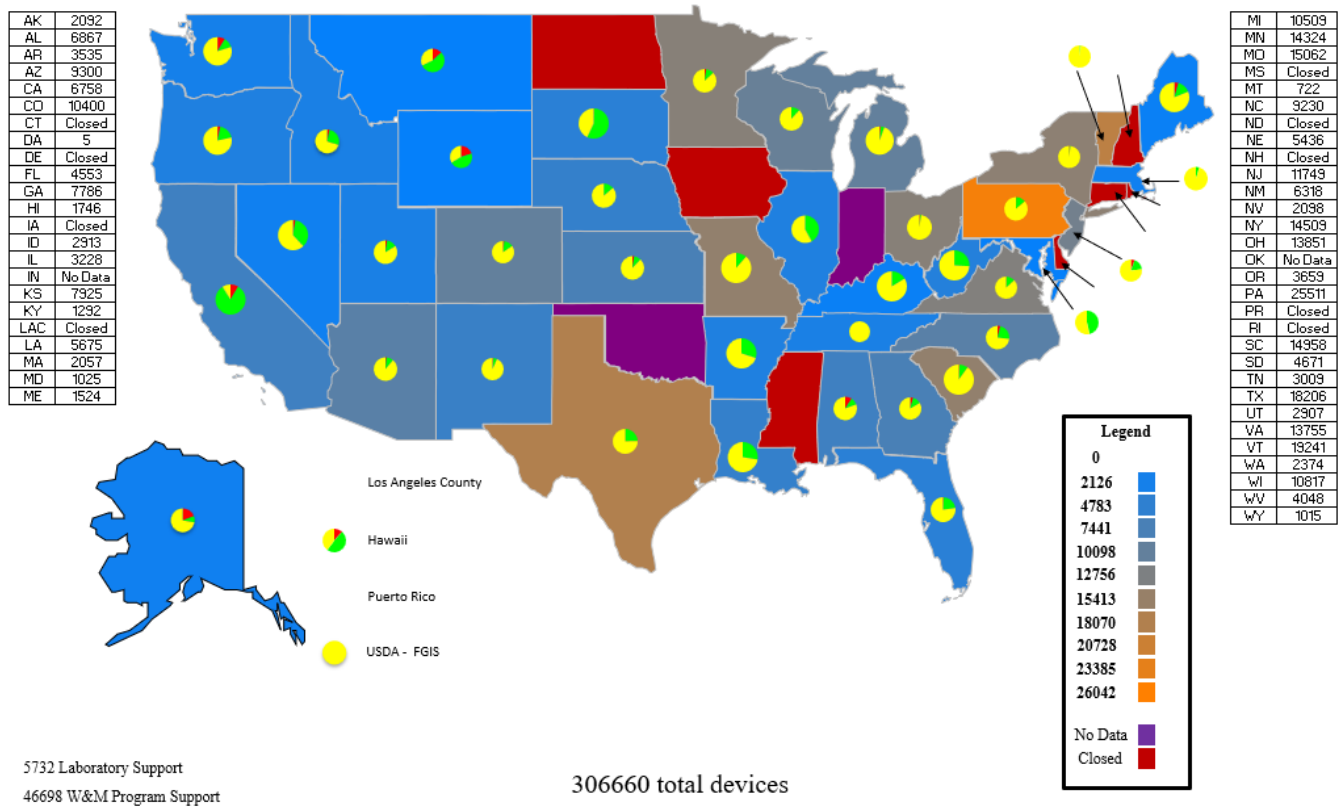
Table 6: Summary of all measurements reported on prior surveys.

[2] 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

[3] 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.

[4] 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

[5] In 2020 COVID-19 and the associated efforts to control the impact of the disease on hospitals nationwide significantly affected the U.S. economy.



5732 Laboratory Support
46698 W&M Program Support
254228 For external customers

306660 total devices
calibrated in 42 labs

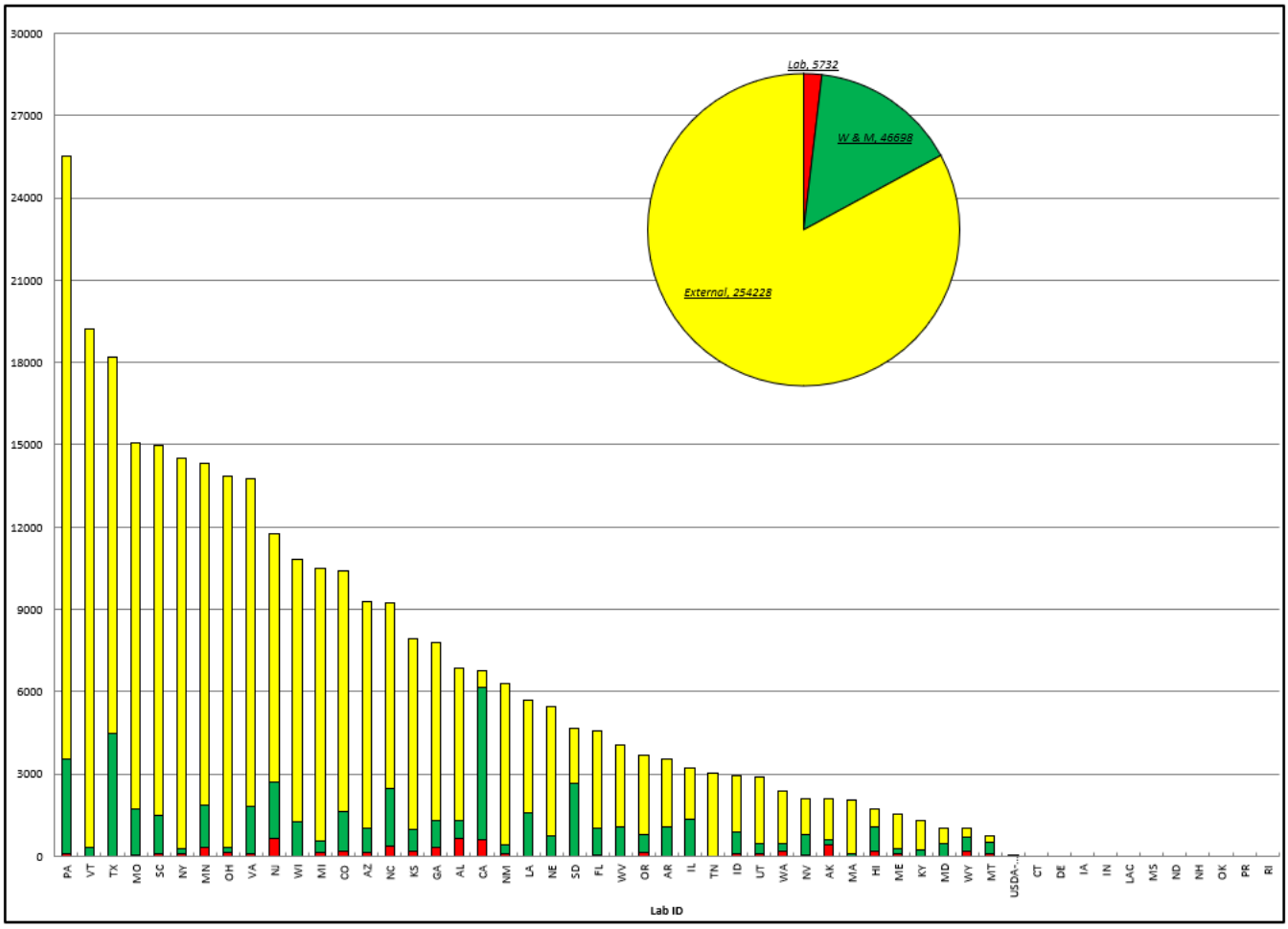


Figure 12: Total of all measurements reported..

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", 2019), SOP 4 and SOP 7 (Harris, NIST IR 6969, "Selected Laboratory and Measurement Practices, and Procedures, to Support Basic Mass Calibrations", 2019).

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", 2019). 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", 2019) are typically tested using echelon III procedures. They are, nevertheless, 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 42 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.

Comparison of previous surveys

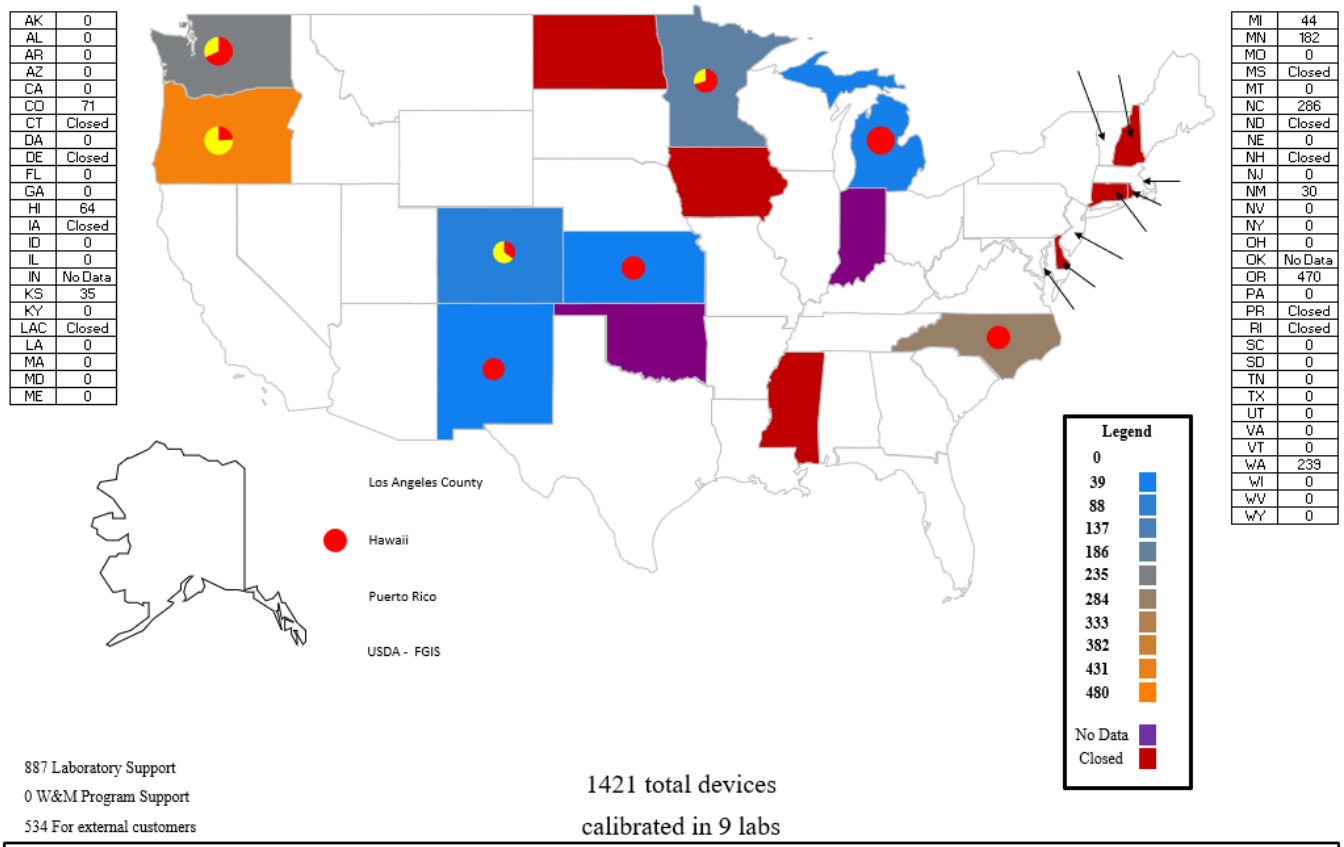
Year	# Labs	Total Devices
1998	10	2,667
1999	15	5,985
2000	16	5,227
2002	15	5,288
2004	14	3,707
2005	14	3,103
2006	14	3,025
2008	17	2,216
2010	19	2,309
2012	12	2,493
2014	13	2,980
2016	11	1,845
2018	11	2,485
2018	11	2,485
2022	9	1,421

Table 7: 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

- 62 % of all Mass I standards were calibrated for internal use by the laboratory.
- 0 % of all Mass I standards were calibrated for the weight and measures program.
- 38 % of all Mass I standards were calibrated for external customers.



887 Laboratory Support
0 W&M Program Support
534 For external customers

1421 total devices
calibrated in 9 labs

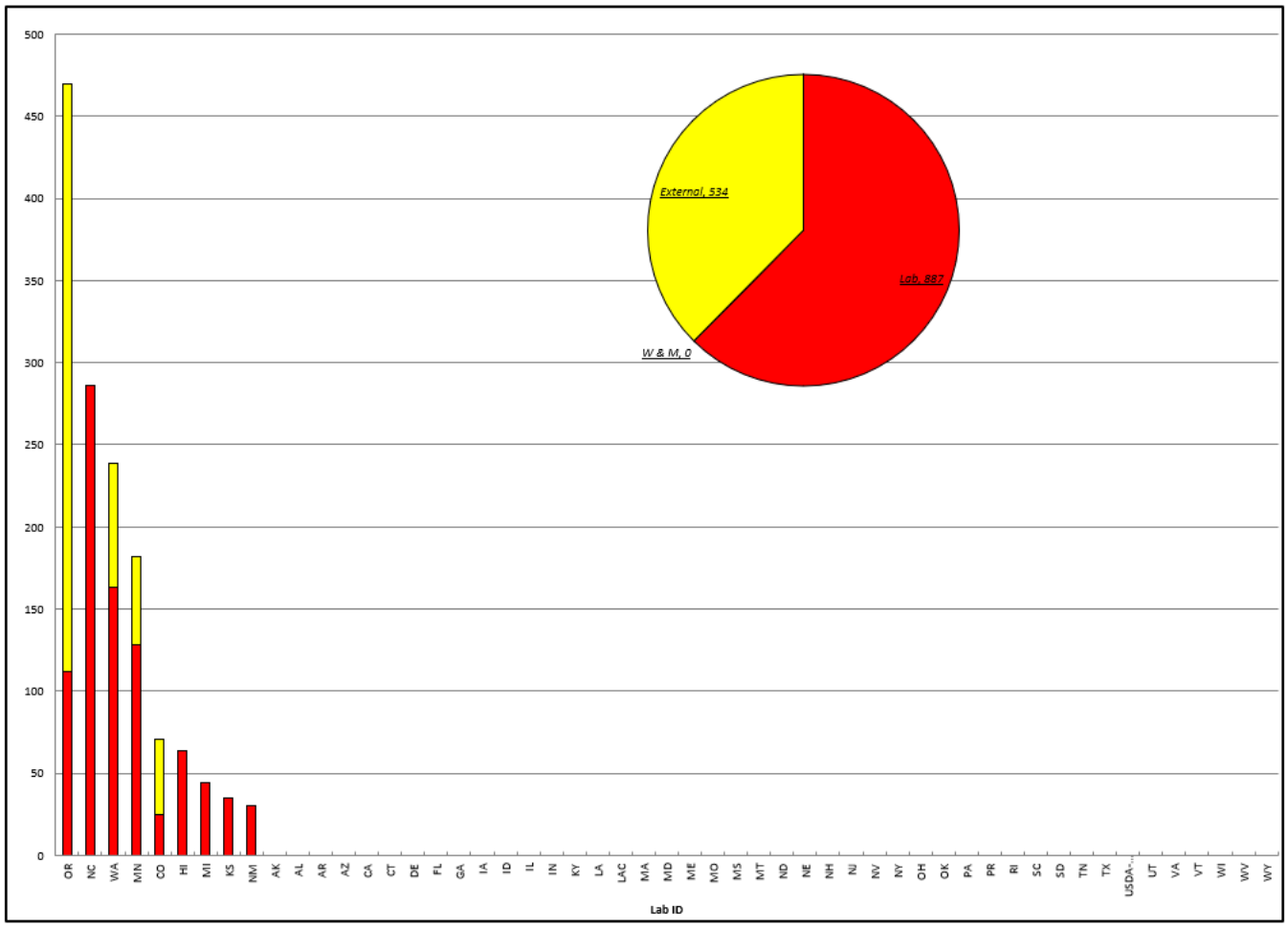


Figure 13: Mass Echelon I tests.

Mass Echelon II

Description

The graphs on the following page represent the total number of Mass Echelon II standards evaluated by the 42 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.

Comparison of previous surveys

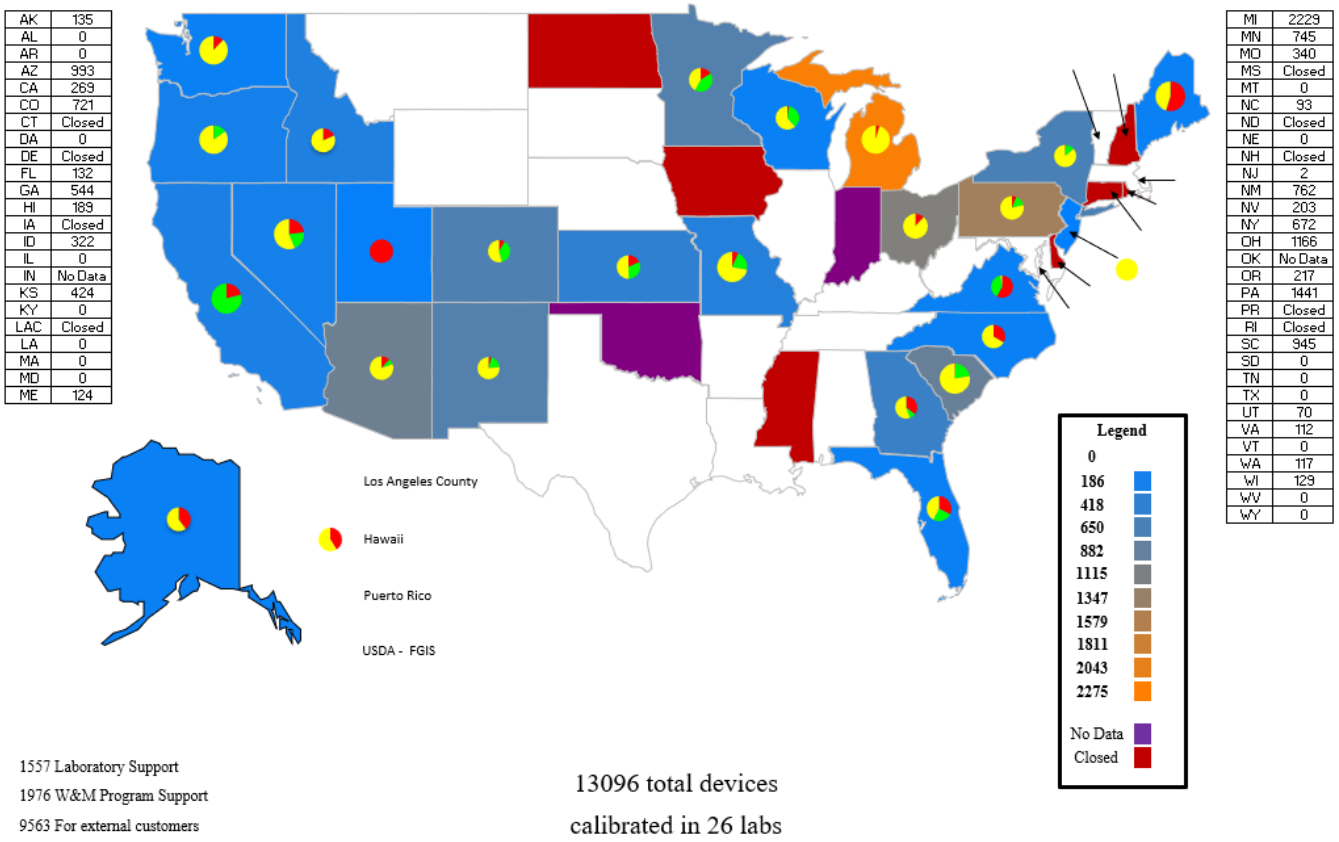
Year	# Labs	Total Devices
1996	38	37,662
1998	36	24,926
1999	35	25,807
2000	38	26,428
2002	37	25,847
2004	32	21,714
2005	32	20,541
2006	33	22,352
2008	32	25,371
2010	34	23,316
2012	30	18,222
2014	26	16,832
2016	27	11,723
2018	27	14,456
2020	26	12,083
2022	26	13,096

Table 8: 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.
- 15 % of all Mass II standards were calibrated for the weight and measures program.
- 73 % of all Mass II standards were calibrated for external customers.



1557 Laboratory Support
1976 W&M Program Support
9563 For external customers

13096 total devices
calibrated in 26 labs

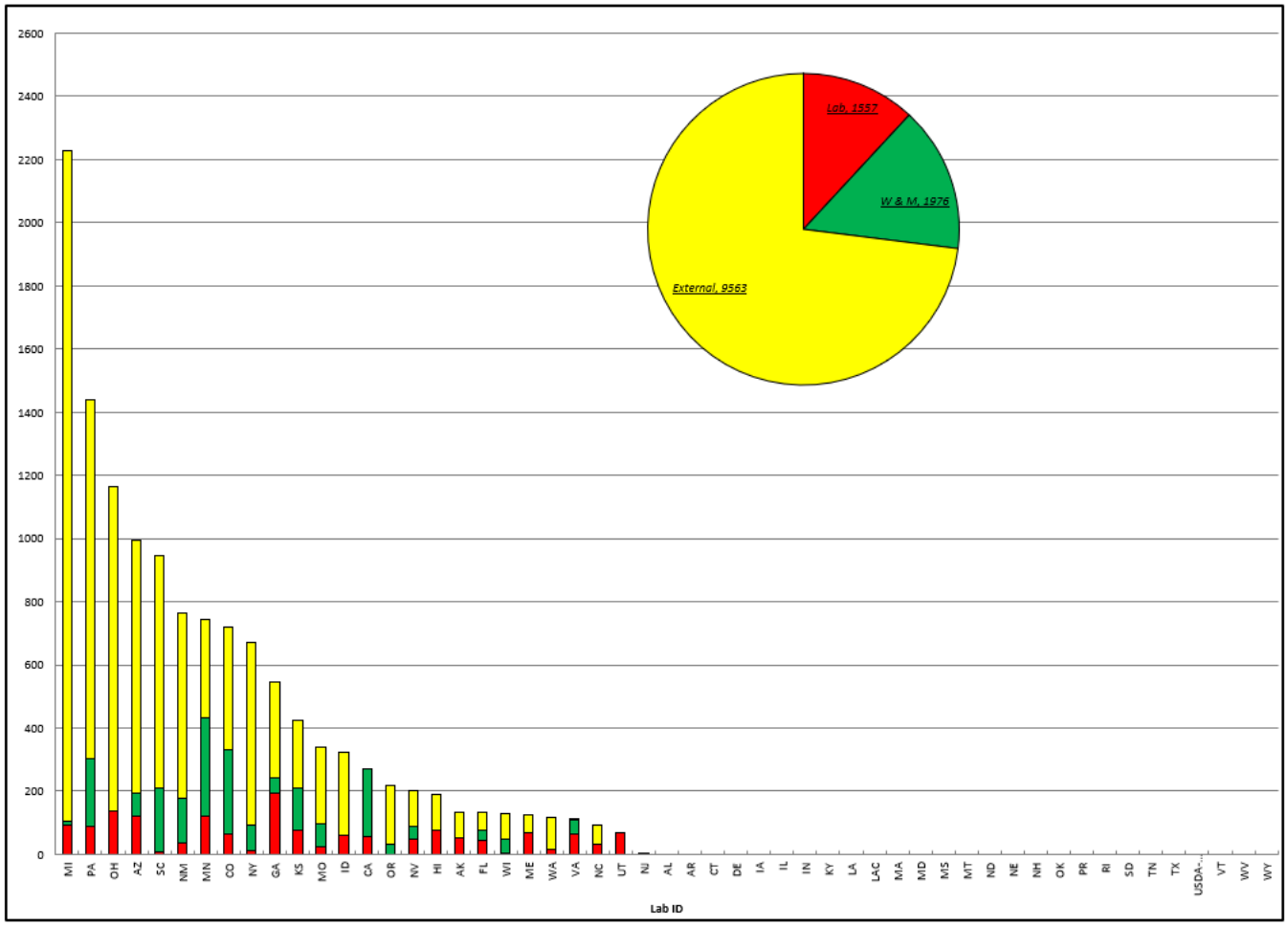


Figure 14: Mass Echelon II tests.

Mass Echelon III

Description

The graphs on the following page represent the total number of Mass Echelon III standards evaluated by the 42 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.

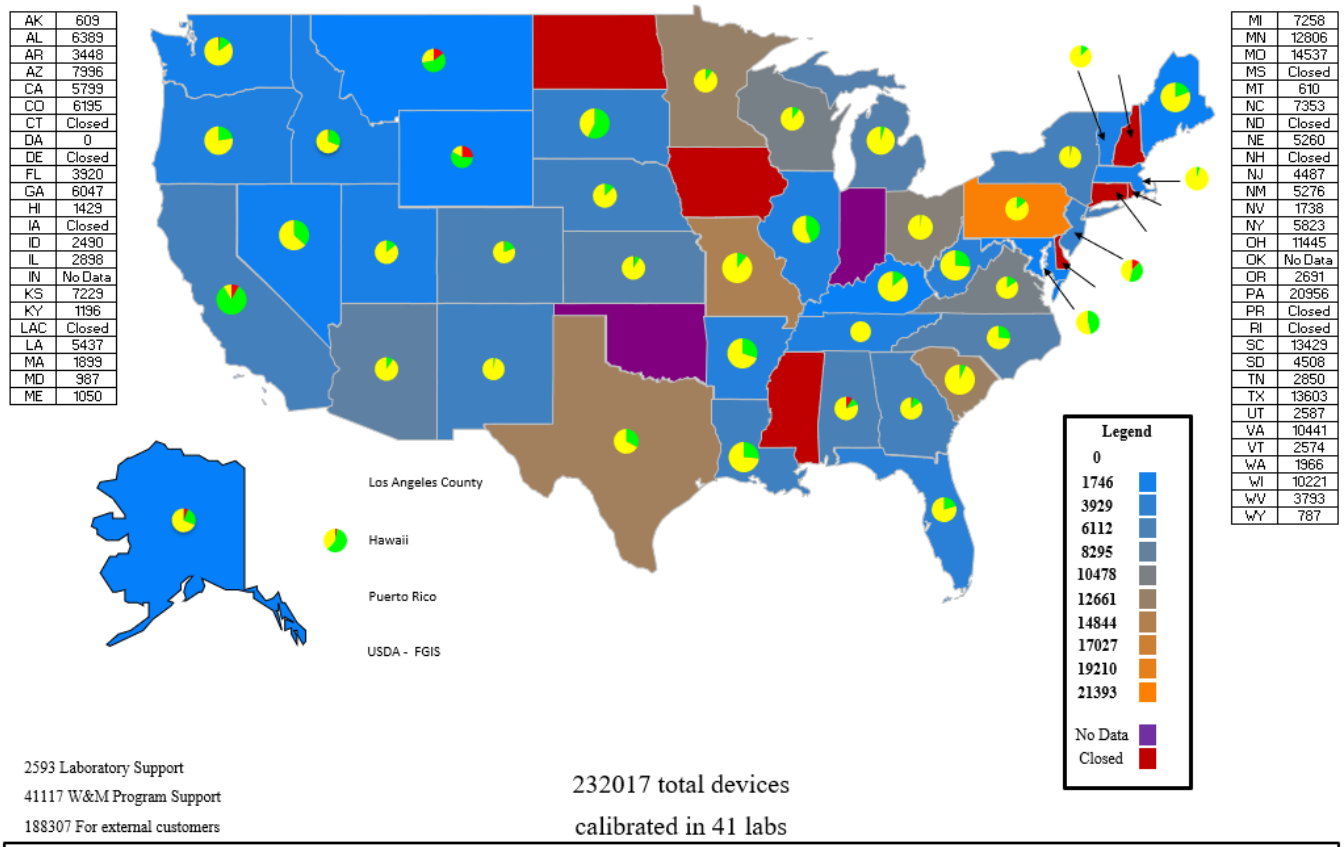
Comparison of previous surveys

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
2020	44	245,846
2022	41	232,017

Table 9: Echelon III tests reported on previous surveys.

Notes and Comments

- 1 % 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.



2593 Laboratory Support
41117 W&M Program Support
188307 For external customers

232017 total devices
calibrated in 41 labs

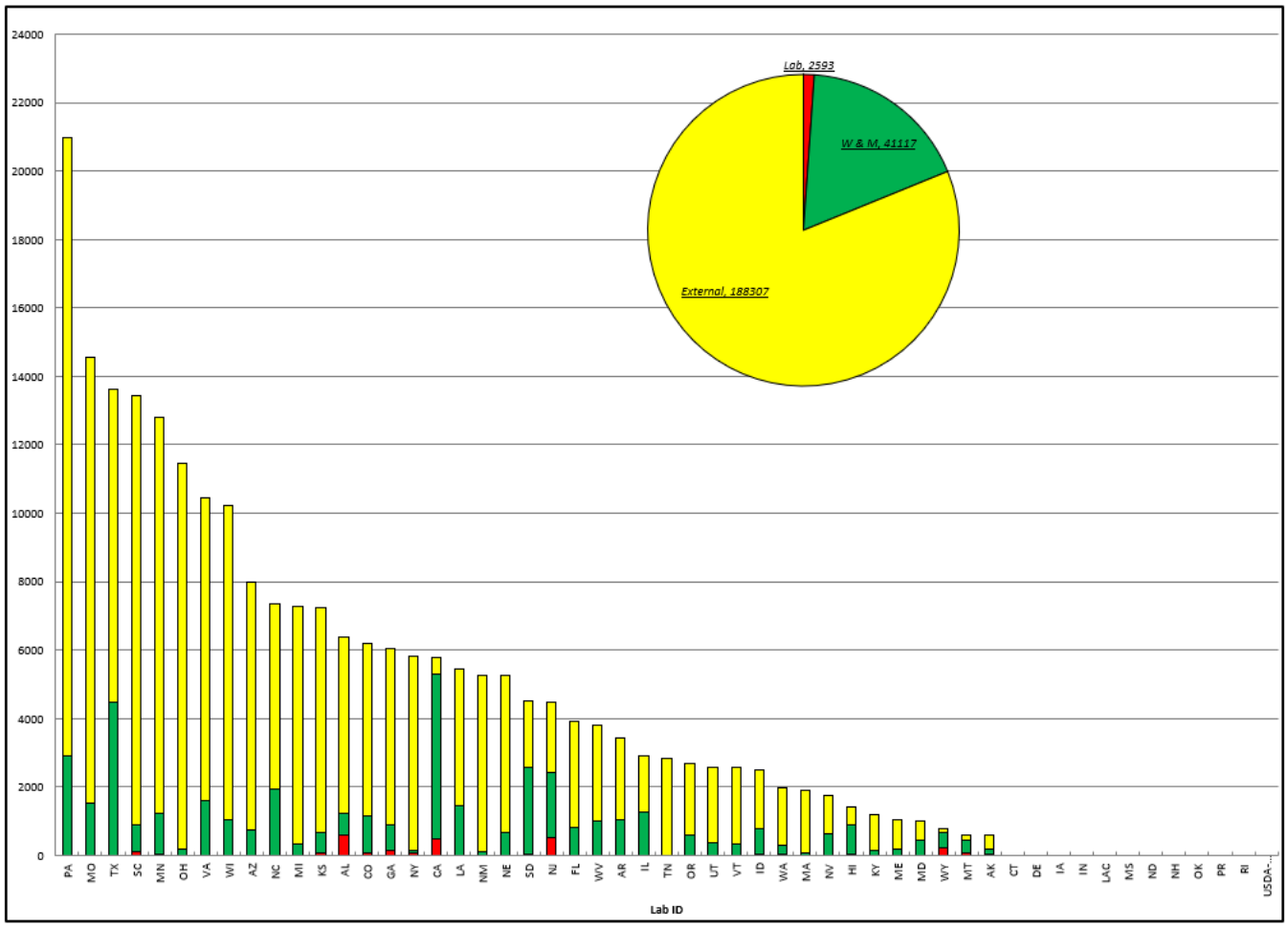


Figure 15: Mass Echelon III tests.

Weight Carts

Description

The graphs on the following page represent the total number of weight carts evaluated by the 42 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.

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
2020	29	587
2022	29	646

Table 10: Weight Cart tests reported on previous surveys.

Notes and Comments

- <1 % of all weight carts were calibrated for internal use by the laboratory.
- 17 % of all weight carts were calibrated for the weight and measures program.
- 83 % of all weight carts were calibrated for external customers.

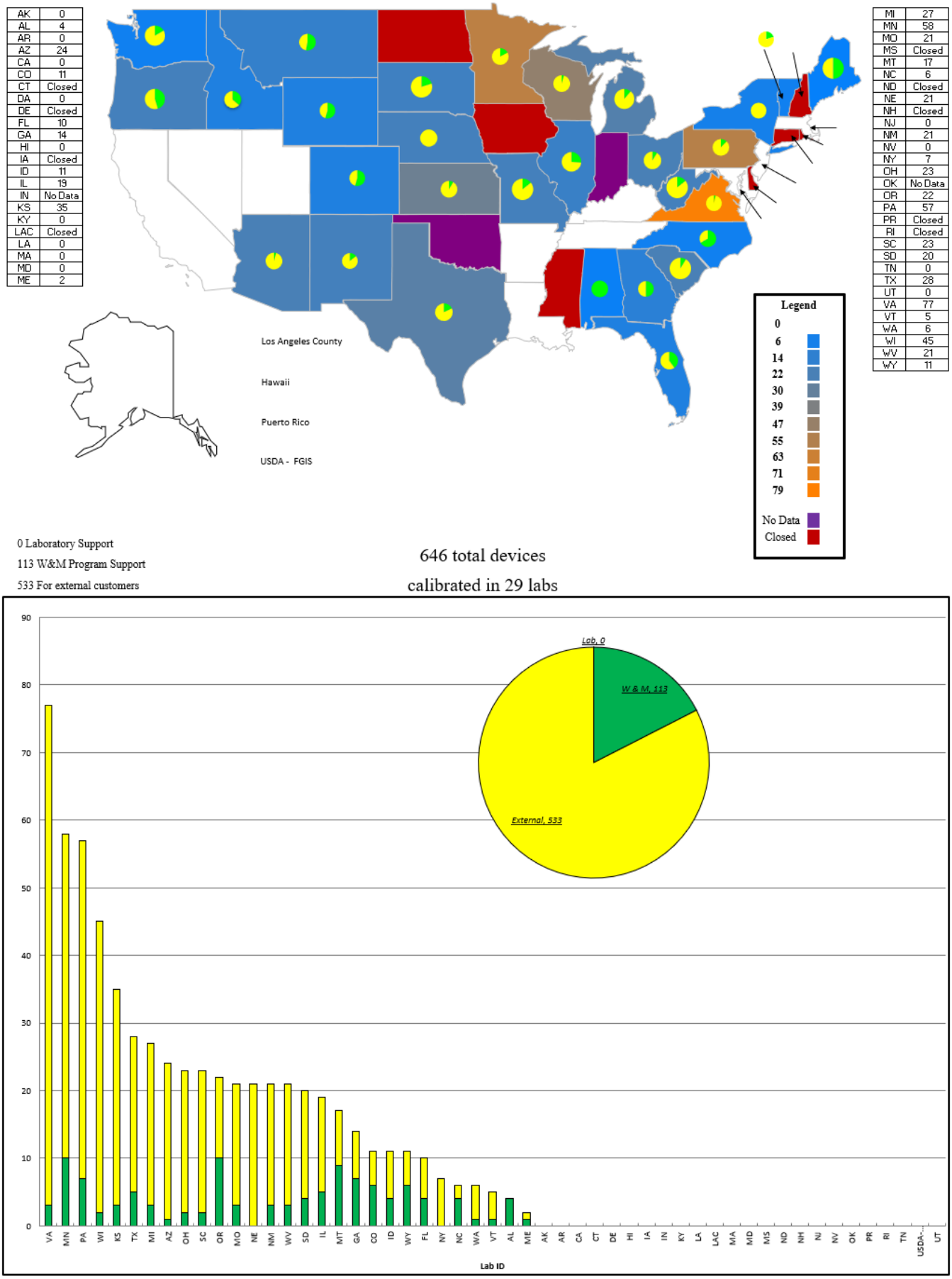


Figure 16: Weight Cart tests.

Railroad Test Cars

Description

The graphs on the following page represent the total number of railroad test cars evaluated by the 42 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.

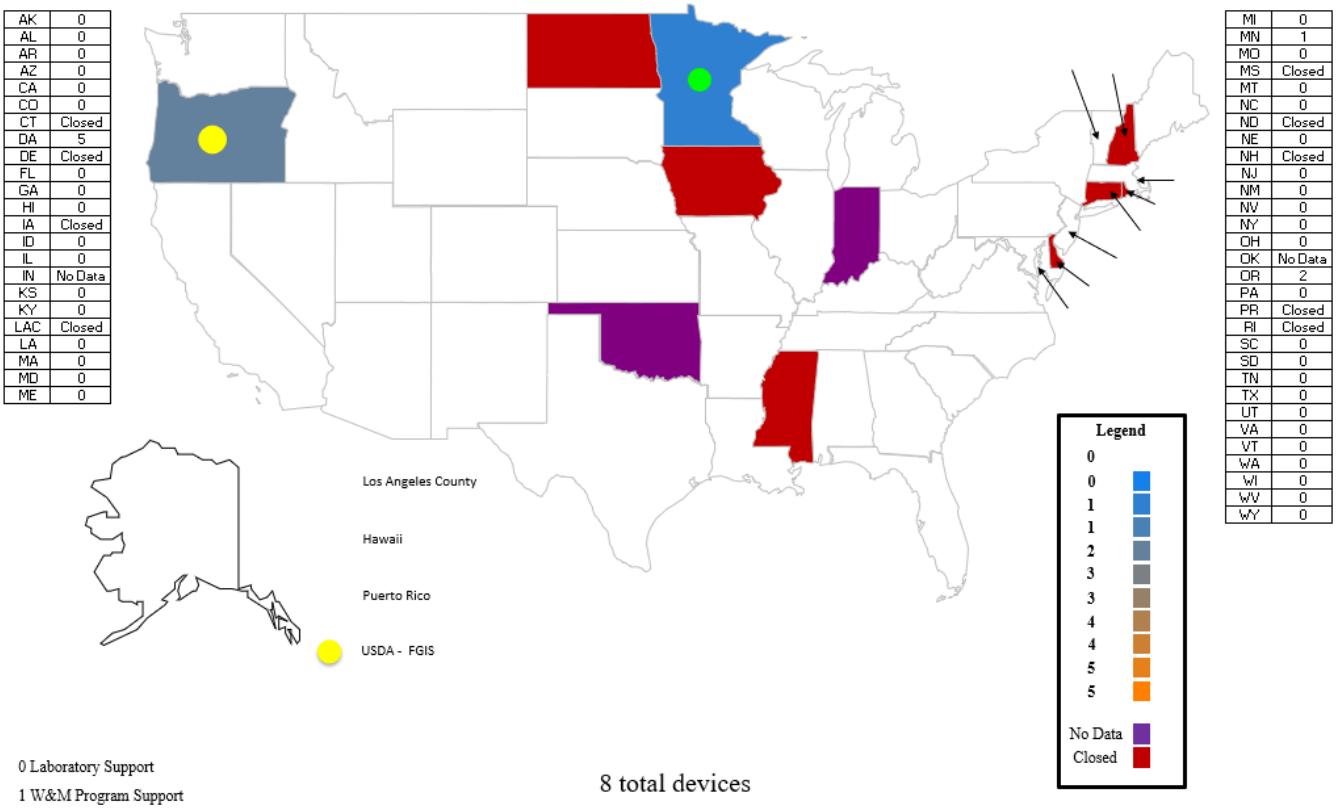
Comparison of previous surveys

Year	# Labs	Total Devices
2016	5	43
2018	3	16
2020	3	30
2022	3	8

Table 11: Railroad Test Car tests reported on previous surveys.

Notes and Comments

- 0 % of all railroad test cars were calibrated for internal use by the laboratory.
- 13% of all railroad test cars were calibrated for the weight and measures program.
- 83% of all railroad test cars were calibrated for external customers.



0 Laboratory Support
1 W&M Program Support
7 For external customers

8 total devices
calibrated in 3 labs

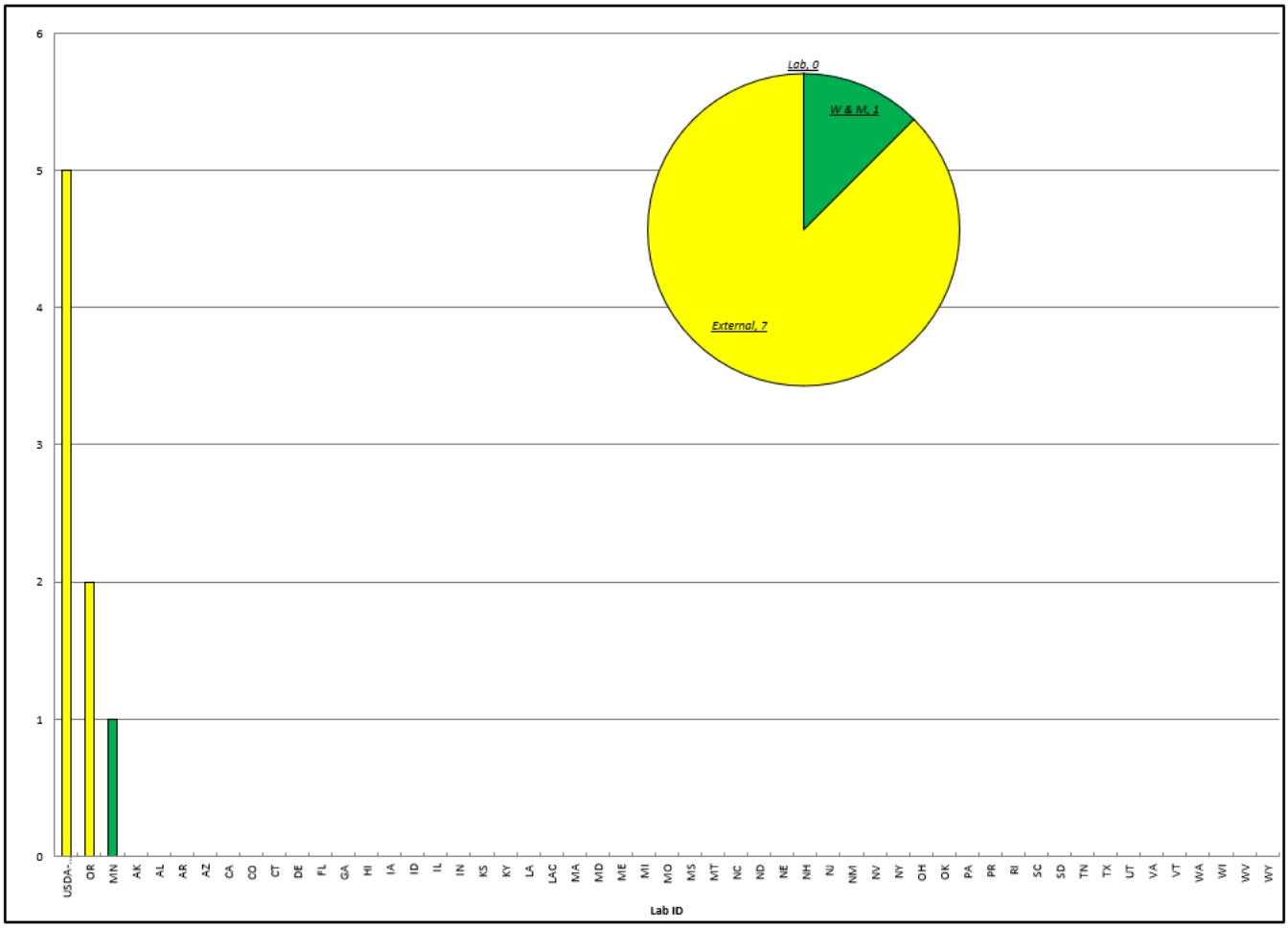


Figure 17: Railroad Test Car tests.

Railroad Specific Weight Carts

Description

The graphs on the following page represent the total number of railroad specific weight carts evaluated by the 42 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.

Comparison of previous surveys

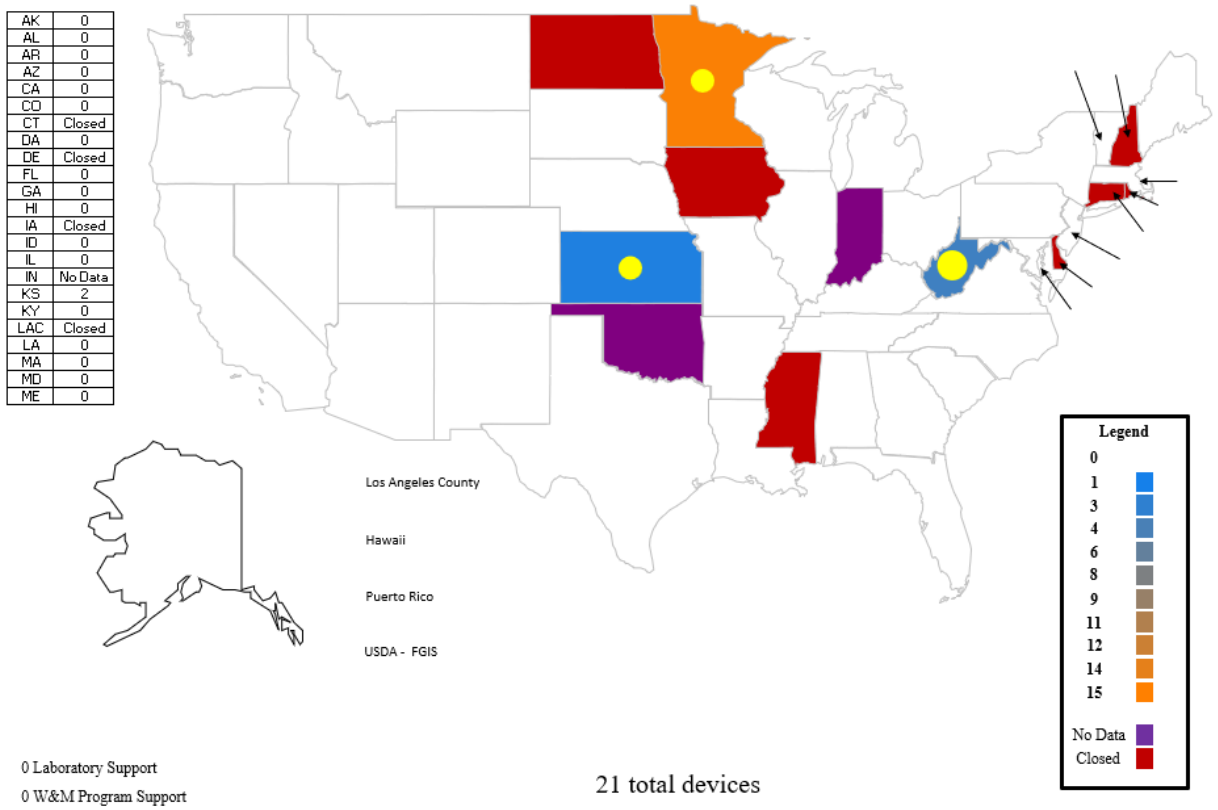
Year	# Labs	Total Devices
2016	5	13
2018	7	33
2020	3	8
2022	3	21

Table 12: Railroad Specific Weight Carts tests reported on previous surveys.

Notes and Comments

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

AK	0
AL	0
AR	0
AZ	0
CA	0
CO	0
CT	Closed
DA	0
DE	Closed
FL	0
GA	0
HI	0
IA	Closed
ID	0
IL	0
IN	No Data
KS	2
KY	0
LAC	Closed
LA	0
MA	0
MD	0
ME	0



MI	0
MN	15
MO	0
MS	Closed
MT	0
NC	0
ND	Closed
NE	0
NH	Closed
NJ	0
NM	0
NV	0
NY	0
OH	0
OK	No Data
OR	0
PA	0
PR	Closed
RI	Closed
SC	0
SD	0
TN	0
TX	0
UT	0
VA	0
VT	0
WA	0
WI	0
WV	4
WY	0

0 Laboratory Support
0 W&M Program Support
21 For external customers

21 total devices
calibrated in 3 labs

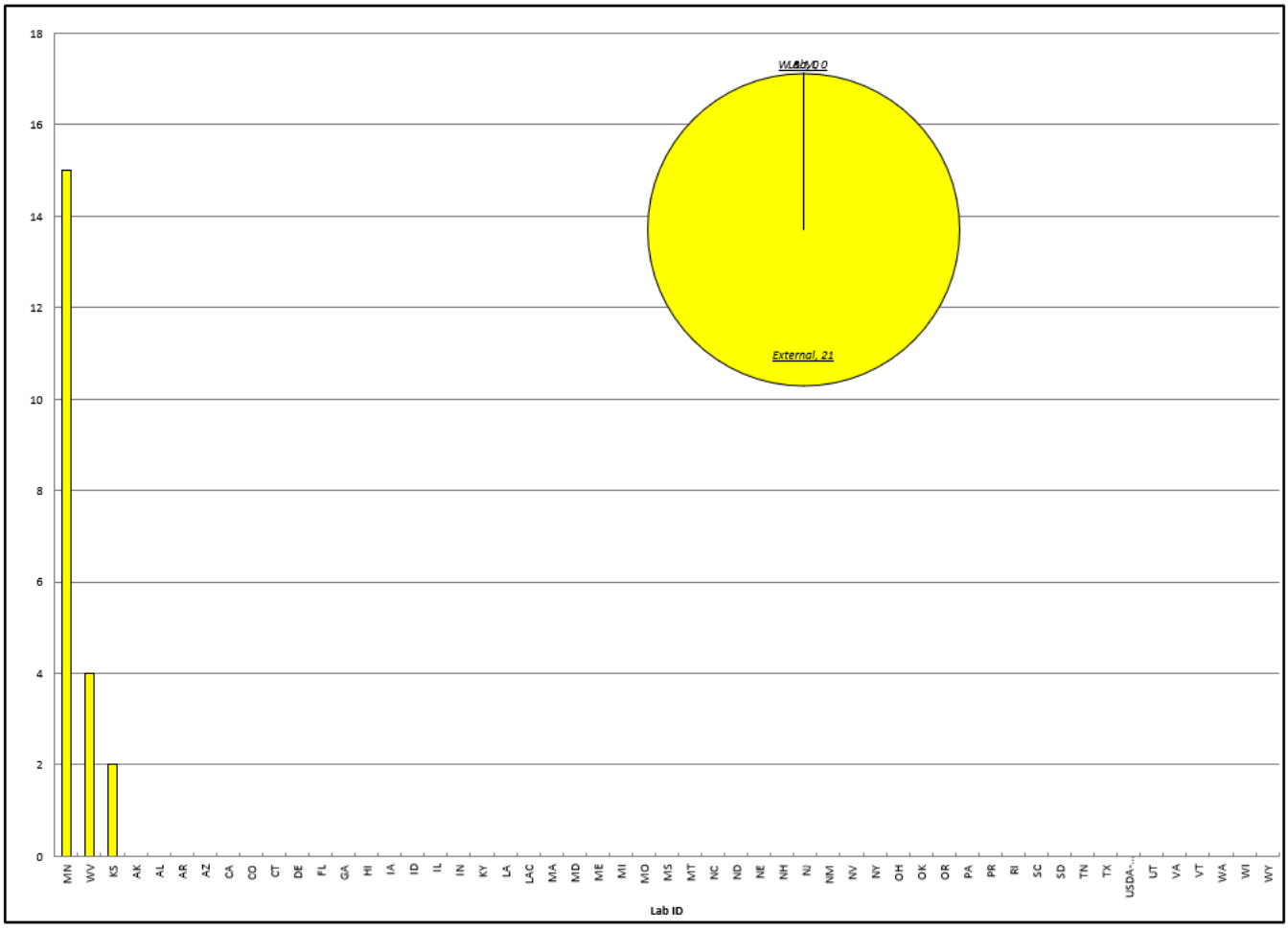


Figure 18: Railroad Specific Weight Cart tests.

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 42 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.

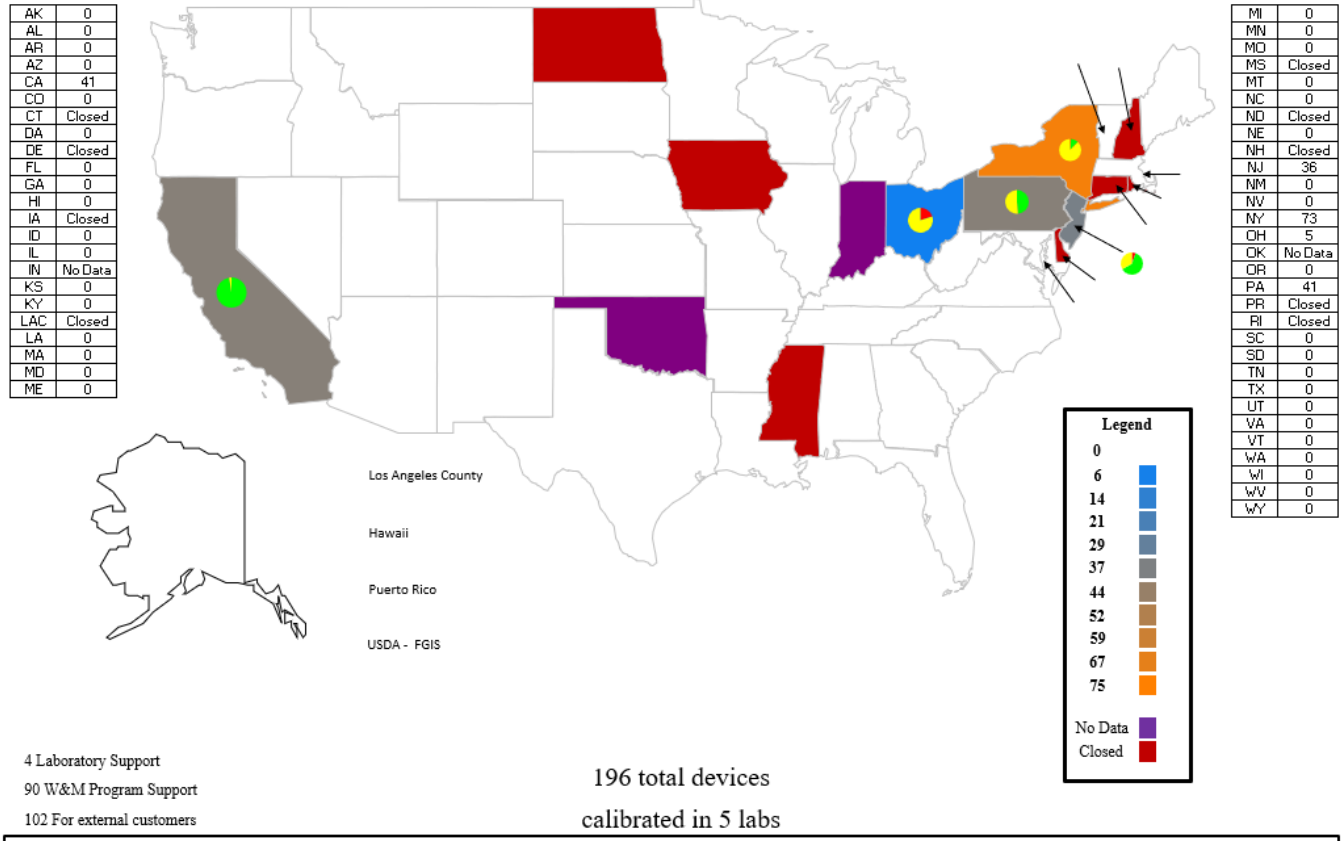
Comparison of previous surveys

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
2020	5	226
2022	5	196

Table 13: Tape measure tests reported on previous surveys.

Notes and Comments

- 2 % of all tape measures were tested for internal use by the laboratory.
- 46 % of all tape measures were tested for the weight and measures program.
- 52 % of all tape measures were tested for external customers.



4 Laboratory Support
90 W&M Program Support
102 For external customers

196 total devices
calibrated in 5 labs

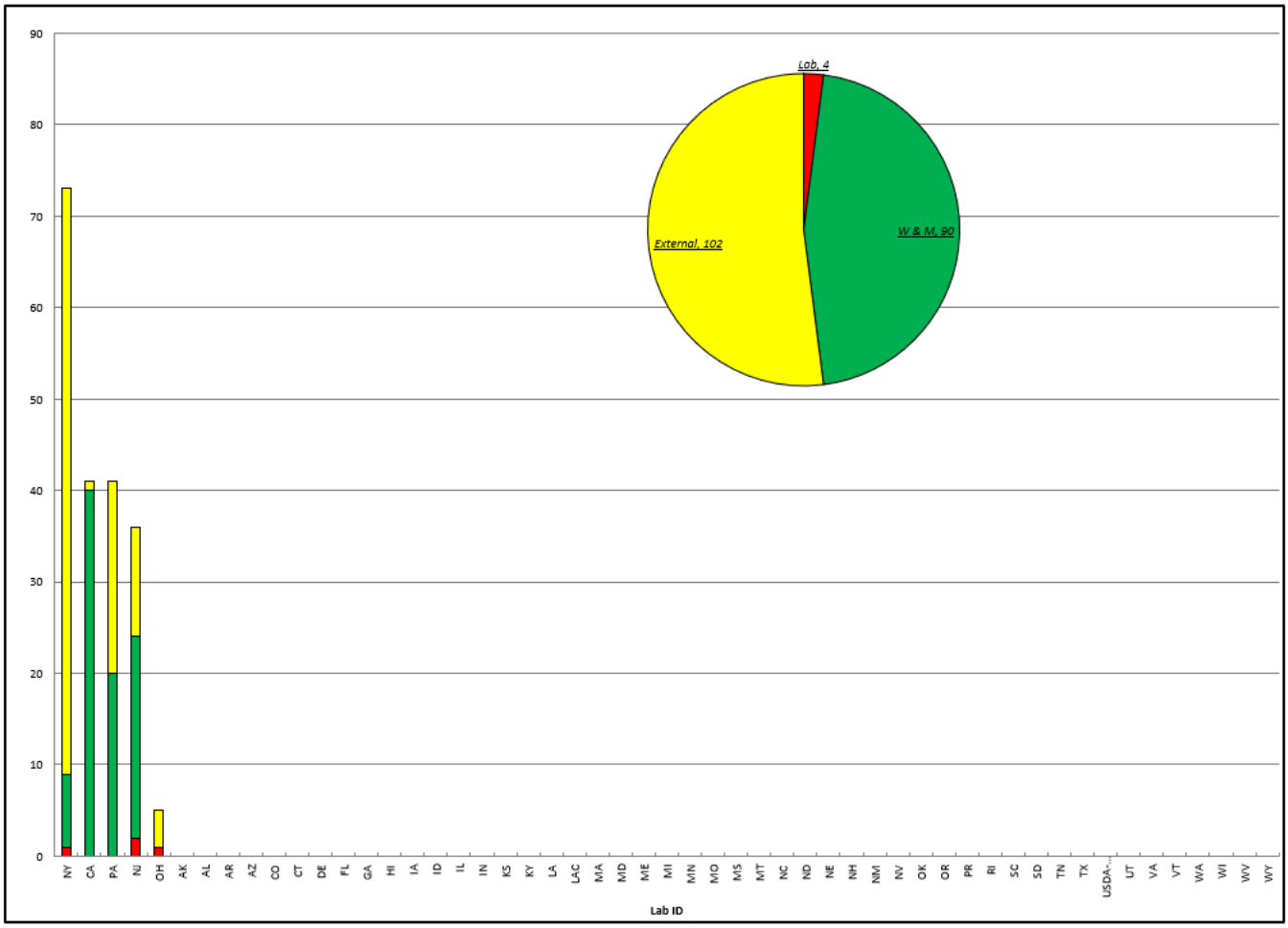


Figure 19: Tape Measure tests.

Rigid Rules

Description

The graphs on the following page represent the total number of rigid rules evaluated by the 42 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.

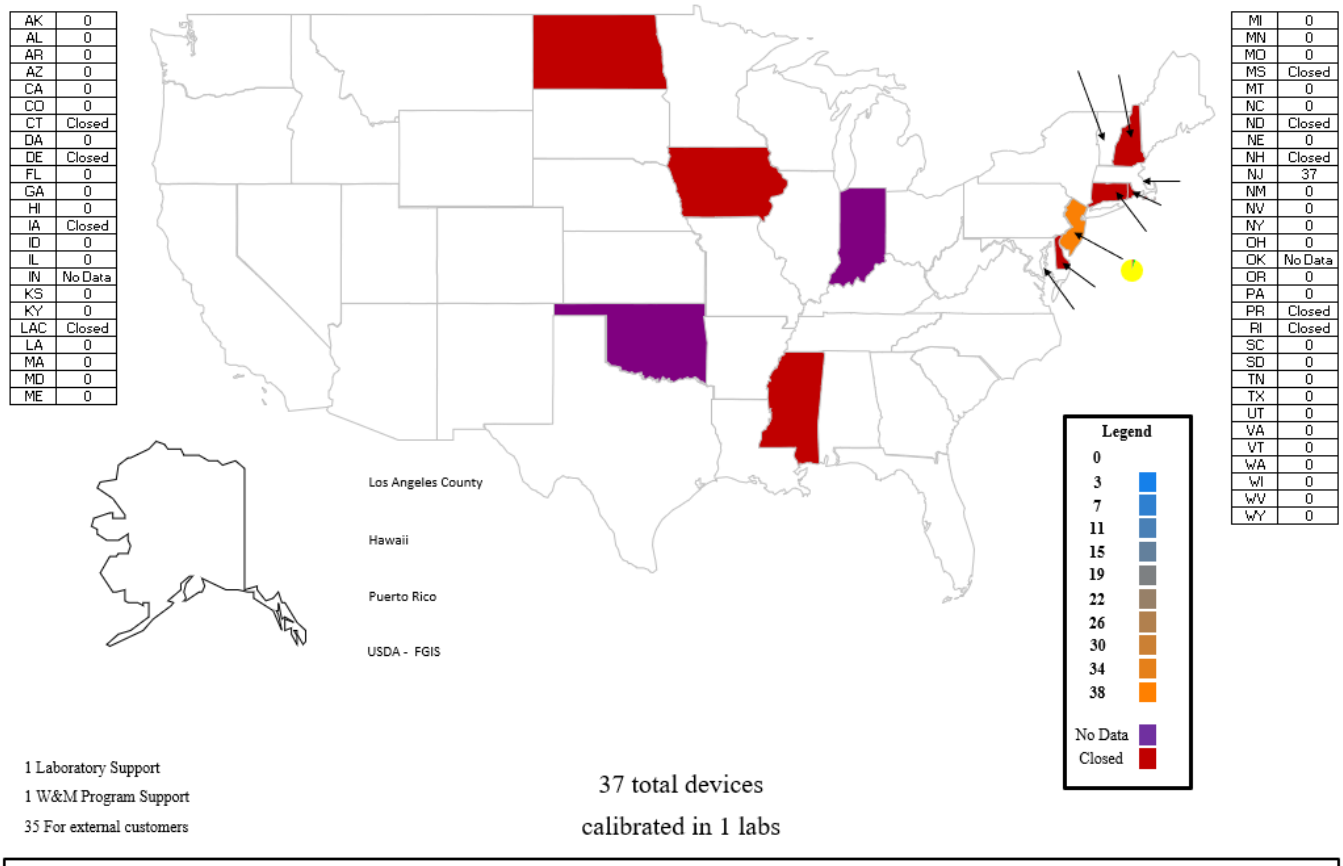
Comparison of previous surveys

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
2020	3	30
2022	1	37

Table 14: Rigid rule tests reported in previous surveys.

Notes and Comments

- 3 % of all rigid rules were tested for internal use by the laboratory.
- 3 % of all rigid rules were tested for the weight and measures program.
- 94 % of all rigid rules were tested for external customers.



1 Laboratory Support
1 W&M Program Support
35 For external customers

37 total devices
calibrated in 1 labs

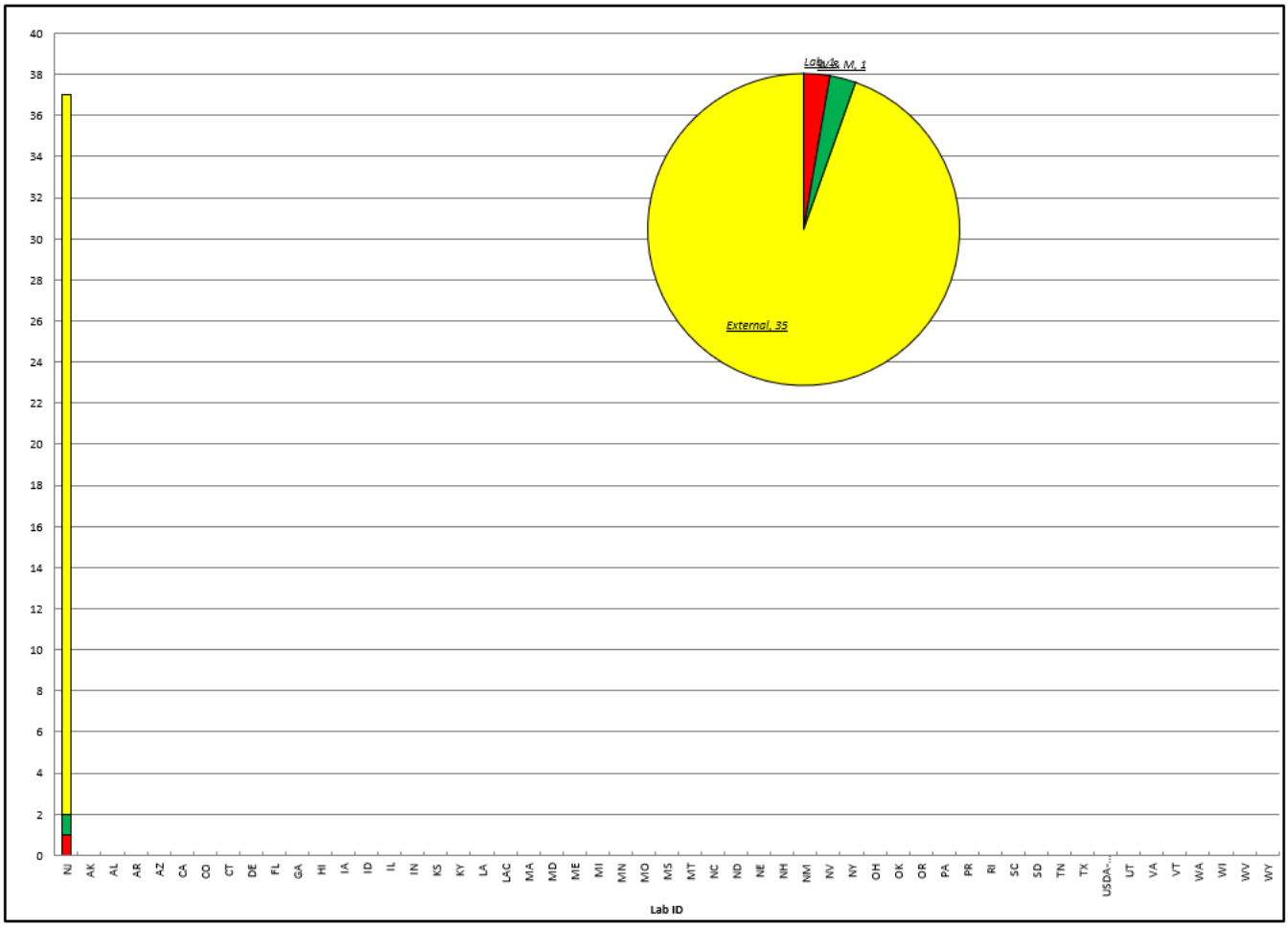


Figure 20: Rigid rule tests.

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 42 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.

Comparison of previous surveys

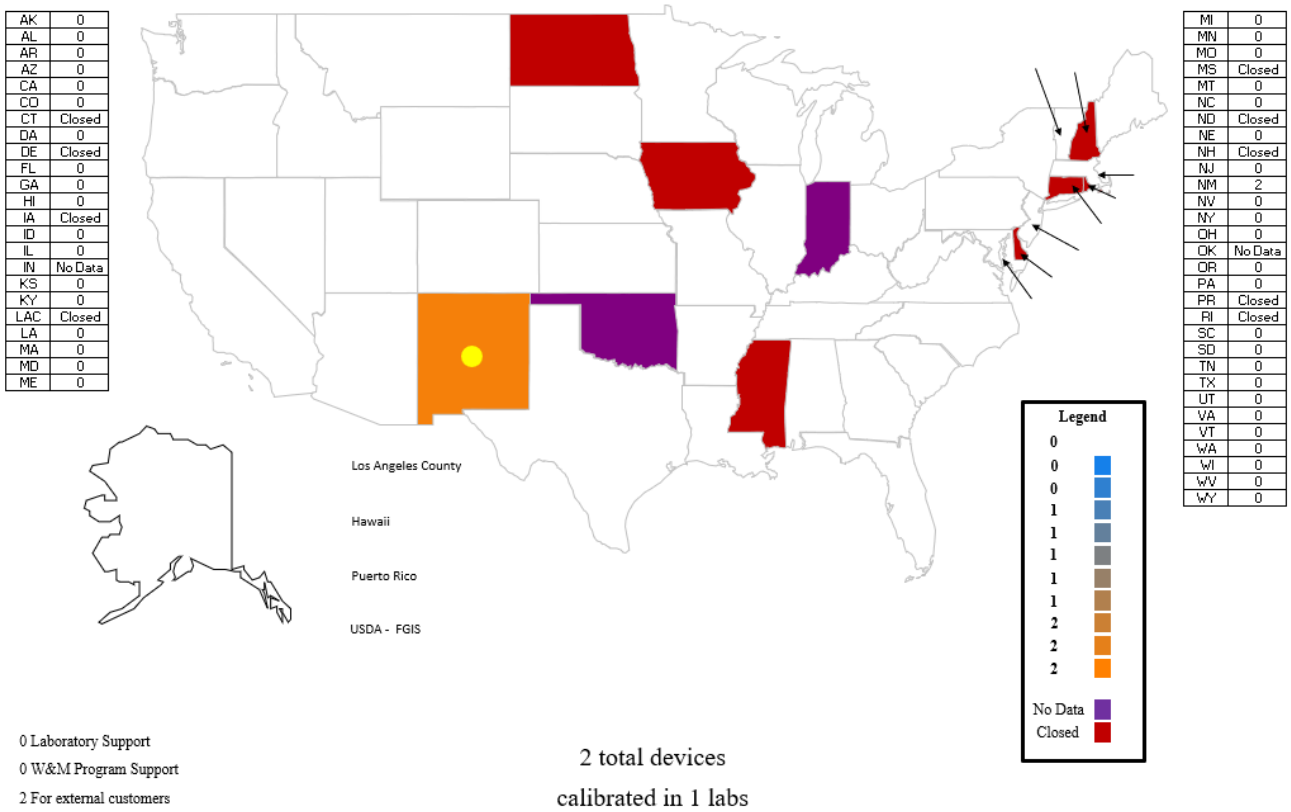
Year	# Labs	Volume Transfer	Gravimetric	Total
1996	29			1,205
1998	24			844
1999	25			853
2000	27			668
2002	24			555
2004	17			332
2005	20	69	140	209
2006	18	82	172	254
2008	18	42	183	225
2010	16	43	288	331
2010	16	43	288	331
2012	8	170	78	248
2014	9	124	119	243
2016	10	6	75	81
2018	9	0	104	104
2020	9	0	189	189
2022	6	2	100	102

Table 15: Glassware calibrations from previous surveys.

Notes and Comments

- 43 % of all glassware standards were tested for the laboratory
- 35 % of all glassware standards were tested for Weights and Measures enforcement programs.
- 22 % of all glassware standards were tested for external customers.

Volume Transfer



0 Laboratory Support
0 W&M Program Support
2 For external customers

2 total devices
calibrated in 1 labs

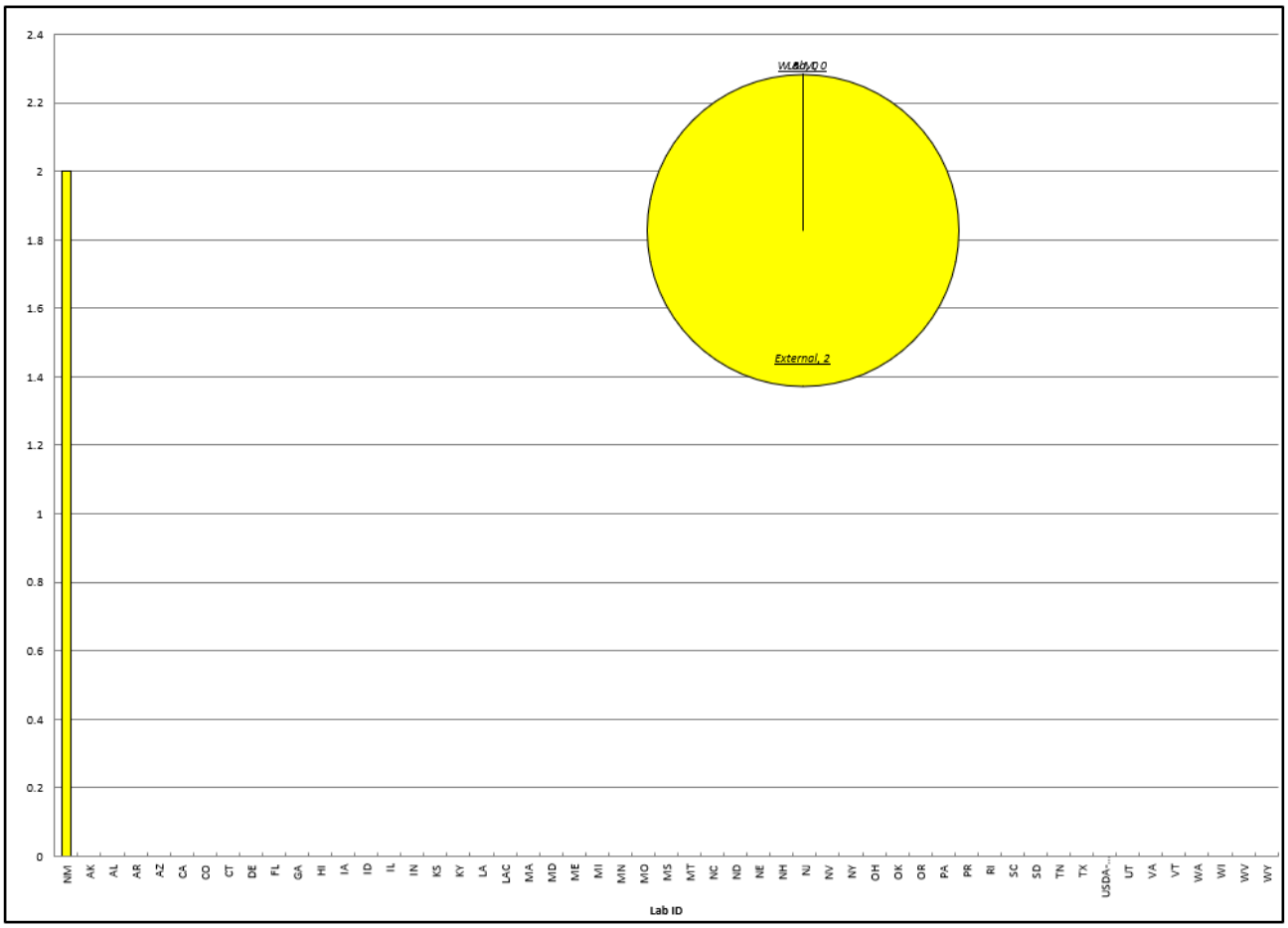
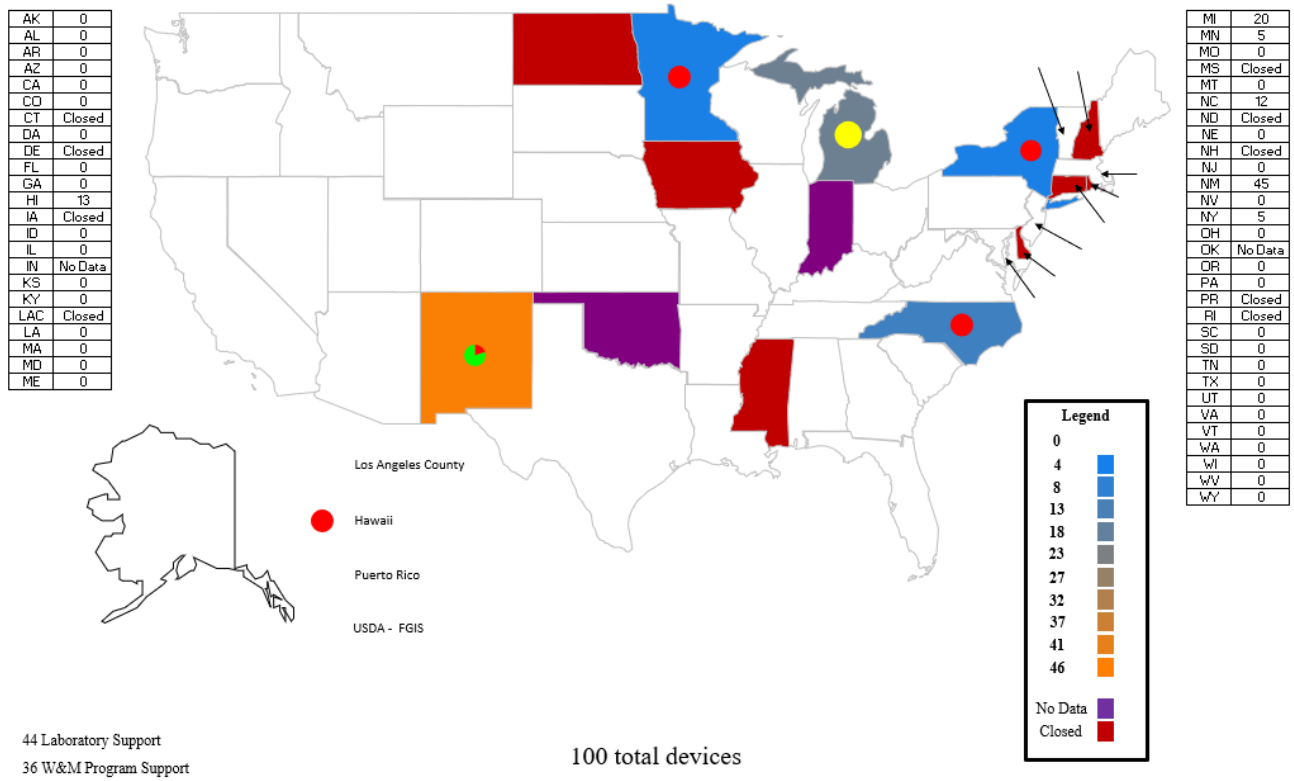


Figure 21: Glassware calibrations, volume transfer method

Gravimetric



44 Laboratory Support
36 W&M Program Support
20 For external customers

100 total devices
calibrated in 6 labs

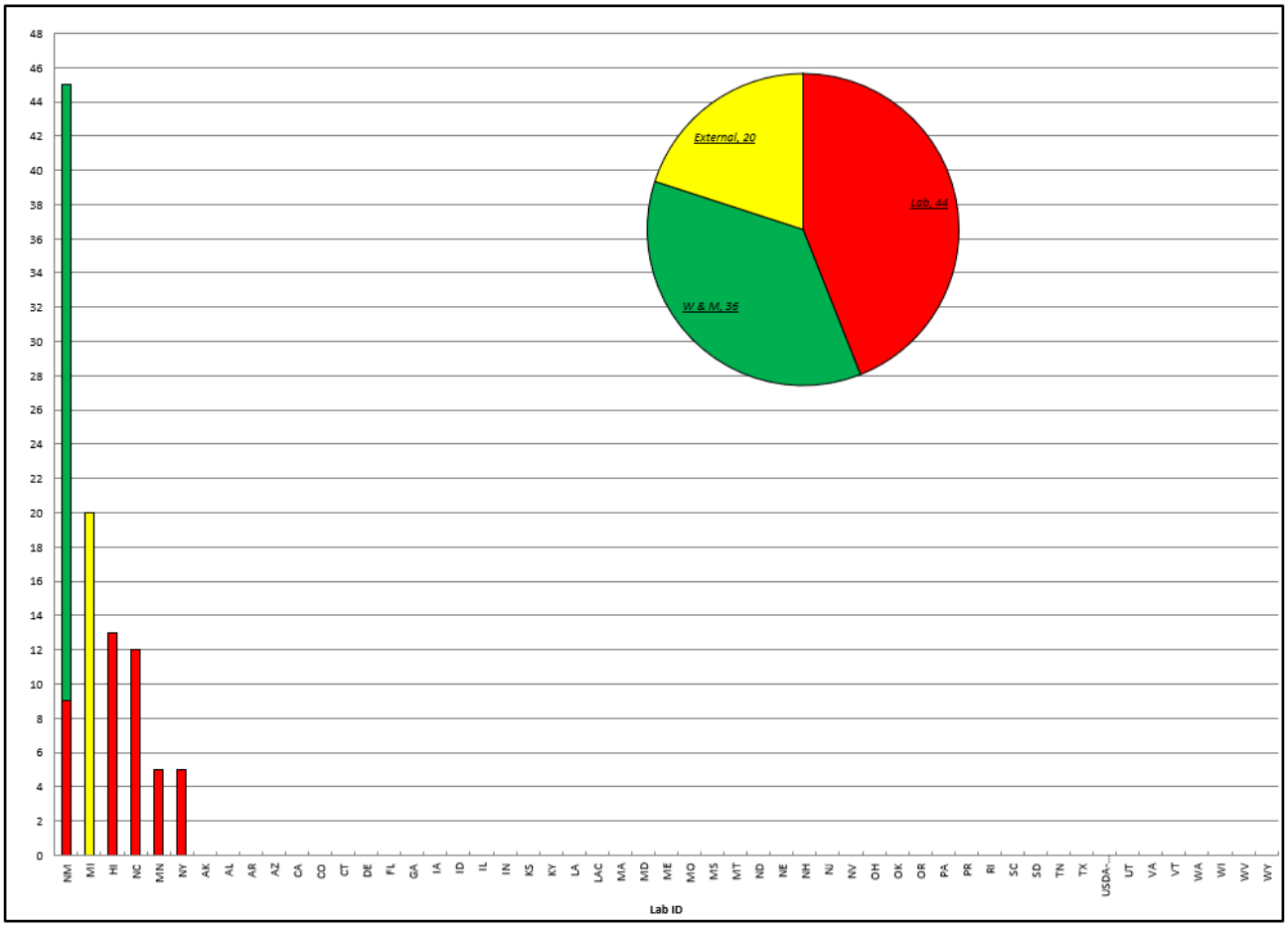


Figure 22: Glassware calibrations, gravimetric method.

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 42 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.

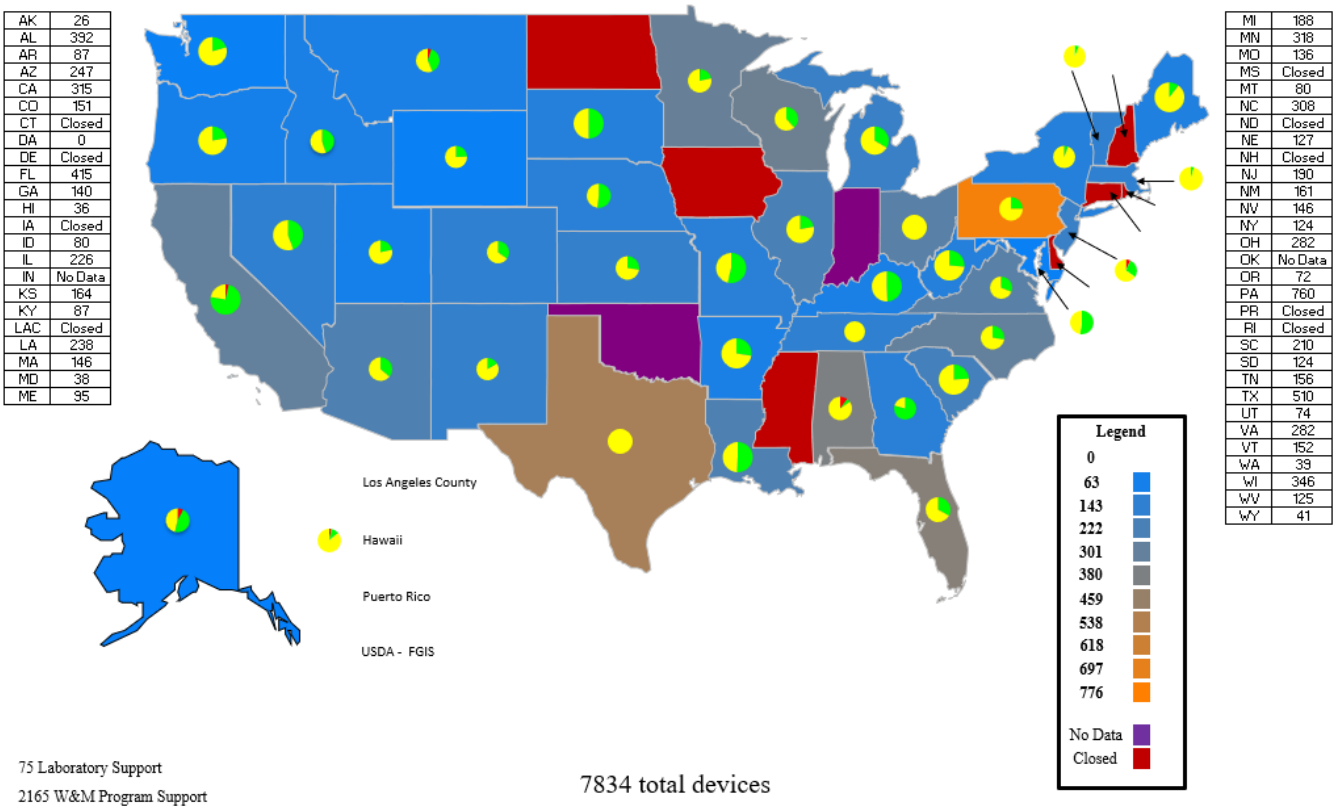
Comparison of previous surveys

Year	# Labs	Volume Transfer	Gravimetric	Total
1996	48	8,290		8,290
1998	46	6,861		6,861
1999	45	6,986		6,986
2000	45	7,368		7,368
2002	48	6,966		6,966
2004	46	6,400		6,400
2005	42	6,925	75	7,000
2006	46	7,532	77	7,609
2008	49	7,321	69	7,390
2010	45	8,216	73	8,289
2012	46	7,533	93	7,626
2014	46	7,863	128	7,991
2016	46	7,926	84	8,010
2018	44	8,308	74	8,341
2020	43	7,265	53	7,318
2022	41	7,834	53	7,887

Table 16: Test Measure (5 ≤ gal.) volume tests from previous surveys.

Notes and Comments

- 1 % of all test measures were tested for the laboratory.
- 28 % of all test measures were tested for Weights and Measures enforcement programs.
- 71 % of all test measures were tested for external customers.



75 Laboratory Support
2165 W&M Program Support
5594 For external customers

7834 total devices
calibrated in 41 labs

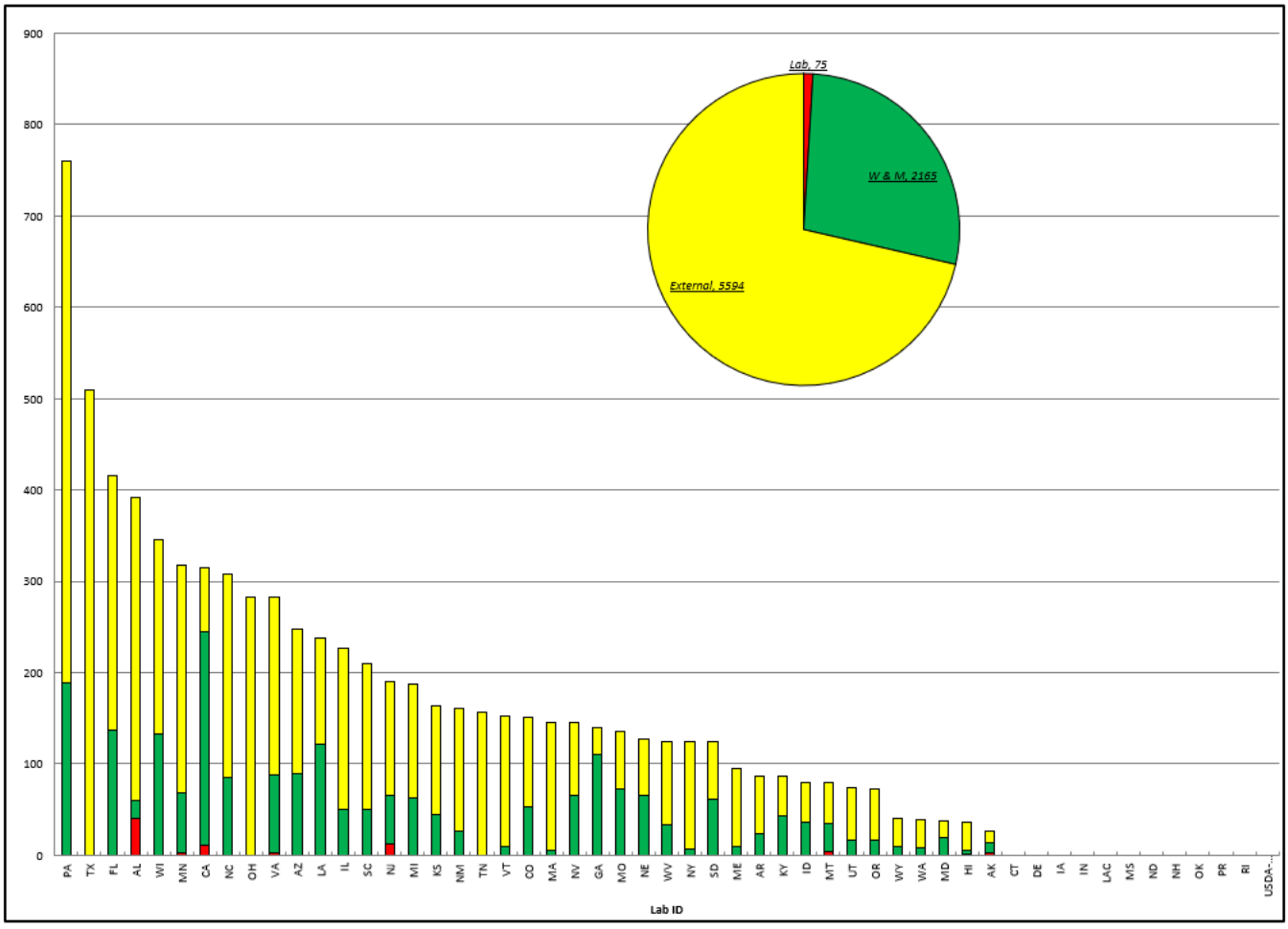
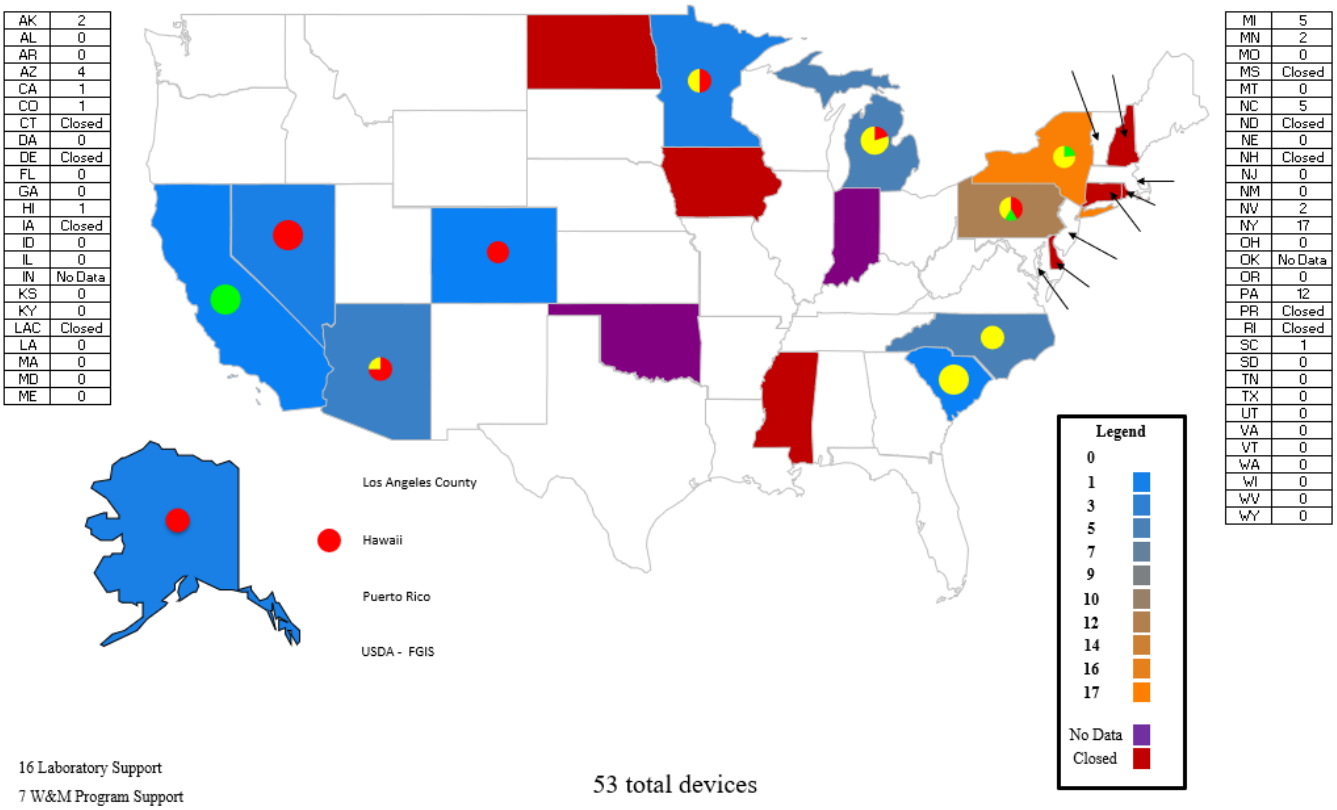


Figure 23: Test Measure tests (≤5 gallon), volume transfer.



16 Laboratory Support
7 W&M Program Support
30 For external customers

53 total devices
calibrated in 12 labs

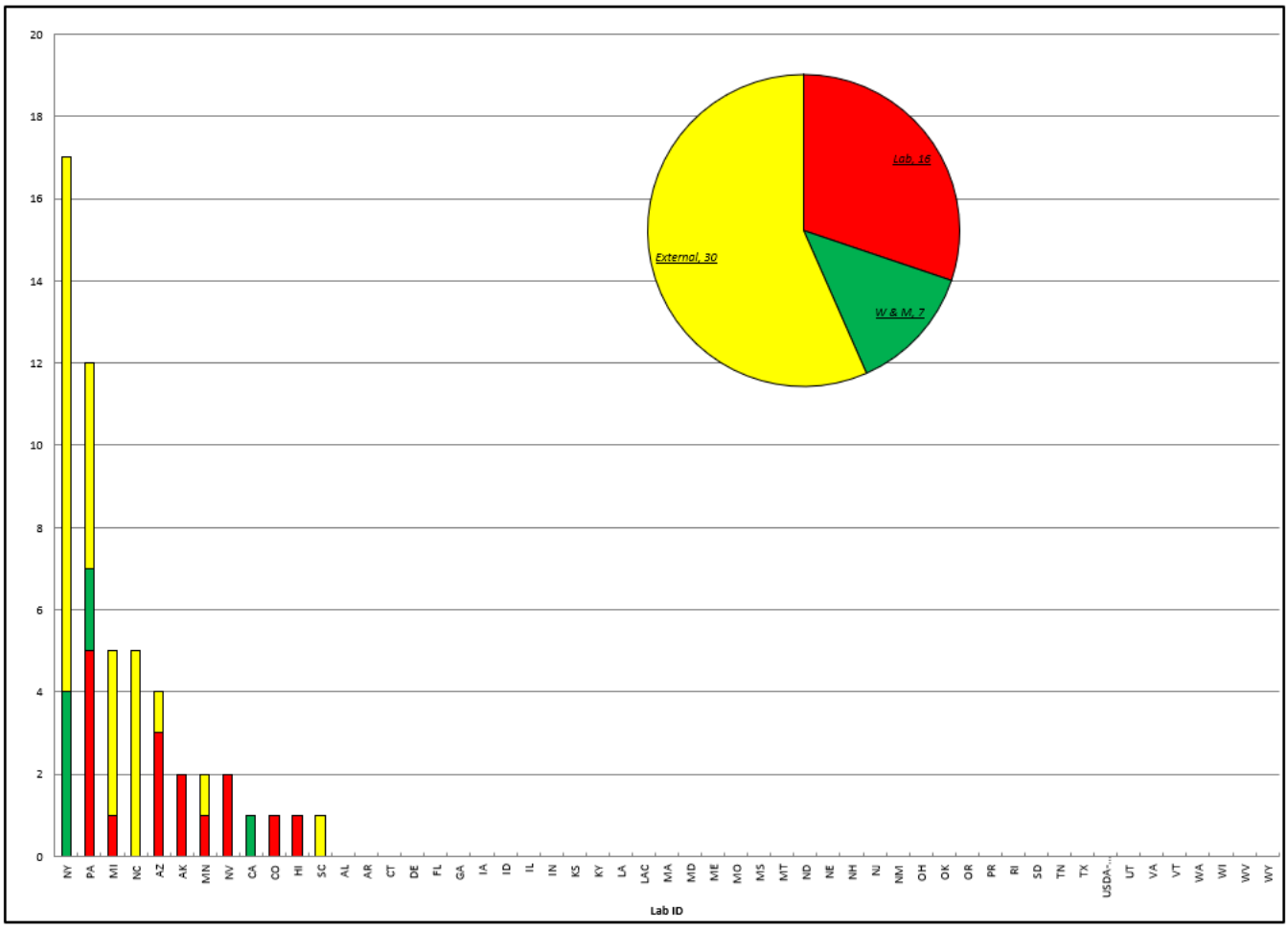


Figure 24: Test Measure tests (≤5 gallon), gravimetric.

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 42 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.

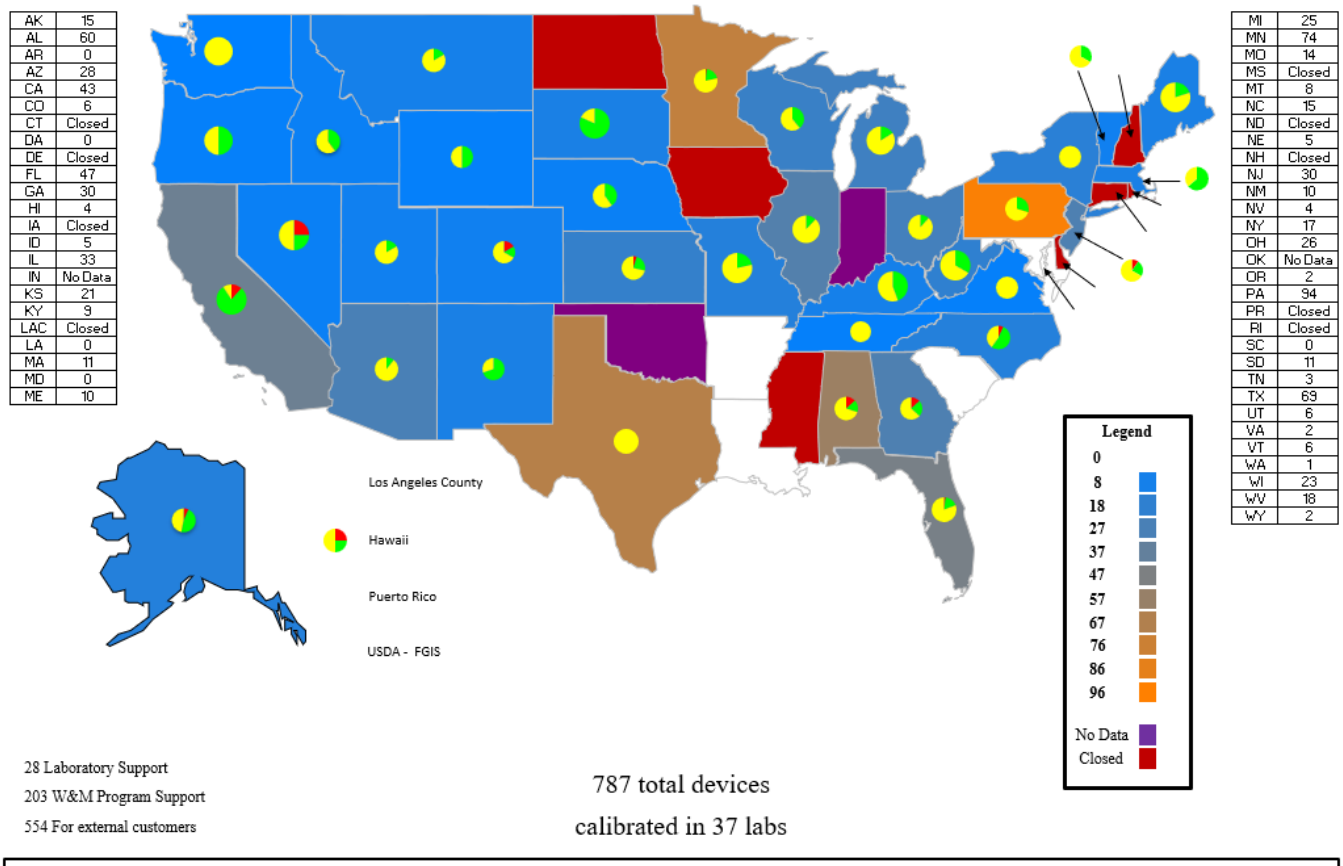
Comparison of previous surveys

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
2020	37	757	33	790
2022	37	785	76	861

Table 17: Provers (>5 gal. and ≤ 100 gal.) volume tests from previous surveys.

Notes and Comments

- 5 % of all provers (> 5 gal. and ≤ 100 gal.) were tested for the laboratory
- 24 % of all provers (> 5 gal. and ≤ 100 gal.) were tested for Weights and Measures enforcement programs.
- 71 % of all provers (> 5 gal. and ≤ 100 gal.) were tested for external customers.



28 Laboratory Support
203 W&M Program Support
554 For external customers

787 total devices
calibrated in 37 labs

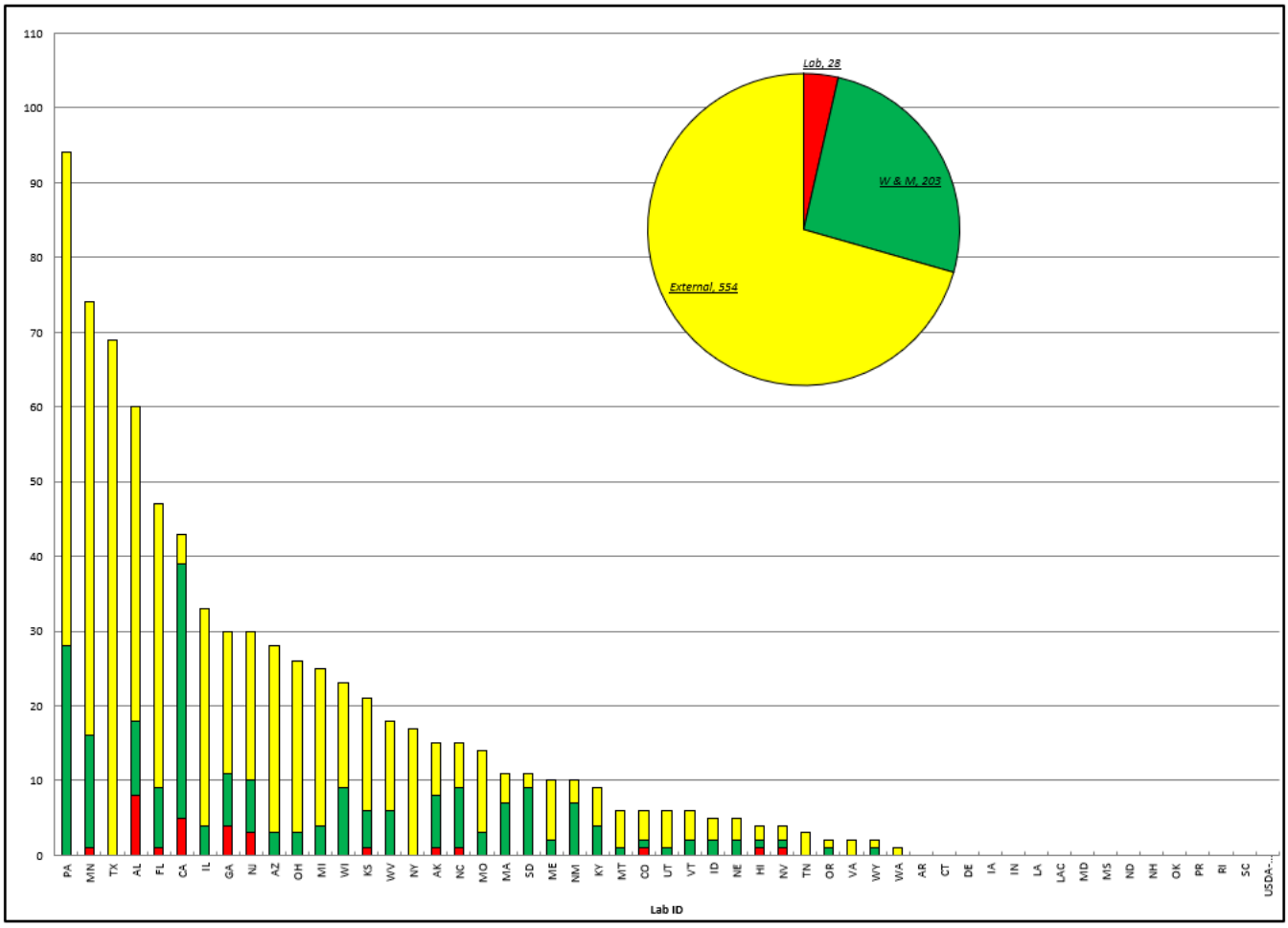
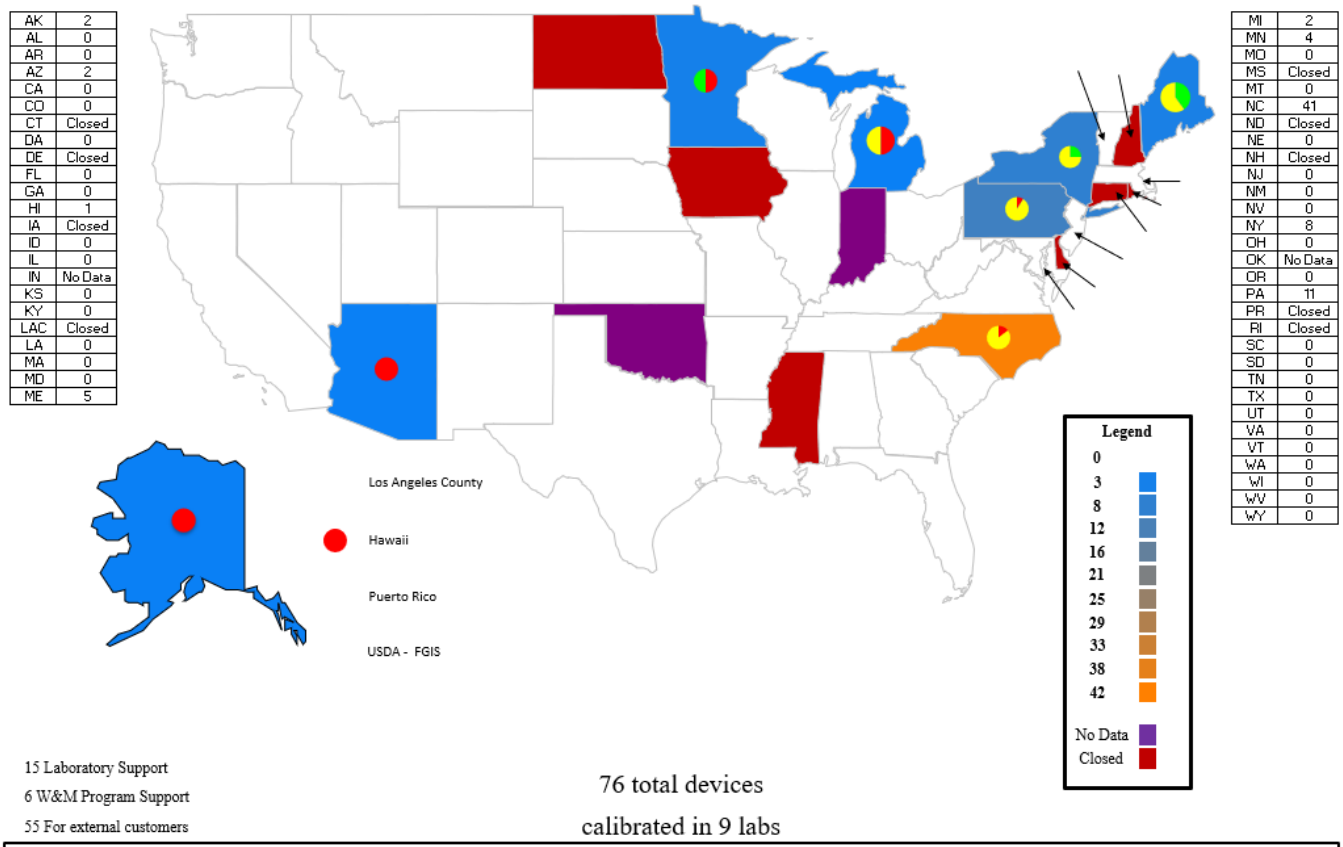


Figure 25: Prover (≥5 gal. and < 100 gal.) tests, volume transfer.

AK	2
AL	0
AR	0
AZ	2
CA	0
CO	0
CT	Closed
DA	0
DE	Closed
FL	0
GA	0
HI	1
IA	Closed
ID	0
IL	0
IN	No Data
KS	0
KY	0
LAC	Closed
LA	0
MA	0
MD	0
ME	5

MI	2
MN	4
MO	0
MS	Closed
MT	0
NC	41
ND	Closed
NE	0
NH	Closed
NJ	0
NM	0
NV	0
NY	8
OH	0
OK	No Data
OR	0
PA	11
PR	Closed
RI	Closed
SC	0
SD	0
TN	0
TX	0
UT	0
VA	0
VT	0
WA	0
WI	0
WV	0
WY	0



15 Laboratory Support
6 W&M Program Support
55 For external customers

76 total devices
calibrated in 9 labs

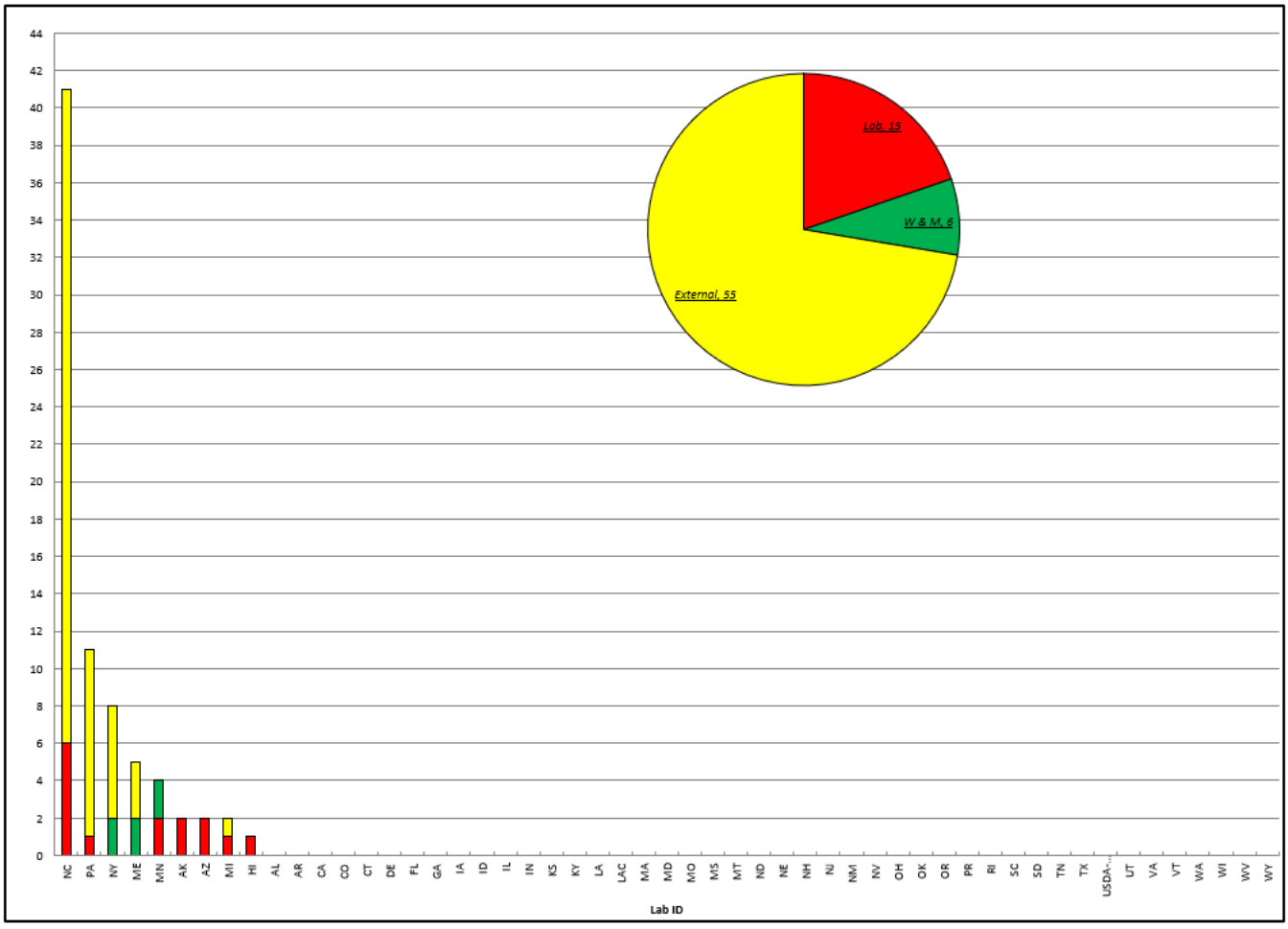


Figure 26: Prover (≥5 gal. and < 100 gal.) tests, gravimetric.

Provers (> 100 gallon)

Description

The graphs on the next two pages represent the total number of volume measurements performed on volumetric provers by the 42 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.

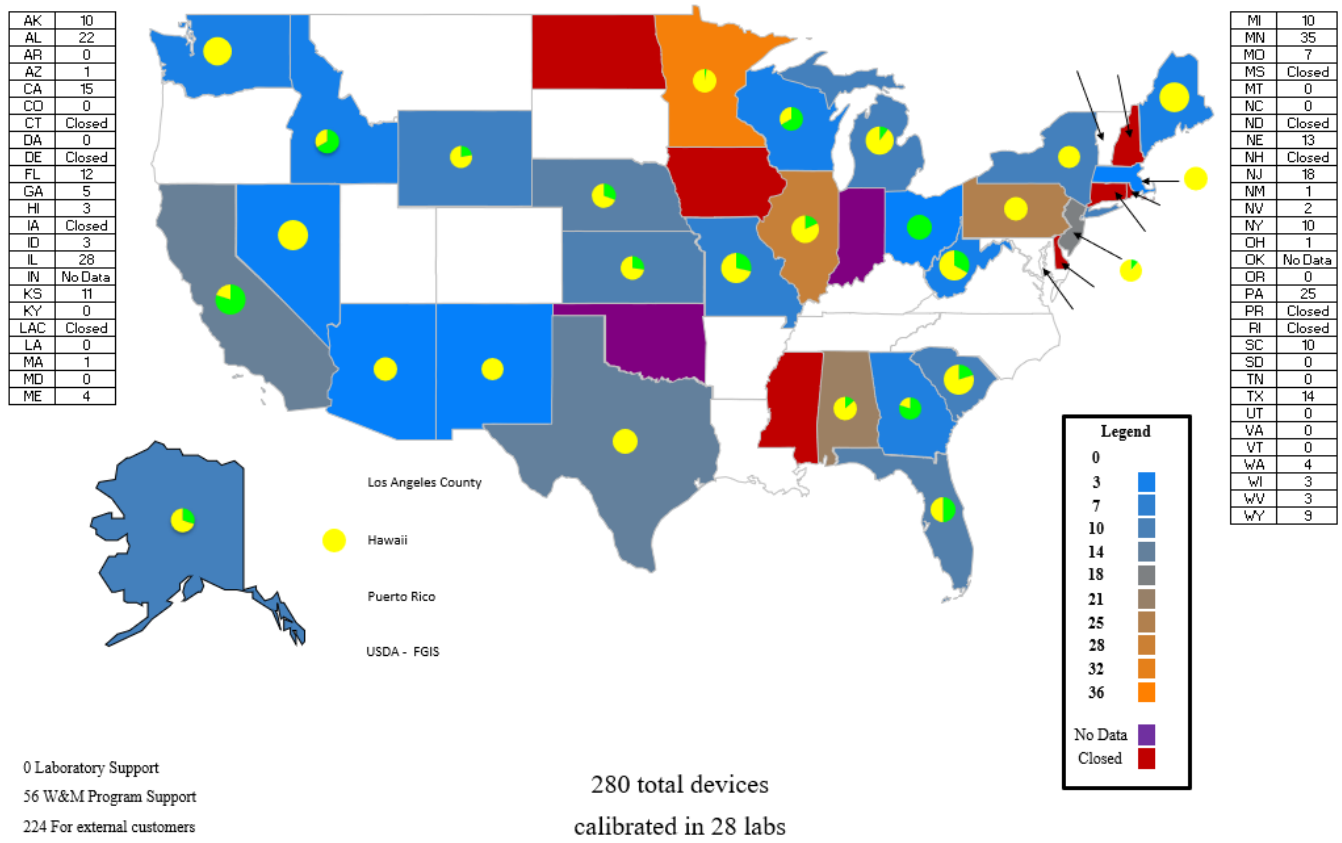
Comparison of previous surveys

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
2020	29	284	0	284
2022	28	280	0	280

Table 18: Provers (> 100 gal.) tests from previous surveys.

Notes and Comments

- 0 % of all provers (> 100 gal.) were tested for the laboratory.
- 20 % of all provers (> 100 gal.) were tested for Weights and Measures enforcement programs.
- 80 % of all provers (> 100 gal.) were tested for external customers.



0 Laboratory Support
56 W&M Program Support
224 For external customers

280 total devices
calibrated in 28 labs

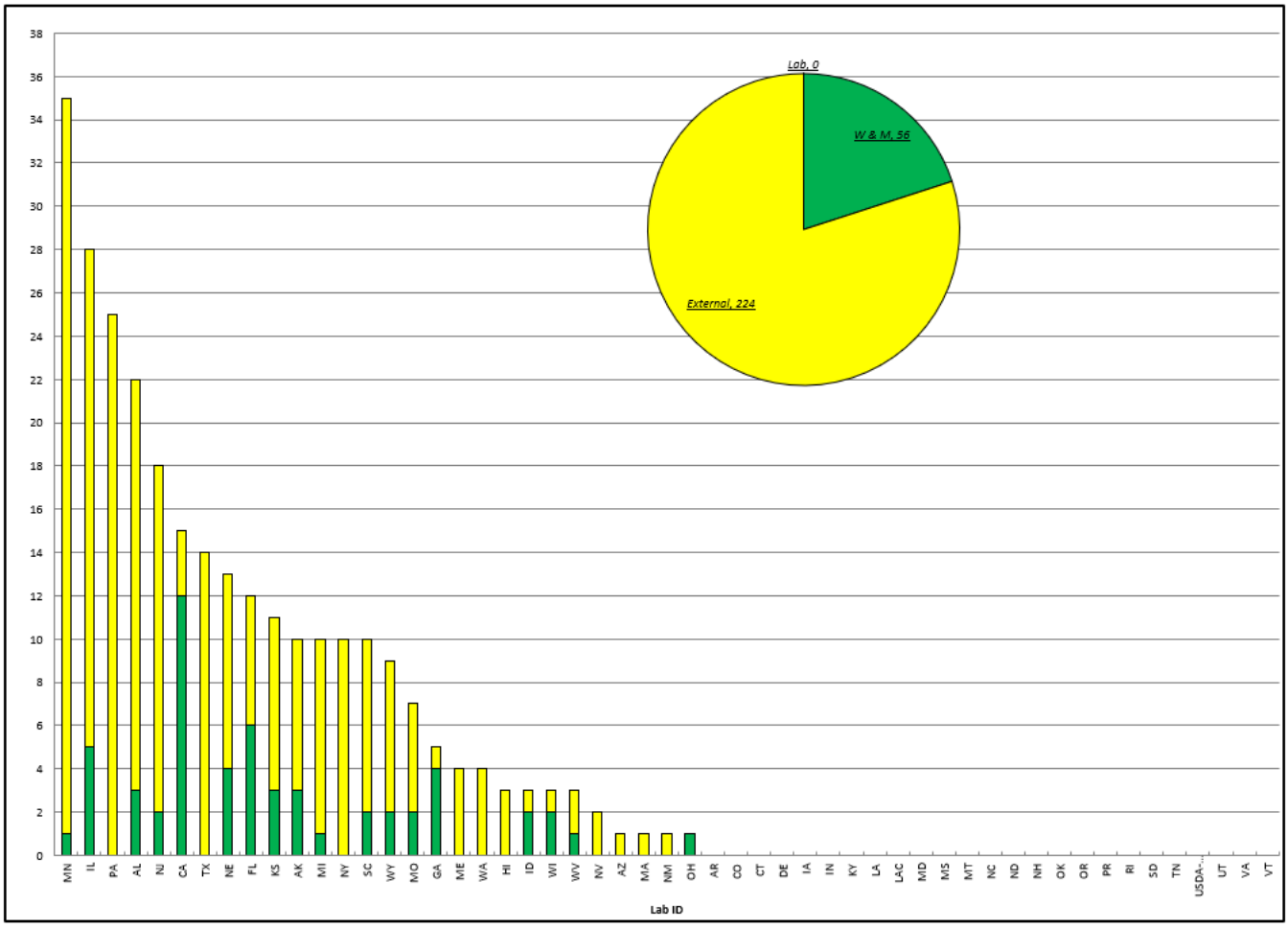


Figure 27: Prover (>100 gal.) tests, volume transfer

No Gravimetric Volume Tests to Report

Figure 28: 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 42 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.

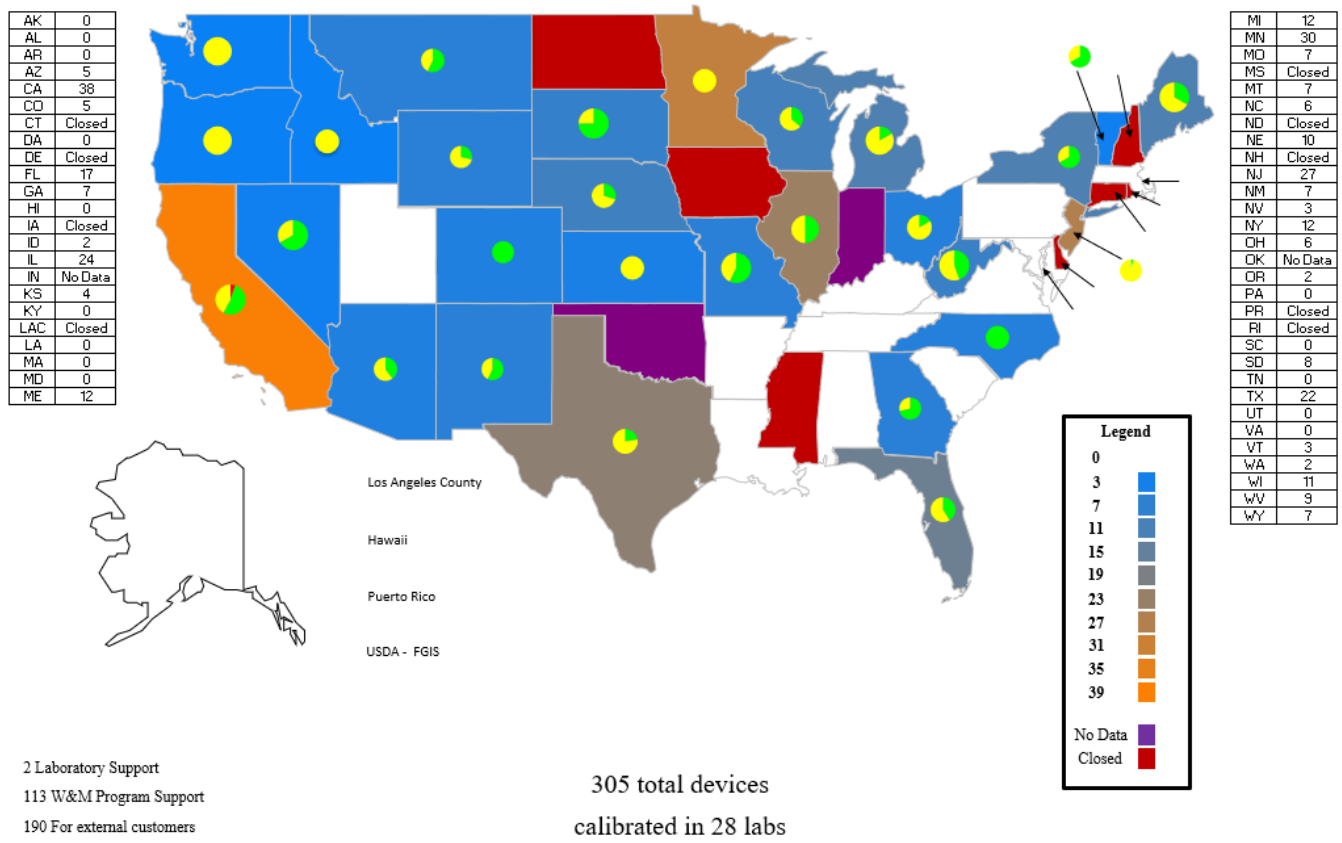
Comparison of previous surveys

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
2020	23	259
2022	28	305

Table 19: LPG Prover volume tests from previous surveys.

Notes and Comments

- 1 % of all LPG provers were tested for the laboratory.
- 37 % of all LPG provers were tested for Weights and Measures enforcement programs.
- 62 % of all LPG provers were tested for external customers.



2 Laboratory Support
113 W&M Program Support
190 For external customers

305 total devices
calibrated in 28 labs

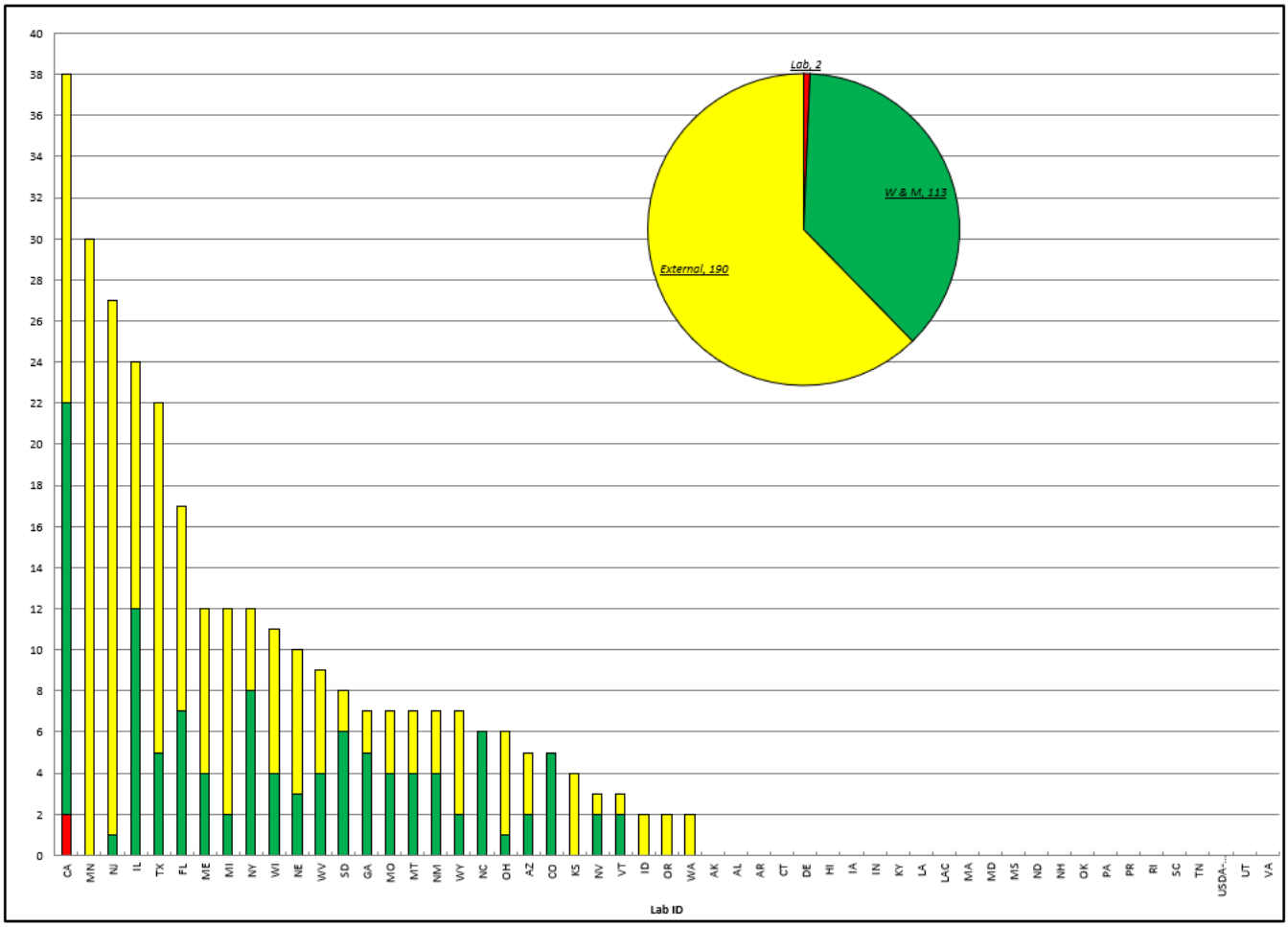


Figure 29: LPG Prover tests, volume transfer

Dynamic Small Volume Provers (SVP)

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 20: 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 42 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.

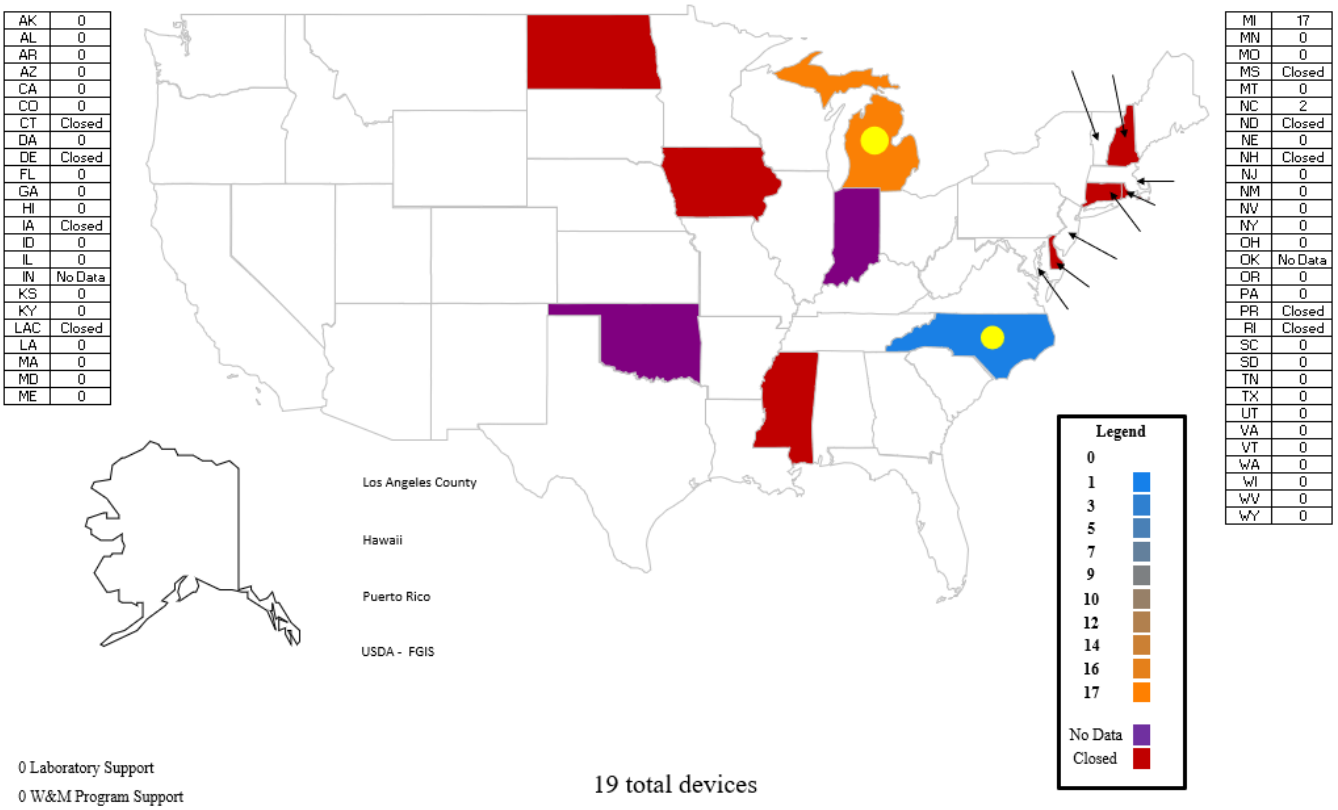
- Lab – work done for the internal use of the metrology laboratory.
- W&M – work done for the weights and measures enforcement program.
- External – work done for customers who do not fall into any of the above categories.

Comparison of previous surveys

Year	# Labs	Total Devices
2018	2	28
2020	2	24
2022	2	19

Table 21: Small Volume, Compact Displacement, and Closed Loop prover tests.

AK	0
AL	0
AR	0
AZ	0
CA	0
CO	0
CT	Closed
DA	0
DE	Closed
FL	0
GA	0
HI	0
IA	Closed
ID	0
IL	0
IN	No Data
KS	0
KY	0
LAC	Closed
LA	0
MA	0
MD	0
ME	0



MI	17
MN	0
MO	0
MS	Closed
MT	0
NC	2
ND	Closed
NE	0
NH	Closed
NJ	0
NM	0
NV	0
NY	0
OH	0
OK	No Data
OR	0
PA	0
PR	Closed
RI	Closed
SC	0
SD	0
TN	0
TX	0
UT	0
VA	0
VT	0
WA	0
WI	0
WV	0
WY	0

0 Laboratory Support
0 W&M Program Support
19 For external customers

19 total devices
calibrated in 2 labs

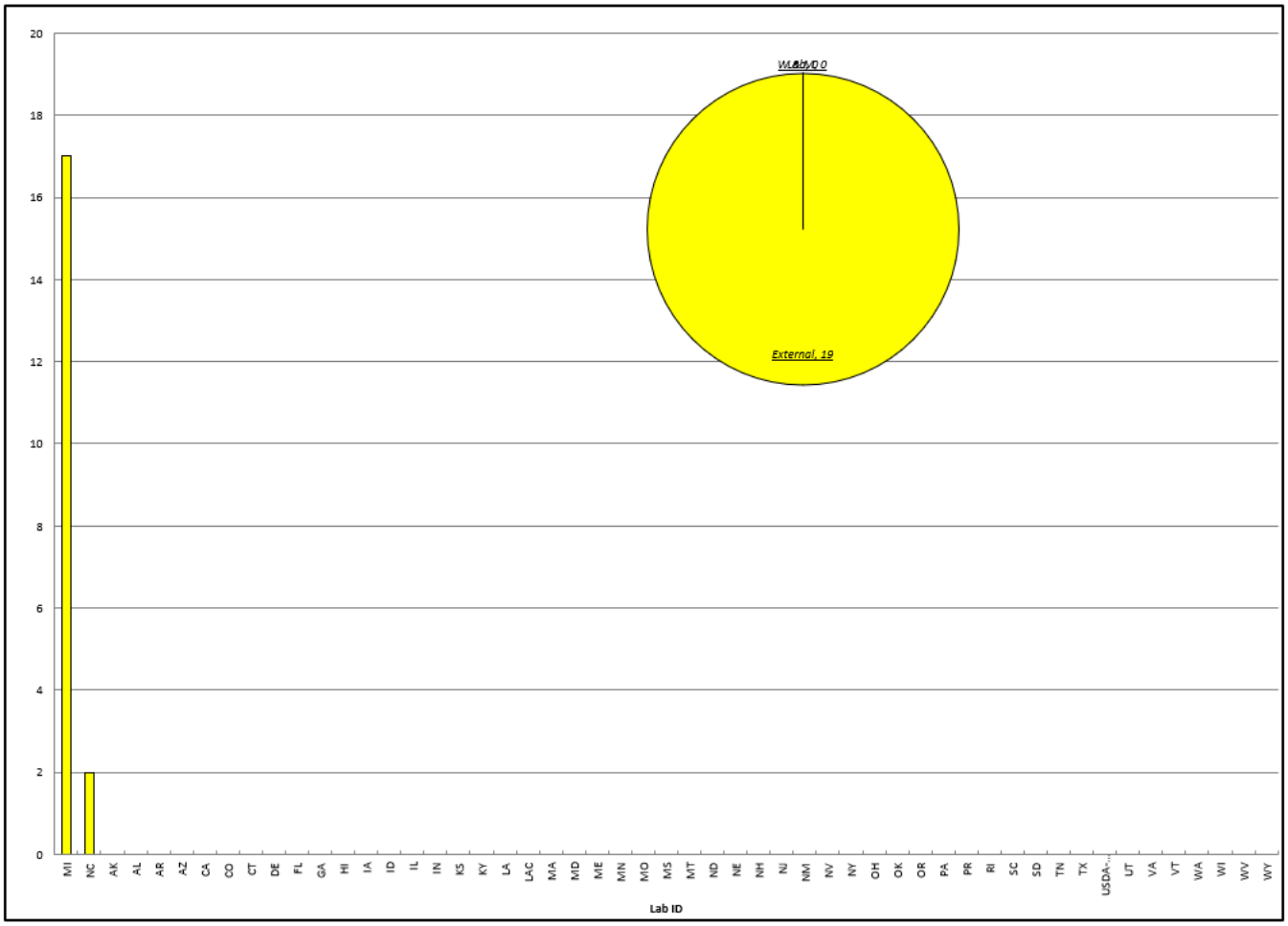


Figure 30: Small Volume, Compact Displacement, and Closed Loop prover tests

Temperature

Description

The graphs on the next page represent the total number of measurements performed on temperature sensing devices by the 42 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.

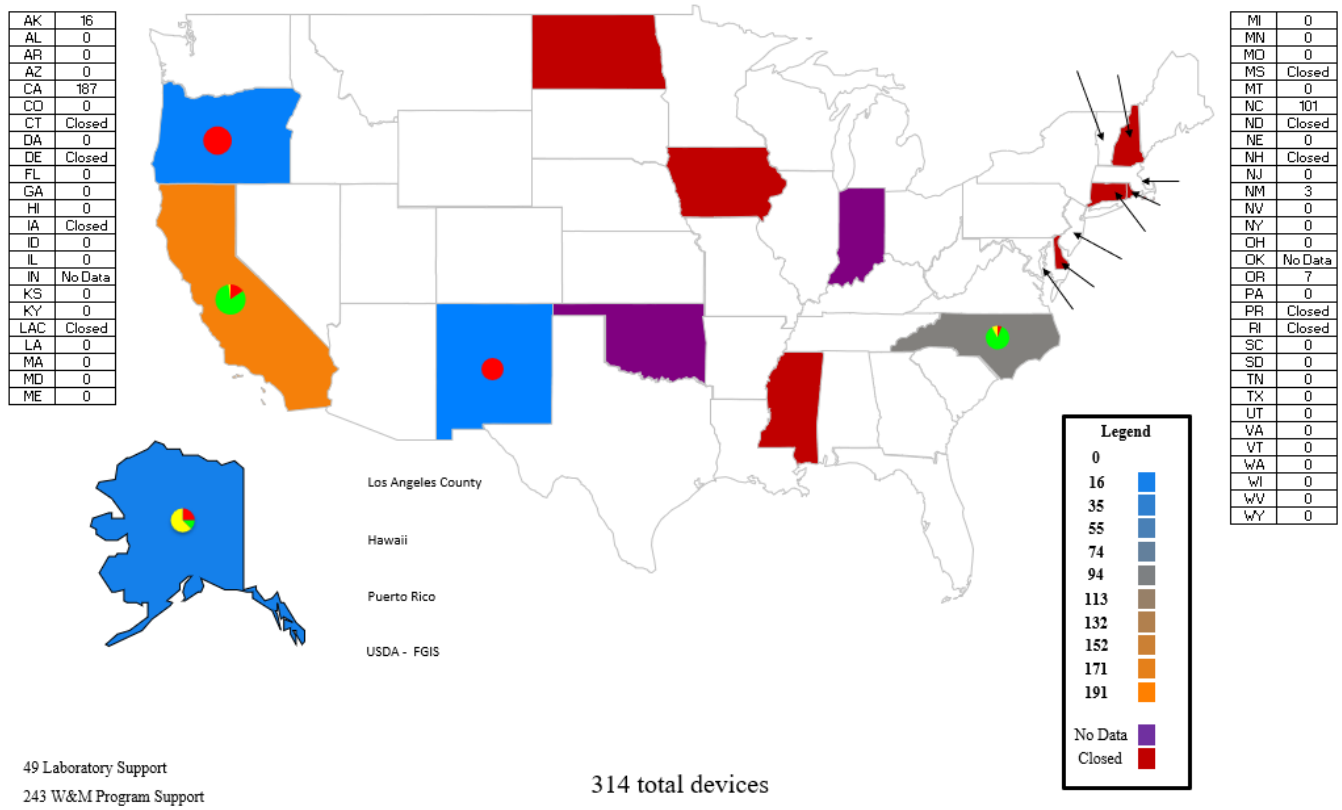
Comparison of previous surveys

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
2020	5	262
2022	5	314

Table 22: Temperature standard tests from previous surveys.

Notes and Comments

- 16 % of all temperature standards were tested for internal use by the laboratory.
- 77 % of all temperature standards were tested for the weight and measures program.
- 7 % of all temperature standards were tested for external customers.



49 Laboratory Support
243 W&M Program Support
22 For external customers

314 total devices
calibrated in 5 labs

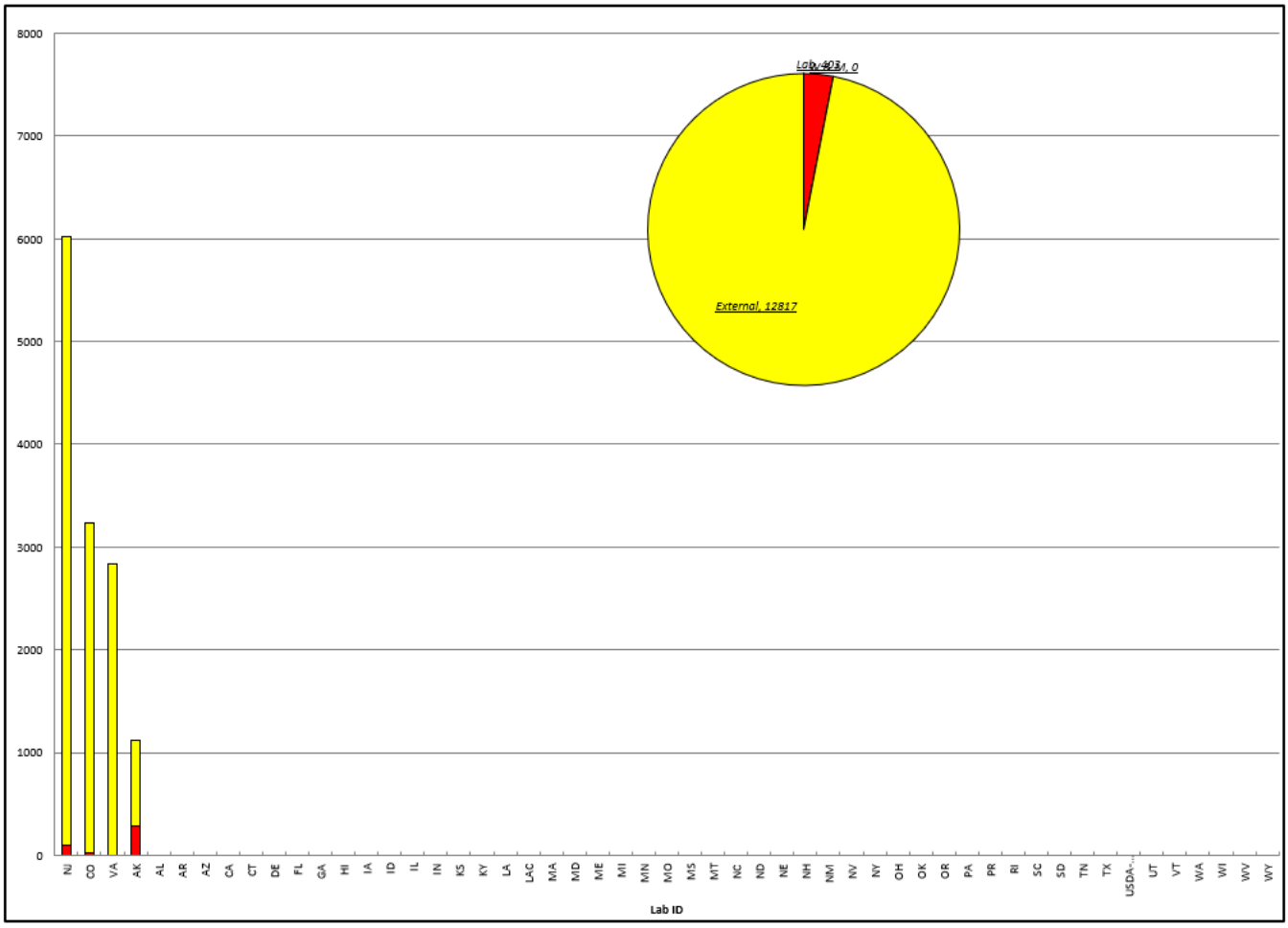


Figure 31: Temperature standard tests.

Frequency

Description

The graphs on the next page represent the total number of measurements performed on frequency standards by the 42 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.

Comparison of previous surveys

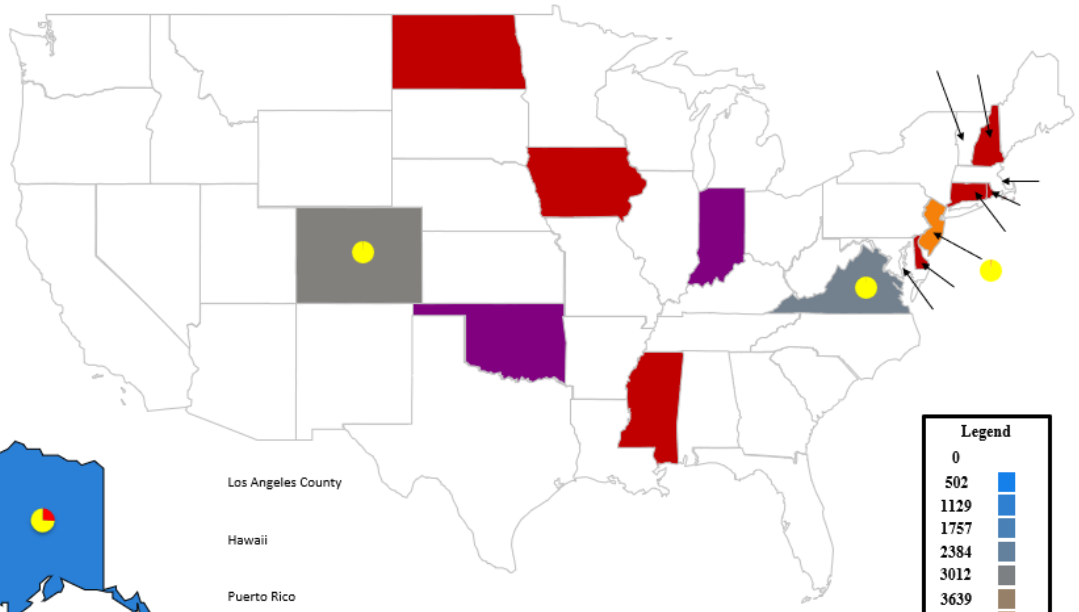
Year	# Labs	Total Devices
1996	6	12,518
1998	4	11,561
1999	5	13,518
2000	7	14,670
2002	6	13,785
2004	3	14,772
2005	4	15,162
2006	4	14,832
2008	4	15,058
2010	4	17,580
2012	4	14,177
2014	4	13,282
2016	4	14,501
2018	3	10,054
2020	4	12,083
2022	4	13,220

Table 23: Frequency standard tests from previous surveys.

Notes and Comments

- 3 % 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.
- 97 % of all frequency standards were tested for external customers

AK	1117
AL	0
AR	0
AZ	0
CA	0
CO	3239
CT	Closed
DA	0
DE	Closed
FL	0
GA	0
HI	0
IA	Closed
ID	0
IL	0
IN	No Data
KS	0
KY	0
LAC	Closed
LA	0
MA	0
MD	0
ME	0



MI	0
MN	0
MO	0
MS	Closed
MT	0
NC	0
ND	Closed
NE	0
NH	Closed
NJ	6023
NM	0
NV	0
NY	0
OH	0
OK	No Data
OR	0
PA	0
PR	Closed
RI	Closed
SC	0
SD	0
TN	0
TX	0
UT	0
VA	2841
VT	0
WA	0
WI	0
WV	0
WY	0

403 Laboratory Support
0 W&M Program Support
12817 For external customers

13220 total devices
calibrated in 4 labs

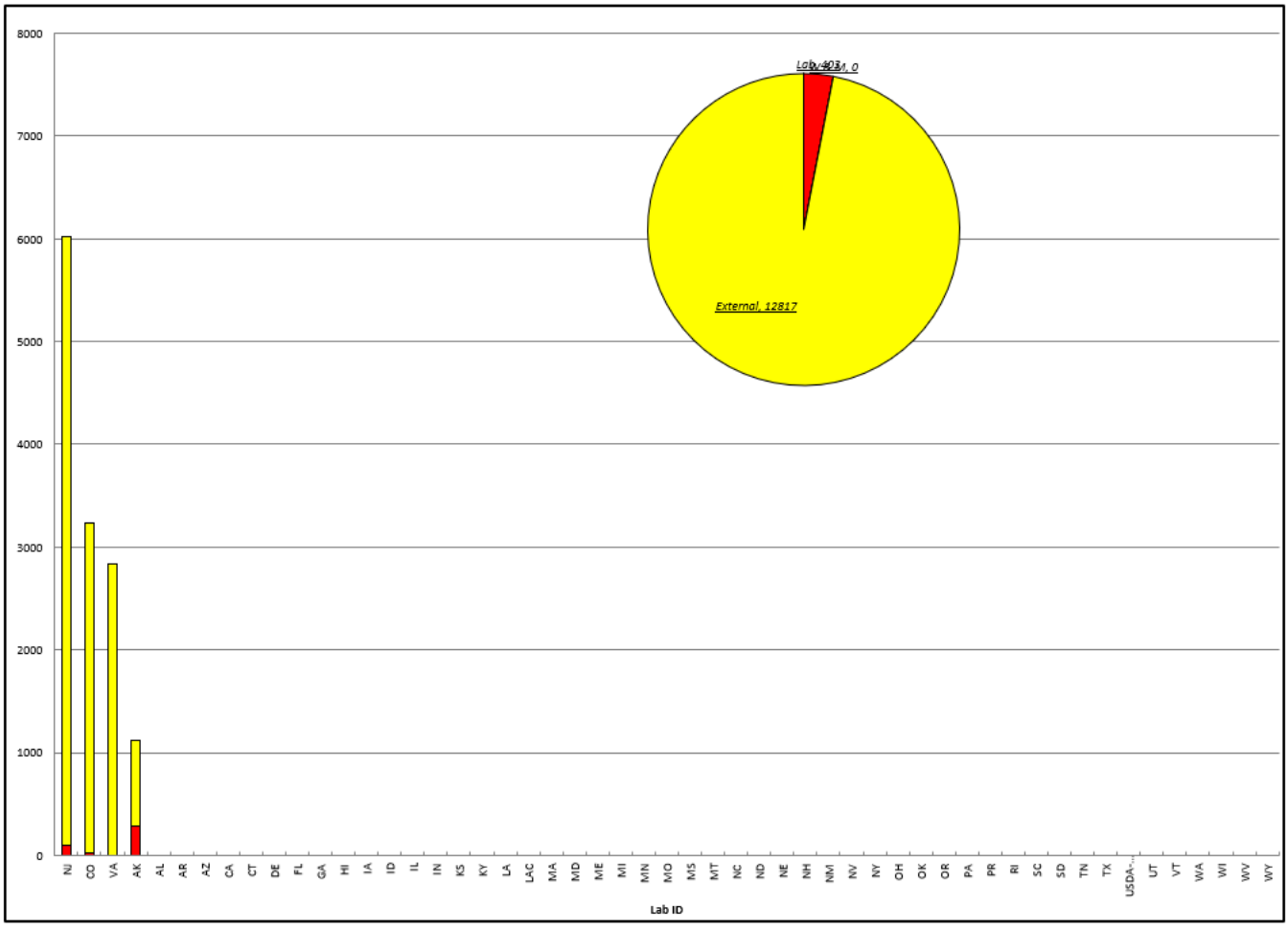


Figure 32: Frequency standard tests

Timing Devices

Description

The graphs on the next page represent the total number of measurements performed on timing devices by the 42 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.

Comparison of previous surveys

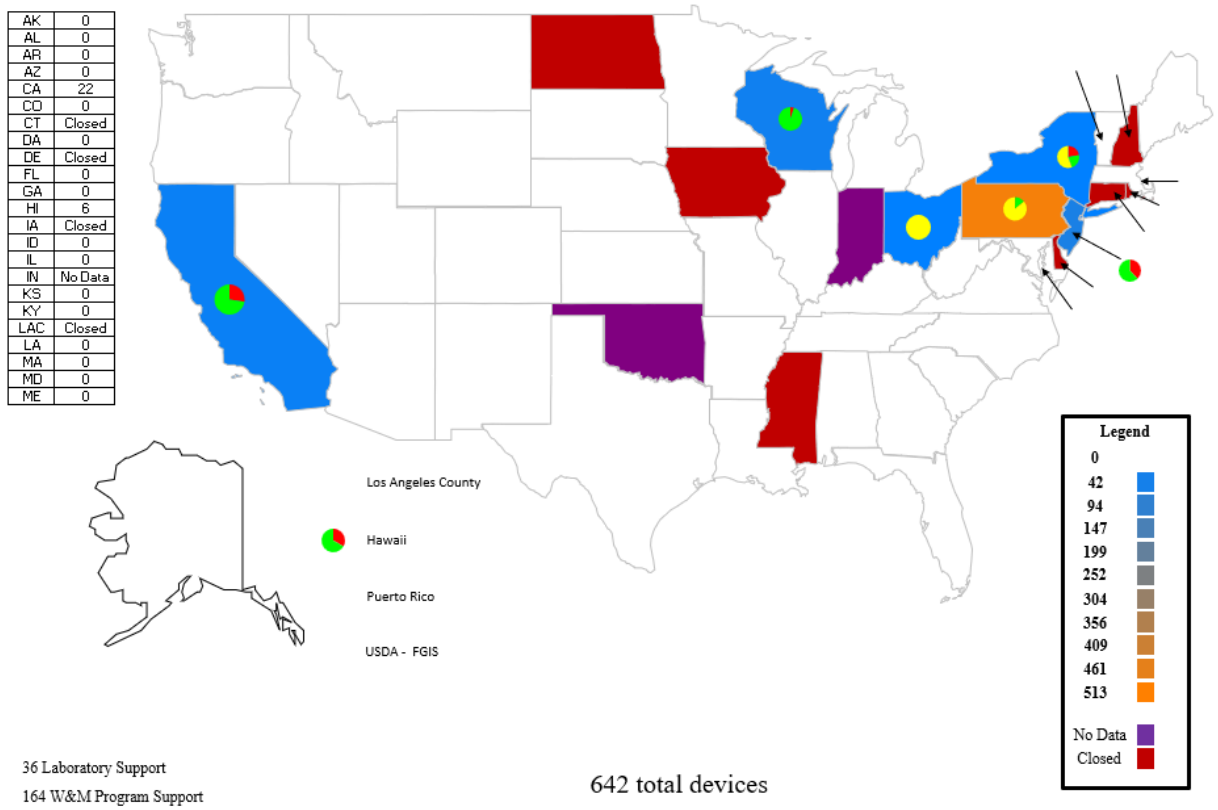
Year	# Labs	Total Devices
1996	13	161
1998	11	380
1999	14	451
2000	13	554
2002	11	479
2004	9	951
2005	8	387
2006	11	365
2008	11	401
2010	9	339
2012	10	577
2014	7	600
2016	8	506
2018	9	4306
2020	9	572
2022	7	642

Table 24: Timing devices tests from previous surveys

Notes and Comments

- 0 % of all timing devices were tested for internal use by the laboratory.
- 27 % of all timing devices were tested for the weight and measures program.
- 73 % of all timing devices were tested for external customers.

AK	0
AL	0
AR	0
AZ	0
CA	22
CO	0
CT	Closed
DA	0
DE	Closed
FL	0
GA	0
HI	6
IA	Closed
ID	0
IL	0
IN	No Data
KS	0
KY	0
LAC	Closed
LA	0
MA	0
MD	0
ME	0



MI	0
MN	0
MO	0
MS	Closed
MT	0
NC	0
ND	Closed
NE	0
NH	Closed
NJ	58
NM	0
NV	0
NY	9
OH	5
OK	No Data
OR	0
PA	503
PR	Closed
RI	Closed
SC	0
SD	0
TN	0
TX	0
UT	0
VA	0
VT	0
WA	0
WI	39
WV	0
WY	0

36 Laboratory Support
164 W&M Program Support
442 For external customers

642 total devices
calibrated in 7 labs

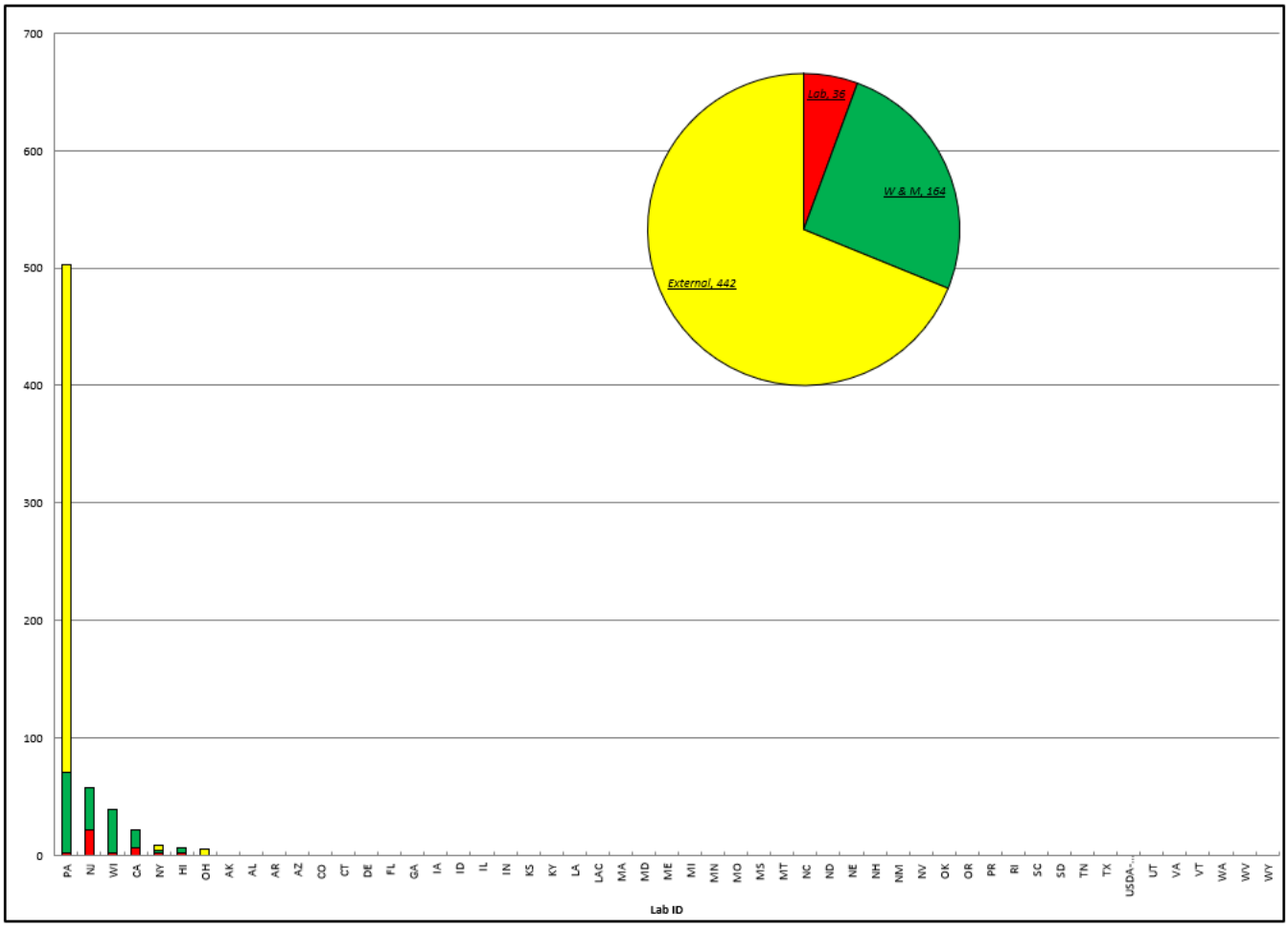


Figure 33: Timing device tests

Wheel Load Weighers

Description

The graphs on the next page represent the total number of measurements performed on wheel load weighers by the 42 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.

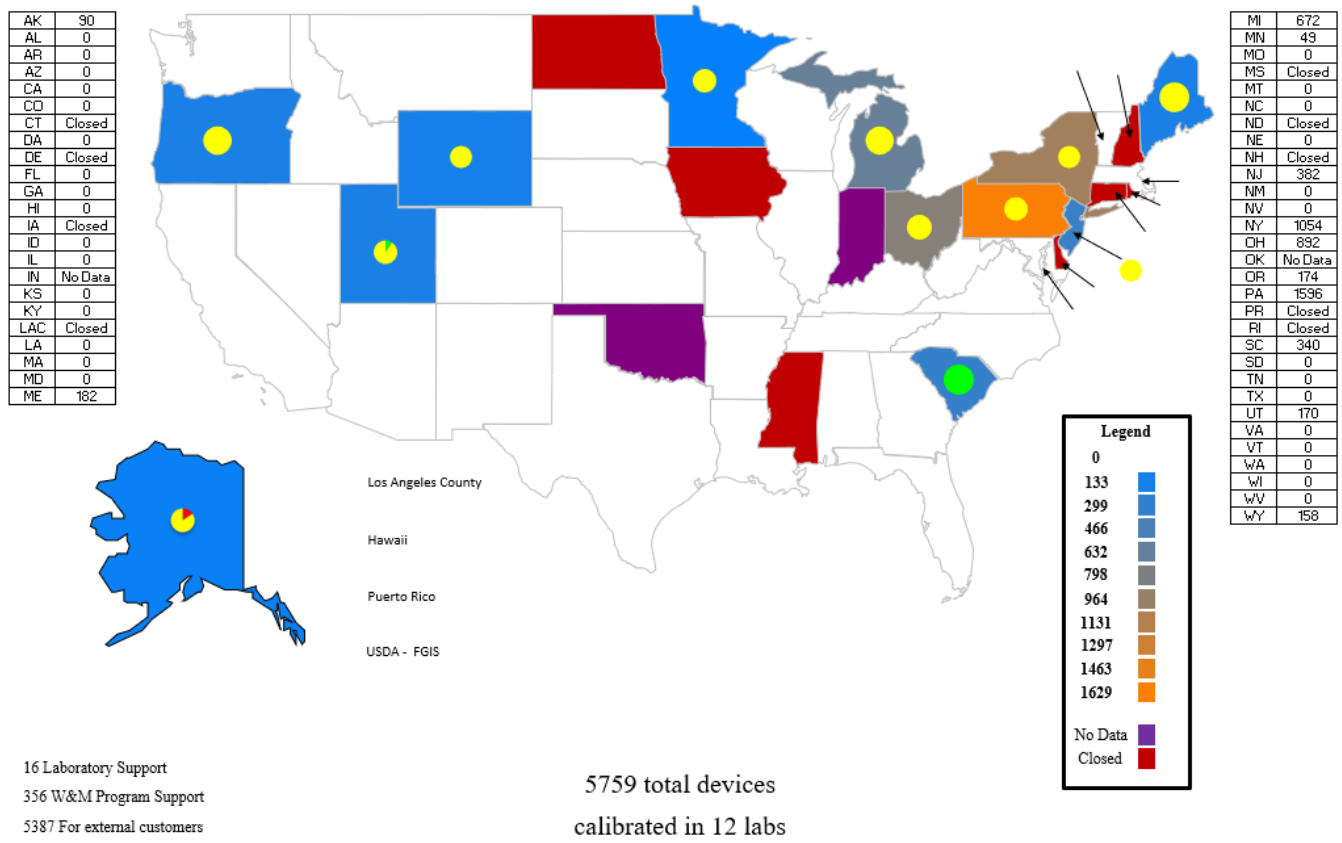
Comparison of previous surveys

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
2020	15	5,934
2022	12	5,759

Table 25: Wheel load weigher tests from previous surveys

Notes and Comments

- 0 % of all wheel load weighers were tested for internal use by the laboratory.
- 6 % of all wheel load weighers were tested for the weight and measures program.
- 94 % of all wheel load weighers were tested for external customers.



16 Laboratory Support
356 W&M Program Support
5387 For external customers

5759 total devices
calibrated in 12 labs

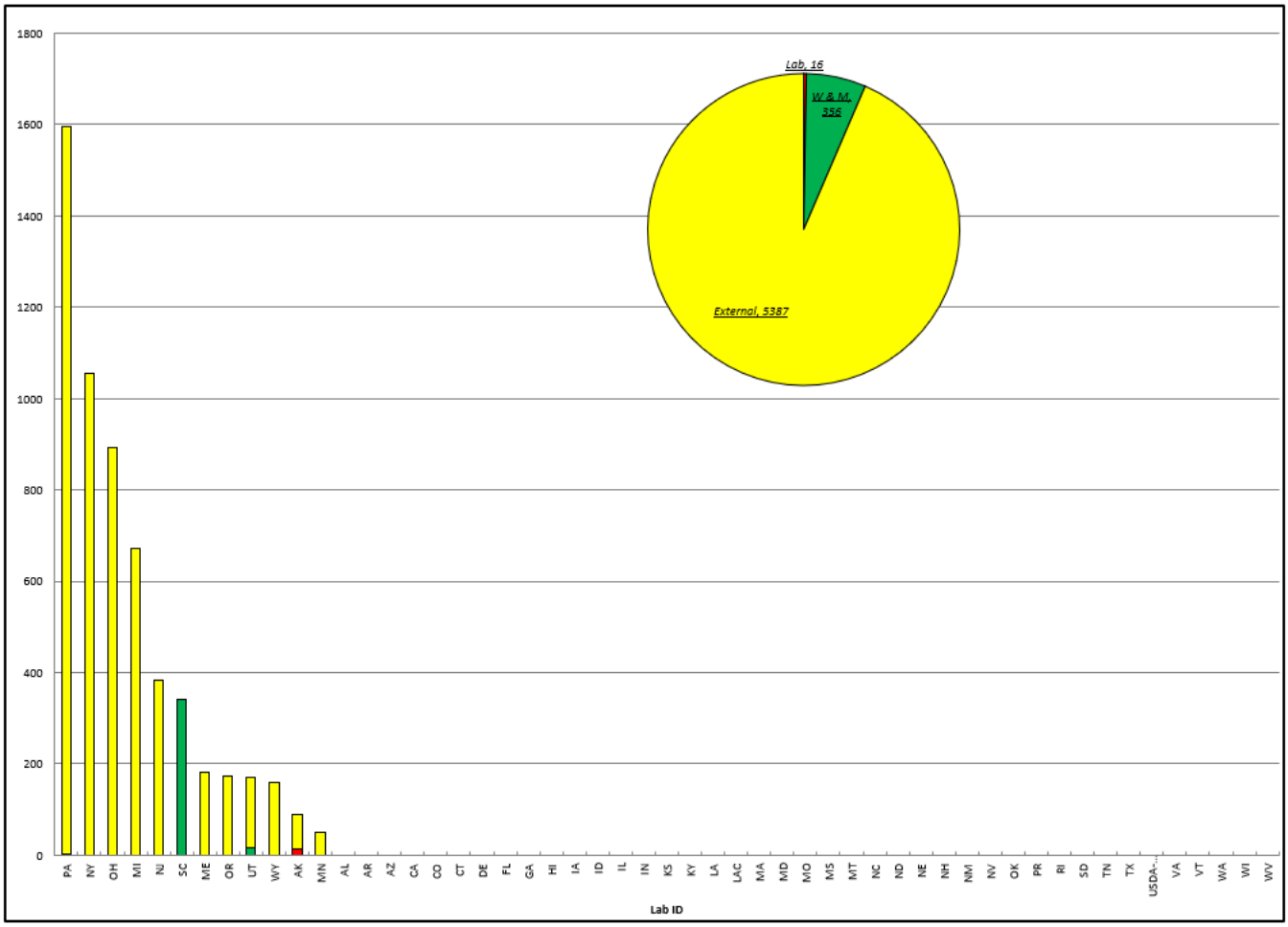


Figure 34: Wheel load weigher test

Electric Watt-hour Meters (NEW 2022)

Description

The graphs on the next page represent the total number of measurements performed on watt-hour meters used to support the testing of electric vehicle charging stations by the 42 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.

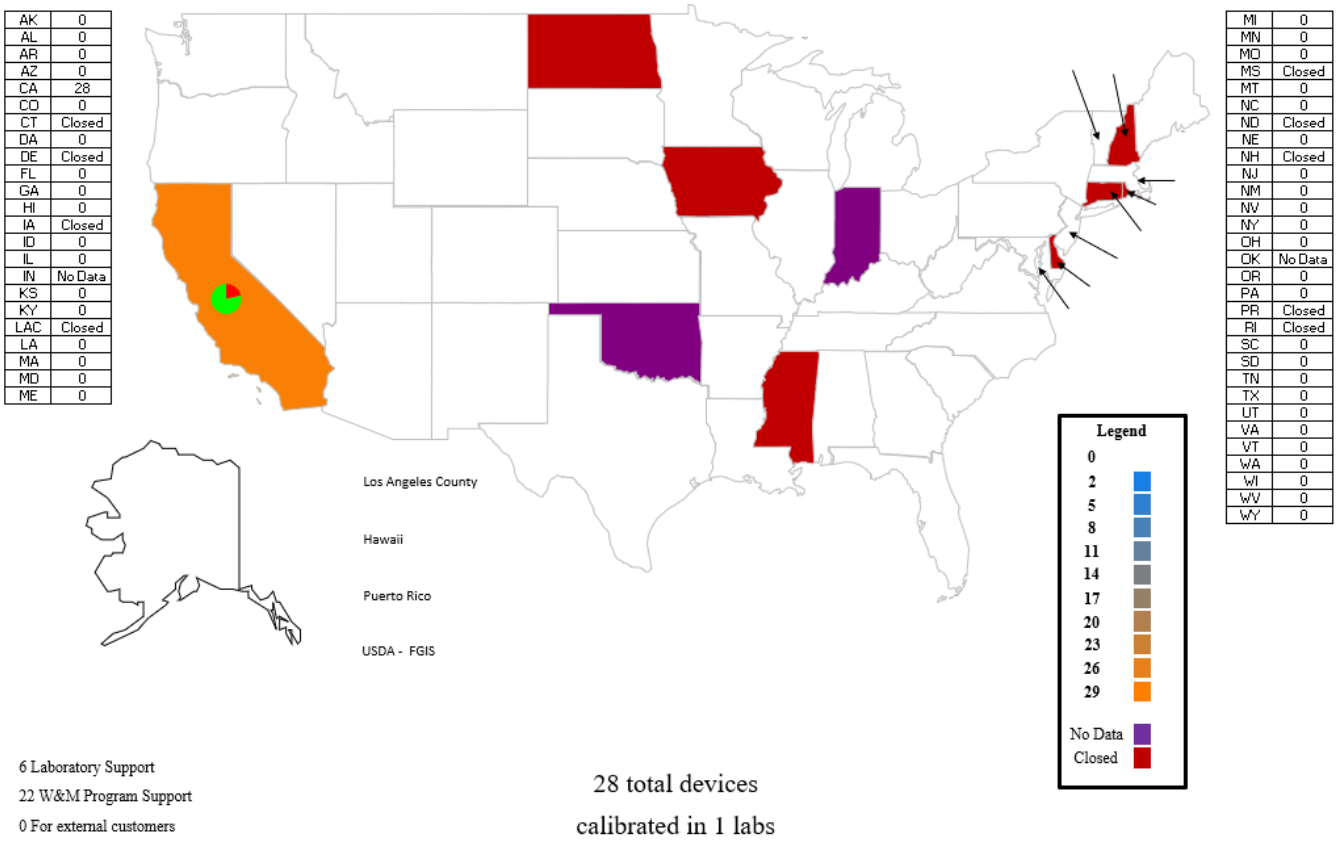
Comparison of previous surveys

Year	# Labs	Total Devices
2022	1	22

Table 26: Timing devices tests from previous surveys

Notes and Comments

- 0 % of all timing devices were tested for internal use by the laboratory.
- 21 % of all timing devices were tested for the weight and measures program.
- 79 % of all timing devices were tested for external customers.



6 Laboratory Support
22 W&M Program Support
0 For external customers

28 total devices
calibrated in 1 labs

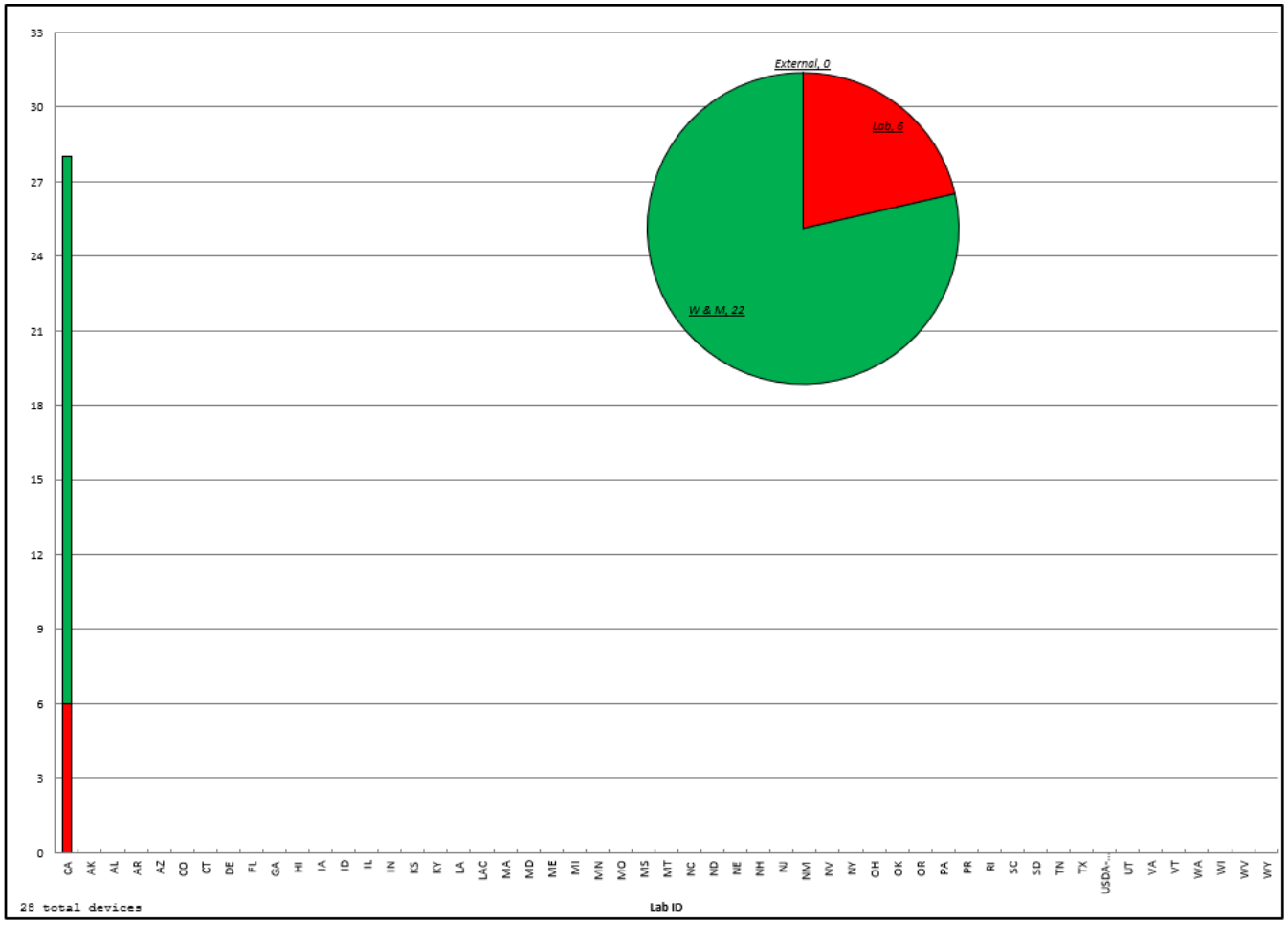


Figure 35: Electric Watt-hour Meters

Lottery Balls

Description

The graphs on the next page represent the total number of measurements performed on lottery balls by the 42 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.

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[7]
2014	8	40,899
2016	6	80,946[8]
2018	4	11,087[9]
2020	5	9,600
2022	5	12,653

Table 27: Lottery balls tests from previous surveys

Notes and Comments

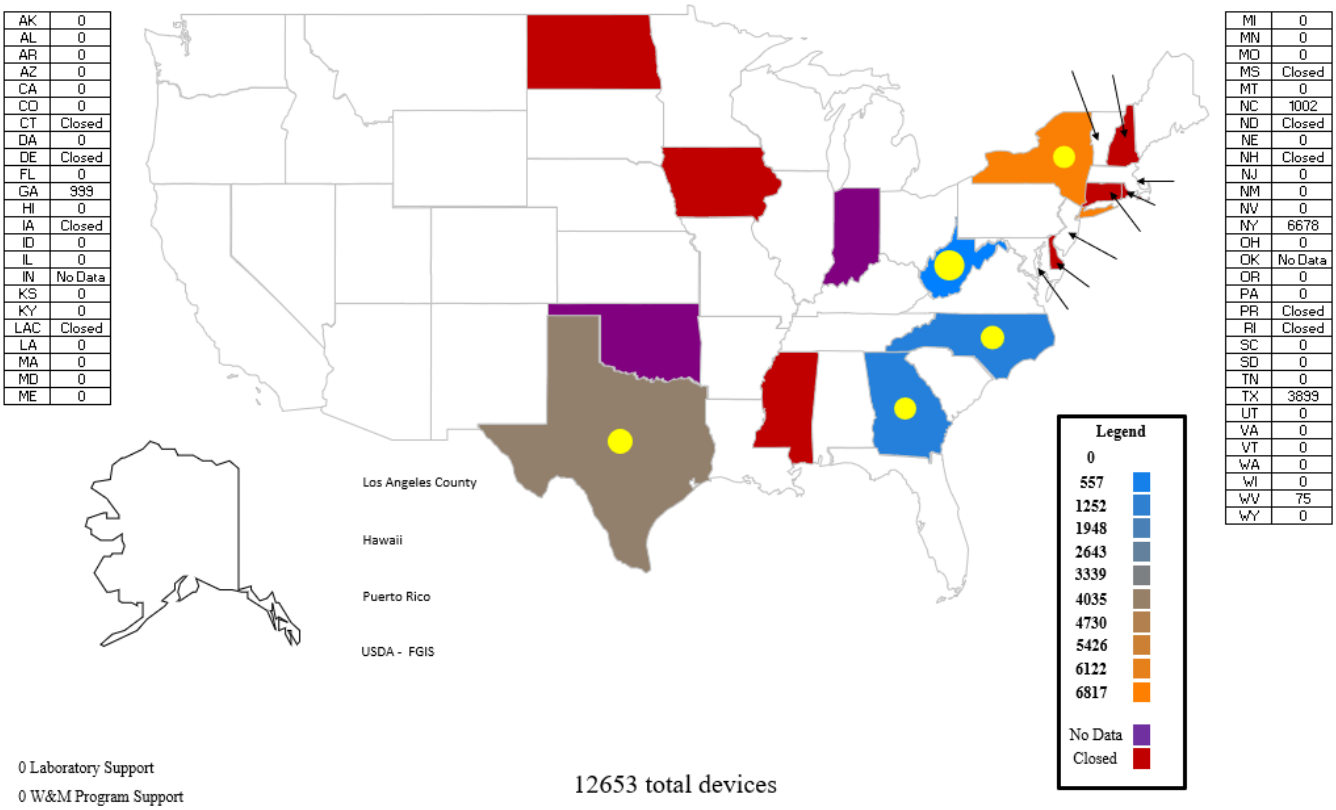
- 100 % of all lottery balls were tested for external customers.

[7] 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.

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

[9] 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.

AK	0
AL	0
AR	0
AZ	0
CA	0
CO	0
CT	Closed
DA	0
DE	Closed
FL	0
GA	999
HI	0
IA	Closed
ID	0
IL	0
IN	No Data
KS	0
KY	0
LAC	Closed
LA	0
MA	0
MD	0
ME	0



MI	0
MN	0
MO	0
MS	Closed
MT	0
NC	1002
ND	Closed
NE	0
NH	Closed
NJ	0
NM	0
NV	0
NY	6678
OH	0
OK	No Data
OR	0
PA	0
PR	Closed
RI	Closed
SC	0
SD	0
TN	0
TX	3899
UT	0
VA	0
VT	0
WA	0
WI	0
WV	75
WY	0

0 Laboratory Support
0 W&M Program Support
12653 For external customers

12653 total devices
calibrated in 5 labs

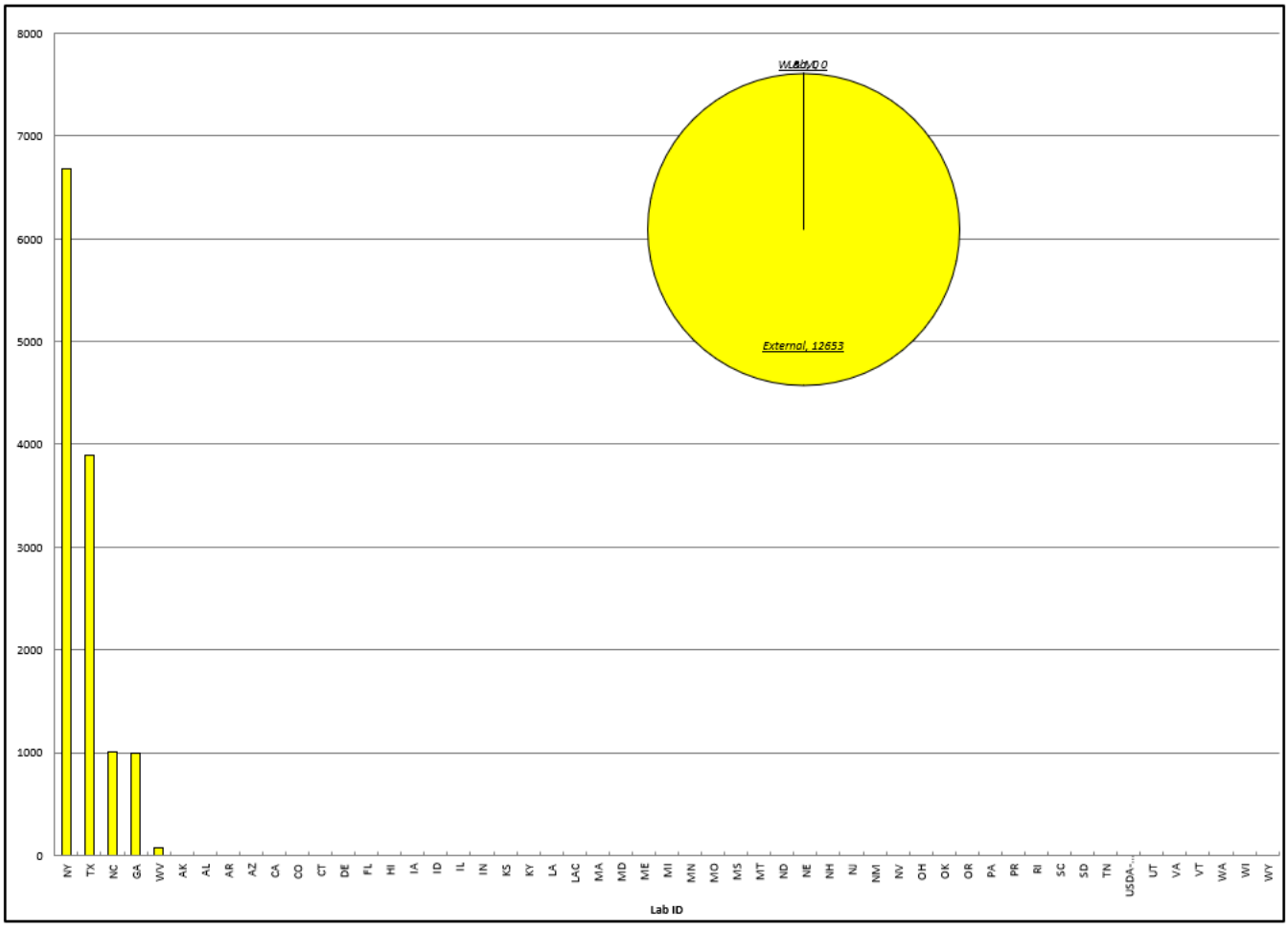


Figure 36 Lottery Ball tests

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.

Description	Lab	Weights and Measures	External	Total
AK Distance testing LIDAR units for law enforcement	0	0	69	69
AK Witness testing of Watt Hour Meters	0	0	1	1
ME shellfish measures	0	0	40	40
NJ Laser Devices	0	0	40	40
NJ Scales < 1,000 lb capacity	0	29	314	343
NJ Water Meter Bench Provers	0	0	76	76
PA Force Gauges ≤ 50 lbf	0	0	15	15
TX Neck Calibration	0	0	61	61
VT Hydrometry: Maple Syrup and Sap	0	0	16,501	16,501

Table 28: Other tests reported by the participating laboratories

Laboratory Fees

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 to prepare measurement standards for calibration.

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[10].

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.

[10] 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 8-32 published in this report beginning on page 158.

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
KY
LA
MD
ME
MI
MN
MO
NC
NE
NM
NY
OK
OR
TX
UT
VA
VT
WA
TN

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
IL
IN
KS
KY
LA
MA
MD
ME
MI
MN
MO
MT
NC
NE
NJ
NM
NV
NY
OH
OK
OR
PA
SC
SD
TX
UT
VA
VT
WA
WI
WY
TN

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
IN
MN
OK
SD
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 are 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 37 on page 96.

Lab ID	Fee Total	Calibration Time	Includes Packing	Includes Setup	Includes Statistical Controls	Includes Certificates
IL	$155.00	1.0	+	+	+	+
NV	$150.00	2.0	+	+	+	+
WI	$146.40	0.5		+	+	+
OR	$135.00	1.0	+	+	+	+
MO	$125.00	1.0	+	+	+	+
AK	$85.00	1.0	+	+	+	+
NE	$80.00	1.0	+	+	+	+
MT	$75.00	1.0	+	+	+	+
VT	$75.00	1.0	+	+	+	+
MI	$72.50	0.5	+	+	+	+
ID	$60.00		+	+	+	+
GA	$55.00					
WA	$52.75	0.5				
AZ	$50.00					
KS	$50.00					
OH	$50.00	0.5	+	+	+	+
SD	$48.00	0.5	+	+	+	+
MA	$45.00	1.0	+	+	+	+
SC	$45.00	0.0	+	+	+	+
CO	$40.00					
ME	$40.00	0.5	+	+	+	+
NM	$35.00	0.8			+	+
FL	$25.00					
NC	$25.00					
UT	$25.00	0.5		+		+
HI	$20.00	1.0	+	+	+	+
AL	$5.00					
AR						
CA						
KY						
LA						
MD						
MN						
NJ						
NY						
PA						
TN						
TX						
USDA-GIPSA						
VA						
WV						
WY						

Labs Responding = 27 Average Fee = $65.54 Average Calibration Time = 0.8 hours

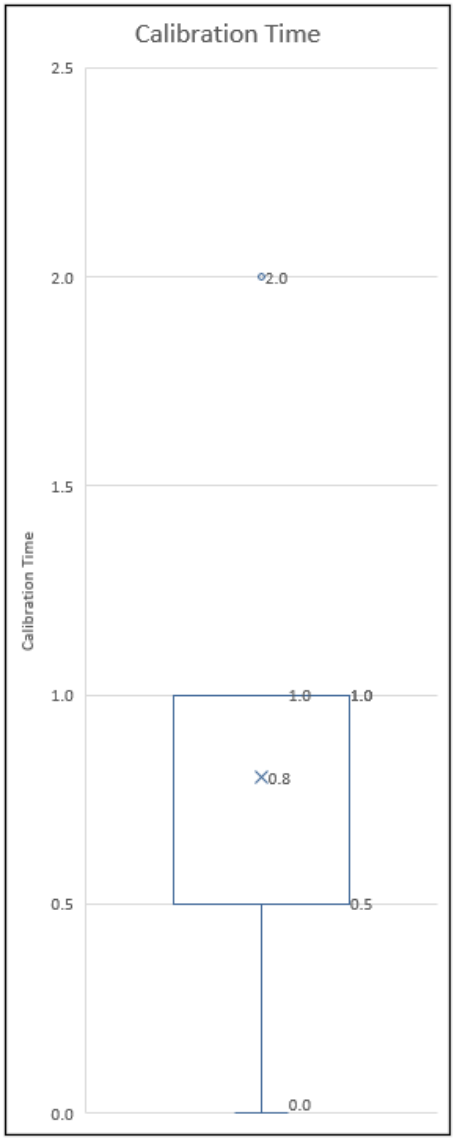


Figure 37: Minimum laboratory fees charged. Calibration time is the minimum calibration time upon which charges are based.

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.

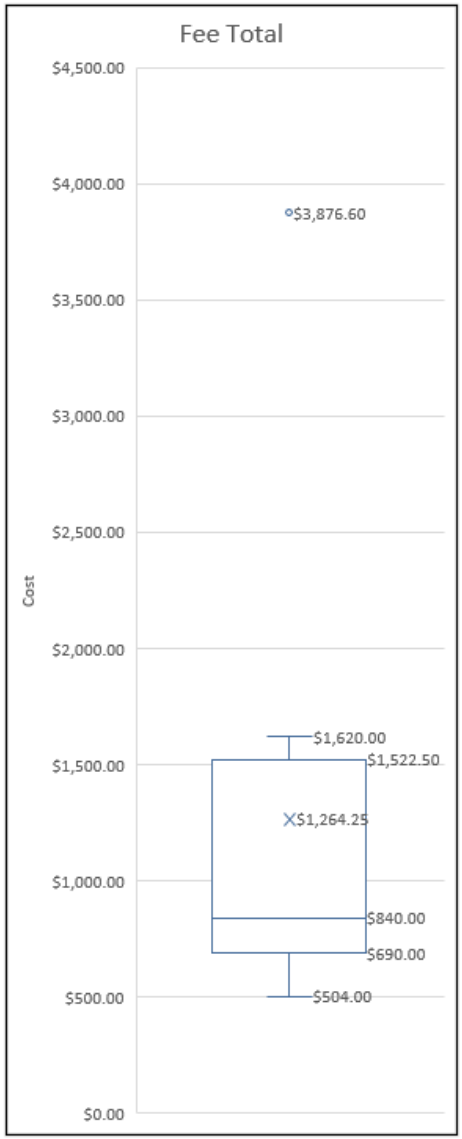
Comparison of Previous Surveys

Survey	Labs Reporting	Average Fee
2004	15	$617.87
2006	16	$758.75
2008	14	$700.07
2010	15	$780.83
2012	14	$820.18
2014	15	$870.90
2016	13	$922.23
2018	10	$933.07
2020	9	$1,028.00
2022	9	$1,264.25

Table 29: Average fee charged for Echelon I mass testing.

Lab ID	Fee Total	Calibration Time	Includes Packing	Includes Setup	Includes Statistical Controls	Includes Certificates
MN	$3,876.60	21.0	+	+	+	+
OR	$1,620.00	12.0	+	+	+	+
MI	$1,522.50	10.5	+	+	+	+
WA	$866.16	8.2	+	+	+	+
KS	$840.00	6.3	+	+	+	
HI	$819.00	22.0	+	+	+	+
NC	$690.00					
CO	$640.00	16.0	+	+	+	+
NM	$504.00	6.0			+	+
AK						
AL						
AR						
AZ						
CA						
FL						
GA						
ID						
IL						
KY						
LA						
MA						
MD						
ME						
MO						
MT						
NE						
NJ						
NV						
NY						
OH						
PA						
SC						
SD						
TN						
TX						
USDA-GIPSA						
UT						
VA						
VT						
WI						
WV						
WY						

Labs Responding = 9 Average Fee = $1264.25 Average Calibration Time = 12.7 hours



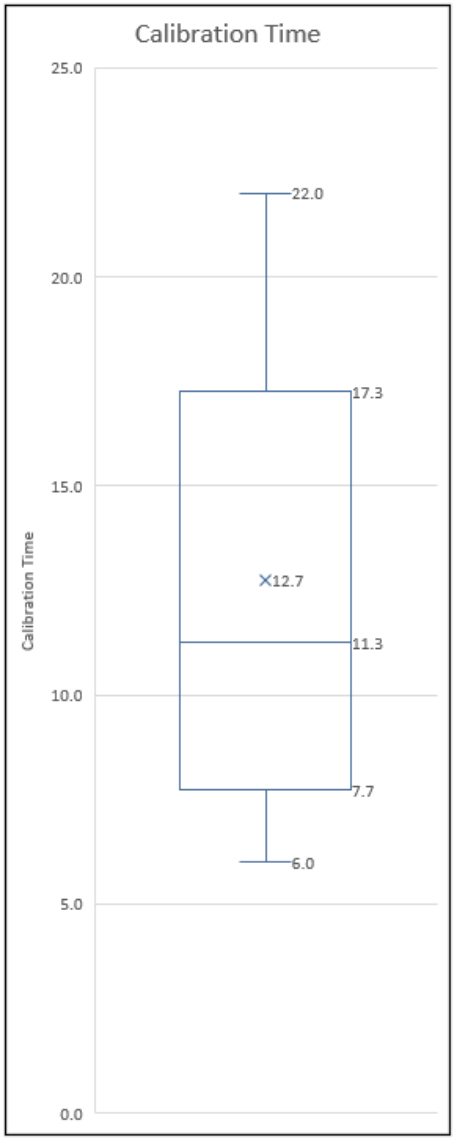


Figure 38: Fees charge for calibrating a precision weight kit containing 21 individual weights ranging from 100 g to 1 mg to ASTM Class 0 tolerances using Echelon I testing techniques.

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.

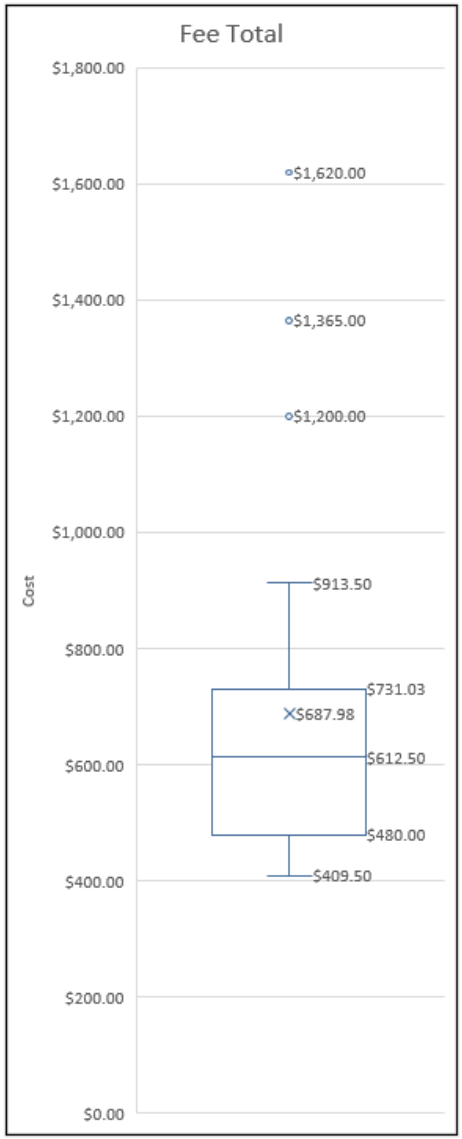
Comparison of Previous Surveys

Survey	Labs Reporting	Average Fee
2000	33	$334.00
2002	39	$414.32
2004	30	$431.43
2006	31	$482.87
2008	29	$496.18
2010	29	$522.09
2012	25	$636.25
2014	27	$601.17
2016	26	$671.85
2018	23	$594.27
2020	22	$620.09
2022	24	$687.98

Table 30: Average fee charged for Echelon II mass testing.

Lab ID	Fee Total	Calibration Time	Includes Packing	Includes Setup	Includes Statistical Controls	Includes Certificates
OR	$1,620.00	12.0	+	+	+	+
PA	$1,365.00	7.5			+	+
CA	$1,200.00	8.0			+	
MI	$913.50	6.3	+	+	+	+
ID	$840.00		+	+	+	+
MN	$737.10	4.1	+	+	+	+
WA	$729.01	6.9	+	+	+	+
NC	$690.00					
AK	$680.00	8.0	+	+	+	+
GA	$630.00	15.0	+	+	+	
HI	$630.00	18.0	+	+	+	+
MO	$625.00	5.0				
NV	$600.00	8.0	+	+	+	+
VA	$588.00	20.0			+	
WI	$570.40	4.0		+	+	
NM	$504.00	6.0			+	+
OH	$500.00	5.0	+	+	+	+
ME	$480.00	6.0	+	+	+	+
NY	$480.00	3.5	+	+	+	+
AZ	$440.00					
CO	$440.00	11.0	+	+	+	+
FL	$420.00	16.0	+	+	+	+
KS	$420.00	5.5	+	+	+	
SC	$409.50	3.5	+	+	+	+
AL						
AR						
IL						
KY						
LA						
MA						
MD						
MT						
NE						
NJ						
SD						
TN						
TX						
USDA-GIPSA						
UT						
VT						
WV						
WY						

Labs Responding = 24 Average Fee = $687.98 Average Calibration Time = 8.5 hours



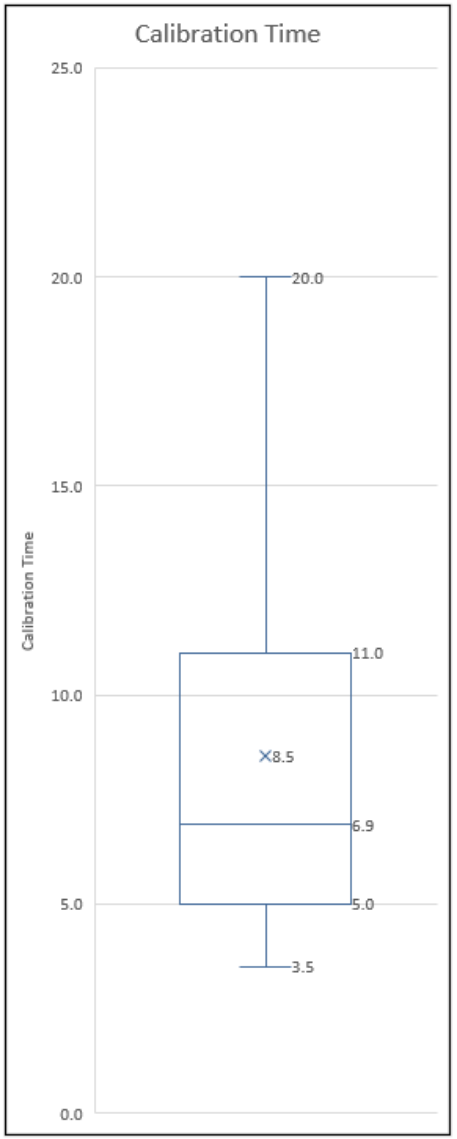


Figure 39: Fees charge for calibrating a precision weight kit containing 21 individual weights ranging from 100 g to 1 mg to ASTM Class 2 tolerances using Echelon II testing techniques.

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.

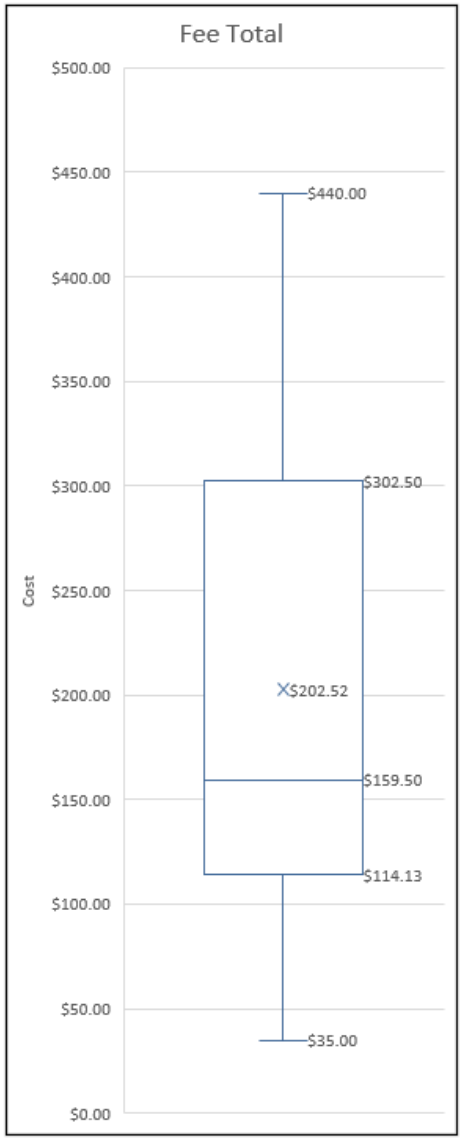
Comparison of Previous Surveys

Survey	Labs Reporting	Average Fee
2000	36	$77.00
2002	41	$94.99
2004	38	$121.13
2006	42	$135.64
2008	44	$156.93
2010	41	$179.30
2012	43	$186.93
2014	46	$187.56
2016	47	$203.97
2018	43	$201.28
2020	43	$185.99
2022	40	$202.52

Table 31: Average fee charged for Echelon III mass testing.

Lab ID	Fee Total	Calibration Time	Includes Packing	Includes Setup	Includes Statistical Controls	Includes Certificates
HI	$440.00	4.0	+	+	+	+
NJ	$440.00	1.5			+	
PA	$440.00	2.0			+	+
TX	$440.00	1.5	+	+		+
MT	$375.00	5.0	+	+		+
OR	$337.50	2.5	+	+	+	+
CA	$330.00	4.4	+	+	+	+
WA	$322.83	3.1	+	+	+	+
MI	$319.00	2.2	+	+	+	+
IL	$310.00	2.0	+	+	+	+
AK	$300.00	3.0	+	+	+	+
WI	$242.40	1.5		+	+	
ID	$242.00		+	+	+	+
NV	$225.00	3.0	+	+	+	+
MN	$200.20	1.4	+	+	+	+
ME	$200.00	2.5	+	+	+	+
OH	$200.00	2.0	+	+	+	+
UT	$200.00	4.0		+		+
AZ	$165.00					
MA	$165.00	3.7	+	+	+	+
AR	$154.00	3.0	+	+	+	+
LA	$154.00	2.5	+	+	+	+
VA	$154.00	0.5			+	
FL	$142.00	2.0	+	+	+	+
NE	$140.00	1.8	+	+	+	+
NM	$132.00	0.5			+	+
MO	$125.00	0.5				
CO	$124.00	3.1	+	+	+	+
GA	$121.00	1.5	+	+	+	
SC	$115.50	1.5	+	+	+	+
AL	$110.00	2.0				
KY	$110.00	3.0	+	+	+	+
NC	$110.00					
WV	$110.00					
SD	$96.00	1.0	+	+		+
NY	$92.50	1.5	+	+	+	+
VT	$75.00	1.0	+	+	+	+
MD	$57.00	3.0		+	+	+
WY	$50.00	2.5	+	+	+	+
KS	$35.00	1.5	+	+	+	
TN						
USDA-GIPSA						

Labs Responding = 40 Average Fee = $202.52 Average Calibration Time = 2.3 hours



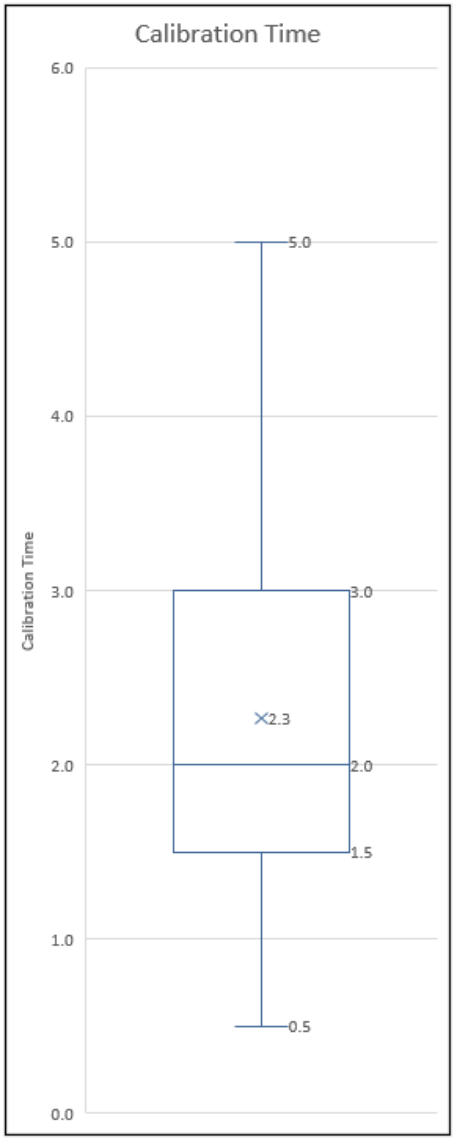


Figure 40: Fees charged for testing a 31 lb weight kit containing 22 pieces to NIST HB 105-1 Class F tolerances using mass echelon III procedures.

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 or ASTM E617 Classes 4 – 7 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.

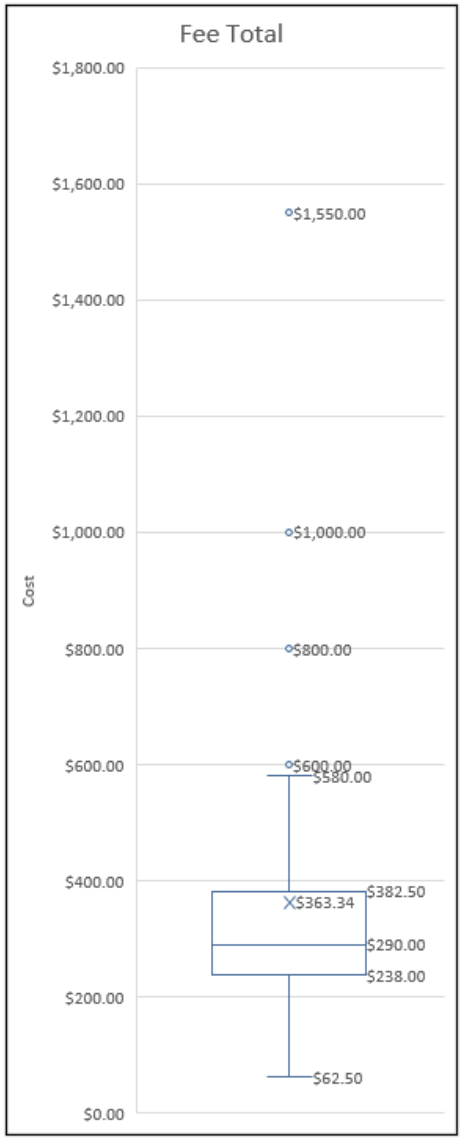
Comparison of Previous Surveys

Survey	Labs Reporting	Average Fee
2014	47	$294.67
2016	47	$351.98
2018	44	$336.72
2020	43	$365.41
2022	40	$363.34

Table 32: Average fee charged for testing 20 50 lb cast iron pipe-handle test weights, with 5 adjustments.

Lab ID	Fee Total	Calibration Time	Includes Packing	Includes Setup	Includes Statistical Controls	Includes Certificates
TX	$1,550.00	2.5	+	+		+
AK	$1,000.00	4.0	+	+	+	+
NJ	$800.00	2.5			+	
CA	$600.00	4.0	+	+	+	+
HI	$580.00	6.0	+	+	+	+
PA	$500.00	1.0			+	+
WI	$479.20	1.5		+	+	
IL	$465.00	3.0	+	+	+	+
KY	$425.00	2.0	+	+	+	+
OR	$405.00	3.0				
NV	$375.00	5.0	+	+	+	+
MI	$362.50	2.5	+	+	+	+
AR	$360.00	3.0	+	+	+	+
NM	$360.00	1.0			+	+
MA	$350.00	5.0	+	+	+	+
NY	$345.00	3.0	+	+	+	+
AZ	$330.00					
MT	$300.00	4.0	+	+		+
WV	$300.00					
WY	$300.00	1.5	+	+	+	+
ID	$280.00		+	+	+	+
ME	$280.00	3.5	+	+	+	+
MN	$273.00	2.7	+	+	+	+
MD	$265.00	3.5		+	+	+
GA	$250.00	3.0	+	+	+	
LA	$250.00	2.5	+	+	+	+
NC	$250.00					
OH	$250.00	2.5	+	+	+	+
FL	$240.00	6.0	+	+	+	+
VA	$240.00	2.0		+	+	
CO	$232.00	5.8	+	+	+	+
WA	$211.00	2.0	+	+	+	+
NE	$210.00	2.0	+	+	+	+
SC	$206.25	2.0	+	+	+	+
UT	$200.00	4.0		+		+
SD	$192.00	2.0	+	+	+	+
VT	$190.00	2.0	+	+	+	+
AL	$160.00	6.0				
KS	$105.00	3.0	+	+	+	
MO	$62.50	0.5				
TN						
USDA-GIPSA						

Labs Responding = 40 Average Fee = $363.34 Average Calibration Time = 3 hours



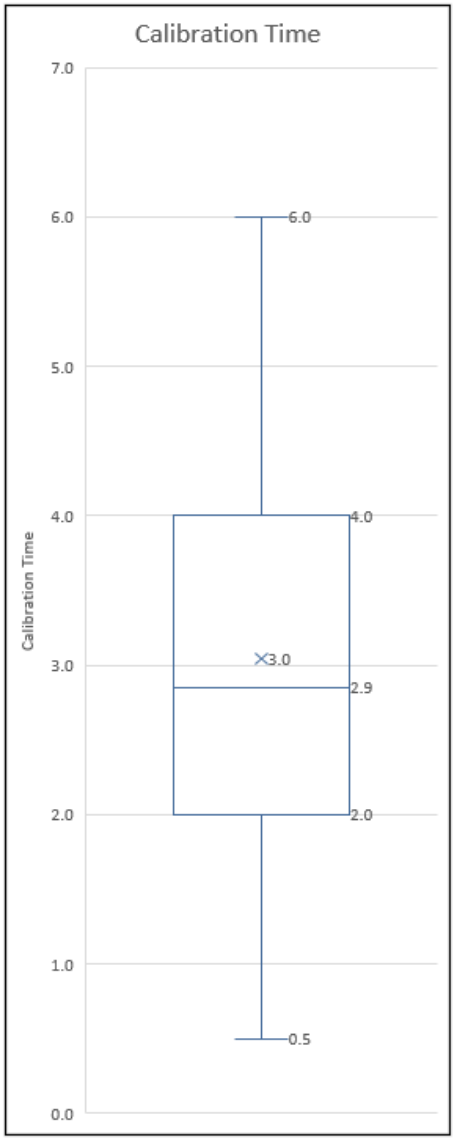


Figure 41: Fees charged for testing a set of 20 50 lb cast iron pipe-handle style test weights to NIST HB 105-1 Class F tolerances using mass echelon III procedures. 5 adjustments were assumed.

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 or ASTM E617 Classes 4 – 7 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.

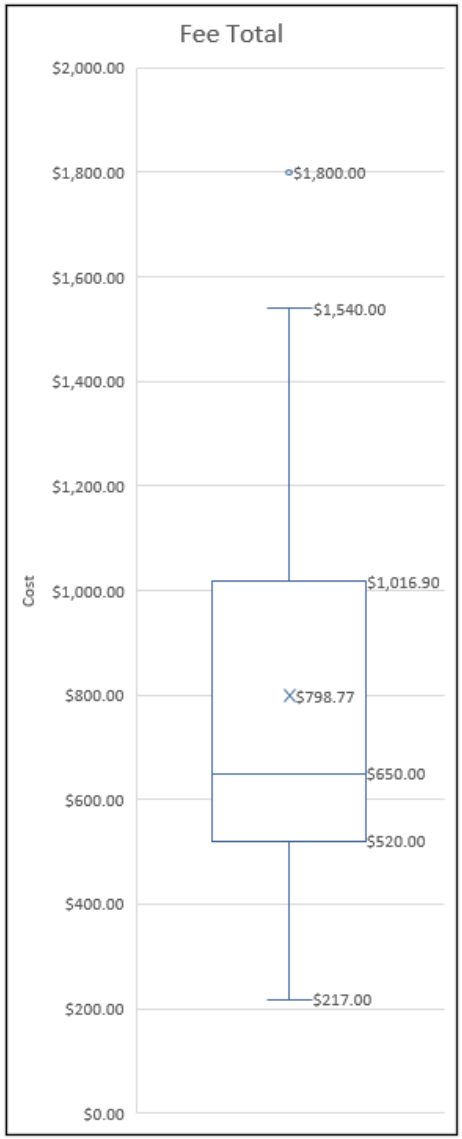
Comparison of Previous Surveys

Survey	Labs Reporting	Average Fee
2014	46	$1,058.00
2016	47	$820.06
2018	44	$857.66
2020	43	$798.32
2022	39	$798.77

Table 33: Average fee charged for testing 24 1,000 lb cast iron test weights, with 5 adjustments

Lab ID	Fee Total	Calibration Time	Includes Packing	Includes Setup	Includes Statistical Controls	Includes Certificates
AK	$1,800.00	6.0	+	+	+	+
CA	$1,800.00	8.0		+	+	
TX	$1,540.00	4.0	+	+		+
HI	$1,416.00	8.0	+	+	+	+
KY	$1,300.00	4.0	+	+	+	+
PA	$1,205.00	3.0			+	+
ID	$1,200.00		+	+	+	+
WI	$1,123.20	4.0		+	+	
OR	$1,080.00	8.0				
MN	$1,073.80	5.2	+	+	+	+
NJ	$960.00	5.0			+	
NY	$960.00	11.0	+	+	+	+
MI	$942.50	6.5	+	+	+	+
IL	$930.00	6.0	+	+	+	+
WV	$820.00					
NM	$816.00	2.0			+	+
NV	$750.00	10.0	+	+	+	+
VA	$748.00	4.0		+	+	
FL	$720.00	6.0	+	+	+	+
LA	$650.00	4.0	+	+	+	+
NE	$644.00	3.0	+	+	+	+
AR	$612.00	8.0	+	+	+	+
MT	$600.00	8.0	+	+		+
WY	$600.00	5.0	+	+	+	+
NC	$580.00					
OH	$580.00	5.8	+	+	+	+
VT	$570.00	5.0	+	+	+	+
ME	$560.00	7.0	+	+	+	+
MA	$540.00	12.0	+	+	+	+
UT	$500.00	10.0	+	+		+
CO	$488.00	12.2	+	+	+	+
SD	$480.00	5.0	+	+	+	+
SC	$465.70	4.0	+	+	+	+
WA	$419.84	4.0	+	+	+	+
GA	$396.00	4.0	+	+	+	
MO	$375.00	1.5				
AL	$360.00	8.0				
AZ	$330.00					
KS	$217.00	4.5	+	+	+	
MD						
TN						
USDA-GIPSA						

Labs Responding = 39 Average Fee = $798.77 Average Calibration Time = 6 hours



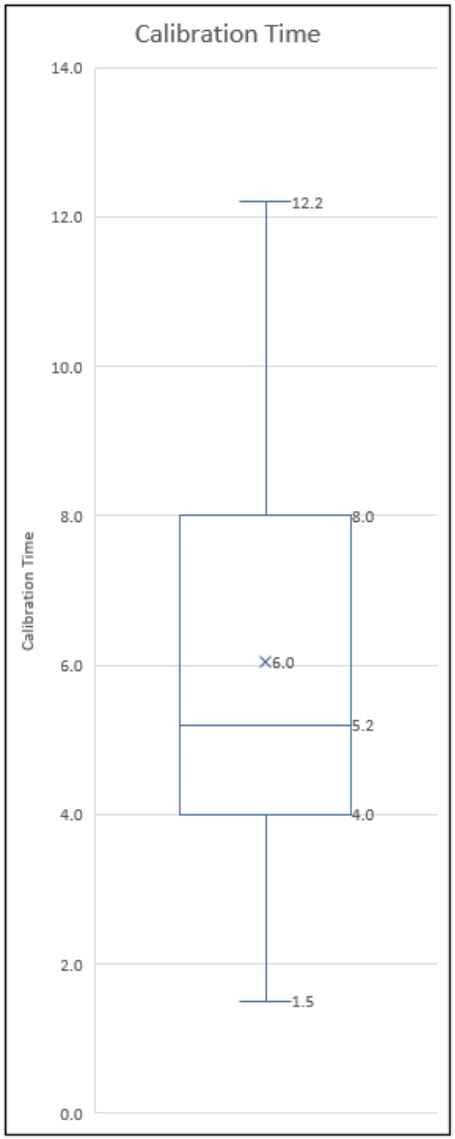


Figure 42: Fees charged for testing a set of 24 1,000 lb cast iron test weights to NIST HB 105-1 Class F tolerances using mass Echelon III procedures. 5 adjustments were assumed.

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", 2019). Laboratories were not asked to allow for cleaning or adjustments.

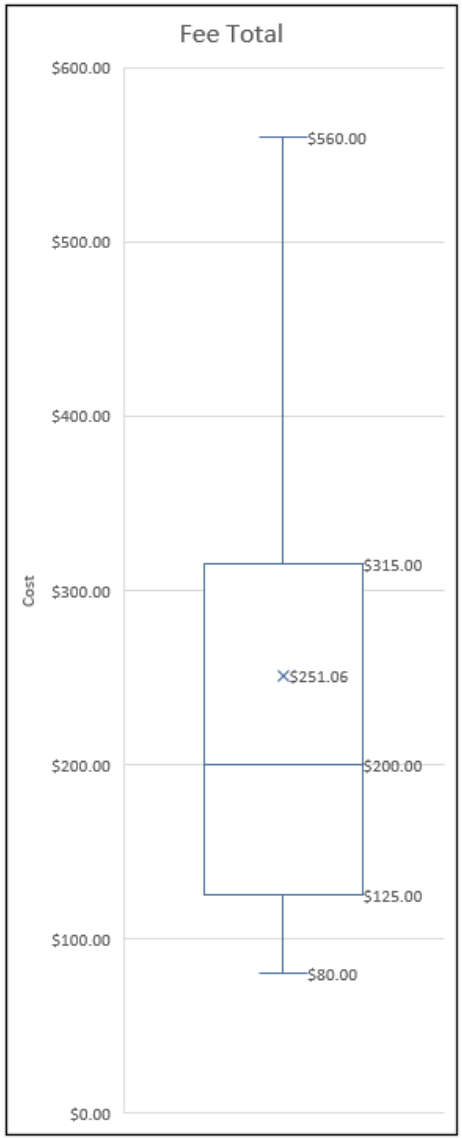
Comparison of Previous Surveys

Survey	Labs Reporting	Average Fee
2004	28	$163.27
2006	31	$205.74
2008	31	$185.80
2010	34	$225.09
2012	30	$201.65
2014	31	$203.97
2016	32	$205.01
2018	31	$208.60
2020	31	$233.00
2022	29	$251.06

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

Lab ID	Fee Total	Calibration Time	Includes Packing	Includes Setup	Includes Statistical Controls	Includes Certificates
ME	$560.00	7.0	+	+	+	+
AK	$510.00	6.0	+	+	+	+
MO	$500.00	2.0				
WA	$432.55	4.1	+	+	+	+
WI	$426.40	2.0		+	+	
MI	$406.00	2.8	+	+	+	+
MT	$375.00	5.0	+	+		+
PA	$315.00	1.5			+	+
IL	$310.00	2.0	+	+	+	+
MN	$309.40	1.0	+	+	+	+
VT	$300.00	3.0	+	+	+	+
OR	$270.00	2.0	+	+	+	+
SC	$265.50	2.0	+	+	+	+
NY	$255.00	8.0	+	+	+	+
NE	$200.00	2.5	+	+	+	+
OH	$200.00	2.0	+	+	+	+
WV	$200.00					
ID	$190.00		+	+	+	+
NM	$145.00	0.5			+	+
VA	$131.00	1.0		+	+	
NC	$125.00					
SD	$125.00	1.3	+	+	+	+
CO	$120.00	3.0	+	+	+	+
AZ	$110.00					
GA	$110.00	2.5	+	+	+	
TX	$110.00	2.5	+	+		+
FL	$100.00	2.0	+	+	+	+
WY	$100.00	2.0	+	+	+	+
KS	$80.00	1.5	+	+	+	
AL						
AR						
CA						
HI						
KY						
LA						
MA						
MD						
NJ						
NV						
TN						
USDA-GIPSA						
UT						

Labs Responding = 29 Average Fee = $251.06 Average Calibration Time = 2.8 hours



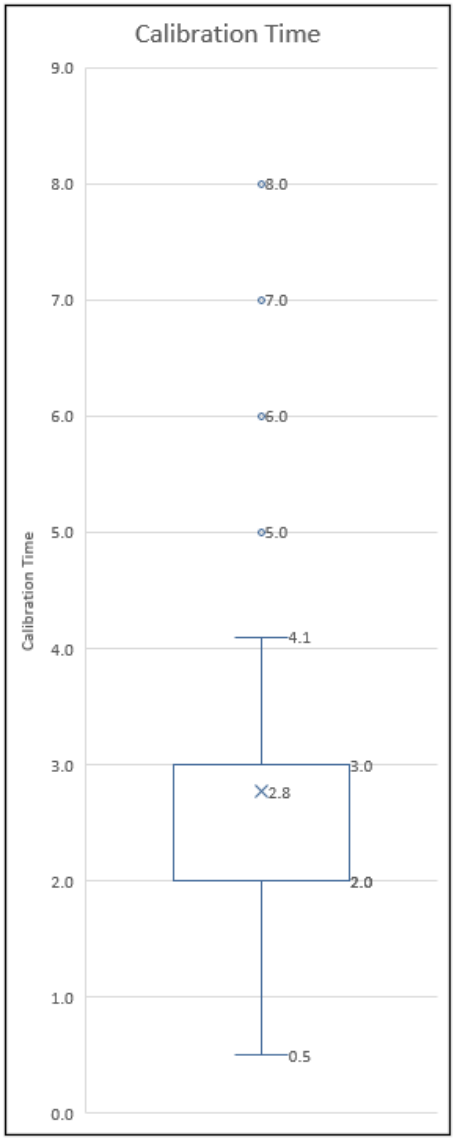


Figure 43: Fees charged for testing a 5,000 lb weight cart according to NIST HB 105-8 tolerances using mass Echelon III procedures.

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 cast cube weights requiring 5 adjustments, 20 50 lb 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.

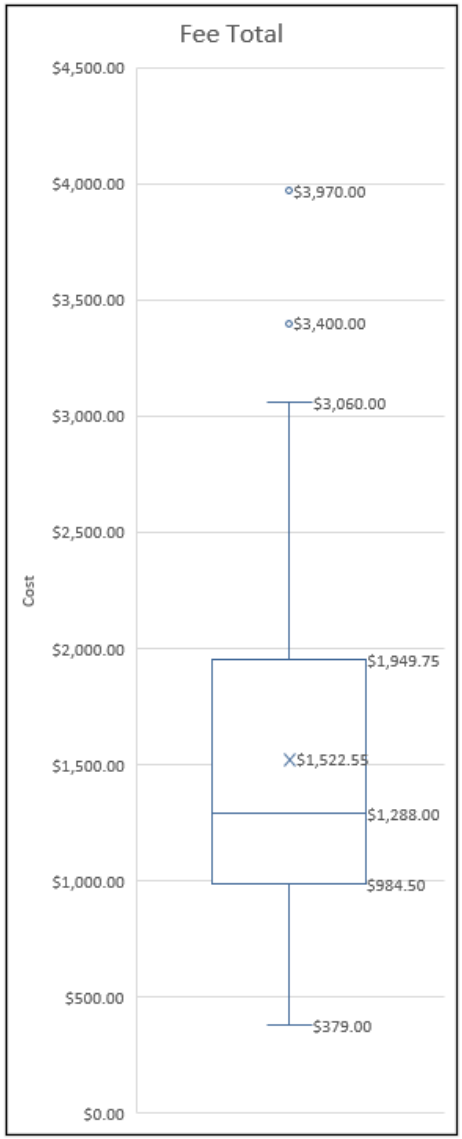
Comparison of Previous Surveys

Survey	Labs Reporting	Average Fee
2004	39	$1,050.56
2006	43	$1,060.77
2008	42	$1,300.30
2010	44	$1,455.69
2012	42	$1,520.41
2014	45	$1,472.13
2016	47	$1,529.57
2018	44	$1,562.19
2020	43	$1,521.59
2022	40	$1,522.55

Table 35: Average fee charged for typical scale truck testing.

Lab ID	Fee Total	Calibration Time	Includes Packing	Includes Setup	Includes Statistical Controls	Includes Certificates
TX	$3,970.00	8.5				
AK	$3,400.00	16.0				
CA	$3,060.00	20.8				
HI	$2,876.00	20.0	+	+	+	+
NJ	$2,640.00	10.5				
PA	$2,585.00	6.5				
WI	$2,020.80	8.0				
IL	$2,015.00	13.0				
OR	$1,998.00	14.8				
ID	$1,964.00	0.0				
KY	$1,945.00	10.5				
MI	$1,943.00	13.4				
MN	$1,747.20	9.8				
MT	$1,500.00	20.0				
NY	$1,490.00	17.0				
NM	$1,440.00	3.8				
OH	$1,430.00	14.3				
NV	$1,425.00	19.0				
WV	$1,340.00	0.0				
VA	$1,296.00	7.0				
AR	$1,280.00	16.0				
FL	$1,244.00	16.0				
ME	$1,240.00	15.5				
MA	$1,220.00	24.3				
NE	$1,134.00	8.5				
LA	$1,108.00	9.5				
UT	$1,100.00	22.0				
NC	$1,050.00	0.0				
WY	$1,000.00	10.5				
AZ	$990.00	0.0				
CO	$968.00	24.2				
SC	$902.95	7.0				
WA	$894.59	8.5				
GA	$888.00	9.5				
SD	$864.00	9.0				
VT	$860.00	8.0				
AL	$740.00	19.0				
MO	$562.50	3.0				
KS	$392.00	10.5				
MD	$379.00	9.5				
TN						
USDA-GIPSA						

Labs Responding = 40 Average Fee = $1522.55 Average Calibration Time = 11.6 hours



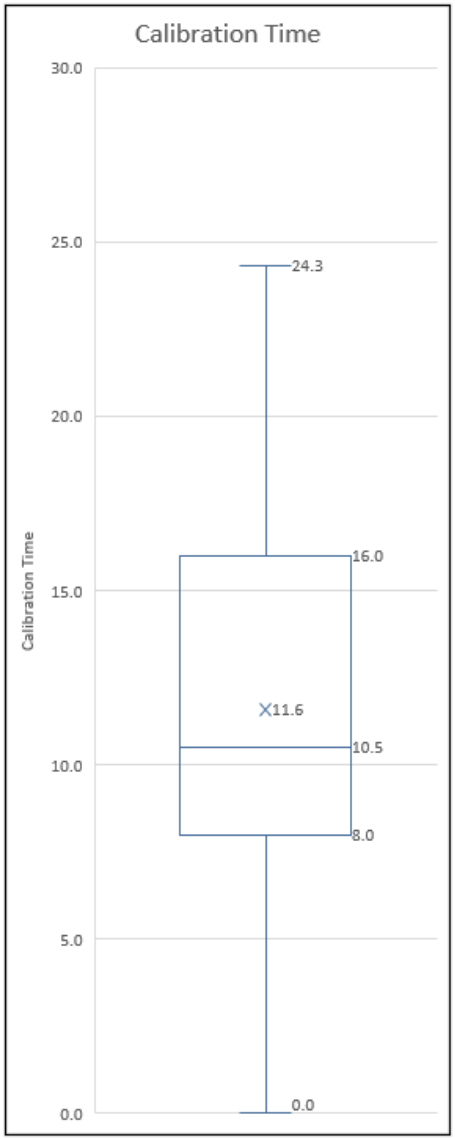


Figure 44: Fees charged for testing a typical scale truck according to mass Echelon III procedures.

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.

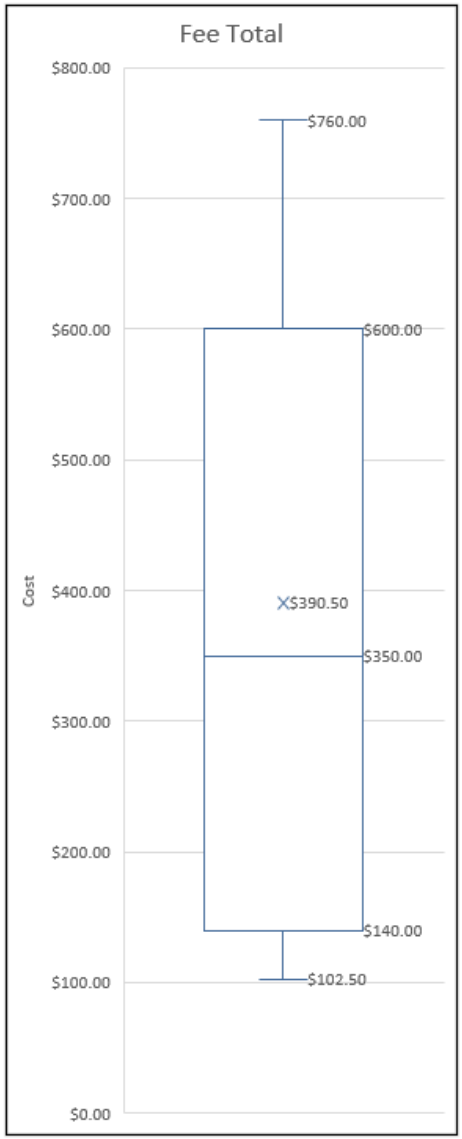
Comparison of Previous Surveys

Survey	Labs Reporting	Average Fee
2000	33	$133.00
2002	36	$173.03
2004	22	$250.89
2006	22	$261.23
2008	18	$244.86
2010	16	$234.16
2012	10	$246.00
2014	9	$198.56
2016	7	$200.71
2018	5	$195.50
2020	6	$262.92
2022	5	$390.15

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

Lab ID	Fee Total	Calibration Time	Includes Packing	Includes Setup	Includes Statistical Controls	Includes Certificates
PA	$760.00	6.0	+	+	+	+
CA	$600.00	4.0	+	+	+	
OH	$350.00	3.5	+	+	+	+
NJ	$140.00	6.0			+	
NY	$102.50	2.0	+	+	+	+
AK						
AL						
AR						
AZ						
CO						
FL						
GA						
HI						
ID						
IL						
KS						
KY						
LA						
MA						
MD						
ME						
MI						
MN						
MO						
MT						
NC						
NE						
NM						
NV						
OR						
SC						
SD						
TN						
TX						
USDA-GIPSA						
UT						
VA						
VT						
WA						
WI						
WV						
WY						

Labs Responding = 5 Average Fee = $390.5 Average Calibration Time = 4.3 hours



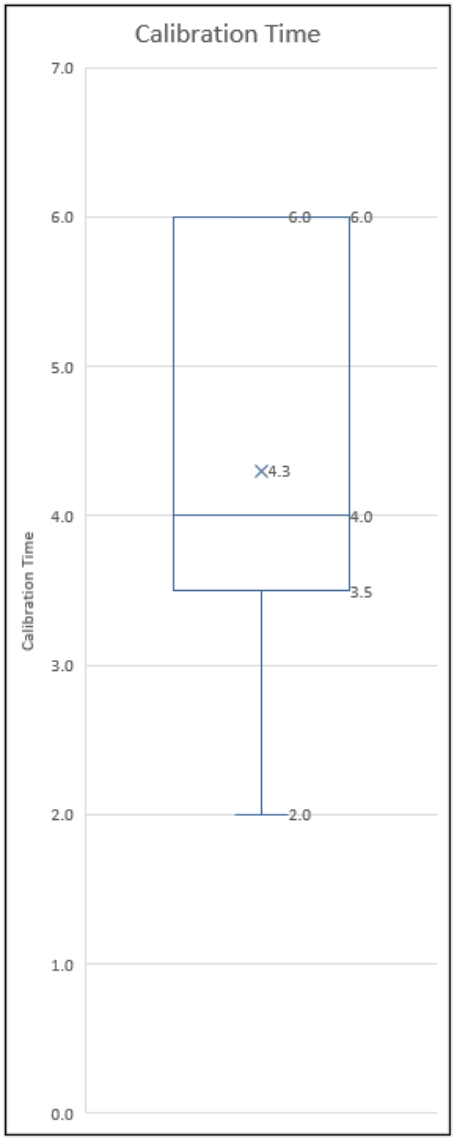


Figure 45: Fees charged for testing a steel 100 ft tape.

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.

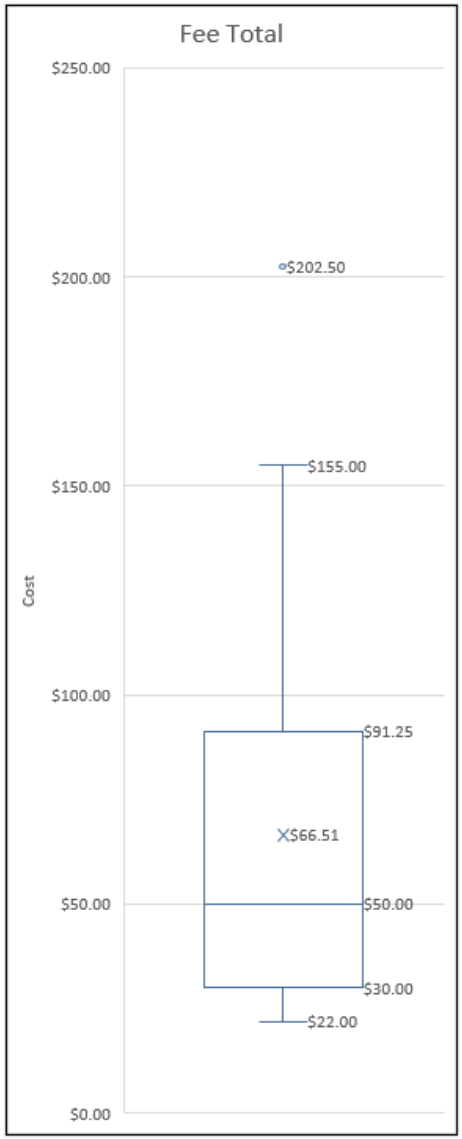
Comparison of Previous Surveys

Survey	Labs Reporting	Average Fee
2000	35	$35.00
2002	41	$41.46
2004	39	$42.06
2006	43	$43.93
2008	43	$56.89
2010	44	$64.44
2012	44	$63.61
2014	46	$62.52
2016	48	$67.07
2018	44	$70.24
2020	43	$65.57
2022	40	$66.51

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

Lab ID	Fee Total	Calibration Time	Includes Packing	Includes Setup	Includes Statistical Controls	Includes Certificates
OR	$202.50	1.5				
IL	$155.00	1.0	+	+	+	+
CA	$150.00	0.5			+	
NV	$150.00	2.0	+	+	+	+
WI	$146.40	1.0		+	+	
PA	$120.00	1.0		+	+	+
WA	$116.05	1.1	+	+	+	+
MI	$101.50	0.7	+	+	+	+
OH	$100.00	1.0	+	+	+	+
HI	$92.00	2.5	+	+	+	+
MN	$91.00	0.5	+	+	+	+
ME	$80.00	1.0	+	+	+	+
SD	$77.00	0.8		+		+
AK	$75.00	1.0	+	+	+	+
MT	$75.00	1.0	+	+		+
ID	$60.00		+	+	+	+
TX	$55.00	0.8	+	+		+
NE	$51.00	0.5	+	+	+	+
AZ	$50.00					
KS	$50.00	0.8	+	+	+	
UT	$50.00	1.0	+	+		+
MA	$45.00	1.0	+	+	+	+
VT	$45.00	0.5	+	+		+
AR	$40.00	1.5	+	+	+	+
CO	$40.00	1.0	+	+	+	+
SC	$37.25	1.0	+	+	+	+
FL	$35.00	2.5	+	+	+	+
NM	$35.00	0.5		+	+	+
MO	$31.25	0.3				
AL	$30.00					
GA	$30.00	1.0				
LA	$30.00	1.5	+	+	+	+
MD	$30.00	2.0		+	+	+
NC	$30.00					
NJ	$30.00	0.8			+	
WV	$30.00					
KY	$25.00	0.5	+	+	+	+
WY	$25.00	1.0	+	+	+	+
NY	$22.50	0.5	+	+	+	+
VA	$22.00	1.0		+	+	
TN						
USDA-GIPSA						

Labs Responding = 40 Average Fee = $66.51 Average Calibration Time = 1 hours



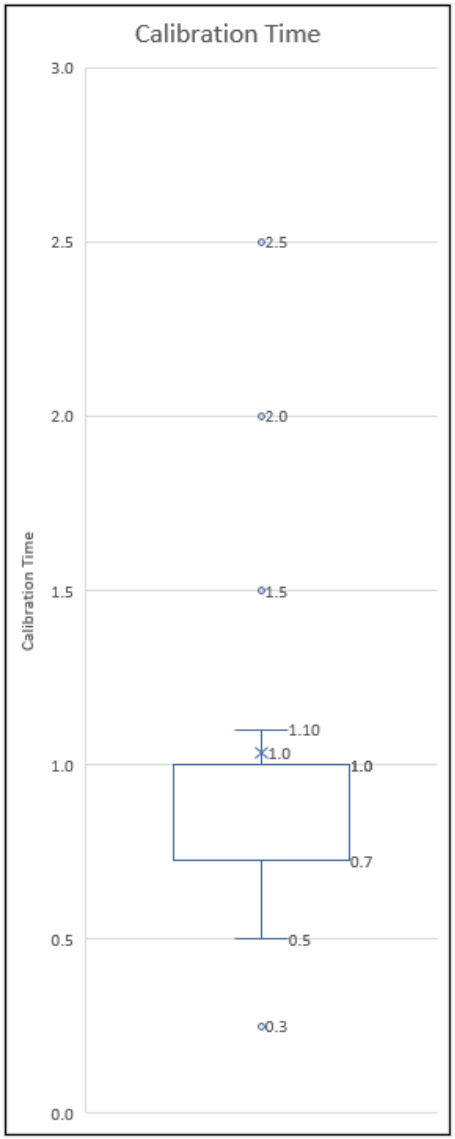


Figure 46: Fees charged for testing a 5 gallon test measure via volume transfer technique.

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.

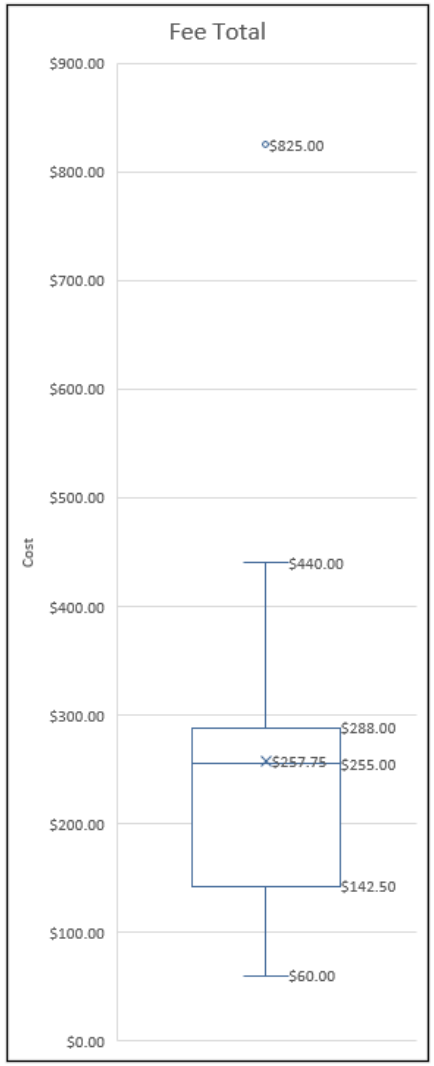
Comparison of Previous Surveys

Survey	Labs Reporting	Average Fee
2006	20	$177.95
2008	17	$173.65
2010	21	$209.25
2012	18	$215.24
2014	22	$200.95
2016	19	$241.26
2018	18	$218.05
2020	16	$216.62
2022	15	$257.75

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

Lab ID	Fee Total	Calibration Time	Includes Packing	Includes Setup	Includes Statistical Controls	Includes Certificates
PA	$825.00	7.5	+	+	+	+
AZ	$440.00					
MN	$364.00	2.0	+	+	+	+
NV	$300.00	4.0	+	+	+	+
HI	$276.00	6.0	+	+	+	+
OR	$270.00	2.0				
WA	$263.75	2.5	+	+	+	+
AK	$255.00	3.0	+	+	+	+
MI	$217.50	1.5	+	+	+	+
KS	$180.00	2.5	+	+	+	
ME	$160.00	2.0	+	+	+	+
MO	$125.00	1.0				
SC	$67.50	1.0	+	+	+	+
NY	$62.50	1.5	+	+	+	+
NC	$60.00					
AL						
AR						
CA						
CO						
FL						
GA						
ID						
IL						
KY						
LA						
MA						
MD						
MT						
NE						
NJ						
NM						
OH						
SD						
TN						
TX						
USDA-GIPSA						
UT						
VA						
VT						
WI						
WV						
WY						

Labs Responding = 15 Average Fee = $257.75 Average Calibration Time = 2.8 hours



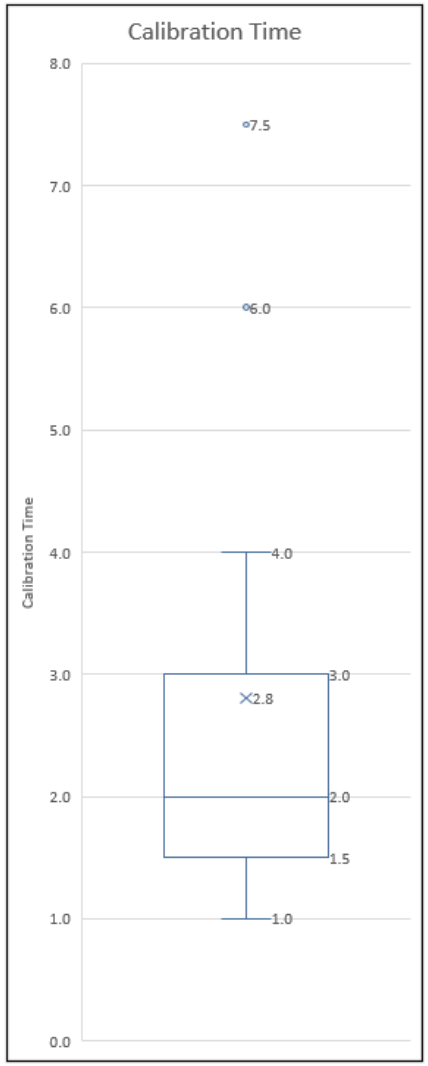


Figure 47 Fees charged for gravimetrically testing a 5 gallon test measure.

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.

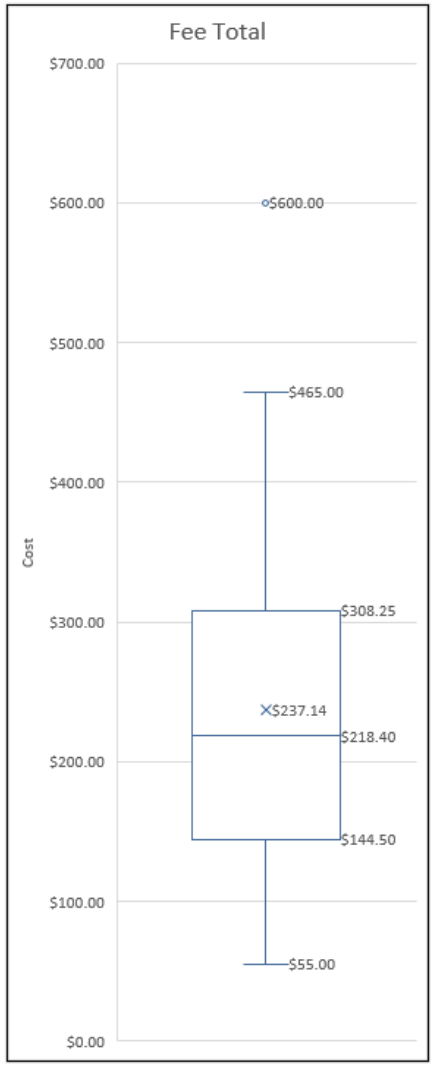
Comparison of Previous Surveys

Survey	Labs Reporting	Average Fee
2000	35	$108.00
2002	40	$125.19
2004	35	$138.73
2006	37	$145.32
2008	36	$191.83
2010	38	$219.76
2012	38	$206.35
2014	40	$217.01
2016	42	$224.16
2018	38	$214.57
2020	39	$217.73
2022	35	$237.14

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

Lab ID	Fee Total	Calibration Time	Includes Packing	Includes Setup	Includes Statistical Controls	Includes Certificates
MT	$600.00	8.0	+	+		+
IL	$465.00	3.0	+	+	+	+
CA	$450.00	0.5			+	
PA	$440.00	2.5	+	+	+	+
OR	$391.50	2.9				
HI	$368.00	5.0	+	+	+	+
MI	$362.50	2.5	+	+	+	+
MA	$360.00	8.0	+	+	+	+
WA	$316.50	3.0	+	+	+	+
NV	$300.00	4.0	+	+	+	+
VT	$300.00	3.0	+	+		+
WI	$282.40	2.5		+	+	
MO	$250.00	1.0				
OH	$250.00	2.5	+	+	+	+
ME	$240.00	3.0	+	+	+	+
SD	$240.00	2.5		+		+
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	+	+	+	+
NE	$160.00	2.0	+	+	+	+
TX	$160.00	2.0	+	+		+
NM	$150.00	1.5	+	+	+	+
UT	$150.00	3.0	+	+		+
SC	$139.00	2.0	+	+	+	+
CO	$120.00	3.0	+	+	+	+
FL	$106.25	3.0	+	+	+	+
NY	$97.50	5.0	+	+	+	+
KS	$85.00	1.3	+	+	+	
KY	$80.00	3.0	+	+	+	+
AL	$75.00					
NC	$68.00					
GA	$55.00	2.0	+	+	+	
AR						
ID						
LA						
MD						
TN						
USDA-GIPSA						
VA						

Labs Responding = 35 Average Fee = $237.14 Average Calibration Time = 2.9 hours



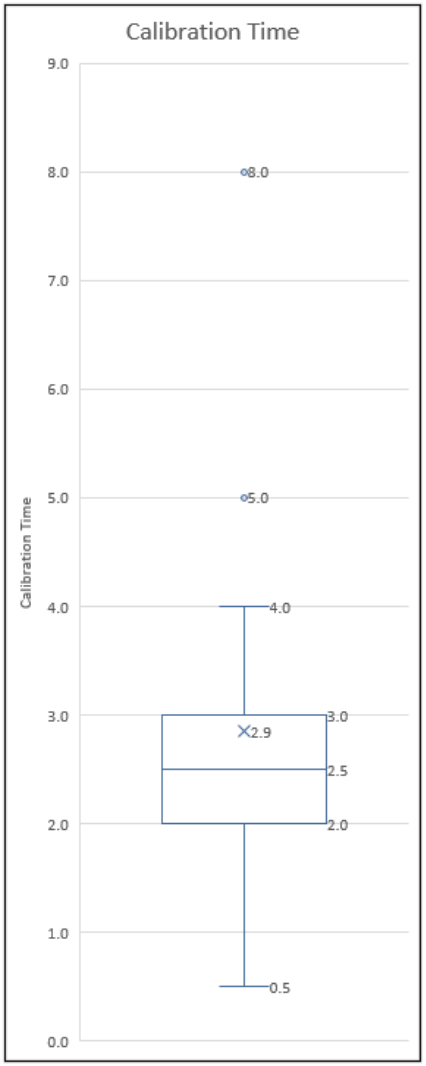


Figure 48: Fees charged for testing a 100 gallon field standard prover via volume transfer technique.

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.

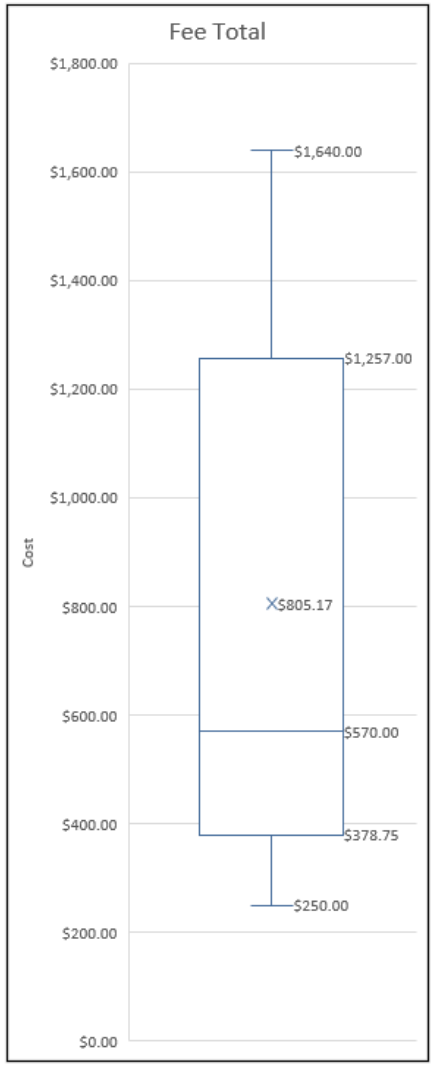
Comparison of Previous Surveys

Survey	Labs Reporting	Average Fee
2006	4	$265.00
2008	7	$434.29
2010	7	$597.14
2012	7	$447.14
2014	8	$670.63
2016	7	$854.29
2018	7	$702.29
2020	7	$702.29
2022	6	$805.17

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

Lab ID	Fee Total	Calibration Time	Includes Packing	Includes Setup	Includes Statistical Controls	Includes Certificates
PA	$1,640.00	15.0	+	+	+	+
MN	$1,456.00	8.0	+	+	+	+
AZ	$660.00					
ME	$480.00	6.0	+	+	+	+
NY	$345.00	8.0	+	+	+	+
NC	$250.00					
AK						
AL						
AR						
CA						
CO						
FL						
GA						
HI						
ID						
IL						
KS						
KY						
LA						
MA						
MD						
MI						
MO						
MT						
NE						
NJ						
NM						
NV						
OH						
OR						
SC						
SD						
TN						
TX						
USDA-GIPSA						
UT						
VA						
VT						
WA						
WI						
WV						
WY						

Labs Responding = 6 Average Fee = $805.17 Average Calibration Time = 9.3 hours



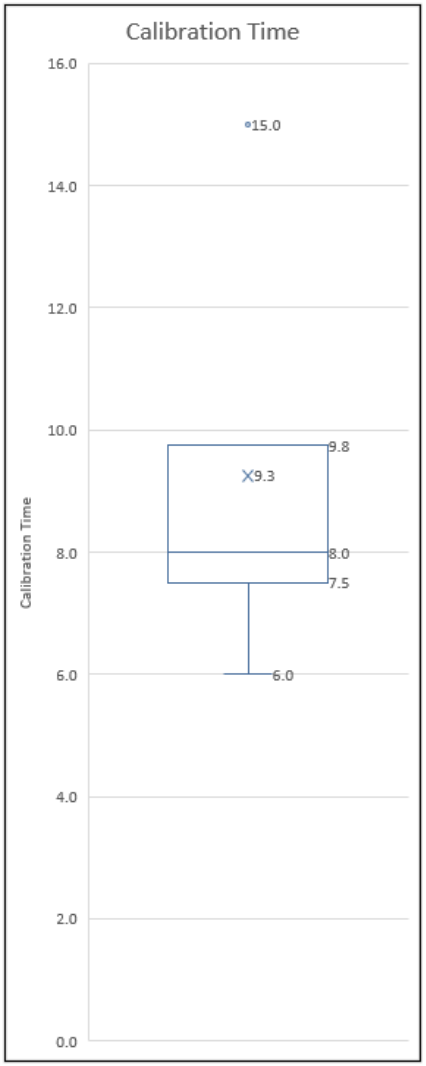


Figure 49: Fees charged for gravimetrically testing a 100 gallon field standard steel prover.

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", 2016) using a volume transfer calibration technique.

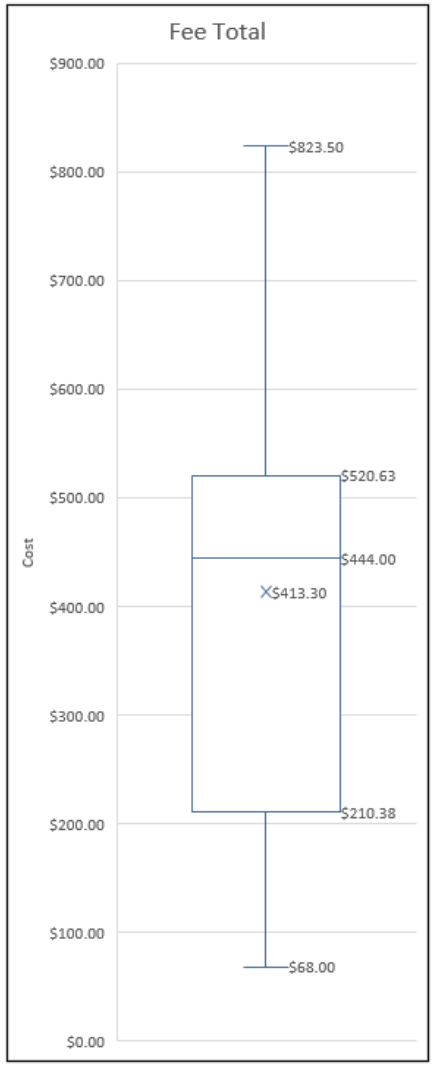
Comparison of Previous Surveys

Survey	Labs Reporting	Average Fee
2006	32	$255.78
2008	31	$295.39
2010	38	$219.75
2012	29	$348.05
2014	31	$347.05
2016	30	$372.44
2018	29	$389.74
2020	28	$394.65
2022	30	$413.30

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

Lab ID	Fee Total	Calibration Time	Includes Packing	Includes Setup	Includes Statistical Controls	Includes Certificates
OR	$823.50	6.1				
CA	$750.00	3.5			+	
MN	$728.00	4.0	+	+	+	+
WI	$706.40	4.0		+	+	
MT	$600.00	8.0	+	+		+
OH	$600.00	6.0	+	+	+	+
MI	$580.00	4.0	+	+	+	+
WA	$527.50	5.0	+	+	+	+
MO	$500.00	2.0				
WV	$500.00					
ME	$480.00	6.0	+	+	+	+
IL	$465.00	3.0	+	+	+	+
NV	$450.00	6.0	+	+	+	+
VT	$450.00	4.0		+	+	+
ID	$448.00		+	+	+	+
AZ	$440.00					
SD	$432.00	4.5		+		+
AK	$400.00	4.0	+	+	+	+
NY	$370.00	7.0	+	+	+	+
TX	$325.00	3.5	+	+		+
NM	$250.00	2.0	+	+	+	+
NE	$240.00	3.0	+	+	+	+
SC	$200.50	3.0	+	+	+	+
FL	$200.00	8.0	+	+	+	+
NJ	$200.00	2.0			+	
WY	$200.00	3.0	+	+	+	+
KS	$170.00	2.0	+	+	+	
CO	$160.00	4.0	+	+	+	+
GA	$135.00	3.0	+	+	+	
NC	$68.00					
AL						
AR						
HI						
KY						
LA						
MA						
MD						
PA						
TN						
USDA-GIPSA						
UT						
VA						

Labs Responding = 30 Average Fee = $413.3 Average Calibration Time = 4.3 hours



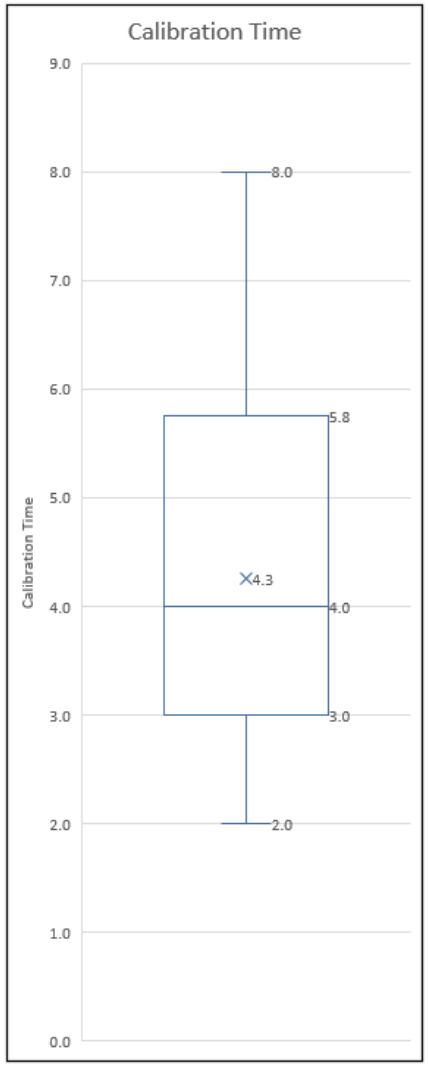


Figure 50: Fees charged for testing a 100 gallon LPG prover.

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
2006	3	$113.33
2008	2	$123.75
2010	1	$100.00
2012	2	$200.00
2014	4	$220.00

Table 42: Average fee charged for testing a SVP via volume transfer 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	$57,276.00	$94,338.00
AL	Laboratory Supervisor	Laboratory Supervisor	$32,287.20	$48,924.00
AR	Quality Manager	Laboratory Supervisor	$50,222.04	$72,822.00
AZ	State Metrologist	Laboratory Supervisor	$46,593.60	$79,424.40
CA	Principal State Metrologist	Laboratory Supervisor	$106,212.00	$120,624.00
CO	Physical Scientist V*	Laboratory Supervisor	$98,280.00	$159,264.00
FL	Senior Metrologist - SES	Laboratory Supervisor	$33,560.88	$68,764.44
GA	State Metrologist	Laboratory Supervisor	$39,038.04	$71,523.00
HI	Metrologist 3	Laboratory Supervisor	$56,304.00	$83,376.00
ID	Ag Program Manager/Metrologist	Laboratory Supervisor	$59,832.00	$106,848.00
ID	Ag Program Specialist/Metrologist	Laboratory Supervisor	$54,156.00	$96,744.00
KS	Agricultural Inspector / State Metrologist	Laboratory Supervisor	$51,600.00	$54,000.00
KY	Metrology Lab Supervisor	Laboratory Supervisor	$41,872.56	$82,194.48
LA	Program Manager of Metrology	Laboratory Supervisor	$58,776.00	$102,996.00
MA	Administrator V	Laboratory Supervisor	$54,000.00	$78,000.00
ME	Metrologist / W&M Program Manager	Laboratory Supervisor	$56,721.60	$77,022.36
MI	Metrologist Manager - 14	Laboratory Supervisor	$69,368.04	$102,044.76
MN	Lab Manager: SPA Manager Senior	Laboratory Supervisor	$80,148.00	$115,320.00
MO	Metrology Lab Manager	Laboratory Supervisor	$41,424.00	$88,248.00
MT	Metrologist	Laboratory Supervisor	$55,920.00	$56,748.00
NC	Program Manager	Laboratory Supervisor	$58,293.96	$102,015.00
NE	Scientist II	Laboratory Supervisor	$43,200.00	$58,800.00
NJ	Supervisor of Licensing Weights and Measures	Laboratory Supervisor	$88,302.48	$128,061.84
NM	Regulatory Lab Mgr, Metrology	Laboratory Supervisor	$65,088.00	$104,136.00
NV	Metrologist III	Laboratory Supervisor	$45,643.68	$67,901.76
NY	Specialist II (lab manager)	Laboratory Supervisor	$79,320.00	$100,344.00
NY	Director	Laboratory Supervisor	$105,504.00	$133,296.00
OH	Laboratory Supervisor	Laboratory Supervisor	$53,892.96	$67,324.68
OR	Lead Metrologist	Laboratory Supervisor	$76,200.00	$117,012.00
PA	Laboratory Supervisor	Laboratory Supervisor	$61,867.92	$93,966.00
SC	Metrology Lab Director/Manager	Laboratory Supervisor	$48,000.00	$75,000.00
TX	Manager for Metrology Laboratory	Laboratory Supervisor	$51,612.00	$84,480.00
UT	State Metrologist	Laboratory Supervisor	$50,040.00	$79,368.00
VT	Weights & Measures Section Chief and State Metrologist	Laboratory Supervisor	$60,864.00	$95,424.00
WA	State Metrologist	Laboratory Supervisor	$50,592.00	$68,076.00
WI	Laboratory Director (Chemist Supervisor)	Laboratory Supervisor	$44,889.60	$74,092.80
WV	Labor Program Specialist	Laboratory Supervisor	$34,260.96	$63,381.96
WV	Labor Programs Manager	Laboratory Supervisor	$47,286.96	$87,480.00
WY	Inspection Supervisor	Laboratory Supervisor	$59,172.00	$88,764.00
AL	Consumer Protection Specialist	Metrology/Calibration Engineer	$28,516.80	$47,757.60
AR	Agri Program Manager	Metrology/Calibration Engineer	$40,340.04	$58,493.04
CA	Measurement Standards Specialist III	Metrology/Calibration Engineer	$63,648.00	$79,680.00
CO	Physical Scientist I	Metrology/Calibration Engineer	$59,220.00	$86,688.00
CO	Physical Scientist II	Metrology/Calibration Engineer	$68,460.00	$100,176.00
HI	Metrologist 2	Metrology/Calibration Engineer	$52,044.00	$77,100.00
KY	Metrology Lab Technician II	Metrology/Calibration Engineer	$31,461.36	$61,752.72

Lab ID	Job Title	Standardized Title	Min Salary	Max Salary
LA	Agriculture Specialist, Metrologist	Metrology/Calibration Engineer	$39,996.00	$73,440.00
MI	Metrology Specialist - 13	Metrology/Calibration Engineer	$64,334.40	$94,494.36
MI	Metrologist - 12	Metrology/Calibration Engineer	$59,321.64	$86,465.64
MI	Metrologist - P11	Metrology/Calibration Engineer	$56,492.76	$79,539.24
MI	Metrologist - 10	Metrology/Calibration Engineer	$48,755.16	$68,764.80
MI	Metrologist - 9	Metrology/Calibration Engineer	$47,195.16	$67,350.36
NC	Quality Assurance Manager	Metrology/Calibration Engineer	$50,357.04	$88,125.00
NC	Grain Moisture Program Supervisor	Metrology/Calibration Engineer	$50,357.04	$88,125.00
NM	Metrologist, Inter	Metrology/Calibration Engineer	$38,424.00	$57,636.00
NV	Metrologist II	Metrology/Calibration Engineer	$41,843.52	$62,055.36
PA	Metrologist (PSL Basic Requirements)	Metrology/Calibration Engineer	$60,558.00	$82,386.96
PA	Metrologist (PSL Intermediate Requirements)	Metrology/Calibration Engineer	$63,179.04	$82,386.96
SD	Metrologist	Metrology/Calibration Engineer	$52,137.36	$59,071.92
TN	Metrologist	Metrology/Calibration Engineer	$53,400.00	$79,896.00
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
VT	Consumer Protection Specialist	Metrology/Calibration Engineer	$42,796.80	$84,364.80
AK	State Metrologist I	Metrology/Calibration Technician	$49,716.00	$82,494.00
AL	Laborer	Metrology/Calibration Technician	$9,000.00	$13,500.00
AR	Metrologist	Metrology/Calibration Technician	$36,155.04	$52,425.00
CA	Measurement Standards Specialist I	Metrology/Calibration Technician	$44,088.00	$54,360.00
CA	Measurement Standards Specialist II	Metrology/Calibration Technician	$50,436.00	$62,400.00
CO	Calibration Technician	Metrology/Calibration Technician	$37,488.00	$52,920.00
FL	Metrologist - LW	Metrology/Calibration Technician	$28,800.00	$57,561.60
FL	Metrologist	Metrology/Calibration Technician	$28,800.00	$57,561.60
FL	Environmental Manager / QA/QC Coordinator	Metrology/Calibration Technician	$45,120.00	$108,355.44
GA	Metrologist	Metrology/Calibration Technician	$30,000.00	$78,000.00
HI	Metrologist 1	Metrology/Calibration Technician	$48,144.00	$71,268.00
KS	Agricultural Inspector / Metrologist	Metrology/Calibration Technician	$42,000.00	$45,000.00
KY	Program Coordinator	Metrology/Calibration Technician	$34,606.80	$67,932.24
KY	Metrology Lab Technician I	Metrology/Calibration Technician	$25,999.44	$51,033.36
MA	Compliance Officer II	Metrology/Calibration Technician	$46,800.00	$60,000.00
MD	Metrologist I	Metrology/Calibration Technician	$46,434.96	$71,124.00
MD	Metrologist II	Metrology/Calibration Technician	$49,403.04	$75,903.00
MN	Technical Manager/Quality Manager/ Lab Administrator: SPA Principal	Metrology/Calibration Technician	$60,468.00	$89,100.00
MN	Metrologist: SPA Senior	Metrology/Calibration Technician	$52,728.00	$77,292.00
MO	Metrology Specialist	Metrology/Calibration Technician	$31,200.00	$69,312.00
NC	Metrologist I	Metrology/Calibration Technician	$43,500.00	$76,125.00
NJ	Weights and Measures Inspector 3	Metrology/Calibration Technician	$74,319.24	$112,696.56
NJ	Weights and Measures Inspector 1	Metrology/Calibration Technician	$53,548.20	$82,023.12
NV	Metrologist I	Metrology/Calibration Technician	$38,440.08	$56,751.84
NY	Specialist I	Metrology/Calibration Technician	$61,260.00	$77,916.00
OH	Weights and Measures Technologist	Metrology/Calibration Technician	$47,353.56	$61,574.16
OR	Metrologist	Metrology/Calibration Technician	$69,252.00	$106,440.00
PA	Metrologist	Metrology/Calibration Technician	$57,839.04	$82,386.96
SC	Lab Technologist I	Metrology/Calibration Technician	$27,516.00	$50,928.00
SC	Lab Technologist II	Metrology/Calibration Technician	$33,492.00	$61,968.00
VA	Lab Research Practitioner II	Metrology/Calibration Technician	$57,499.92	$57,499.92
VA	Lab Research Practitioner II	Metrology/Calibration Technician	$57,000.00	$57,000.00

Lab ID	Job Title	Standardized Title	Min Salary	Max Salary
WI	Metrologist	Metrology/Calibration Technician	$44,889.60	$74,092.80
WV	Labor Inspector I	Metrology/Calibration Technician	$27,662.04	$51,173.04
WV	Labor Inspector II	Metrology/Calibration Technician	$29,046.96	$53,736.00
WY	Inspection Specialist	Metrology/Calibration Technician	$41,448.00	$62,184.00
AZ	Assistant State Metrologist	Support Staff	$36,168.00	$67,982.40
CA	Laboratory Assistant	Support Staff	$35,712.00	$47,988.00
CO	Admin Assistant III	Support Staff	$44,400.00	$59,400.00
FL	Laboratory Techinician IV	Support Staff	$28,800.00	$51,234.96
KY	Agricultural Regulatory Specialist I	Support Staff	$31,461.36	$61,752.72
NC	Administrative Associate II	Support Staff	$26,705.04	$46,734.00
NC	Application Systems Analyst I	Support Staff	$64,004.04	$96,006.96
NJ	Agency Service Representative 3	Support Staff	$46,431.84	$65,324.76
PA	Laboratory Adminstrative Assistant	Support Staff	$37,143.96	$55,433.04
TX	Adminsistrative Assistant IV	Support Staff	$32,976.00	$52,008.00
VA	Administer	Support Staff	$17,280.00	$17,280.00
VT	Consumer Protection Specialist	Support Staff	$42,796.80	$84,364.80
WI	Metrologist (LTE)	Support Staff	$34,483.20	$56,870.40
CO	*supervises multiple labs within division			
IL	Public Service Administrator		$55,344.00	$132,948.00
IL	Metrologist Associate		$45,504.00	$79,860.00
IL	Products & Standards Inspector		$45,408.00	$65,376.00
USDA-GIPSA	Program Manager		$109,728.00	$142,656.00
USDA-GIPSA	Industrial Specialist		$92,280.00	$119,964.00

Table 43: 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

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 for cost of living variations across the nation.

Laboratory Supervisor

	Minimum	Maximum	Average
Minimum Salary	$32,287.00	$48,924.00	$40,605.50
Maximum Salary	$106,212.00	$159,264.00	$132,738.00
Salary Range	$73,925.00	$110,340.00	$92,132.50

Metrologist/Calibration Engineer

	Minimum	Maximum	Average
Minimum Salary	$28,517.00	$47,758.00	$38,137.50
Maximum Salary	$68,460.00	$100,176.00	$84,318.00
Salary Range	$39,943.00	$52,418.00	$46,180.50

Metrologist/Calibration Technician

	Minimum	Maximum	Average
Minimum Salary	$9,000.00	$13,500.00	$11,250.00
Maximum Salary	$74,319.00	$112,697.00	$93,508.00
Salary Range	$65,319	$99,197.00	$82,250.00

Support Staff

	Minimum	Maximum	Average
Minimum Salary	$17,280.00	$17,280.00	$17,280.00
Maximum Salary	$64,004.00	$96,007.00	$80,005.50
Salary Range	$46,724.00	$78,727.00	$62,725.00

Table 44: SLP metrologist compensation summary by standardized job titles. Calculations are rounded to the dollar.

Laboratory Supervisor

Lab ID	Min Salary	Max Salary
AK	$57,276.00	$94,338.00
AL	$32,287.20	$48,924.00
AR	$50,222.04	$72,822.00
AZ	$46,593.60	$79,424.40
CA	$106,212.00	$120,624.00
CO	$98,280.00	$159,264.00
FL	$33,560.88	$68,764.44
GA	$39,038.04	$71,523.00
HI	$56,304.00	$83,376.00
ID	$59,832.00	$106,848.00
ID	$54,156.00	$96,744.00
KS	$51,600.00	$54,000.00
KY	$41,872.56	$82,194.48
LA	$58,776.00	$102,996.00
MA	$54,000.00	$78,000.00
ME	$56,721.60	$77,022.36
MI	$69,368.04	$102,044.76
MN	$80,148.00	$115,320.00
MO	$41,424.00	$88,248.00
MT	$55,920.00	$56,748.00
NC	$58,293.96	$102,015.00
NE	$43,200.00	$58,800.00
NJ	$88,302.48	$128,061.84
NM	$65,088.00	$104,136.00
NV	$45,643.68	$67,901.76
NY	$79,320.00	$100,344.00
NY	$105,504.00	$133,296.00
OH	$53,892.96	$67,324.68
OR	$76,200.00	$117,012.00
PA	$61,867.92	$93,966.00
SC	$48,000.00	$75,000.00
TX	$51,612.00	$84,480.00
UT	$50,040.00	$79,368.00
VT	$60,864.00	$95,424.00
WA	$50,592.00	$68,076.00
WI	$44,889.60	$74,092.80
WV	$34,260.96	$63,381.96
WV	$47,286.96	$87,480.00
WY	$59,172.00	$88,764.00

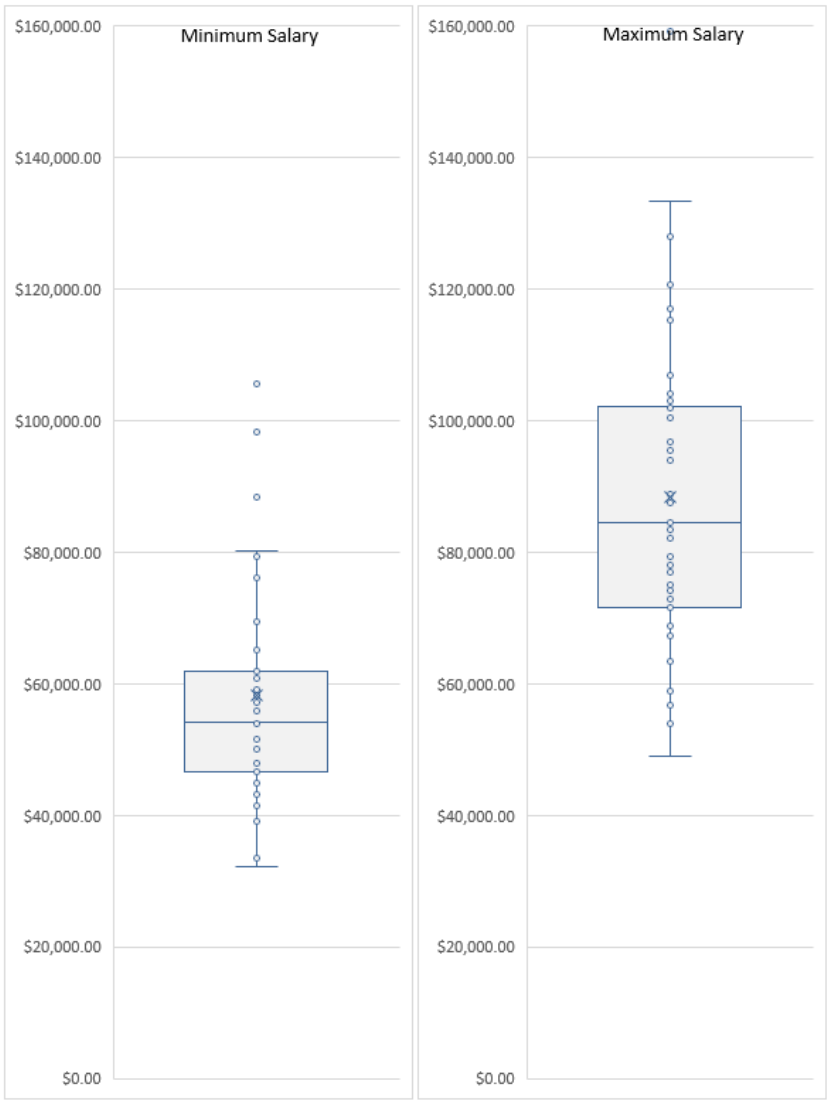


Figure 51: Salaries for Laboratory Supervisors

Metrology/Calibration Engineer

Lab ID	Min Salary	Max Salary
AL	$28,516.80	$47,757.60
AR	$40,340.04	$58,493.04
CA	$63,648.00	$79,680.00
CO	$59,220.00	$86,688.00
CO	$68,460.00	$100,176.00
HI	$52,044.00	$77,100.00
KY	$31,461.36	$61,752.72
LA	$39,996.00	$73,440.00
MI	$64,334.40	$94,494.36
MI	$59,321.64	$86,465.64
MI	$56,492.76	$79,539.24
MI	$48,755.16	$68,764.80
MI	$47,195.16	$67,350.36
NC	$50,357.04	$88,125.00
NC	$50,357.04	$88,125.00
NM	$38,424.00	$57,636.00
NV	$41,843.52	$62,055.36
PA	$60,558.00	$82,386.96
PA	$63,179.04	$82,386.96
SD	$52,137.36	$59,071.92
TN	$53,400.00	$79,896.00
TX	$36,972.00	$58,392.00
TX	$42,240.00	$68,952.00
VT	$42,796.80	$84,364.80

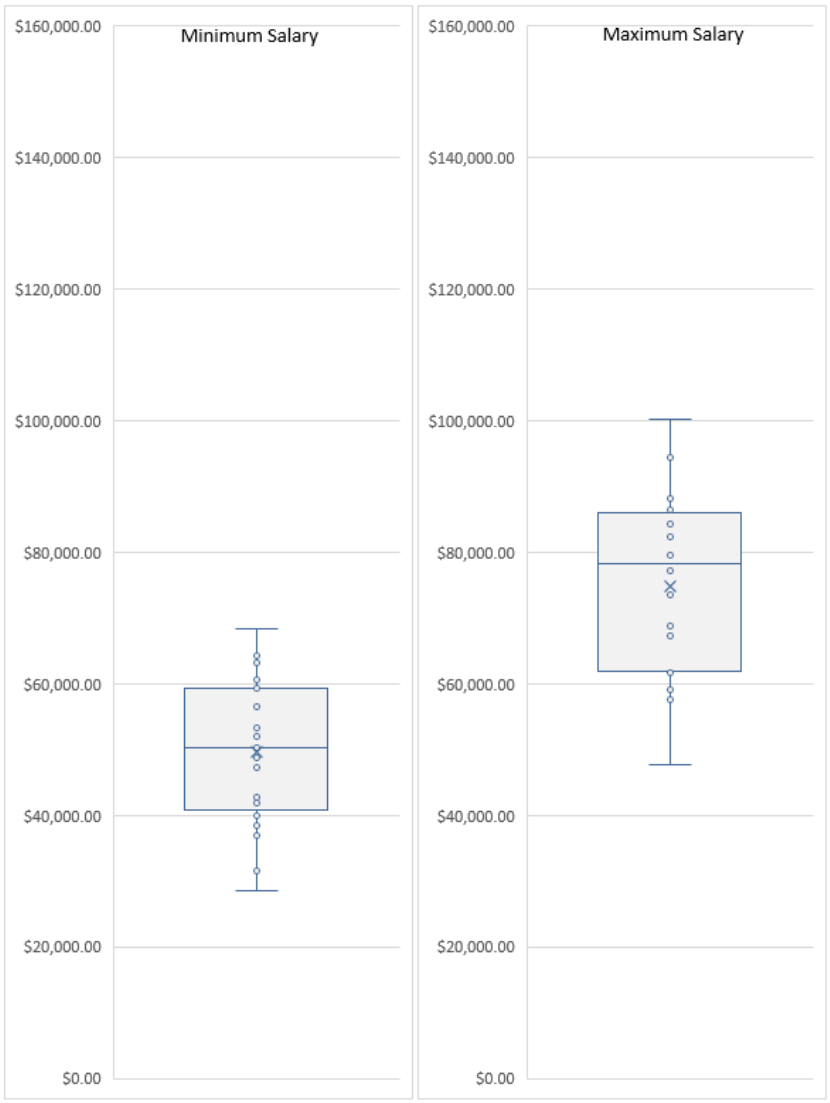


Figure 52: Salary ranges for Metrology/Calibration Engineers

Metrology/Calibration Technician

Lab ID	Min Salary	Max Salary
AK	$49,716.00	$82,494.00
AL	$9,000.00	$13,500.00
AR	$36,155.04	$52,425.00
CA	$44,088.00	$54,360.00
CA	$50,436.00	$62,400.00
CO	$37,488.00	$52,920.00
FL	$28,800.00	$57,561.60
FL	$28,800.00	$57,561.60
FL	$45,120.00	$108,355.44
GA	$30,000.00	$78,000.00
HI	$48,144.00	$71,268.00
KS	$42,000.00	$45,000.00
KY	$34,606.80	$67,932.24
KY	$25,999.44	$51,033.36
MA	$46,800.00	$60,000.00
MD	$46,434.96	$71,124.00
MD	$49,403.04	$75,903.00
MN	$60,468.00	$89,100.00
MN	$52,728.00	$77,292.00
MO	$31,200.00	$69,312.00
NC	$43,500.00	$76,125.00
NJ	$74,319.24	$112,696.56
NJ	$53,548.20	$82,023.12
NV	$38,440.08	$56,751.84
NY	$61,260.00	$77,916.00
OH	$47,353.56	$61,574.16
OR	$69,252.00	$106,440.00
PA	$57,839.04	$82,386.96
SC	$27,516.00	$50,928.00
SC	$33,492.00	$61,968.00
VA	$57,499.92	$57,499.92
VA	$57,000.00	$57,000.00
WI	$44,889.60	$74,092.80
WV	$27,662.04	$51,173.04
WV	$29,046.96	$53,736.00
WY	$41,448.00	$62,184.00

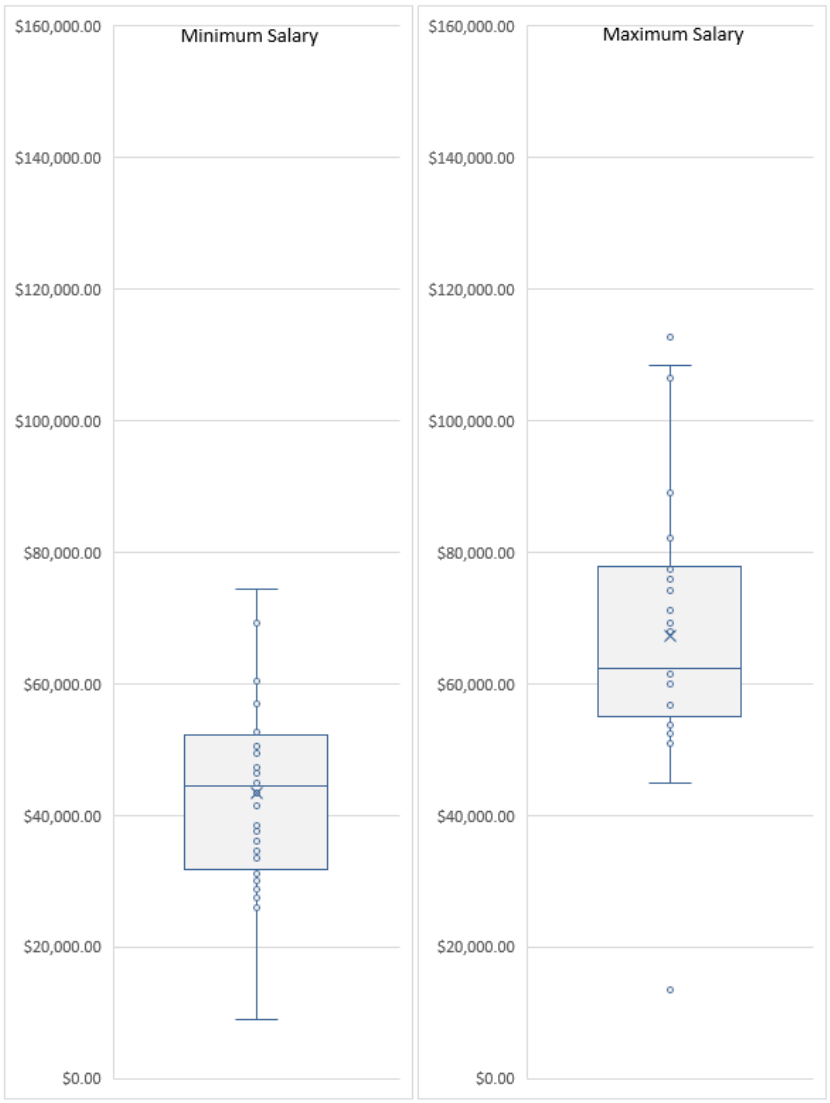


Figure 53: Salary ranges for Metrology/Calibration Technicians

Support Staff

Lab ID	Min Salary	Max Salary
AZ	$36,168.00	$67,982.40
CA	$35,712.00	$47,988.00
CO	$44,400.00	$59,400.00
FL	$28,800.00	$51,234.96
KY	$31,461.36	$61,752.72
NC	$26,705.04	$46,734.00
NC	$64,004.04	$96,006.96
NJ	$46,431.84	$65,324.76
PA	$37,143.96	$55,433.04
TX	$32,976.00	$52,008.00
VA	$17,280.00	$17,280.00
VT	$42,796.80	$84,364.80
WI	$34,483.20	$56,870.40

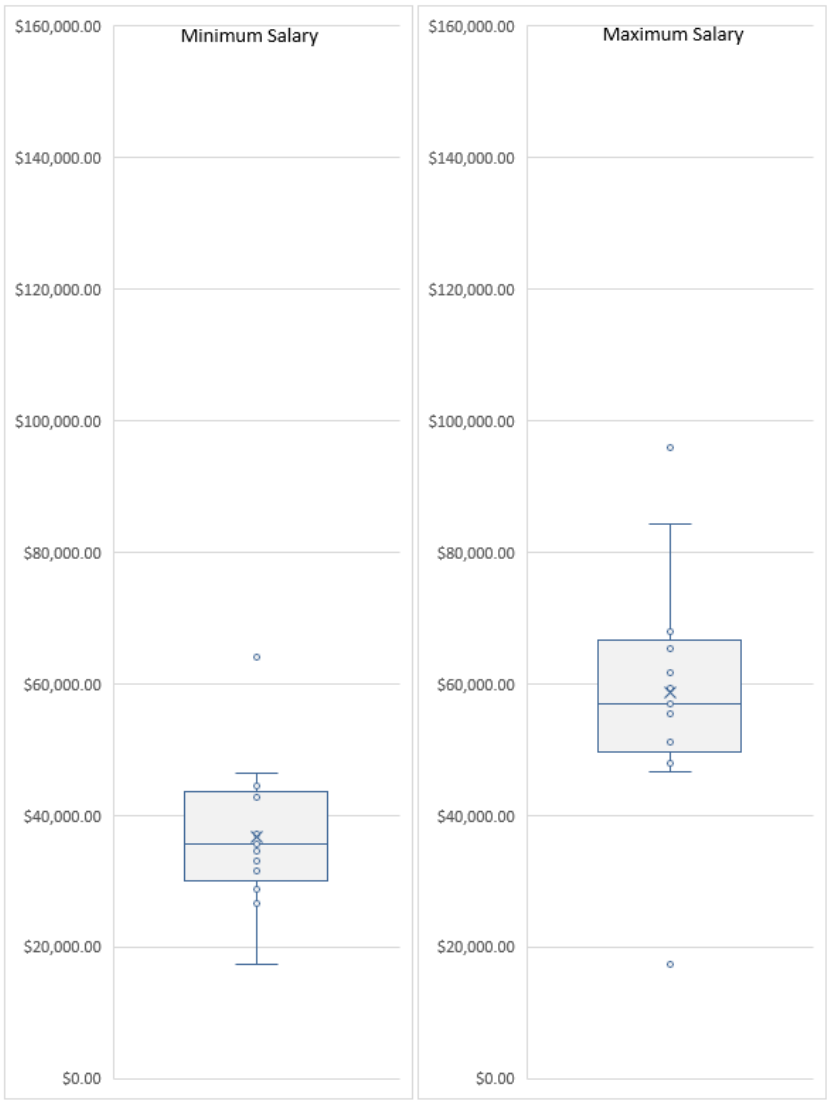


Figure 54: Salary ranges for Support Staff

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	Garret Brown	garret.brown@alaska.gov	N	Y	Y	Y	Y	N	Y	Y	N	2023	18	8	26
AK	Travis Garding	travis.garding@alaska.gov	N	N	N	N	N	N	N	N	N	2050	3	9	12
AL	Michael Bridges	michael.bridges@agi.alabama.gov			Y	Y						2027			
AL	Anthony Gallagher	anthony.gallagher@agi.alabama.gov			Y	Y						2041	7		7
AR	Jill Franke	jill.franke@agriculture.arkansas.gov	N	N	Y	Y	N	N	N	N	Y	2033	8		8
AR	Nikhil Soman	nikhil.soman@agriculture.arkansas.gov	N	N	Y	Y	N	N	N	N	N	2030	12		12
AR	Kayla Hankins	kayla.hankins@agriculture.arkansas.gov	N	N	N	N	N	N	N	N	Y	2051	1		1
AR	Claude Riche	claude.riche@agriculture.arkansas.gov	N	N	N	N	N	N	N	N	Y	2045	1		1
AZ	Brian Sellers	bsellers@azda.gov		Y	Y	Y	Y					2024	18.5		18.5
AZ	Mauro Nieves	mnieves@azda.gov										2036	3		3
CA	Tony Gruneisen	Anthony.Gruneisen@cdfa.ca.gov	N	Y	Y	Y	Y	Y	Y	Y	N	2032	22	0	22
CA	Toni Bulai	Toni.Bulai@cdfa.ca.gov	N	Y	Y	Y	Y	Y	Y	Y	N	2040	6.6	9	15.6
CA	Demi Noll	Demielle.Noll-Tennin@cdfa.ca.gov	N	N	N	N	N	N	N	N	N		1	0	1
CO	Tiffany Brigner	tiffany.brigner@state.co.us	N	N	N	N			N			2028	3	0	3
CO	Steven Hine	steven.hine@state.co.us	N	N	N	N			N				0	0	0
CO	Andrew Shopes	andrew.shopes@state.co.us	N	Y	Y	Y			Y			2051	2	0	2
CO	Kate Smetana	kate.smetana@state.co.us	Y	Y	Y	Y			Y			2040	10	0	10
FL	Megan Money	Megan.Money@fdacs.gov	N	Y	Y	Y	N	N	N	N	N	2042	10		10
FL	Mike Kruse	Mike.Kruse@fdacs.gov	N	Y	Y	Y	N	N	N	N	N	2043	8		8
FL	Amy Smith	Amy.Smith@fdacs.gov	N	Y	Y	Y	N	N	N	N	N	2036	10		10
GA	Stan Diffie	stan.diffie@agr.georgia.gov	N	Y	Y	Y	N	N	N	N	N	2026	6		6
GA	Wesley Thompson	wesley.thompson@agr.georgia.gov	N	N	N	N	N	N	N	N	N	2052	1		1
USDA-GIPSA	Marcus Harwitz	Marcus.Harwitz@usda.gov			Y							2021	9	20	29
USDA-GIPSA	Oscar Porter	Oscar.KC.Porter@usda.gov			Y									2	2
HI	Michael Tang	michael.tang@hawaii.gov	Y	Y	Y	Y	Y	N	Y	N	N	2019	22	0	22
ID	Stacie Ybarra	stacie.ybarra@isda.idaho.gov	N	Y	Y	Y	Y	N	N	N	N	2032	12		12
IL	John Satterlee	john.satterlee@illinois.gov			Y	Y					Y	2046	5		5
IL	Karl Cunningham	karl.cunningham@illinois.gov			Y	Y					Y	2025	19		19
IL	Austin Boyett	Austin.Boyett@illinois.gov										2047	0		0
IL	Stephanie Somer	Stephanie.Somers@illinois.gov										2048	0		0
KS	Kevin Uphoff	Kevin.Uphoff@ks.gov	Y	Y	Y	Y	Y	N	N	Y	N	2036	11	0	11
KS	Evan Johnson	ClarenceEvan.Johnson@ks.gov	N	Y	Y	Y	Y	N	N	N	N	2049	4	0	4
KY	Jason Glass	Jason.glass@ky.gov	N	N	Y	Y	N	N	N	N	N	2027	19	0	19
KY	Chester Watson	chester.watson@ky.gov	N	N	Y	Y	N	N	N	N	N	2034	15	0	15

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
LA	Whitney Corley	wcorley@ldaf.state.la.us			Y	Y						2054	4.4		4.4
LA	Jennifer Adair	jadair@ldaf.state.la.us			Y	Y						2055	3.5		3.5
LA	Tyler Holmes	tholmes@ldaf.state.la.us			N	N						2059	0.2		0.2
MA	Ray Costa	ray.costa@mass.gov	N	N	Y	Y	N	N	N	N	N	2023	11	36	47
MA	Hain Wan (Will) Setow	hain.setow@mass.gov	N	N	N	N	N	N	N	N	N	2050	1	0	1
MD	Zach Tripoulas	zacharias.tripoulas@maryland.gov	N	N	Y	Y	N	N	N	N	N	2040	10		10
MD	Tong Hsu	tong.hsu@maryland.gov	N	N	Y	Y	N	N	N	N	N	2043	6		6
ME	Brad Bachelder	bradford.bachelder@maine.gov	N	Y	Y	Y	Y	Y	N	N	N	2052	10	1	11
MI	Craig VanBuren	vanburenc9@michigan.gov	N	N	N	N	N						23		23
MI	Neil Jones	jonesn@michigan.gov	Y	Y	Y	Y	Y						23		23
MI	Nick Santini	santinin@michigan.gov	Y	Y	Y	Y	Y						12		12
MI	Ryanne Hartman	hartmanr9@michigan.gov	N	Y	Y	Y	Y						12		12
MI	Scott Ferguson	fergusons9@michigan.gov	N	Y	Y	Y	Y						12		12
MI	Steve Galvan	galvans@michigan.gov	N	N	N	N	N						7		7
MI	Nicole Byndas	byndasn@michigan.gov	N	Y	Y	Y	Y						5	5	10
MN	Benj FitzPatrick	Benjamin.FitzPatrick@state.mn.us	Y	Y	Y	Y	Y	N	N	N	N	2047	7.5	0	7.5
MN	Eric Johnson	Eric.E.Johnson@state.mn.us	N	N	N	N	N	N	N	N	N	2047	3.5	4	7.5
MN	Anna Pierce	Anna.Pierce@state.mn.us	N	Y	Y	Y	Y	N	N	N	N	2055	4.5	0	4.5
MN	Heidi Jones	Heidi.Jones@state.mn.us	N	N	N	N	N	N	N	N	N	2024	23	0	23
MN	Valare Falkner	Valare.Falkner@state.mn.us	N	N	N	N	N	N	N	N	N	2055	3.5	0	3.5
MN	Nick Santori	Nick.Santori@state.mn.us	N	N	N	N	N	N	N	N	N	2040	1	15	16
MO	John Bell	johnny.bell@mda.mo.gov	N	Y	Y	Y	Y	N	N	N	N	2032	2	0	2
MO	Houston Naugher	houston.naugher@mda.mo.gov	N	Y	Y	Y	Y	N	N	N	N	2053	6	0	6
MT	David Fraser	dafraser@mt.gov	N	N	Y	Y	N	N	N	N	N	2030	10	0	10
NC	Sharon Woodard	sharon.woodard@ncagr.gov	Y	Y	Y	Y	Y	Y	N	Y	Y	2022	30		30
NC	Spurgeon Van Hyder	van.hyder@ncagr.gov	Y	Y	Y	Y	Y	Y	N			2024	28		28
NC	Robert Rogers	robert.rogers@ncagr.gov	Y	Y	Y	Y	Y	Y	N	Y		2041	11	8	19
NC	Charles Edward Stephens	ed.stephens@ncagr.gov							N			2052	0.5		0.5
NC	Kevin Knox	kevin.knox@ncagr.gov							N			2053			
NE	Joel P. Lavicky	joel.lavicky@nebraska.gov			Y	Y						2040	7		7
NJ	Michael J. Cecere	CecereM@dca.njoag.gov	N	N	Y	Y	N	Y	Y	N	N	2019	16	0	16
NJ	Kyle C. Pierson	PiersonK@dca.njoag.gov	N	N	Y	Y	N	Y	Y	N	N	2035	7.5	0	7.5
NM	Clay Ivey	civey@nmda.nmsu.edu	Y	Y	Y	Y	Y	N	N	N	N	2030	13	0	13
NV	James Kellames	jkellames@agri.nv.gov	N	Y	Y	Y	Y	N	N	N	N	2043	8	0	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
NV	Kiara Saunders	kriske@agri.nv.gov	N	Y	Y	Y	Y	N	N	N	N	2048	5	0	5
NY	Jeremy Best	jeremy.best@agriculture.ny.gov		Y	Y	Y	Y	Y	Y			2049	4		4
NY	Jonathan Fox	jonathan.fox@agriculture.ny.gov		Y	Y	Y	Y	Y	Y			2039	8		8
NY	Michael Lejeune	michael.lejeune@agriculture.ny.gov		Y	Y	Y	Y	Y	Y			2035	8		8
OH	Tom Buck	tom.buck@agri.ohio.gov	N	Y	Y	Y	Y	Y	Y	N	N	2032	9	0	9
OH	Ken Johnson	ken.johnson@agri.ohio.gov	N	Y	Y	Y	Y	Y	Y	N	N	2020	33	6	39
OH	Daniel Walker	daniel.walker@agri.ohio.gov	N	Y	Y	Y	Y	Y	Y	N	N	2042	11	10	21
OH	Keith Crider	keith.crider@agri.ohio.gov	N	N	N	N	N	N	N	N	N	2027	1	37	38
OR	Aaron Aydelotte	Aaron.AYDELOTTE@oda.oregon.gov	Y	Y	Y	Y	Y	N	N	Y	N	2029	22	0	22
OR	Ray Nekuda	Raymond.NEKUDA@oda.oregon.gov	Y	Y	Y	Y	Y	N	N	N	N	2037	15	0	15
PA	James P. Gownley	jgownley@pa.gov	N	Y	Y	Y	Y	Y	Y	N	N	2030	21	0	21
PA	Christopher J. Drupp	cdrupp@pa.gov	N	Y	Y	Y	Y	Y	Y	N	N	2034	15	0	15
PA	Richard M. Radel, Jr.	riradel@pa.gov	N	Y	Y	Y	Y	Y	Y	N	N	2025	14.5	0	14.5
PA	Dustin Claycomb	duclaycomb@pa.gov	N	Y	Y	Y	Y	Y	Y	N	N	2031	8.5	5	13.5
PA	Kenrick Singh	kensingh@pa.gov	N	N	N	N	N	N	N	N	N	2046	0.25	0	0.25
SC	Kristin Sherrick	ksherrick@scda.sc.gov	N	Y	Y	Y	Y	N	N	N	N	2048	5	0	5
SC	Candice Zegilla	cmzegilla@scda.sc.gov	N	N	N	N	N	N	N	N	N	2052	0	0	0
SC	Timothy Jones	tjones@scda.sc.gov	N	Y	Y	Y	Y	N	N	N	Y	2044	8	0	8
SD	Ron Peterson	ron.peterson@state.sd.us	N	N	Y	Y	N	N	N	N	N	2026	11	0	11
SD	Dwight Johnson	dwight.johnson@state.sd.us	N	N	Y	Y	N	N	N	N	N	2034	1	0	1
TN	Nicholas Andersen	Nicholas.andersen@tn.gov			Y	Y	Y						6		6
TN	Rong Zhang	Rhong.Zhange@tn.gov			Y	Y	Y						5		5
TN	Sara Purdue	Sara.Purdue@tn.gov											2		2
TX	Lisa Corn	lisa.corn@texasagriculture.gov	N	Y	Y	Y	Y	N	N	N	N	2035	15	0	15
TX	Keri Schatte	keri.schatte@texasagricultre.gov	N	Y	Y	Y	Y	N	N	N	N	2038	6	0	6
TX	Heather Exner	heather.exner@texasagriculture.gov	N	N	N	N	N	N	N	N	N	2032	1	0	1
TX	Kirt Weyand	kirt.weyand@texasagriculture.gov	N	N	N	N	N	N	N	N	N		0.75	0	0.75
TX	Allison Haas	allison.haas@texasagriculture.gov	N	N	N	N	N	N	N	N	N		0.5	0	0.5
UT	Bill Rigby	brigby@utah.gov		Y	Y	Y						2030	18		18
VA	William Scott	William.scott@vdacs.virginia.gov	N	Y	Y	Y	N	N	Y	N	N	2044	8	5	13
VA	Armeta Robinson	Armeta.Robinson@vdacs.virginia.gov	N	N	N	N	N	N	N	N	N	2023	1	0	1
VT	Marc Paquette	marc.paquette@vermont.gov	N	N	Y	Y	N	N	N	N	N	2021	17	0	17
VT	Scott Dolan	scott.dolan@vermont.gov	N	N	Y	Y	N	N	N	N	N	2041	11	0	11
WA	Leslie German	lgerman@agr.wa.gov	Y	Y	Y	Y	Y	N	Y	N	N	2029	6	0	6

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
WI	Justin Lien	justin.lien@wisconsin.gov	N	Y	Y	Y	N	N	Y	N	N	2044	8	0	8
WI	Paul Masterson	paul.masterson@wisconsin.gov	N	Y	Y	Y	N	N	Y	N	N	2045	7	0	7
WI	Ronald DePouw	ronald.depouw@wisconsin.gov	N	Y	Y	Y	N	N	Y	N	N	2047	5	0	5
WI	Bradley Wing	bradleya.wing@wisconsin.gov	N	N	N	N	N	N	Y	N	N	2052	6	0	6
WV	Tory Brewer	Tory.D.Brewer@wv.gov	N	N	Y	Y	N	N	N	N	N	2046	10	0	10
WV	Alysan Miller	Alysan.Miller@wv.gov	N	N	N	N	N	N	N	N	N	2058	1	0	1
WY	Robert Weidler	robert.weidler@wyo.gov			Y	Y						2029	14	0	14
WY	Todd Stiles	todd.stiles@wyo.gov			Y	Y						2032	7	0	7

Table 45: Listing of SLP metrologists as of 2022. 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.

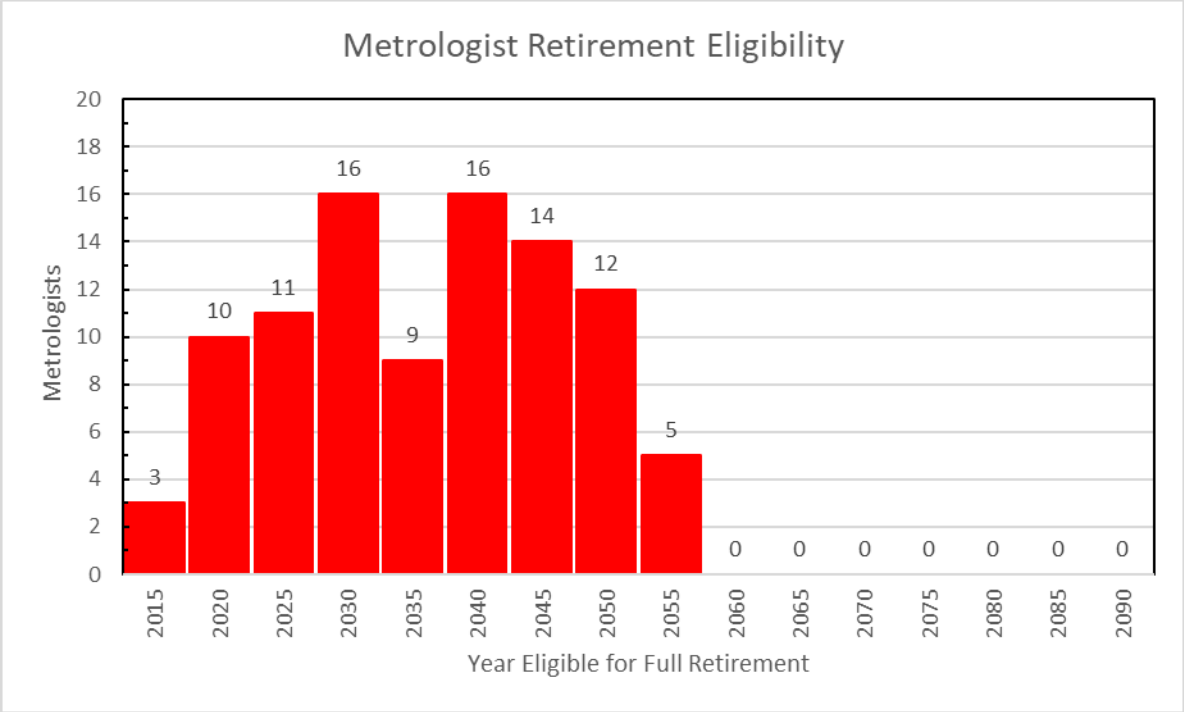


Figure 55: Retirement Eligibility Histogram. Of the 110 metrologists, 96 reported the year they would be eligible for full retirement. This may not reflect when any one person plans to leave the SLP.

Mass I	13
Mass II	52
Mass III	80
Vol Trans	78
Vol Grav	43
Length	18
Time/Frequency	24
Temperature	7
Grain Moisture	7

Table 46: 110 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

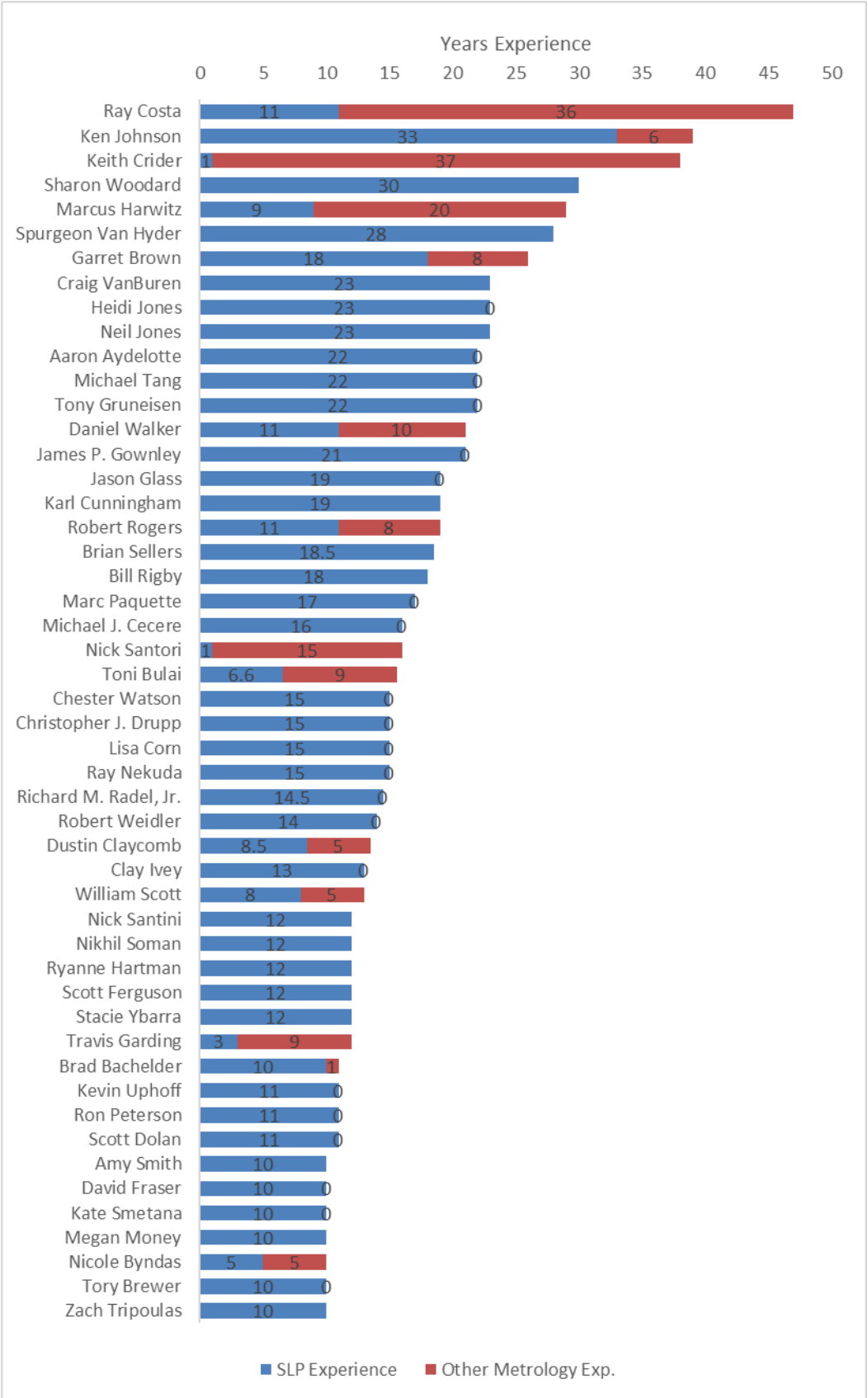
	Number of Metrologists	Average SLP Experience	Average Other Experience	Average Total Experience
2000	111	8.7	2.4	11.0
2002	113	9.1	2.1	11.2
2004	111	8.1	2.6	10.8
2006	112	8.3	3.1	11.4
2008	125	9.2	2.4	11.6
2010	121	9.5	1.9	11.4
2012	110	8.7	2.1	10.8
2014	118	9.2	1.7	10.9
2016	116	8.8	2.8	10.3
2018	119	9.3	1.4	10.7
2020	122	8.5	1.3	9.8
2022	110	8.8	2.6	10.4

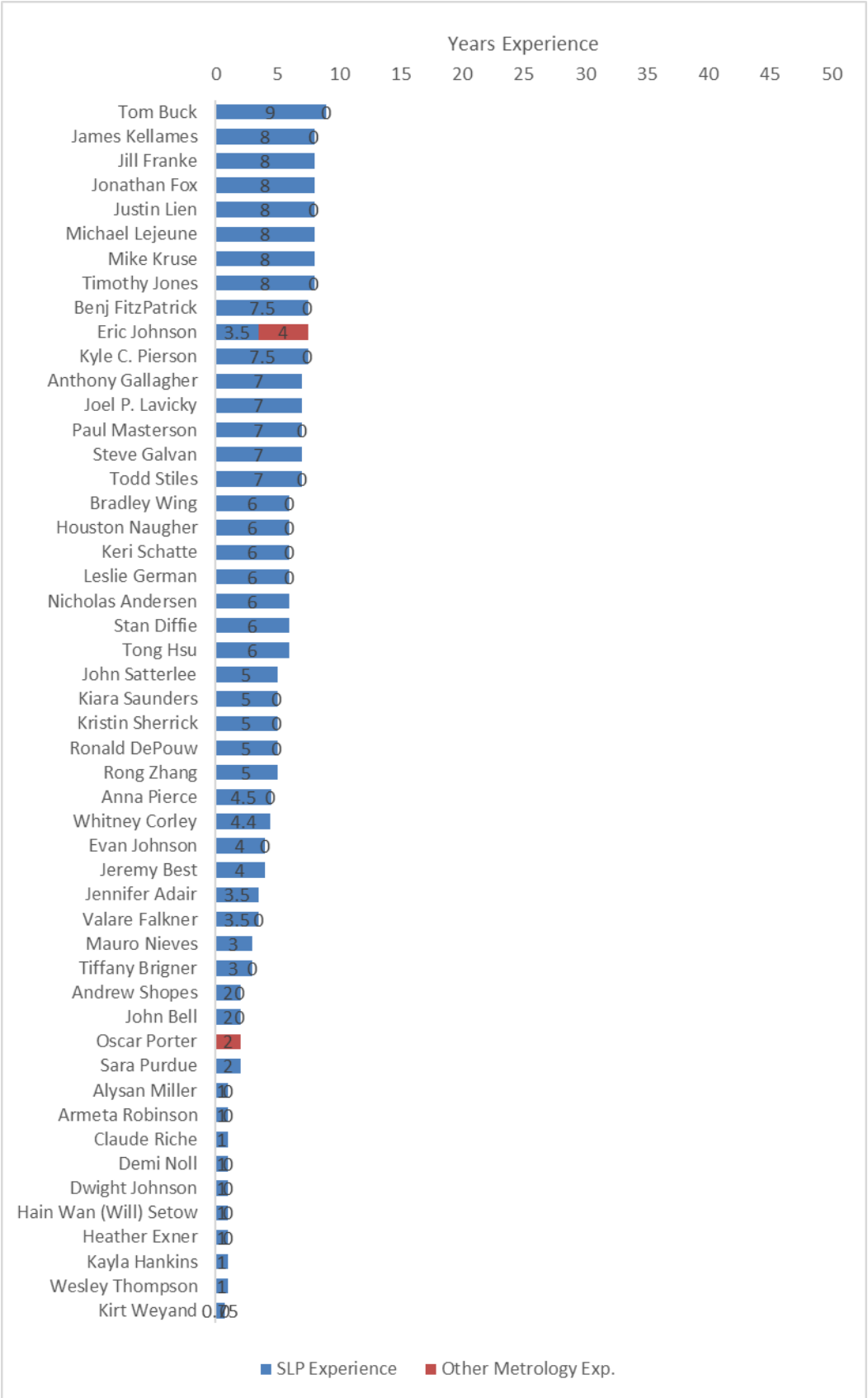
Table 47: Comparison matrix summarizing metrology experience reported by metrologists.

Comments:

- Data was collected for 110 metrologist in the SLP from 42 laboratories.

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 recognition or 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
Ray Costa 11 36
Ken Johnson 33 6
Keith Crider 1 37
Sharon Woodard 30
Marcus Harwitz 9 20
Spurgeon Van Hyder 28
Garret Brown 18 8
Craig VanBuren 23
Heidi Jones 23 0
Neil Jones 23
Aaron Aydelotte 22 0
Michael Tang 22 0
Tony Gruneisen 22 0
Daniel Walker 11 10
James P. Gownley 21 0
Jason Glass 19 0
Karl Cunningham 19
Robert Rogers 11 8
Brian Sellers 18.5
Bill Rigby 18
Marc Paquette 17 0
Michael J. Cecere 16 0
Nick Santori 1 15
Toni Bulai 6.6 9
Chester Watson 15 0
Christopher J. Drupp 15 0
Lisa Corn 15 0
Ray Nekuda 15 0
Richard M. Radel, Jr. 14.5 0
Robert Weidler 14 0
Dustin Claycomb 8.5 5
Clay Ivey 13 0
William Scott 8 5
Nick Santini 12
Nikhil Soman 12
Ryanne Hartman 12
Scott Ferguson 12
Stacie Ybarra 12
Travis Garding 3 9
Brad Bachelder 10 1
Kevin Uphoff 11 0
Ron Peterson 11 0
Scott Dolan 11 0
Amy Smith 10
David Fraser 10 0
Kate Smetana 10 0
Megan Money 10
Nicole Byndas 5 5
Tory Brewer 10 0
Zach Tripoulas 10
SLP Experience
Other Metrology Exp.


Years Experience
0
5
10
15
20
25
30
35
40
45
50
Tom Buck 9 0
James Kellames 8 0
Jill Franke 8
Jonathan Fox 8
Justin Lien 8 0
Michael Lejeune 8
Mike Kruse 8
Timothy Jones 8 0
Benj FitzPatrick 7.5 0
Eric Johnson 3.5 4
Kyle C. Pierson 7.5 0
Anthony Gallagher 7
Joel P. Lavicky 7
Paul Masterson 7 0
Steve Galvan 7
Todd Stiles 7 0
Bradley Wing 6 0
Houston Naugher 6 0
Keri Schatte 6 0
Leslie German 6 0
Nicholas Andersen 6
Stan Diffie 6
Tong Hsu 6
John Satterlee 5
Kiara Saunders 5 0
Kristin Sherrick 5 0
Ronald DePouw 5 0
Rong Zhang 5
Anna Pierce 4.5 0
Whitney Corley 4.4
Evan Johnson 4 0
Jeremy Best 4
Jennifer Adair 3.5
Valare Falkner 3.5 0
Mauro Nieves 3
Tiffany Brigner 3 0
Andrew Shopes 2 0
John Bell 2 0
Oscar Porter 2
Sara Purdue 2
Alysan Miller 1 0
Armeta Robinson 1 0
Claude Riche 1
Demi Noll 1 0
Dwight Johnson 1 0
Hain Wan (Will) Setow 1 0
Heather Exner 1 0
Kayla Hankins 1
Wesley Thompson 1
Kirt Weyand 0.75
SLP Experience
Other Metrology Exp.

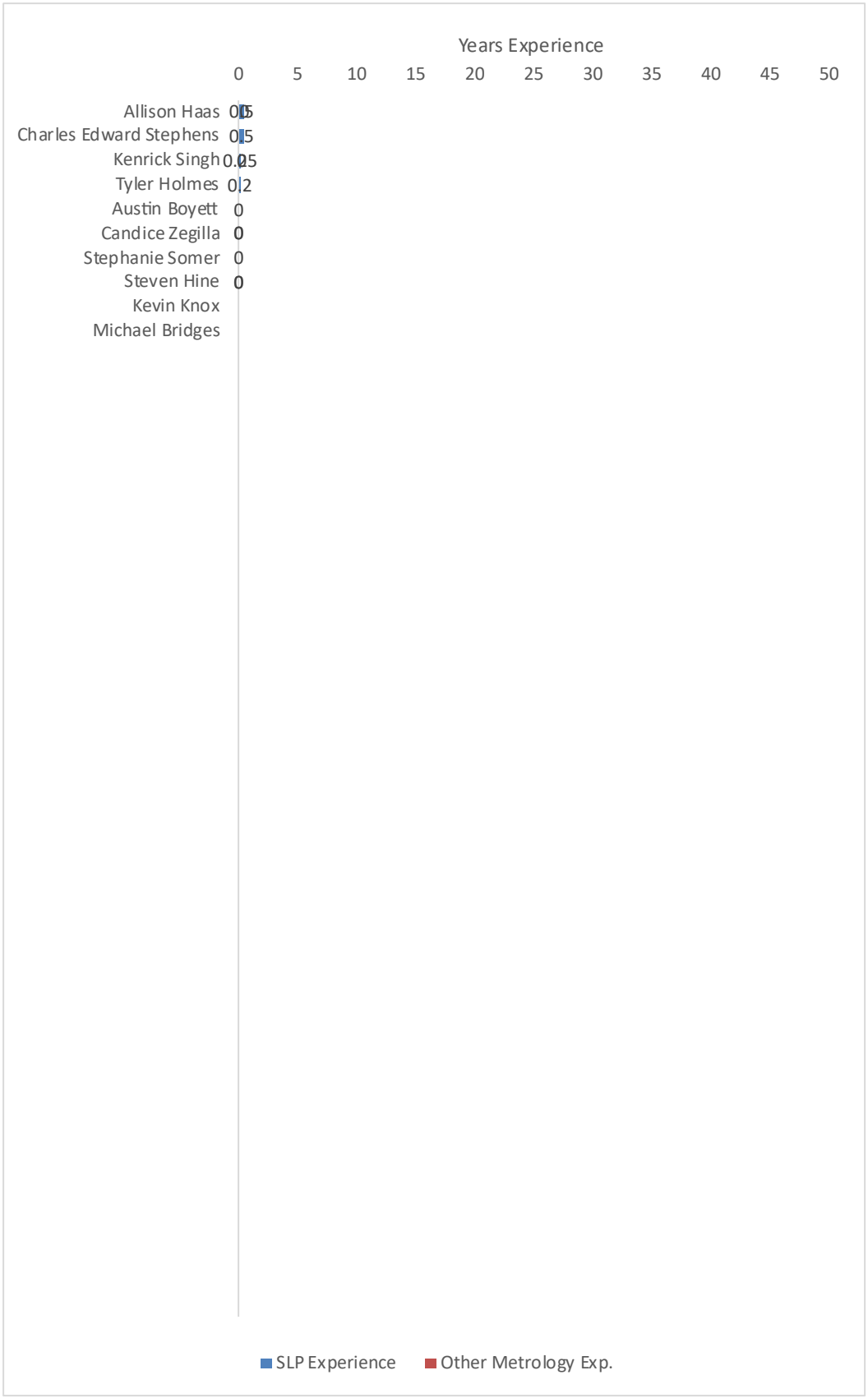


Figure 56: SLP metrologists ranked by years of experience (cont). Blue indicates experience in the SLP, Red indicates other metrology experience.

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[11].
- 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	Yes	No	Yes	No	No	No
AR	No	No	Yes	Yes	No	Yes
AZ	No	No	Yes	Yes	No	Yes
CA	No	No	Yes	Yes	No	Yes
CO	No	No	Yes	Yes	No	No
FL	Yes	No	Yes	Yes	No	Yes
GA	No	No	Yes	Yes	No	No
USDA-GIPSA	No	No	Yes	Yes	No	Yes
HI	No	No	Yes	Yes	No	No
ID	No	No	Yes	Yes	No	No
IL	No	No	Yes	Yes	No	No
KS	No	No	Yes	No	No	Yes
KY	No	No	Yes	Yes	No	Yes
LA	No	No	Yes	Yes	No	No
MA	Yes	No	Yes	Yes	No	No
MD	No	No	Yes	Yes	No	No
ME	No	No	Yes	Yes	No	Yes
MI	No	No	Yes	Yes	No	Yes
MN	No	No	Yes	No	No	No
MO	No	No	Yes	Yes	No	Yes

[11] 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
MT	No	Yes	Yes	Yes	No	Yes
NC	No	No	Yes	Yes	No	Yes
NE	Yes	No	Yes	Yes	No	No
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	Yes
OR	No	No	Yes	Yes	No	Yes
PA	No	No	Yes	No	No	No
SC	No	No	Yes	Yes	No	Yes
SD	No	No	Yes	Yes	No	Yes
TN	No	No	Yes	No	No	No
TX	No	No	Yes	Yes	No	Yes
UT	Yes	No	Yes	Yes	No	Yes
VA	No	No	Yes	Yes	No	No
VT	No	No	Yes	Yes	No	Yes
WA	No	No	Yes	Yes	No	Yes
WI	No	No	Yes	Yes	No	Yes
WV	No	No	Yes	Yes	No	Yes
WY	No	No	Yes	Yes	No	Yes

Table 48: 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?
- 2020 – Questions related to COVID-19 impact on lab operations.
- 2022 – Questions related to remote work, laboratory renovations, program funding, and EV charging station support.

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

No.	Question	Yes	No
1	As of 31 December 2022, does your laboratory have a vacancy in a position described in Section 4?	8	33
2	Is your laboratory facility owned by the governing entity under which it operates? (i.e. state, county, municipality, federal district, tribe, territory, or commonwealth)	28	14
3	Is your laboratory facility rented or leased by the governing entity under which it operates? (answer No if you answered Yes to question 3)	14	28
4	Has your laboratory had any renovations since 1 January 2021?	11	31
5	Has your laboratory had any new construction since 1 January 2021?	3	38
6	Are there any renovations expected to start or continue in 2023?	5	34
7	Is new new laboratory construction expected to begin in 2023? (if the project is adding to an existing laboratory answer No here, answer Yes to question 7)	2	34
8	Does your laboratory currently test watt-hour meters which are used to test electric vehicle charging stations?	0	41
9	Does your laboratory plan to test watt-hour meters which are used to test electric vehicle charging stations in 2023?	3	31
10	Does your laboratory allow teleworking?	16	25
11	Identify the average 1-way commute completed by the metrology staff in your lab:		
	0-10 miles	15	5
	11-20 miles	16	7
	21-30 miles	10	6
	31-40 miles	9	7
	41-50 miles	2	7
	> 50 miles	2	7
12	Laboratory Funding, Is your laboratory funded by:		0
	Fees (including calibration fees and service registration fees)	26	12
	Weights and Measures program funds	26	10

Table 49: Summary of responses to supplementary questions in section 1.

Question	Count	Response
Q. 1		**As of 31 December 2022, does your laboratory have a vacancy in a position described in Section 4?**
Yes	8	AR,FL,ID,KY,NC,NM,OH,WV
No	33	AK,AZ,CA,CO,GA,HI,IL,KS,LA,MA,MD,ME,MI,MN,MO,MT,NE,NJ,NV,NY,OR,PA,SC,SD,TN,TX,USDA-GIPSA,UT,VA,VT,WA,WI,WY
No Answer	1	AL
Q. 2		**Is your laboratory facility owned by the governing entity under which it operates? (i.e. state, county, municipality, federal district, tribe, territory, or commonwealth)**
Yes	28	AL,AR,CO,FL,GA,HI,ID,IL,LA,MD,ME,MI,MO,NC,NJ,NV,NY,OH,PA,SC,SD,TN,TX,USDA-GIPSA,UT,VT,WV,WY
No	14	AK,AZ,CA,KS,KY,MA,MN,MT,NE,NM,OR,VA,WA,WI
No Answer	0	
Q. 3		**Is your laboratory facility rented or leased by the governing entity under which it operates? (answer No if you answered Yes to question 3)**
Yes	14	AK,AZ,CA,KS,KY,MA,MN,MT,NE,NM,OR,VA,WA,WI
No	28	AL,AR,CO,FL,GA,HI,ID,IL,LA,MD,ME,MI,MO,NC,NJ,NV,NY,OH,PA,SC,SD,TN,TX,USDA-GIPSA,UT,VT,WV,WY
No Answer	0	
Q. 4		**Has your laboratory had any renovations since 1 January 2021?**
Yes	11	AK,CA,CO,GA,KS,MN,MT,NV,OH,TX,WA
No	31	AL,AR,AZ,FL,HI,ID,IL,KY,LA,MA,MD,ME,MI,MO,NC,NE,NJ,NM,NY,OR,PA,SC,SD,TN,USDA-GIPSA,UT,VA,VT,WI,WV,WY
No Answer	0	
Q. 5		**Has your laboratory had any new construction since 1 January 2021?**
Yes	3	IL,MA,UT
No	38	AK,AR,AZ,CA,CO,FL,GA,HI,ID,KS,KY,LA,MD,ME,MI,MN,MO,MT,NC,NE,NJ,NM,NV,NY,OH,OR,PA,SC,SD,TN,TX,USDA-GIPSA,VA,VT,WA,WI,WV,WY
No Answer	1	AL
Q. 6		**Are there any renovations expected to start or continue in 2023?**
Yes	5	AK,MO,MT,NM,UT
No	34	AR,AZ,CA,CO,GA,HI,IL,KS,KY,LA,MA,MD,ME,MI,MN,NC,NE,NJ,NV,NY,OH,OR,PA,SC,SD,TN,TX,USDA-GIPSA,VA,VT,WA,WI,WV,WY
No Answer	3	AL,FL,ID

Question	Count	Response
Q. 7		**Is new new laboratory construction expected to begin in 2023? (if the project is adding to an existing laboratory answer No here, answer Yes to question 7)**
Yes	2	NE,NM
No	34	AK,AZ,CA,CO,GA,HI,IL,KS,KY,LA,MA,MD,ME,MI,MN,MO,MT,NC,NJ,NV,NY,OH,OR,PA,SC,SD,TN,TX,USDA-GIPSA,UT,VA,VT,WA,WY
No Answer	6	AL,AR,FL,ID,WI,WV
Q. 8		**Does your laboratory currently test watt-hour meters which are used to test electric vehicle charging stations?**
Yes	0	
No	41	AK,AL,AR,AZ,CA,CO,FL,GA,HI,ID,IL,KS,KY,LA,MA,MD,ME,MI,MN,MO,MT,NC,NE,NJ,NM,NV,NY,OH,OR,PA,SC,SD,TN,TX,USDA-GIPSA,UT,VA,VT,WA,WV,WY
No Answer	1	WI
Q. 9		**Does your laboratory plan to test watt-hour meters which are used to test electric vehicle charging stations in 2023?**
Yes	3	CA,MO,TX
No	31	AK,AL,AR,AZ,CO,ID,KS,KY,LA,MA,MD,ME,MI,MN,NE,NJ,NM,NV,NY,OH,OR,PA,SC,SD,TN,USDA-GIPSA,UT,VT,WA,WV,WY
No Answer	8	FL,GA,HI,IL,MT,NC,VA,WI
Q. 10		**Does your laboratory allow teleworking?**
Yes	16	FL,GA,KS,KY,ME,MI,MN,MT,NC,NJ,NY,SD,TX,USDA-GIPSA,VT,WA
No	25	AK,AL,AR,AZ,CA,CO,HI,ID,IL,LA,MA,MD,MO,NM,NV,OH,OR,PA,SC,TN,UT,VA,WI,WV,WY
No Answer	1	NE
Q. 11		**Identify the average 1-way commute completed by the metrology staff in your lab:**
		0-10 miles
Yes	15	AR,AZ,CA,GA,HI,IL,MO,NE,NM,NV,SC,TN,TX,WI,WV
No	5	KY,MD,OH,UT,VT
No Answer	22	AK,AL,CO,FL,ID,KS,LA,MA,ME,MI,MN,MT,NC,NJ,NY,OR,PA,SD,USDA-GIPSA,VA,WA,WY
		11-20 miles
Yes	16	AZ,CO,FL,ID,KS,KY,ME,MN,MT,OR,SC,TX,USDA-GIPSA,VA,WI,WY
No	7	AR,HI,MD,NV,OH,UT,VT
No Answer	19	AK,AL,CA,GA,IL,LA,MA,MI,MO,NC,NE,NJ,NM,NY,PA,SD,TN,WA,WV

Question	Count	Response
		21-30 miles
Yes	10	AK,MI,MO,NC,PA,SC,SD,TX,UT,VT
No	6	AR,HI,KY,MD,NV,OH
No Answer	26	AL,AZ,CA,CO,FL,GA,ID,IL,KS,LA,MA,ME,MN,MT,NE,NJ,NM,NY,OR,TN,USDA-GIPSA,VA,WA,WI,WV,WY
		31-40 miles
Yes	9	FL,LA,NJ,NY,OH,SC,WA,WI,WV
No	7	AR,HI,KY,MD,NV,UT,VT
No Answer	26	AK,AL,AZ,CA,CO,GA,ID,IL,KS,MA,ME,MI,MN,MO,MT,NC,NE,NM,OR,PA,SD,TN,TX,USDA-GIPSA,VA,WY
		41-50 miles
Yes	2	MA,MD
No	7	AR,HI,KY,NV,OH,UT,VT
No Answer	33	AK,AL,AZ,CA,CO,FL,GA,ID,IL,KS,LA,ME,MI,MN,MO,MT,NC,NE,NJ,NM,NY,OR,PA,SC,SD,TN,TX,USDA-GIPSA,VA,WA,WI,WV,WY
		> 50 miles
Yes	2	AL,VT
No	7	AR,HI,KY,MD,NV,OH,UT
No Answer	33	AK,AZ,CA,CO,FL,GA,ID,IL,KS,LA,MA,ME,MI,MN,MO,MT,NC,NE,NJ,NM,NY,OR,PA,SC,SD,TN,TX,USDA-GIPSA,VA,WA,WI,WV,WY
Q. 12		**Laboratory Funding, Is your laboratory funded by:**
		Fees (including calibration fees and service registration fees)
Yes	26	AK,CA,CO,FL,ID,IL,KY,LA,MD,ME,MI,MO,MT,NC,NE,NJ,NV,OH,OR,SC,SD,TX,USDA-GIPSA,VT,WA,WI
No	12	AL,AR,GA,HI,KS,MA,NY,PA,TN,UT,VA,WY
No Answer	4	AZ,MN,NM,WV
		Weights and Measures program funds
Yes	26	AK,AL,AZ,CO,ID,IL,KS,LA,ME,MI,MN,MO,MT,NE,NJ,NV,OH,OR,SC,SD,TN,UT,VA,VT,WA,WI
No	10	AR,GA,HI,KY,MA,MD,NY,PA,TX,WY
No Answer	6	CA,FL,NC,NM,USDA-GIPSA,WV

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

Supplementary Questions Section 2

Questions 1 – 10: In #1 - #10 identify some requests for calibration services that you are currently unable to provide.

AK - Echelon I mass
AK - Liquid in glass thermometers
AK - 1 gallon test measure
AK - 0.5 gallon test measure
AR - Volume LPG
CO - Gravimetric
CO - Flow meter
CO - Length
CO - EV charging
FL - Thermometry
FL - Small Volume Gravimetric
GA - Calibration of 2000 lb weights
GA - Calibration of 6000 lb carts
HI - thermometers
HI - pressure measurement devices
IL - Echelon 2
IL - Temp.
KS - Dynamic small volume provers
KS - Thermometers
KS - Watt-Hour Meters used to test EV Charging Stations
KY - Mass II Calibrations
KY - Weight Carts
LA - weight carts
LA - large volume provers
LA - MEII
MA - Class 1 Weight Kits (1 or 2 per year at most)
ME - Temperature
ME - Mass Echelon I
MN - Several request for Masterscale calibrations during winter months. (our master scale is closed Nov - April). Additional issues getting our Master Scale calibrated have caused extra delays for customers.
MN - OIML E1
MN - 5 Liter measure
MN - 6000 lb and 10 000lb weight cart/rail carts
MT - Gravemetric Volume
MT - Echelon II or Higher Mass
MT - Echelon I or Higher Volume
MT - Length
MT - Volume Less Than 5 Gallons

MT - Tuning Forks
NC - Gauge Blocks
NC - Pressure Gauges
NC - Electrical Port Chargers
NE - Echellon II calibrations for industry, ASTM 2/3
NJ - Calibrations of 1 and 2 gallon test measures, either gravimetric or volume transfer
NJ - Mass, Echelon 2
NM - 1000 gallon prover
NM - 6000 lb Weight Cart
NV - Calipers
NV - Pipettes
NV - Tape measurers
NY - Stopwatches that don't meet precision requirements
NY - Ounce weights at Echelon II
NY - Ech I mass calibrations
NY - Vol gravimetric larger than 100 gal
PA - Mass Echelon I
PA - Thermometers
PA - LPG Prover Calibrations
SC - Calibrations of Echelon I Status (SOP 28)
SD - 1250, 1500 lb
TN - Weights Carts
TN - 50 gallon provers
USDA-GIPSA - 1000 lb cast weights
USDA-GIPSA - 50 lb cast weights
USDA-GIPSA - 25 lb cast weights
USDA-GIPSA - 500 lb cast weights
UT - Weight Cart
VA - wheelload weighers
VA - trigger pull gauge
VA - temperature
VA - large provers > 100 gallons
VT - Glass Wear 1 gil to 1/2 gallon, 50 mL to 200 mL
VT - Steel Tape 25' to 102'
VT - Class 2 weights 1 mg to 500 mg, 1 kg to 5 kg
WI - On the rare occasion, request for a Class I calibration
WY - No requests outside of our scope

Table 51: Responses to supplementary questions #1-#10 in section 2

Question 11: If you answered Yes to Question 10 of Section 33 (Supplementary Y/N questions) please describe your current telework practices.

FL - Management is allowed to work from home if needed.
GA - Teleworking is only allowed under special conditions with the approval of the Laboratory Division Director
HI - none
KS - In the event of illness or inclement weather employees can telework for administrative duties.
KY - 1 day per week agreed upon in writing
MA - No
MD - N/A
ME - I can telework on thursdays to catch up with phone calls, emails, write reports, attend meetings, etc.
MI - Lab staff have the ability to telework on an as needed basis.
MN - MN Commerce allows teleworking as long as business needs are meet. Currently all metrologist telework approximately one day a week.
MT - Lab staff was given the option to tele-work but we choose not too.
NC - Telework only when necessary and if there is work you can do at home.
NJ - Support staff and metrologists are permitted to work from home up to two days per week on specific and designated days for each employee. This is done to ensure that an adequate staff is working inside the office at all times. The tasks performed at home include processing and proofreading certificates, updating work logs and scheduling appointments. Please note that in practice, the metrologists rarely work from home.
NV - Was allowed, but is being discontinued as of July 1, 2023.
NY - Permitted on a case-by-case basis, per request, when work that can be done at home is available and when in-lab calibrations are not needed that day.
SD - Telework for documentation; only during inclement weather.
TX - 1 day a week telework, 4 days in lab
VT - Clerical work can be done from home.
WA - Only for duties where I can use the laptop. No measurements.
WI - Not Applicable
WY - N/A

Table 52: Telecommuting options.

Question 12. If you answered Yes to Question 4 Section 33 (Supplementary Y/N questions) please describe the renovations completed.

AK - Replacement of steam generator component of lab HVAC system. Replacement of duct heating coil for lab HVAC system. Modernization of laboratory keycard access system.
CA - Epoxy floors installed, Drop ceiling replaced with hard ceiling, new light fixtures, new cabinetry.
CO - additional DI water line in Volume lab
GA - A new AC controlling system was installed.
KS - Partial HVAC remodel adding humidifier units.
MN - New piers in large mass lab, to accomidate a new balance (MT XK2003KLC). New measurer tipper wall and drain installed in bay area. New air handler and humdifier for Multipurpose laboratory.
MT - Renovations to Large Volume drop area, new mezinine and water delivery system. Renovations to Large Mass Lab, epoxy floor coating and fabricated workbenches.
NM - Construction of new lab is on going estimated time of finish is July of 2023
NV - New stand alone humidifier in our receiving room.
OH - Exterior drains installed around outside of entire building to remove runoff from going under building. Stabilized south wall to prevent movement. Removed old balance table and installed new marble tables in small mass lab.
TX - New HVAC system and ducts, better insulation in walls, new humidifiers, canopies on external garage doors for sun protection
WA - HVAC system upgraded.

Table 53: Laboratory completed renovations.

Question 13. If you answered Yes to Question 5 Section 33 (Supplementary Y/N questions) please describe any improvements you realized over your existing laboratory facility.

IL - New plumbing, and a new HVAC system for the entire building
MA - (1) Laboratory was relocated from Needham to Ashland, MA in the final week of October 2021. (2) Large Mass Comparator placed on 3-foot-thick concrete pad protruding only 3 inches above floor level. (3) Addition of 100-gal & 50-gal slicker standard on mezzanine to the laboratory. (4) Overhead garage door opening increased from 10 feet wide and 12 feet high (in former laboratory) to 12 feet wide and 14 feet high (in current laboratory).
UT - New lab nearing completion. Planned to move March 16, 2023
WI - While I (Justin) answered no, we will be expanding the width of an entryway between our Volume lab and the Loading dock, to allow for extra room to move customer work to and from the receiving area.

Table 54: Laboratory completed improvements.

Question 14: If you answered Yes to Question 6 Section 33 (Supplementary Y/N questions) please describe the renovations planned.

AK - Widening and heightening of laboratory "freight" door opening, and new laboratory door to replace the old one.
MO - Adding an office for the lab manager in a part of the grain moisture lab. This will allow the metrology specialist to move into the existing office and open up a area for a secretary when funding is available.
MT - New rigging equipment for Large Mass Lab. Small volume area will be walled off to keep it separate from the shop.
UT - Finishing new lab construction
WI - While there are no plans for renovations in 2023, we anticipate replacing laboratory humidifiers for each of the three (3) rooms: small mass, large mass, volume. New equipment may extend to other components related to the HVAC handling system.

Table 55: Laboratory planned renovations.

Question 15. If you answered Yes to Question 7 Section 33 (Supplementary Y/N questions) please describe any improvements you expect to realize over your existing laboratory facility.

NE - Replacing garage doors to reduce outside air flow around the seals. Possibly having a double door.

Table 56: Laboratory planned improvements.

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 57

Lab ID	Comments Survey Sections 1-6
FL	section 4: Lab Experienced Staffing Reorg. - approved and implemented March 2022 - Lab gained an additional Metrologist Position Sr. Metrologist SES now serves as the Laboratory Manager/Supervisor & Metrology/Calibration Technician Metrologist & Lab Tech. IV positions are currently Vacant as of 2/15/23 - recruiting for another Metrologist has been unsuccessful so far Environmental Manager is temporarily serving as backup for calibrations as needed and is keeping signatory status until the laboratory is fully staffed & now serves as an additional quality control personnel for the lab and other labs in the Bureau.
MA	Minimum & Maximum Monthly Salary are private information.
NC	There is no way to adequately determine W&M officials or Service Companies. Number provided is a guestimation
NE	We do not accept any certificates that are traceable through Mexico or Canada at this time.
NJ	Salary, Weights and Measures Inspector 1 - Employees with this title are now 4 years without a contract. When it is settled, it is anticipated to be retroactive which will impact 2022 salaries.
TN	Tennessee code requires that the calibration certificates for service persons be from a NIST recognized state lab.
WI	Suggestion with future WorkLoad Suvey Forms such as this one - I'd much prefer to have this comments section allow me to bullet point or separate out various ideas and/or comments. As it currently stands, everything stays clumped together and the user must then identify the different thoughts and comments that are being provided. DONE..... For Section 3: per the metrology lab lease/contract, the area of the lab is listed at 7,081 square feet, of which roughly 3,700 square feet is devoted to lab space. The remaining portion is used to store field trailers for field inspector use. Section 5: completed 384 work orders for 2022, of which 67 were assoc. with internal calibrations for WI field inspector staff members and equipment. Please note that we do not have a means to separate out and tally up "Service Companies" whether in/out of state.
WV	The Labor Program Manager is not typically involved in calibration functions. They have been listed this time because they happen to have signature authority for the lab due to personnel changes and training.

Table 57: Comments provided by respondents regarding sections 1 through 6 of the survey.

Comments Section 7

Section 7 of the survey includes questions regarding individual metrologists working in the SLP. Comments provided by individual SLP laboratories are listed in Table 58.

Lab ID	Comments Survey Sections 7
CA	Recognized by the NIST OWM to measure AC electric energy at 120 V, 0.5 A, 0 ° phase angle.
MD	Grain is not on Scope. State regulator use only.
MI	Santini, Byndas, Ferguson, Galvan are approved signatories for wheel load weighers
MN	Weight carts, Rail test cars and carts (master scale), wheel load scales
NJ	Wheel Load Weighers 20 000 lb to 2 500 lb
NY	We are also recognized for lottery ball weight, diameter.
PA	We are also recognized for force 0 to 50 lbf
VT	Hydrometry: Marc Paquette, Mike Larose, Ryan Lockwood
WI	With regards to Time/Frequency, the WI laboratory performs Stopwatch calibrations. And when it comes retirement, eligibility is based off of thirty (30) years in state service, while holding a permanent position. Please note that while Bradley Wing has been employed (as a limited term employee (LTE)) since 2016, he hadn't received permanent status as a Metrologist until August 2022.

Table 58: Comments provided by respondents regarding section 7 of the survey.

Comments – Survey Sections 8 to 32

Sections 8 through 32 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 59.

Lab ID	Comments Survey Sections 8-32
AK	Section 31: Alaska does not have registered service agents (RSAs).
MA	24 - 1000 lb weight (5 adjusted) requires 6 hours x 2 men equaling 12 hours One - 100 gal prover using VT requires 4 hours x 2 men equaling 8 hours
MO	We charge 125.00 per hour per employee. If two employees work on a weight cart for two hours the charge would be for 4 hours = $500.00. Weight carts, 1000 lb cast iron, 500 lb cast iron , LPG provers, and refined fuel provers over 5 gallons will usually require two employess.
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, SVPs and Thermometry
NE	1000lb weights have a charge fo $23.50 per weight, 25-50lb weights are $8.50 per weight. Adjustments are at a rate of $80 per hour.
NV	We completed sections 8-30 based on certificates produced in 2022 (Jan. - Dec.). Hopefully this was the correct timeframe, but one was not specified.
SC	In Section 9 Echelon II answers, ASTM Class 1 calibrations are included in the numbers.
SD	Volume greater than 5 gallons and LPG to 100 gallons were added to our scope in mid-2022
VT	All weight calibration is by the hour $75/hour for instate and $95/hour out of state.
WI	Section 31, Line 125 (5,000 lb Weight Cart). If cart needs to be adjusted into tolerance, our lab would charge an adjustment and retest fee of $80.00 minimum, for a new total of 506.40
WV	For clarification, we do NOT charge to calibrate our own W&M field equipment and WV does not have city, county, or township jurisdictions. However, we DO charge for W&M field equipment if it comes from another state.
WY	Prices listed are for in state customers; out of state customers are charge double the in state rate.

Table 59: Comments provided by respondents regarding section 8 through 32 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	Section 33 Survey Comments
MA	In the section 33, Supplementary Questions 1, the drop-down boxes does that open at the top of each line. It would be nice if this workbook could be reconfigured so that the printout of it comes out nicely on an 8.5" x 11" sheet of paper either in portrait or landscape or a combination of both. Presently, each sheet of this survey has to be reconfigured to be able to print it.
ME	Sorry it took me so long Van
NE	Keep up the good work. We would like to try to get the equipment to offer EVC charging calibration for field equp. Its all cost dependent.
OH	Section 33, Question 7, has an incorrect reference to Question 7. It should be ? Section 31 is the Fees table, not Section 30. The instructions say that table is Section 30 The "Total" cells in Sections 8 to 30 are not protected. Protect these cells so the sum formulas aren't deleted.
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.
WI	I'm hoping that hard copies of the 2022 Workload Survey will be published and circulated. A physical copy is much preferred over electronic form! Thanks for the consideration.

Table 60: General comments provided by respondents of the workload survey.

2022 Survey Form

Section 1

Loaded . . .	
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

2022 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 accepting 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/OWM 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

Go To 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 8-32)

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]	
	Actual Counts	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]	
	Actual Counts	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]	
	Actual Counts	TOTAL	0
Section 11	**Weight Carts**		
	Number of weight carts calibrated.	Lab (Internal)	
		W&M Program[1]	
		External Customers[2]	
	Actual Counts	TOTAL	0
Section 12	**Railroad Test Cars (Master Scale)**		
	Number of cars calibrated.	Lab (Internal)	
		W&M Program[1]	
		External Customers[2]	
	Actual Counts	TOTAL	0
Section 13	**Railroad Specific Weight Carts**		
	Number of weight carts calibrated.	Lab (Internal)	
		W&M Program[1]	
		External Customers[2]	
	Actual Counts	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.

Section 14	**Volume - Glassware**			
	Number of individual pieces of volumetric glassware calibrated. Note: Indicate number of Volume Transfer and/or Gravimetric tests.		Vol-Transfer	Gravimetric
		Lab (Internal)		
		W&M Program[1]		
		External Customers[2]		
	Actual Counts	TOTAL	0	0
Section 15	**15.Volume - SVP (Dynamic Volumetric Systems)**			
	Number of small volume provers and closed loop provers calibrated.	Lab (Internal)		
		W&M Program[1]		
		External Customers[2]		
	Actual Counts	TOTAL	0	
Section 16	**Volume - LPG**			
	Number of individual LPG provers calibrated.	Lab (Internal)		
		W&M Program[1]		
		External Customers[2]		
	Actual Counts	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.		Vol-Transfer	Gravimetric
		Lab (Internal)		
		W&M Program[1]		
		External Customers[2]		
	Actual Counts	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.		Vol-Transfer	Gravimetric
		Lab (Internal)		
		W&M Program[1]		
		External Customers[2]		
	Actual Counts	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.		Vol-Transfer	Gravimetric
		Lab (Internal)		
		W&M Program[1]		
		External Customers[2]		

	Actual Counts	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]		
	Actual Counts	TOTAL	0	
Section 21	**Length - Rigid Rules**			
	Number of individual rigid rules tested. Please enter #devices tested, NOT number of points tested.	Lab (Internal)		
		W&M Program[1]		
		External Customers[2]		
	Actual Counts	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]		
	Actual Counts	TOTAL	0	
Section 23	**Frequency**			
	Number of frequency standards tested (includes tuning forks).	Lab (Internal)		
		W&M Program[1]		
		External Customers[2]		
	Actual Counts	TOTAL	0	
Section 24	**Timing Devices**			
	Number of timing devices tested (stopwatches).	Lab (Internal)		
		W&M Program[1]		
		External Customers[2]		
	Actual Counts	TOTAL	0	
Section 25	**Wheel Load Weighers**			
	Number of wheel load weighers tested.	Lab (Internal)		
		W&M Program[1]		
		External Customers[2]		
	Actual Counts	TOTAL	0	
Section 26	**Lottery Balls**			
	Number of lottery balls tested.	Lab (Internal)		
		W&M Program[1]		
		External Customers[2]		
	Actual Counts	TOTAL	0	
Section 27	**Watt-Hour Meters used to test EV Charging Stations**			
	Number of Watt-Hour meters tested.	Lab (Internal)		
		W&M Program[1]		
		External Customers[2]		
	Actual Counts	TOTAL	0	
Section 28	**(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 29	**(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 30	**(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 standards, 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 31	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 :							

Section 32	**Do you charge:**	
	Do you charge out of state customers higher fees than in state customers?	
	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 8-32

Go To Supplimentary Questions 1.

Go To Previous Sheet (Survey Section 7)

Section 33: *Supplementary Questions 1. (Yes/No)*		
1	As of 31 December 2022, does your laboratory have a vacancy in a position described in Section 4?	
2	Is your laboratory facility owned by the governing entity under which it operates? (i.e. state, county, municipality, federal district, tribe, territory, or commonwealth)	
3	Is your laboratory facility rented or leased by the governing entity under which it operates? *(answer No if you answered Yes to question 3)*	
4	Has your laboratory had any renovations since 1 January 2021?	
5	Has your laboratory had any new construction since 1 January 2021?	
6	Are there any renovations expected to start or continue in 2023?	
7	Is new new laboratory construction expected to begin in 2023? (if the project is adding to an existing laboratory answer No here, answer Yes to question 7)	
8	Does your laboratory currently test watt-hour meters which are used to test electric vehicle charging stations?	
9	Does your laboratory plan to test watt-hour meters which are used to test electric vehicle charging stations in 2023?	
10	Does your laboratory allow teleworking?	
11	**Identify the average 1-way commute completed by the metrology staff in your lab:**	
12	0-10 miles	
13	11-20 miles	
14	21-30 miles	
15	31-40 miles	
16	41-50 miles	
17	> 50 miles	
18	**Laboraty Funding, Is your laboratory funded by:**	
20	Fees (including calibration fees and service registration fees)	
21	Weights and Measures program funds	
22	General Fund Allocation	
23	Other Funds	
24	**Please indicate whether or not your lab uses the following software:**	
25	Qualtrax	
26	IndySoft	
27	MC Link	
28	Balance Link	
29	Q-Pluse	
30		

Comments, Supplementary Questions 1.

Go To Supplementary Questions 2.

Go To Previous (Sections 8 - 32)

Renovations:
5 - Answer Yes if any renovations were made to your facility since 2021. This includes any updates or additions to an existing laboratory. It does not include new MT&E including mass comparators.

6 - New construction means construction of an entirely new laboratory facility which can include the buildout of a new leased space, new laboratory space added to an existing structure, or an entirely new structure.

7 and 8 are similar. In these answer yes if work is planned to start in 2023.

The question as posed is intended to help metrologists who may be facing either a remodel or planning a new lab identify labs which are or have recently done the same.

Follow up questions are included in the next section to describe additional details of the project(s).

For questions 11 - 17,

compute the average 1-way commute for all full time metrology staff in your lab (including support staff)

Questions 18-23,

Answer Yes for any portion of the fees you charge are returned to the laboratory fund to help cover laboratory operational costs. Answer No if the fees charged are returned to the agency.

Answer Yes to Weights and Measures program funds if your laboratory is closely associated with and operates from a common cost center and funding as the Weights and Measures program.

Answer Yes to General Fund allocation if your laboratory funds includes general fund money in any amount.

Answer Yes to "Other Funds" for all funding not described in 20, 21, and 22.

Use the Comments Section below to provide any additional details you feel are important.

Section 34: *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	If you answered Yes to Question 10 of Section 33 (Supplementary Y/N questions) please describe your current telework practices.	
13	If you answered Yes to Question 4 Section 33 (Supplementary Y/N questions) please describe the renovations completed.	
14	If you answered Yes to Question 5 Section 33 (Supplementary Y/N questions) please describe any improvements you realized over your existing laboratory facility.	
15	If you answered Yes to Question 6 Section 33 (Supplementary Y/N questions) please describe the renovations planned.	
16	If you answered Yes to Question 7 Section 33 (Supplementary Y/N questions) please describe any improvements you expect to realize over your existing laboratory facility.	
17		
18		
19		
20		

Go To Survey Comments

Back To Supplementary Questions 1.

Section 34	Comments on Survey

Go To Prevous Sheet (Supplementary Questions 2.)

End of Survey