Appendix A. Final Report of the Privatization Work Group

Allan M. Nelson, Connecticut, Chairman

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Summary

"Privatization" is defined in this study as the shift of responsibility for maintaining equity in the marketplace from the government sector to the private sector. The future of weights and measures as a government function appeared to be under siege in many parts of the Nation when the Task Force on Planning for the 21st Century recommended that the issue of "privatizing" weights and measures be studied. Reports that several states had improved their programs by privatizing weights and measures functions elicited very negative responses from many weights and measures government jurisdictions.

On the recommendation of the Task Force on Planning for the 21st Century, the Executive Committee established the Privatization Work Group to study the issue from several perspectives:

1. Was there information from either those who had "privatized," or had refused to privatize did not have, which would permit consensus to be developed about rational alternatives to maintaining equity in the marketplace?

The Work Group found that those who had claimed to have privatized did not know the full extent of the weights and measures regulatory functions to maintain a fair marketplace. In general, governments that had "privatized" had shifted device testing activities to private service and repair agencies, but had not found ways to privatize testing packaged commodities, transaction verification, investigation of complaints, or the enforcement of weights and measures laws and regulations.

The Work Group also found that most weights and measures agencies had already privatized testing and placing devices into service after installation or repair. Most weights and measures agencies in other countries had not privatized that far. (Two reports prepared for Canada's Legal Metrology Branch are available upon request.) Weights and measures regulatory agencies must find ways to partner with private sector groups to effectively maintain equity in the marketplace. Government agencies cannot contract for or transfer to the private sector those functions that are regulatory and enforcement in nature.

The Work Group concluded that:

a. Government decision makers who believe that weigbts and measures can be privatized do not understand tbe scope and breadth of weights and measures, nor its intrinsic regulatory nature for maintaining equity in the marketplace.

b. Weights and Measures agencies should be prepared to explain the scope of weights and measures responsibilities when questions are asked about shifting functions to the private sector. Regulatory functions, police powers, rightly belong only to the government. The Work Group generated visual aids that assist in explaining the scope of weights and measures. (See pages 125-128, Report of the 78th NCWM, 1993.)

c. Shifting device testing responsibilities from public agencies to private companies does not privatize the weights and measures regulatory function. Government oversight over device testing is still required when private companies, such as food stores, are required to purchase testing services (for their scales, for example) from otber private companies. (See pages 58-61 in the 1993 Report of the 78th NCWM.)

2. Was the negative response to the concept of privatization merely a self-serving response by government agencies that private businesses did not share?

The Work Group was established with both public and private membership. The Scale Manufacturers Association and the Gas Pump Manufacturers Association both declared that privatization of marketplace regulation was not possible, nor was it desirable, from the perspective of businesses trying to compete in a marketplace that would degrade to a "free-for-all." (See page 61 of the Report of the 78th NCWM, 1993.)

The Work Group concluded that marketplace regulation cannot be privatized and that even more than ever there is a need for weights and measures government presence.

a. Unfortunately, many businesses do not understand the need for weights and measures enforcement. It is imperative that weights and measures seek out its business customers and explain what weights and measures government agencies can do to assist business. Weights and measures at all levels needs to market its regulatory services. (See Chairman Tom Geiler's speech appended to this final report, page 79.)

b. Weights and measures cannot continue to do its job in tbe same way as always, however. Whether weights and measures regulation is supported by general taxation or by fees to businesses, it must devise ways to gain greater efficiency at the same or reduced costs. This includes greater use of computers and use of sampling in more than the package testing area. (See Darrell Guensler's discussion appended to this final report, page 77.)

3. What steps could be taken to improve equity in the marketplace within the resources available?

The ultimate objective of privatization is to save government revenues for other purposes. Introducing efficiencies and increasing program effectiveness can also save government resources. The Work Group discussed many alternatives to traditional weights and measures activities that might increase efficiency and effectiveness, such as sampling from a device population (also called variable frequency of inspection), similar to sampling packages for net contents testing (See page ?.) Cross-jurisdictional measures to determine the effectiveness of program alternatives are lacking.

The Work Group determined that (1) the as-found errors in devices should be recorded (rather than allowing the device owner to rezero his device before testing); and (2) the actual errors in devices should be recorded (rather than just "in" or "out" of tolerance) so that the economic impact of errors can be estimated as compared with program costs. These numerical estimates can be used to set the "benchmark" level of equity at a particular time. Changes in program can then be assessed against these benchmarks as to their effectiveness.

The Work Group recommends tbat a new work group be established to build on the outlines of what individual agencies and this work group have done to measure the benefits of weights and measures activities. The objectives of this work group would be to devise ways to measure whether changes in process, procedures, or program are actually improvements. Its scope of work would be to provide tools to measure the benefits and costs of individual parts of a weights and measures program, and to provide uniformity in reporting those measures and uniformity in the meaning of the data reported. The Work Group would report to the Education Committee or its successor, the Administration and Public Affairs Committee.

The Work Group also recommends that a second work group be added to the NCWM already formed by the Central Weights and Measures Association to develop standards for a jurisdictional accreditation program. This work group should also report in some way to the Administration and Public Affairs Committee. See Sid Colbrook's remarks at the end of this report.

Earlier Meeting Reports and Products
The first meeting, October 1992, produced a set of visual aids that could be used or modified to describe weights and measures and explain the regulatory functions that cannot be shifted to the private sector. At this meeting, the Work Group analyzed the functions of maintaining equity in the marketplace. Traditional functions begin with the metrology laboratory to assure accuracy in transactions involving measurements, on through a list of other functions and activities, including sampling from marketplace transactions.

Members of the Conference and Work Group also wrote letters explaining the weights and measures regulatory functions, and visited legislatures and other decision makers to provide rationale for maintaining weights and measures regulatory oversight by the government. This was successful for the States of Iowa, Massachusetts, and Washington, and the city of Indianapolis.

The Kansas Experience
The second meeting was held June 1993 in Topeka, KS, because Kansas has advertised its weights and measures program as being more effective than ever as a privatized program. The Work Group found that Kansas required all businesses to get their commercial devices tested annually by a private service company. However, Kansas weights and measures was not privatized in the sense defined by the Privatization Work Group; that is, maintaining a fair marketplace continued to be the responsibility of Kansas State government. Kansas maintained approximately the same staffing level, still checked packages, scales, and handled complaints. The State had found that the frequency of inspecting and testing large capacity scales had declined over the years to about a 4-year cycle. Kansas now requires annual testing at the expense of the device owner, and uses its staff to test devices after repair agencies had performed their annual inspections. In this way, Kansas maintained its regulatory oversight over the marketplace.

Since Kansas had not had the resources to inspect annually, they mandated that businesses buy annual inspections from the private sector. However, they do not empower private companies to reject or condemn devices, and the State oversees the work of the private companies. Kansas still needs more resources to train these companies and to better utilize them as contractors of the service part of the weights and measures function. For example, the repair firms that the Work Group talked with did not inspect devices against specification requirements; they tested the devices and adjusted them to perform within tolerances.

The Washington State Experience
The third meeting of the Work Group was held in November 1993 in Seattle, Washington. A report of this meeting is on page 104. The purpose was to discuss a study conducted by the Washington Office of Financial Management on the subject of the cost benefit of weights and measures in Washington, and to compare that with other States. Although the study did determine the very real economic benefits of weights and measures in Washington and led to the continuation of the program, the study leaders were not able to evaluate the worth of the Washington program in comparison with other States. The lack of uniformity in the report to Washington was yet another instance of the harm often caused by nonuniformity in reporting and field enforcement (assumed because the compliance rates were so very different from jurisdiction to jurisdiction). Several recommendations were made about the kind of data needed to make cost/benefit decisions. Work Group members who direct weights and measures regulatory programs submitted copies of their reporting forms and quickly came to the conclusion that standardized report forms are needed in order to compare compliance data and error rates. The Work Group also noted that actual errors need to be recorded in order to make economic evaluations.

Analysis: The Regulatory Role of Weights and Measures
Many definitions of "privatization" are quite general, often, meaning the shift of services from government to private sources in order to save government funds for other priorities. Privatization of such services as trash collection, parks maintenance, and hospitals are examples of successful shifts from public to private providers. However, the heart of weights and measures is regulation of the marketplace to maintain equity, although many weights and measures activities are perceived as services. The Work Group hypothesized that privitization of weights and measures may seem reasonable to some groups since it is viewed as a device-testing service, not as a general regulatory function of government. If a State can split service from regulatory functions, then the service portion may be privatized. Thus, all but 12 States have regulations that permit private agencies to install devices and place them into service without the presence of weights and measures officials. Kansas has gone one step further, requiring devices to be tested at least annually by a private company. Kansas retains its regulatory

powers and thus must maintain its capability to test devices, hence must add to its resources the capability to train the private companies that test devices.

Weights and Measures Is Not a Device Testing Service
If we focus on today's weights and measures agencies, we see that many are reducing staff and other resources so that they little more than test devices; this is inadequate marketplace oversight. All weights and measures agencies should also be ensuring that potential customers are adequately informed, training and inspecting the work of registered repair companies and weighmasters, testing packages, and buying and selling undercover to ensure that entire transactions are conducted fairly. Under tough fiscal constraints, the only way jurisdictions can possibly find the time and resources to look at other elements of the marketplace is by devising ways to sample devices, not test every device annually. Jurisdictions know that they should focus resources on transactions with poor compliance levels. Unfortunately, many agencies feel trapped into generating fees for device testing. In other words, they must convince decision makers that licensing and fees must support the other elements of weights and measures marketplace oversight. Fees must be set high enough to support the total program or general tax revenues must be made available for these other activities for which fees cannot be charged.

Communications with Decision Makers
In order to justify the amount of fees or general tax revenues supporting a weights and measures program, legislators, governors, business leaders, and the general public must be made aware of the benefits of marketplace regulation. Weights and measures agencies and their management must interface with the community they serve, explaining the weights and measures function and how it helps, and listening to the community to find ways to serve them better, more effectively, more efficiently, and at less cost. **NCWM Chairman Geiler provided a copy of his speech on the subject of privatization; it is appended to the end of this report and will provide for thoughtful discussion by those considering privatization of weights and measures functions.**

Economic Benefits of Weights and Measures
Weights and measures agencies need measures of effectiveness against which to compare changes and determine the efficacy of their programs. This was a serious flaw in Washington State when it discussed privatizing weights and measures. There was no data available on the economic value of weights and measures regulation in Washington. The data provided by other States in response to a questionnaire from Washington indicated that there were no uniform measures that could indicate the economic value of the basic functions that cost the most, such as device inspection. Washington State has been collecting some of that data over the past 2 years, the indication that economic benefits far outweigh the costs. For example, in the area of large capacity scale testing in Washington, which costs the state less than $500,000 to operate, annual dollar savings from devices that would have continued to be used without repair when they were in fact operating beyond the tolerances were more than $30 million dollars. Unfortunately, this information was not available before the State Legislature decided to withdraw general tax revenues as a source of funding this program. However, the program is now fee supported and there is general agreement that weights and measures is a necessary government function. A copy of the Washington State Study is available from the Office of Weights and Measures.

Final Meeting Report
The final meeting of the Privatization Work Group was held June 1994 in Las Cruces, NM. It was held to summarize the work and to make one last attempt to determine whether means and methods were available, or would have to be invented, to permit comparison of compliance levels, cost, or economic benefit from one jurisdiction to another.

Record As-Found Error
Dave Smith, NC, piloted efforts in his jurisdiction to collect data on the actual errors found during device testing. His studies indicate that the field officials cannot test as many devices when more data must be collected. The officials must be retrained and the report forms modified. For example, inspectors cannot immediately disconnect automatic temperature compensators when testing volume delivery devices. They must run an additional test in the as-found condition in order to determine the amount of error that would presumably continue if weights and measures inspectors had not tested at that time. In addition, the field inspector cannot effectively obtain the sales data or other economic value data of the commodities being measured. To estimate the economic value of inspection will require the State office to find the economic value of commodities being measured. A state office can obtain this information from state or regional trade associations and marketing boards. **Mr. Smith's report is appended to this report.**

Darrell Guensler pointed out that until one can measure effectiveness of a program, there is no way to measure whether changes can improve it. He pointed out that we must list the objectives and outcome measures for each element of a program, then have national norms against which to compare. Only through this standard setting and data collection can the promise of future efficiencies from sampling devices, rather than testing each one, be assessed. One of the prime statements

made at the Work Group meetings, is that Weights and Measures agencies must learn to "hoe where the weeds are." As resources diminish, we must resort to selective testing and focus on worst actors. A cop on the beat has a deterrent effect, but few jurisdictions can afford more cops on a beat. Mr. Guensler also pointed out that we must find different ways to fund our programs; assessing a license or fee demands that agencies test annually as external proof that businesses are getting value for their fee. This does not permit rational programmatic adjustments.

As a result of discussion at this last meeting, however, the Work Group decided that recording the actual error and as-found errors should be collected as part of a sampling effort in each jurisdiction to determine the "marketplace conditions" at the time of the survey. It is not necessary to record the as-found error and the actual numerical errors found for every device tested. A sample will also provide the economic information needed. Chip Kloos, Hunt-Wesson, provided guidance on sampling and some simple sampling plans as tools for determining the level of compliance without having to test every device (or every business). His report is also appended to this report.

Mr. Kloos provided a report that guides inspection agencies through widely available sampling plans, Military Standards 414 and 105-D, showing to read these plan to determine how much sampling of the population (of meters, of scales, of businesses, of business locations) is needed to be effective in lieu of 100% testing. The Military Standards have been widely used since World War II as decision tools to determine when to increase testing if results are poor and when to reward suppliers or companies who routinely comply.

Mr. Kloos provided descriptions of how to use these standard statistical tools both for decision making and for estimating the level of compliance. Military Standard 105D is called a set of "attributes" sampling plans, that is, one decides whether a device, for example, is in tolerance or not; is "good" or "no good"; black or white. Military Standard 414 is called "variables" sampling plans, because one can often record the actual measurement value associated with any inspection, for example, the error for each device, such as -4 cu in. Attributes sampling plans require larger sample sizes than variables sampling plans, but both give valid results. Handbook 133 provides variations on Mil Std 414 as a means to test the net contents of packaged goods. All sampling plans are based on taking random samples. Alternative sampling might include cluster sampling, which is useful when most of the inspector's time is spent traveling to and from an inspection site. Another type of sampling is called stratified sampling. These tools allow us to concentrate either on devices or on businesses.

Uniformity at the Enforcement Level

The need for uniformity at the enforcement level was one of the key issues identified by the Task Force on Planning for the 21st Century. Washington State and the Privatization Work Group were not able to cross compare the effectiveness of different jurisdictions due to the differences in interpretation, nor the information they recorded about what they did. In Kansas, the data before and after requiring annual testing by private service agencies was non-intercomparable due to a lack of uniformity in what was considered noncompliance before and after the program was changed. This affected the resulting statistics of the efficacy of the programmatic changes. When the Work Group investigated whether there were model report forms or other information in the training modules that might be used to standardize reporting, only the net contents package inspection module, Module 10, had a standardized report form. Another standardized report form is that of the U.S. Department of Agriculture's Packers and Stockyards Administration form for testing livestock scales. The Work Group agreed that if standardized reporting were instituted, much greater uniformity in testing and inspection would result. **The Work Group recommends the survey and establishment of standards in reporting key numerical data on errors found in the marketplace to use for measuring the state of equity and the effect of changes.**

The Added Efficiency of Computers

Although not absolutely mandatory in order to benefit from standardized reporting, government agencies should take advantage of the labor savings that computers can provide. In order to establish a central data bank either within the State headquarters or at the national level, data must at some point be made accessible by computer. The greatest efficiency would be to provide field inspectors with lap-top computers for field entry of data. Today computers are much more rugged and will hold up in hostile field conditions much better than their predecessors. In addition, tiny battery-powered printers are available that can provide a professional report in the field to the business on-site. Linking a lap-top computer by modem to a central office computer to upload and download the data provides additional speed of data entry without the usual keyboard data entry errors that occur when one person tries to read another person's handwritten information.

Some jurisdictions have computerized their package inspection reports. One jurisdiction, Kern County CA, is in the process of computerizing all its inspection reports. Ideally, we should seek uniformity in computer programs and data while these new systems are being invented. California may be able to purchase a few lap-top computers and provide pilot study experience in this area. NIST OWM is evaluating an off-the-shelf software package, a front-end application that permits data bases to accept data from an electronic report form. OWM expects to evaluate it with the NTEP Laboratories and eventually

expand it. Sid Colbrook reminded the Work Group of the absolute necessity for developing standardized test procedures for all aspects of weights and measures activities for which data may be collected, ensuring that any information system is compatible with a national system. **The Weights and Measures Information System (WAMIS) computer bulletin board is underutilized and could be a convenient vehicle for collecting national data. A survey is needed to determine what systems and software jurisdictions are currently using.**

Another advantage of computer access in the field would be accessibility to all the helps in testing procedures, such as providing a compact and portable way to prompt and guide field inspectors in test and inspection procedures. Computers can contain all of the handbooks, modules, and examination procedures and have examination procedure outlines integrated with the report forms as guides to assist the inspector who is conducting the test. This would be a great aid to any inspector who must conduct an inspection in a while. **The successor of the Privatization Work Group should survey the jurisdictions to determine what computer programs are already in use to record data from the field, the type of data that is collected, and the purposes for which the data is collected.** The Work Group believes that portable computers will become as necessary an adjunct for field inspection as traceable weights and provers.

Program Accreditation

Sid Colbrook, IL, discussed the efforts of the Central Weights and Measures Association (CWMA) to establish a weights and measures accreditation program within the Central region. CWMA believes that standards for all aspects of a weights and measures government agency should be established and that accreditation should be offered to those programs that meet these standards. CWMA has a volunteer corps to develop the standards, namely Sid Colbrook, Steve Malone, NE, Jim Truex, OH, and Tom Stabler, Mettler-Toledo. CWMA discussed the possibility of conducting an audit of a state program against the standards, not only of its administration and management, but also of the marketplace condition within the jurisdiction. Several years ago the Conference evaluated of weights and measures programs with a group of three to five NCWM members visiting and reporting on their general status. There were general criteria, but they were not strictly applied. CWMA thinks that jurisdictions are now ready for more standardization and the resulting benefits. The accreditation program has five primary objectives: development of uniform testing procedures, uniform training for inspectors, uniform training for administrators, uniform standards for metrology, and a higher degree of integrity in the overall programs. Industry will benefit from uniformity, of course, but State now realize potential benefits as well. Having adopted Handbook 44 isn't enough to attain enforcement uniformity; we need peer pressure to stay uniform. Weights and measures agencies make short cuts that they shouldn't.

Linking the CWMA group to the NCWM would have mutual benefits. CWMA would get resources from the Conference and a technical advisor. The NCWM Administration Committee would get highly motivated volunteers to flesh out minimum standards. **Mr. Colbrook's presentation is appended to this report. The Work Group believes that the CWMA group should become a work group under the program evaluation group recommended to carry on the work of the Privatization Work Group.**

Industry's Role in Delivering an Effective Weights and Measures Program

Enlightened businesses are NCWM members. Slightly more than half the membership of the NCWM is Associate, that is, from private sector participants. It is important that neither individual weights and measures agencies nor the NCWM itself lose sight of industry as its customers. We have in the past 10 years begun to strength and formalize the vital relationship with businesses within the NCWM -- membership on the National Type Evaluation Technical Committee, on work groups, and on subcommittees. The moves that the Executive Committee is making to establish Associate membership on the Executive Committee is a very important step in bonding the business community at the national level to the regulatory community. Associate members are anxious to help bring new Associate members up to speed and enlist them in important work of the Conference. This same participation and interaction is needed at the State and local level. Some State weights and measures associations have strong and vital working relationships with their business leaders; others need to establish this as the only way that retailers can be educated to accept something different from annual testing as the service they receive for their licenses or fees.

Concerning the role of repair and service companies, no private business that sells or services equipment for a fee should ever be put into the role of condemning or taking equipment out of service. Service agencies can provide an important adjunct to government testing of devices, but only if they are provided adequate training. Unfortunately, no service agency can afford much of its own training, so a jurisdiction may have to require the training on laws, regulations, and test methods at least on an annual basis to get the expertise required. Many Associate members believe that this is not just a weights and measures government responsibility, but a shared responsibility to train service agency people. The Institute of Weights and Measures, an Associate membership underwritten effort, has trained hundreds of service people on NTEP these past 2 years. Some local divisions of the International Society of Weighing and Measurement (ISWM) also provide good "Scales on

Saturday" training. But adequate funding is never available, and most States have no training requirements for their registered service agencies. The only other driving force to get repair agency staff trained is when a jurisdiction "causes problems" by rejecting more than the normal number of devices. This gets service companies' attention, and causes unnecessary frustration on the part of the government agency, the device owner, and the service company alike.

Another improvement in the State weights and measures system would be a standardized test form for repair agencies instead of the different state reporting requirements and forms. Repair agencies are growing in size and many do business across State lines. Many States do not require any specific report form, or if they do, it is not the same form as used by their own staff. How can a State audit the adequacy of a repair agency not using the same report and not doing the same test?

It may also be time to change the Uniform Regulation for the Voluntary Registration of Service Persons and Service Agencies to a mandatory requirement. All repair firms should meet the same standards within any jurisdiction. Instead of removing their licenses, 12 weeks of training might be imposed when serviced equipment still does not meet tolerances. Device manufacturers would gladly participate in repair company training and provide vital resources. A jurisdiction must have the resources to test devices very soon after service in order to review the quality of any service company's work. Years ago the Laws and Regulations Committee studied the Registration Regulation and found that its greatest shortcomings then were the lack of administrative policy guidelines on how to test, train, and monitor repair companies. Data on repair firms cannot be adequately maintained without computer database information retrieval. This aspect of weights and measures government oversight should be part of the minimum standards for jurisdiction accreditation. **Remarks by Daryl Tonini, Scale Manufacturers Association, are appended to this report, focussing on industry's role in weights and measures. Mr. Rich Tucker, Tokheim Corporation, representing the Gas Pump Manufacturers Association, also provided his position in writing, also appended.**

Due to individual competitive issues, it is often the trade associations, rather than individual businesses, that actively support a weights and measures agency. As long as there are no "problems," businesses are uninterested in weights and measures. Individual businesses will more willingly help to provide training, but might not be as willing to go to a State legislature in support for weights and measures (although individual businesses have done so). Efforts by Ken Butcher this past year have led the Food Marketing Institute to offer the NCWM a booth at its mammoth trade show in Chicago next year. It is important to seize every opportunity to let businesses know more about weights and measures and why regulation will help their business.

How Does a Weights and Measures Agency Funded by Fees Fund Package Testing and Undercover Purchases?
Mr. Smith explained that fees are just a tax directed at a narrow segment of the business population. Weights and measures agencies should get involved when fee programs are introduced or modified to make sure that the fees are high enough to support other aspects of the weights and measures program. Device testing should be only a small part of any well rounded weights and measures program. All Work Group members were philosophically opposed to using civil penalties, fines or other retributive system, to support a weights and measures program. However, some legislators feel that there is no need for a regulatory program if there are no violations. The Work Group does not want any weights and measures agency to be perceived as bounty hunters. Programs should be able to demonstrate their costs and offsetting revenues from fees, fines, and other revenue sources, but not directly depend upon those revenue sources. Chip Kloos, from Hunt-Wesson said that the primary beneficiaries of package testing are the packagers and that they might very well be willing to support package testing programs. Unfortunately, the closest special interest groups speaking for weights and measures to the legislatures represent device manufacturers and service agencies. This gives additional credence to the perception of weights and measures as device testing agencies only. In addition, many agencies have been reduced to programs supported only by their device inspection fees and only test devices.

Some jurisdictions are considering other methods to generate funds, such as consulting or training businesses on a cost recovery basis. These services would be nonregulatory in nature and would not cost the taxpayer anything. For example, the NJ Department of Transportation is now trained and licensed to consult for businesses to reduce car use; their services are paid by industry.

Mr. Kloos raised the issue of in-plant inspection of packages as another area that would benefit manufacturers and which they might be willing to support. Mr. Guensler reported that California officials visit packaging plants about every other year, and that they use retail inspection as a means to force packagers to fill full net weight. Mr. Kloos said that his company's plants were located in five States, but that checking there would benefit all 50 States, and that funding such a project might be possible. Mr. Colbrook said that his agency would need additional clarification of authority to go into plant, for example, an inspection warrant, or administrative search warrant. Mr. Guensler said that the greatest benefit from in-plant inspection would be to the small packager lacking the statistical and quality control capabilities of large companies.

The Privatization Work Group concluded its work by offering to make its members available for guidance and continuity to assist the next work group, if the Executive Committee and Education Committee acts favorably on the Privatization Work Group's recommendations.

Privatization Work Group	
Allan M. Nelson, Connecticut, Chairman	Thomas F. Geiler, Barnstable MA
Sidney Colbrook, Illinois	Randy Hutton, Winn-Dixie
Tom Stabler, Mettler-Toledo	Jennifer Colman, Food Marketing Institute
Darrell Guensler, California	Chip Kloos, Hunt-Wesson, Inc.
N. David Smith, North Carolina	Daryl Tonini, Scale Manufacturers Association
Richard Tucker, Tokheim Corporation	Carroll Brickenkamp, NIST, Office of Weights and Measures
	Robert Bruce, Legal Metrology Branch, Canada

National Data Sharing and Funding Concerns

by Darrell Guensler, California

Why Collect Data?
There are at least two reasons to collect data. The first is to help improve program effectiveness and efficiency. The second is to provide information to help justify necessary programs in order to secure adequate resources to carry them out.

What Data Should Be Collected?
Marketplace transaction data can reveal how accurate transactions are at a given time, help in priority setting, and be used as a bench mark to measure against in the future to determine program effectiveness. This data should include
the average error found in a random sample (taken across the entire marketplace of the jurisdiction being evaluated) of a given type of transaction (retail gasoline transactions, packaged meat sales, scanner pricing transactions, etc.)
Also it is useful to record error information by
type of business (grocery versus discount drug, aluminum can buyers versus household movers, etc.),
by business name (Safeway, Thrifty, etc.) and
by region (county, city, etc.) if applicable.
This information may also aid in budget justifications.

Complaint data, recorded by type of transaction and by specific business, is also useful for priority setting and budget justification.

Inspection result data which includes detailed information on what was inspected, the results of the inspection, and the impact of the error (if applicable) is useful in various ways. Useful data includes:

For device inspections:
manufacturer,
model number,
serial number,
size or capacity,
product measured,
device owner,
service company,
as-found error converted to percentage, (at least one or two points in the inspection), etc.

For package inspections:
packer,
date of pack or pull date,
package size,
lot size,
product,
seller,
as-found error, etc.

For bulk products sales verifications:
seller,
product,
grade (if applicable),
manufacturer (if applicable),
as-found error, etc.

Annual sales data on the various products under inspection (devices, packages, or bulk) is necessary to properly extend the effect of the as-found errors.

Population and general data including workload measurements (number of devices, number of establishments, etc.), available personnel resources, costs (by program), number of people impacted by program (statewide population, etc.), and per capita costs are all useful.

Translate Error to Dollar Value Loss or Gain
Error data can be translated to impact on the marketplace in several ways:

Weighing or Measuring Devices. By utilizing annual sales data in the jurisdiction and applying average retail prices and device errors to the equation, the overall impact of the mean error on the marketplace can be projected. Also, comparisons can be made to previous evaluations of the jurisdiction or to evaluations conducted on comparable jurisdictions. Further, with individual establishment information, projections can be made relative to the impact on fair competition between sellers. Finally, these impacts can be compared to the cost of providing the verification service.

Prepackaged and Bulk Sale Commodities. Similar evaluations can be made for packaged commodities or bulk sales. For example, (for purposes of the example, uncertainties are disregarded) if a random selection is taken of prepackaged meat in a county jurisdiction and the mean error is determined to be +1.51 percent, the impact can be projected in various ways. If compared to the mean error of -0.78 percent determined in a county which has no inspection program, the savings to consumers (based on annual sales of approximately $62 million) is $1.4 million for a program, which in this case, costs less than $60,000 annually to operate. If compared to a statewide average of +1.69 percent, the results show that the program compares favorably to the larger area. If individual packer data is evaluated it may show significant enough differences to project fair competition comparisons.

Is Standardized Format Necessary?
If the data is to be shared nationwide it must be collected in a standardized format. Field data should be collected and transferred electronically. Data format and accompanying software which enhances the field inspection as well as collects data should be centrally developed and disseminated to the participating agencies.

How Do We Fund Package Testing and Undercover Purchases?
Weights and measures package testing and undercover purchases are properly funded through general tax revenues since the benefits are universal. If this funding source is not available, the next place to look is to the primary beneficiaries of the program.

In the case of undercover purchases, the primary beneficiary is the seller's competitor. Large errors which have a significant impact on buyers are normally self-evident and therefore self-correcting. Small errors normally only detected by weights and measures undercover purchases have minimal impact on individual buyers but have a significant impact on competitors trying to make a legitimate profit in the marketplace.

In the case of package checking activities, the primary beneficiary is the packer's competitor since, as stated above, most errors identified in the marketplace have the greatest impact on fair competition.

Finding an efficient method of taxing the primary beneficiaries is a difficult process. In the case of packagers, a tax could be levied on the number of packages produced or sold in a given jurisdiction. In the case of undercover purchases, a license fee could be established for businesses which make bulk sales of commodities.

Depending on civil penalties for funding may be a dangerous and possibly unethical procedure. It is however, quite appropriate to utilize the civil penalty process to recover investigative costs. Why should the law abiding business pay for the extra costs of investigation caused by the bad actor?

Another possible method of gaining better compliance, with less general fund resources, is to develop a cost recovery training and consulting program to offer businesses. Under such a concept, weights and measures cold conduct non-regulatory inspections and training of store or plant personnel to better equip them for compliance with weights and measures requirements.

Weights and Measures, a Service of Government or a Private Sector Function?

by Thomas F. Geiler, Barnstable, MA

Traditional weights and measures functions have been a service of government to protect the interests of buyers and sellers of measured commodities. This service has been viewed as a third party in all commercial transactions intent on ensuring equity by preventing any bias or fraud. In most industrialized countries this function has been provided by the Federal Government. In the United States, however, the responsibility for weights and measures services lies with the States by virtue of the States Rights portion of the U. S. Constitution. Many States patterned their State Constitution after the U. S. Constitution and shared their responsibility with cities and counties in structuring their weights and measures function as a joint state, county, or city responsibility.

One of today's buzzwords in and out of government is "privatization." This is a term often applied to the act of transferring a traditional government function to the private sector with the aim of reducing the cost of government, or increasing private sector competitiveness and improving service levels. There are as many definitions as there are proposals and each identifies some perceived benefit to a change in the structure of providing the service.

Weights and Measures services have increasingly been the subject of discussion as a possible beneficiary of privatization. Before we can begin to understand how such a proposal may impact the delivery of services, we need to understand the basic service of a weights and measures program. While there are variations from state to state in their weights and measures service delivery, the basic components of the function are very similar and usually consist of the following services.

A. Metrology Laboratory Program. A function where the state maintains traceability to measurement standards of the National Institute of Standards and Technology and is able to issue certification, to standards in use in that state by government and private industry, of the accuracy of those standards based upon a comparison to certified state standards. This function is the foundation of every weights and measures program and provides for uniform standards world wide through state, national, and international metrology agreements.

B. Device Inspection Program. A program of providing certification, usually annual, to all commercial weighing and measuring devices in operation in the jurisdiction. The certification is issued upon a satisfactory inspection and test of the device that indicates that the device is accurate, within prescribed limitations, through the full range of its indications and that it is correct. To be correct a device must conform to standard design requirements and specifications, be used for the purpose for which it was intended, and not be susceptible to or modified for fraudulent use.

C. Net Weight Compliance Program. A program where a percentage of prepackaged commodities are randomly selected and tested to determine compliance with the stated quantity. Inspections are done in packaging plants, warehouses, and retail outlets and involve a full range of commodities. The vast majority of commodities inspected in this program are commodities that were weighed or measured on noncommercial devices that are not inspected in device inspection programs.

D. Transaction Verification Program. A program where inspectors will make undercover or test purchases of commodities to determine the accuracy of the stated quantity. This function is generally a random sample process on a percentage of the total number of commodities available and may also be the result of complaints. Generally, the target is non-prepackaged commodities such as found at service deli, fish, meat, and dairy counters, etc., or petroleum products, such as gasoline, diesel fuel, home heating oil, etc., purchased through a metering system. This program provides verification of the accuracy of a stated quantity and may frequently involve a product, such as gasoline of home heating oil, which the consumer has no means of verifying the quantity received. This function may frequently involve the use of a device which was inspected in the device inspection program and provides additional verification that the device is being used correctly and not in a fraudulent manner, and is maintained in an accurate and correct condition.

E. Complaint Investigation Program. This program provides a process to investigate complaints received from consumers and industry relating to measurement shortages and overcharges. While many of the complaints received will fit into the everyday investigation of one of the other existing weights and measures functions, many will not. Complaints regarding the sale of firewood, coal, building materials, etc. will require investigation outside of those normally conducted by existing programs.

F. Government Purchase Verification. Most weights and measures jurisdictions provide assistance to other government agencies within their jurisdiction in verifying the quantity of purchased goods. Everything from fuel to school lunch food

items, road sand and salt, paper products, chemicals and fertilizers, etc. may be remeasured by weights and measures officials for other government agencies to ensure full value for government purchases.

G. Packaging and Labeling Regulation Program. Weights and measures regulations include the Uniform Packaging and Labeling Regulation which is modeled after the Fair Packaging and Labeling Act adopted by federal agencies. This regulation requires a uniform approach to packaging and package labeling to provide consumers with a clear, accurate declaration that assists consumers in making value judgments. These regulations also prevent misleading or deceptive packaging or labeling practices designed to confuse or deceive the consumer. This program involves inspection of a random sample of prepackaged commodities offered for sale in the marketplace.

H. Method of Sale Program. Either through individual state laws or through the Uniform Regulation for the Method of Sale of Commodities, all states have some form of consumer protection to prevent deceptive method of sale practices which prevent value comparisons by consumers. Method of sale regulations and laws specify the appropriate unit of measure for a particular commodity and require all commodities of a particular class be sold by a prescribed method of sale to allow for value comparison and prevent confusion or deception. Weights and measures departments are frequently called upon by industry within their jurisdiction for assistance in developing appropriate packaging and labeling formats for new products. A random sample survey is utilized to ascertain compliance in the marketplace.

I. Unit Pricing, Item Pricing, Open Dating. Most states have either a mandatory or voluntary regulation, or a combination of both, to regulate Unit Pricing, Item Pricing and/or Open Dating. In this program, assistance is provided to local industry in understanding their requirements in these areas, as well as a random marketplace survey to determine compliance levels.

J. Weighmaster Program. A program to provide a registration, licensing and enforcement process for "public weighmasters" or third-party measurers in commercial transactions. The purpose of the program is to ensure accurate measurements by public weighmasters and is accomplished by a registration/licensing function and random field inspection of weighmaster activities.

K. Electronic Retail Checkout System Program. The advent of bar coding and electronic scanners, which enter the price of a commodity into a cash register automatically rather than manual entry by a cashier, caused a need to create the process of scanner verification, or more accurately, computer verification. A representative sample of commodities is selected and run through the scanning system in the same manner a cashier would process a retail customer's order. At the conclusion, the cash register tape is compared to the stated price of the item for agreement and to determine any noncompliance or overcharges.

L. Motor Fuel Inspection Program. A program to verify that motor fuels be properly labeled at the point of retail sale. Consumers need to know the octane or cetane rating of the fuel, as well as the presence of additives, such as oxygenates. Inspectors randomly sample motor fuel dispensers to determine labeling compliance. Samples of motor fuel are taken to be analyzed in a motor fuel laboratory to determine octane or cetane levels and to determine the presence of additives and the percentages. This process determines the compliance level and helps maintain consumers confidence in their purchase of motor fuels.

M. Serviceperson/Agency Registration Program. Most states have some form of mandatory or voluntary registration requirements for service persons and service agencies for commercial weighing and measuring devices. This program is conducted primarily for the benefit of the users, manufacturers, and distributors of commercial weighing and measuring devices. The program involves accepting applications from, and issuing registration certificates to, an individual or agency, or both, that provides acceptable evidence that he, she or it is fully qualified by training or experience to install, service, repair, or recondition a commercial weighing or measuring device; has a thorough working knowledge of all appropriate weights and measures laws, orders, rules, and regulation; and has possession of or available for use, and will use, calibrated weights and measures standards and testing equipment appropriate in design and adequate in amount.

N. Type Evaluation Program. This is a program of cooperation between the National Institute of Standards and Technology (NIST), the National Conference on Weights and Measures, the States, and the private sector for determining, on a uniform basis, conformance of NIST Handbook 44 "Specifications and Tolerances and Other Technical Requirements for Weighing and Measuring Devices," NIST Handbook 105.1, Specifications and Tolerances for Reference Standards and Field Standard Weights and Measures, Specifications and Tolerances for Field Standard Weights (NIST Class F) NIST Handbook 105.2 "Specification and Tolerances for Reference Standards and Field Standard Weights and Measures, Specifications and Tolerances for Field Standards Measuring Flask," or NIST Handbook 105.3 "Specifications and Tolerances for Reference Standards and Field Standard Weights and Measures, Specification and Tolerances for Graduated Neck Type Volumetric

Field Standards." This program is essential to the industry in the jurisdiction to provide a level playing field and a nationally uniform standard for equipment design and construction, as well as the application thereof.

O. Training. The broad range of weighing and measuring devices and the rapidly changing technology require a professional training program for weights and measures officials to keep pace with current requirements and regulations and to be able to apply the requirements uniformly. This function is key to the success of all of the other weights and measures functions. Both the retail industry and the device service industry rely on a professional weights and measures function to conduct their competitive activities on a level playing field. Poorly trained weights and measures officials add to the cost of doing business of effected industries and reduce the efficiency of the jurisdiction's weights and measures program, and greatly reduces the ability of the service to achieve its goal of equity in the marketplace.

P. Administration. This function will vary from jurisdiction to jurisdiction according to the structure of that particular government agency. As with any effective program, professional administration is key to the success of the program. Administration includes a process for effectively resolving noncompliance issues.

Many states have other functions which are unrelated to a traditional weights and measures program which has been assigned to, and is being performed by, the weights and measures agencies.

The basic function of a weights and measures program described above all have one common goal; to provide industry with a uniform set of standards and regulations by which they may operate and to provide consumers with an assurance that the standards and regulations are being adhered to. Most states have annual sales of commodities sold by units of measure in excess of a billion dollars. Annual sales in the larger states may be one hundred billion dollars. In all states, the cost of operating a professional weights and measures program is usually less than 1/10 of 1% of that state's overall annual marketplace dollar volume. Even a moderately successful weights and measures program will have the effect of reducing marketplace measurement errors by at least 20 times the cost of the program.

The current trend to reduce the size and cost of government has opened every government function to review as a possible candidate for privatization. Discussion of privatization of weights and measures services usually centers around only one function of the service and that is the device inspection program. In a typical weights and measures program, the device inspection function may account for up to 50% of the department resources. Most weights and measures privatization efforts are based on the premise that there exists a duplication of service (device inspection) by the public and private sector and that the elimination of the duplication would increase efficiency and reduce costs. The basis for the suggestion that there is a duplication of services is apparently based on the observation that weights and measures officials inspect and test weighing and measuring devices and that private sector service persons also inspect and test weighing and measuring devices. This observation demands a closer examination to determine any duplication that may exist.

In a typical government weights and measures function, the weights and measures inspector does inspect and test weighing and measuring devices. The inspection and testing of weighing and measuring devices by weights and measures officials generally fall into three categories: initial verification, subsequent verification, and complaint investigation. Initial verification is usually at the request of the device owner and involves a new or remanufactured device being placed into service for the first time. The weights and measures inspector inspects the device to determine that the device is correct, that is, that it is appropriate for the intended use, and that the device is in compliance with design, maintenance and user requirements. The inspector then tests the device to determine the accuracy of value or performance of the equipment under examination by comparison with the actual physical standards of the official. Upon a satisfactory inspection and test of the device, the inspector places an approval seal conspicuously on the device indicating legal compliance at the time of test.

Subsequent verification by the weights and measures inspector is usually unannounced and scheduled by the weights and measures jurisdiction on a regular basis, most often annually. The basic process for inspection and test are the same for initial and subsequent verification. Complaint investigation is generally the result of a consumer complaint, but may also be the result of a competitor complaint, serviceperson complaint or even a complaint from the device owner resulting from a concern over the current accuracy of the device. The inspection and test, as the result of a complaint, may be the same process as for subsequent verification, or it may be something less depending on the nature of the complaint and the personal knowledge of the inspector regarding the device.

In all cases, the weights and measures official is acting as a third party with no financial interest in the device or the use of the device. Every state has conflict of interest laws and ethics regulations which prevent the weights and measures official from having any financial interest in the business of buying, selling or repairing weighing and measuring devices or any financial interest in the business entity which is utilizing a commercial weighing or measuring device. These laws and

regulations are intended not only to prevent any collusion or improprieties, but also the appearance of any conflict or impropriety. Third party verification of measurement accuracy has been the basis of a strong consumer confidence in marketplace accuracy for over two thousand years. Several centuries ago, when weighing and measuring devices were simple balances or measure containers, European cities would commonly have a weights and measures official who was present in the marketplace with official city scales and measures to reweigh or remeasure consumer purchases to verify measurement accuracy and to preserve a sense of order and equity in the marketplace.

As the marketplace grew so did the need for weights and measures services. Government appointed weights and measures officials would go to the several marketplaces and inspect and test the commercial weighing and measuring devices in use and to enforce the laws of equity in the marketplace. Then, as today, this service was to protect the interests of buyers and sellers alike, regardless of whether the measuring device belonged to the buyer or seller. Today's consumer is much better educated than those of past centuries. He has the ability to count, add, subtract, multiply, divide, and to understand and use algebraic formulas. However, he still does not have his own commercial weighing and measuring device and must rely on the accuracy of the device owned by the merchant and the third party verification of that device by the weights and measures official.

The private sector manufacturers sells, installs, services and maintains commercial weighing and measuring devices. Suggestions of duplication of service between weights and measures programs and the private sector center on the weights and measures device inspection function and the segment of industry that installs, services, and maintains commercial weighing and measuring devices. Let us try to examine the similarity and differences of these two functions.

The major difference is that the weights and measures function is a law enforcement activity with no financial or beneficial interest in the device or the transaction. The private sector agency is a for profit entity, selected and compensated by the device owner.

Service agencies install, service and maintain weighing and measuring devices and in the process of so doing should perform a similar, if not identical, inspection and test procedure as the weights and measures inspector to ensure that the device is in legal compliance. This is the basis for the suggestions that there is a duplication of services between the two groups. While there are similarities in procedures between the weights and measures official and the service persons, it is an error to suggest that the functions are the same. The service person, in many cases, is also an agent of the device manufacturer or distributor, as well as under contract to the device owner. His willingness to reject or condemn a device found out of compliance in these circumstances is complicated by his financial interest in his employment. His ability to adhere to a prescribed test and inspection procedure is complicated by his motivation of profit and competitiveness.

It is not uncommon for a retail company with a large number of weighing or measuring devices of a particular class, such as gasoline pumps or scales, to employ their own service technicians. The motivation of the technician in these instances is considerably different from that of the weights and measures inspector.

Most service technicians have skills and expertise limited to only a few classes of devices. Often the technician's training is limited to that of a single manufacturer of equipment. A weights and measures official is most often trained to be able to inspect and test the full range of weighing and measuring devices. The major reason for this is that the training for the weights and measures official is limited to the inspection and testing process, while the service technician must also be trained in maintenance and repair technology. A typical supermarket today might have 30-50 commercial retail scales. Typically, all of the scales would be inspected by a single weights and measures official. Service and maintenance of this equipment, however, would typically be provided by three to five different service agencies. In the State of New Hampshire, which has "privatized" the device inspection function of weights and measures, costs to the retailer have risen dramatically for device inspection services. There are many small retail outlets throughout the state which typically include retail grocery sales, gasoline sales, propane sales and hardware sales. All of the commercial weighing and measuring devices in these outlets were annually inspected by a single weights and measures official inspector when the State provided the service. Today, this same retailer must obtain this service from up to five different service agencies. There simply does not exist any private sector equivalent of a weights and measures inspector. There does exist a large network of private sector agencies that have found their niche in the marketplace. A service agency that might offer maintenance and repair service to the retail gasoline industry typically does not offer this service to the retail fuel oil delivery company or the retail propane delivery dealer. The service agencies that maintain and repair supermarket scanner scales typically do not maintain or repair deli, meat or produce scales. Because of the high costs of training, test equipment, parts inventory and arrangements with distributors and manufacturers, service agencies tend to concentrate on their marketplace niche.

Transferring the weights and measures device inspection responsibility to the private sector service industry is technically possible. The service industry is, or should be, very capable of performing an official inspection and test on the commercial weighing and measuring devices they maintain and repair. However, to suggest that this transfer of responsibility is designed to reduce or eliminate duplication of effort, reduce costs, or improve efficiency is false. While costs to government agencies may be reduced, costs to the retail industry will skyrocket. Third party verification is eliminated and, along with this, is an erosion of consumer confidence in the marketplace. The retailer's relationship with the service industry will also change.

When in the past, a weights and measures official would reject or condemn a weighing or measuring device for noncompliance, the retailer would contact a service agency for repair or replacement of the equipment with reasonable confidence in the decision of the inspector and the advice of the service agency. When a device is rejected by a service agency who also happens to have several expensive components, or even a new device that he can sell the retailer to get the retailer's equipment back in business, the confidence starts to erode and the entire process becomes a little suspicious. Third party verification also has a significant benefit to the retailer in this process.

What about the cost reduction benefits to government? Earlier we identified the device inspection function of a weights and measures program as something less than 50% of the program resources and costs. Would the transferring of this function to the private sector save the government 50% of the weights and measures costs? Proposals to "privatize" device inspection usually include a proposal for a device inspection audit program. Instead of inspection and testing of all of the devices each year, the idea is to inspect and test a portion, usually about 20% of the devices, each year as an audit function to ensure that the private sector's service industry is conducting the inspection and tests according to the legal requirements and to maintain some third party verification. If we test only 20% of the devices annually, will we then save 80% of the program costs? By conducting a random sample of the devices within the state instead of all the devices the cost per inspection will increase because of travel time costs. When inspecting 100% of the devices, the inspector would be assigned a geographic area to minimize travel time and costs. By reducing the total number of devices tested a jurisdiction will have to greatly expand the geographic area for the inspector.

We must also remember that one component of the device inspection program is complaint investigation. "Privatizing" this aspect of the program is not feasible, so the cost of this function is also retained, however, the cost of this will increase for the same geographic reasons as the audit.

A portion of the device inspection program costs of a weights and measures program is also clerical. These costs generally will increase because the private sector is required in a "privatization" effort to send their official test reports to the weights and measures agency for review.

Most "privatization" proposals also require that all service agencies and service persons pay a fee to the state and obtain a license or registration annually. This licensing or registration function will generate additional revenue for the state, but it will also increase the clerical responsibility of the agency and the cost of clerical services.

A close scrutiny of the real costs of a weights and measures "privatization" effort will show a slight reduction in the cost to government while corresponding costs to retailers increase eight to ten times. While experiencing dramatic increases in their costs retailers will also have to deal with the erosion of confidence. The erosion of confidence develops between the retailer and the service agency and the consumer and the retailer, as well as between the retailer and his competition. The level playing field benefit of state weights and measures function is also reduced in this proposal. No business likes government regulation. Complying with any regulation has a cost and the cost is especially painful if you as a business person are paying that cost and you suspect that a competitor is not.

Much has been said recently about government maintenance of our infrastructure. Observations have been made that we as a nation are more concerned with today than we are with tomorrow. Leading economists have suggested that personnel saving is down, spending on capital improvements by the private sector is down, and government spending and maintenance of infrastructure is down. If these observations are true, and they certainly appear to be true, our fiscal problems will be even greater tomorrow.

Weights and measures services are our marketplace infrastructure. The strength of tomorrow's marketplace depends on today's maintenance of that infrastructure. Changes to the methods of providing weights and measures services should be carefully reviewed to ensure that the marketplace infrastructure is maintained or improved by the changes. Proposed changes in the delivery of traditional weights and measures services must carefully address conflict of interest issues and marketplace confidence concerns. Costs must be reviewed not only with an eye towards government costs, but also with a review of the costs to the retail industry, the service industry, and to the consumer.

Any review of weights and measures services should include an audit or review of the current conditions in a state. The audit should identify the beneficiaries of weights and measures services and the type of services that are needed. After identifying what services are needed and the benefits, the audit should identify all of the options for providing the service. Each option should be carefully reviewed to determine the most effective and efficient method to deliver the service. Proposals to change components of a weights and measures function which do not closely examine the effects the changes will have on remaining services are short sighted.

John Quincy Adams, in a remark made to the Senate in 1821, stated "Weights and measures may be ranked among the necessaries of life to every individual of human society. They enter into the economical arrangements and daily concerns of every family and are necessary to every transaction of trade and commerce." These remarks are still true today and emphasize the importance of maintaining a weights and measures service delivery system that meets the need of every individual of human society.

National Data Sharing

by N. David Smith, North Carolina

Unless the "as found" condition of weights and measures devices is documented, it is impossible to accurately determine the operating condition of devices in a jurisdiction. The usual listing of rejection rates is of little value if scales and meters are zeroed and adjusted before testing. It is likely historical rejection rates are in fact under reported. To correct this situation, it is desirable to document "as found" conditions. This activity, however, does have a few drawbacks:

a. Inspectors must be retrained and reporting forms modified.

b. More time must be allocated to perform inspections and this additional time means fewer devices will be inspected.

c. With fewer devices being inspected, inspection totals, when compared to prior time periods, may falsely indicate that inspection activity has declined.

d. Program resources (fees), if directly tied to the number of inspections performed, will suffer since the number of inspections is down.

Yet, the value of "as found" reporting is too great not to pursue. Such reporting, coupled with a national reporting form, could provide valuable information on evaluating the effectiveness of individual jurisdictions, identifying types and models of devices with excessive rejection rates, and documenting the true economic value of an effective weights and measures program.

What information must be collected and how should it be documented? By necessity, the extra documentation must not be extensive if weights and measures jurisdictions are required to alter their routines to capture the needed information. In addition, the information must be available in the course of routine inspections so that the impact on historical inspection rates will be minimal. Since weights and measures jurisdictions follow Handbook 44 procedures, the logical action is to incorporate those procedures on a national or standardized reporting form. Suggested "as found" documentation is:

a. For all devices, the condition of the device (scale on zero, meter on zero, etc.) immediately prior to the inspection routine.

b. For all devices not at zero, the amount of the error (plus and minus).

c. For small commercial scales, the error at one and five pound loads.

d. For all other scales, the largest error at any point in the test procedure.

e. For any meter, the error at the testing volume.

Of course, the amount of error provides limited information unless an economic value is placed on the error. For many commodities, the value of the commodity being measured is easy to obtain, but for others, it is much more difficult to document since many commodities may be weighed on a single scale or various prices may be charged depending on the quantity purchased. In some instances, the merchant may not want to reveal prices being paid for particular commodities. In any event, securing commodity value information must not become an adventure requiring lengthy amounts of time to procedure.

Perhaps commodities can be put in broad categories, such as:

a. construction materials
b. grain and feed
c. forest products
d. petroleum products
e. retail motor fuels
f. and so on - this list could become endless but it must be kept to a manageable number since a simple check off form (or code) is desirable.

Therefore, it is imperative that the sought after information be limited to: "as found" information, commodity being measured and its value, and perhaps information on the weighing or measuring device. (The latter could be controversial since competitive forces could use the information to discredit a competitor.)

Unless NIST is in the position to equip weights and measures jurisdictions (or at least a few jurisdictions) with portable computers, the transfer of computer technology to field inspections will be very slow. A more likely prospect is a software program to capture inspection information from the paper reports sent to a central office. Of course, the paper reports or inspection forms must be standardized so everyone is reporting the same information.

NIST computer specialists should be able to design the appropriate software programs for distribution to jurisdictions with capable computer hardware. However, the field information must be entered into the computer and this takes resources which may not be available to many jurisdictions.

Once captured, the information can be shared in a variety of ways. With the increasing popularity of electronic communication (e-mail), large volumes of data can quickly be distributed.

HOW DO WE FUND PACKAGE TESTING AND UNDERCOVER PURCHASES?

No weights and measures program is complete unless it has the resources to perform package inspections and respond to complaints. Simply testing devices ignores a significant portion of the commercial transaction. For example, is the cash discount computed correctly; are products sold from bulk deliberately misweighed; are packaged products misweighed for weekend sales; are merchants remotely manipulating the accuracy of motor fuel dispensers; and are vendors cheating sellers by short weighing commodities? In most cases which come to the attention of weights and measures officials, citizens suspect they have been cheated and report it to the authorities. When people are being deliberately cheated, it doesn't do any good to test the weighing or measuring device and in fact, responding to the complaint by just testing the device may discourage complaints. People sense when government is adequately responding to their complaints and quickly lose confidence when inadequate measures are taken. It is imperative that a weights and measures program has sufficient resources to conduct routine package inspections and respond to consumer complaints even if it means that undercover purchases must be made.

Ideally, package inspection and undercover investigations are funded through general revenue sources along with device inspections. When device inspections are supported through fees, there is great temptation to restrict inspection activities to those areas generating the fees. Since package inspections and undercover investigations do not generate any fees, they are usually left out of the weights and measures equation. Such thinking is short sighted for a complete weights and measures program encompasses certain activities, regardless of the sources of funding.

Inspection Sampling

by Chip Kloos, Hunt-Wesson

Inspection sampling is not a new concept. It is used whenever there are more items to be inspected than there is time or resources available to inspect them. It is used most frequently in the area of package inspection.

However, when it comes to device inspection, the owners of the devices as well as the inspectors themselves expect every device to be inspected periodically. But in this time of diminishing resources, sampling may be the answer to maintaining responsibility without having to resort to 100 percent inspection.

Objectives of Sampling

Sampling can be used to achieve two different objectives. The most common and obvious use of sampling for regulatory officials is for the purpose of obtaining information to make compliance decisions. This is called acceptance sampling and is used to make pass (acceptance) or fail (rejection) decisions. This approach could be applied to devices where individual establishments, such as a trailer park or gasoline service station, are responsible for maintaining their devices. When an establishment is being inspected, not every device needs to be evaluated in order to reach a compliance decision. Only a representative sample would be required.

The second objective that sampling could achieve is that of estimation. Instead of a pass or fail decision, sampling can be used to estimate the compliance level of devices within a jurisdiction. Again, 100 percent inspection is not necessary to obtain an accurate estimate of the compliance level.

Acceptance Sampling

Acceptance sampling is based on the premise that repeated samples will be taken periodically. If sampling rather than 100% inspection is performed, the frequency of inspection could be increased where needed. This approach to sampling can be applied to individual establishments, to package lots, or to device types where compliance is required.

There are basically two different types of acceptance sampling plans: attribute plans and variable plans. With attribute sampling plans, each device or item inspected would be tested to see whether or not it complied with the requirement(s). The acceptance of the establishment (lot) would be based on the number of non-complying items found in the sample. Actual measurement of each device is not required (though usually performed), only whether it complies or not is recorded. Since there are no quantifying measurements that accompany each observation, relatively large samples are required to achieve the desirable level of confidence associated with the compliance decision. Basically, each device would be tested to see if it possesses the desired attribute of compliance or not, e.g., pass/fail, go/no-go or nondefective/defective only.

Variable sampling plans would require a measurement to be made in order to determine the compliance of each device. In this case, each observation would have more information (the variable) on how good or bad it is. Smaller sample sizes are required when compared to attribute plans with the same level of confidence because of this added information.

Examples of both types of acceptance sampling plans are shown below. An attribute sampling plan based on Military Standard Plan 105D (MIL-STD-105D) is illustrated in Table 1. An example of a variable sampling plan based on Military Sampling Plan 414 (MIL-STD-414) is shown in Table 2. It is interesting to note that the attribute plan required a sample size of 13 while the variable plan required only 5 items and both reach the same conclusion. Tables referenced in both examples are found in the Appendix.

You will note that both types of plans provide for a variety of inspection levels. In Mil-Std-105D, there are four Special levels (S-1 to S-4) and three General levels (I - III) shown in Table I of the plan. Although General level II is traditionally used, General level I could be used for typically good establishments and General level III could be used for poorer establishments if you want to vary the intensity of inspection. Similarly, Mil-Std-414 has five inspection levels (I - V) shown in Table A-2 of the plan. Although level IV is used most often, the levels can also vary accordingly.

The Acceptable Quality Level (AQL) is the defect level or percent noncompliance typically associated with high quality. It is the defect level that has approximately a 95 percent chance of passing the inspection. In the above examples where the AQL is 4.0 percent, if a station had 4.0 percent of its pumps out of compliance, there is approximately a 95 percent chance that it would pass the inspection. It is equivalent to the highway (good) mileage shown on a new car sticker. There is another aspect of the plan called the Reject Quality Level (RQL). This is the defect level that has approximately only a 10 percent chance of passing. In the plan shown in Table 1, the RQL is 26.8 percent. That is, if the station had 26.8 percent

of its pumps out of compliance, it would have approximately a 10 percent chance of passing the inspection. The RQL is equivalent to the city (bad) mileage on a new car sticker. These quantities, the AQL and RQL for each plan, can be read off the Operating Characteristic Curves (O-C Curves) contained in the Mil-Std Handbooks.

One other feature of the acceptance sampling plans contained in Mil-Std 105D and Mil-Std-414 are the switching rules. For a given level of inspection, the sample size and acceptance criteria can be changed in accordance with consistently good or poor establishments (just like with production lots). The rules are shown in Figure 1 and indicate that the requirements can be relaxed or reduced when an establishment consistently passes inspections or tightened when it fails some of the inspections. Realize that the sampling plans and switching rule generally apply to continuous manufacturing processes where production lots are being continuously inspected. It is a bit of a jump in going form a continuous manufacturing process to a group of gas stations located within a jurisdiction that is inspected once every year or so, but the methods are quite suitable.

TABLE 1. ATTRIBUTE SAMPLING PLAN (MIL-STD-105D)

PROCEDURE	EXAMPLE
1. Determine the total number of devices subject to inspection.	1. Assume a gas station has 30 pumps subject to inspection.
2. Determine the appropriate sample size code letter from Table I in the Appendix. Look under Lot Size for the total number and use General Inspection Level II.	2. For a total of 30 pumps, the sample size code letter would be D.
3. Define the Acceptable Quality Level (AQL).	3. An Acceptable Quality Level of 4.0% is desired.
4. Determine the appropriate sampling plan for the desired sample size code letter and AQL from Table II-A. This will include the definition of the sample size and the accept/reject criteria.	4. The sample size code letter D would require 8 pumps to be inspected. However, an AQL of 4.0% requires that code letter E and a sample size of 13 pumps be used. The station would be accepted (pass) if no more than 1 pump (Ac = 1) was found to be defective and the station would be rejected (fail) if 2 or more pumps (Re = 2) were found to be defective.
5. Determine if each pump, as found, is in compliance (is non-defective).	5. Using a five gallon prover and tolerance limits of 6 cubic inches (in^3), the results showed errors of -3, +5, -6, -2, +3, +3, -7, +5, -3, -7, +4, +2 and -2 in^3.
6. Determine whether the station passes or fails the inspection.	6. Since two of the 13 pumps exceeded the tolerance limits of $\pm$ 6 in^3, the station failed the inspection.

TABLE 2. VARIABLE SAMPLING PLAN
(MIL-STD-414)

PROCEDURE

1. Determine the total number of devices subject to inspection.
2. Determine the appropriate sample size code letter from Table A-2 in the Appendix. Look under Lot Size for total number and use Inspection Level IV.
3. Determine the Acceptable Quality Level (AQL).
4. Determine the appropriate sampling plan for the desired sample size code letter and AQL from Table B-3.
5. Measure the error of each pump as found.
6. Calculate the average and standard deviation of the errors.
7. Calculate the number of standard deviations each tolerance limit is from the sample average.
8. Estimate the total percent defective pumps (percent of pumps estimated to exceed the tolerance limits) based on how far (how many standard deviations) each tolerance limit (Q_U and Q_L) is from the sample average using Table B-5.
9. Determine whether the station passes (est. % defective M) or fails (est. % defective > M) inspection.

Sampling for Estimation Purposes

If, instead of acceptance sampling, your objective is to accurately estimate the compliance level of devices within a jurisdiction, a simpler sampling plan can be used. For estimation purposes, you want a sample that is large enough to be representative of the population of devices under consideration and reasonably accurate. The simplest approach is based on the assumption that the population is fairly homogeneous, i.e., not made up of groups that are distinctly different with regard to compliance level. It utilizes the principle of random sampling where each device in the population has an equal chance of being included in the sample. The size of the sample is based on the total number of devices in the population, the estimated compliance level and how accurate you want the estimate to be. This would be a good approach to doing a marketplace survey to determine the level of equity in the marketplace at the time of the survey.

Table 3 below shows the sample sizes needed to estimate the percent compliance for population sizes ranging from 10 devices to infinity (a whole lot). The sample sizes are based on the assumption that the level of compliance is approximately 95 percent or 90 percent and the desired level of accuracy (error of the estimate) is either 1 percent or 5 percent. The table shows that if the level of compliance is lower (90% vs. 95%), the sample size increases. The reason is that with more non-complying (defective) devices, you would need to do more sampling than you would if there were fewer non-complying devices in order to achieve an accurate estimate of the compliance level. Similarly, if the desired level of accuracy is high (1% error of the estimate vs. 5%), the sample size would also need to be increased. It is interesting to note that for a population size greater than 10,000, the sample size does not change that much, particularly with a 5 percent error of the estimate.

If the assumption of homogeneity of the population is not valid and there are distinctly different levels of compliance with different establishments or device manufacturers, a stratified sampling plan would be more appropriate. In this case, for example, let's say there are two distinct levels of compliance: good establishments or devices and poor establishments or devices. The population would be segregated (stratified) into the two groups (good and poor) and a reduced sample size applied to the good group and an increased sample size applied to the poor group.

Another type of sampling called cluster sampling should also be considered. When faced with a large territory to cover, it may be inconvenient to try to sample the entire state or jurisdiction with equal coverage. Rather than covering 100 percent of the territory, randomly select counties or subsections within the jurisdiction (clusters) and extensively sample within these clusters. That way, not all areas within the jurisdiction will be sampled but, as long as each section or cluster has an equal chance of being selected for inspection, you will obtain a valid estimate of the compliance level. The advantage associated with cluster sampling is that you can concentrate your efforts in fewer areas (perhaps those needing special attention), thus being more thorough, while at the same time minimizing the amount of necessary travel time.

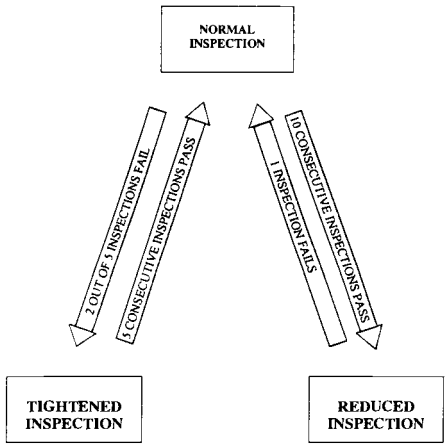

Figure 1. Switching Rules

Table 3. Sample Sizes (n) needed to Estimate Pecent Compliance

Total No. of Devices (N)	Estimated Compliance Level (p)			
	95%		90%	
	Error of the Estimate (e)			
	1%	5%	1%	5%
10	10	9	10	10
25	25	19	25	22
50	49	31	50	38
100	96	44	98	60
500	396	67	440	112
1,000	656	71	783	126
5,000	1,378	75	2,094	140
10,000	1,597	76	2,648	142
50,000	1,831	76	3,359	144
100,000	1,865	76	3,475	144
∞	1,900	76	3,600	144

$n = 4Np(1-p) \quad ((N-1)e^2 + 4p(1-p))$

Examples of both stratified sampling and cluster sampling schemes can be developed. However, the move from 100 percent inspection to random sampling should be digested first before moving to the more complicated sampling designs.

Additional questions beyond the scope of this introduction to sampling must also be considered. These might include the effect of charging fees for devices that are not inspected, the impact of longer periods between inspections at the same establishments or for the same devices and keeping track of those devices not yet inspected.

Sampling definitely adds another level of complexity to inspection. However, it is the only practical way to maintain responsibility over a wide area and a large number of devices with diminishing resources.

MIL-STD-105D
29 April 1963

SUPERSEDING
MIL-STD-105C
18 July 1961

MILITARY STANDARD

SAMPLING PROCEDURES AND TABLES FOR INSPECTION BY ATTRIBUTES

TABLE I--Sample size code letters

(See 9.2 and 9.3)

Lot or batch size			Special inspection levels				General Inspection levels		
			S-1	S-2	S-3	S-4	I	II	III
2	to	8	A	A	A	A	A	A	B
9	to	15	A	A	A	A	A	B	C
16	to	25	A	A	B	B	B	C	D
26	to	50	A	B	B	C	C	D	E
51	to	90	B	B	C	C	C	E	F
91	to	150	B	B	C	D	D	F	G
151	to	280	B	C	D	E	E	G	H
281	to	500	B	C	D	E	F	H	J
501	to	1200	C	C	E	F	G	J	K
1201	to	3200	C	D	E	G	H	K	L
3201	to	10000	C	D	F	G	J	L	M
10001	to	35000	C	D	F	H	K	M	N
35001	to	150000	D	E	G	J	L	N	P
15001	to	500000	D	E	G	J	M	P	Q
50001	and	over	D	E	H	K	N	Q	R

CODE
LETTERS

TABLE II-A--Single sampling plans for normal inspection (Master table)

See 9.4 and 9.5

Sample size code letter	Sample size	Acceptable Quality Levels (normal inspection)																																					
		0.010		0.015		0.025		0.040		0.065		0.10		0.15		0.25		0.40		0.65		1.0		1.5		2.5		4.0		6.5		10		15		25		40		65		100		150		250		400		650		1000	
		Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re	Ac	Re
A	2																											0	1			⇩		1	2	2	3	3	4	5	6	7	8	10	11	14	15	21	22	30	31
B	3																											0	1	⇧	⇩	1	2	2	3	3	4	5	6	7	8	10	11	14	15	21	22	30	31	44	45
C	5																											⇧	⇧	1	2	2	3	3	4	5	6	7	8	10	11	14	15	21	22	30	31	44	45		
D	8																							0	1	⇧	⇧	⇧	⇧	1	2	2	3	3	4	5	6	7	8	10	11	14	15	21	22	30	31	44	45		
E	13																							⇧	⇧	⇧	⇧	1	2	2	3	3	4	5	6	7	8	10	11	14	15	21	22	30	31	44	45				
F	20																					⇧	⇧	1	2	2	3	3	4	5	6	7	8	10	11	14	15	21	22												
G	32																	0	1	⇧	⇧	⇧	⇧	1	2	2	3	3	4	5	6	7	8	10	11	14	15	21	22												
H	50															0	1	⇧	⇧	⇧	⇧	1	2	2	3	3	4	5	6	7	8	10	11	14	15	21	22														
J	80															⇧	⇧	⇧	⇧	⇧	⇧	1	2	2	3	3	4	5	6	7	8	10	11	14	15	21	22														
K	125											0	1	⇧	⇧	⇧	⇧	1	2	2	3	3	4	5	6	7	8	10	11	14	15	21	22	⇧															
L	200											⇧	⇧	1	2	2	3	3	4	5	6	7	8	10	11	14	15	21	22	⇧																			
M	315							0	1	⇧	⇧	1	2	2	3	3	4	5	6	7	8	10	11	14	15	21	22	⇧																						
N	500					0	1	⇧	⇧	⇧	⇧	1	2	2	3	3	4	5	6	7	8	10	11	14	15	21	22	⇧																						
P	800			0	1	⇧	⇧	⇧	⇧	1	2	2	3	3	4	5	6	7	8	10	11	14	15	21	22	⇧																						
Q	1250	0	1	⇧	⇧	⇧	⇧	1	2	2	3	3	4	5	6	7	8	10	11	14	15	21	22	⇧																								
R	2000	⇧		⇧		1	2	2	3	3	4	5	6	7	8	10	11	14	15	21	22	⇧																											

⇩ = Use first sampling plan below arrow. If sample size equals, or exceeds, lot or batch size, do 100 percent inspection.
⇧ = Use first sampling plan above arrow.
Ac = Acceptance number.
Re = Rejection number.

Executive Committee

MIL-STD-414
11 June 1957

SUPERSEDING
ORD-M608-10
June 1954
NAVORD OSTD 80
8 May 1952

MILITARY STANDARD

SAMPLING PROCEDURES AND TABLES FOR INSPECTION BY VARIABLES FOR PERCENT DEFECTIVE

TABLE A-2 Sample Size Code Letters[1]

Lot Size		Inspection Levels				
		II	II I	I V		
3 to	8	B	B	B	B	C
9 to	15	B	B	B	B	D
16 to	25	B	B	B	C	E
26 to	40	B	B	B	D	F
41 to	65	B	B	C	E	G
66 to	110	B	B	D	F	H
111 to	180	B	C	E	G	I
181 to	300	B	D	F	H	J
301 to	500	C	E	G	I	K
501 to	800	D	F	H	J	L
801 to	1,300	E	G	I	K	L
1,301 to	3,200	F	H	J	L	M
3,201 to	8,000	G	I	L	M	N
8,001 to	22,000	H	J	M	N	O
22,001 to	110,000	I	K	N	O	P
110,001 to	550,000	I	K	O	P	Q
550,001 and over		I	K	P	Q	Q

[1]Sample size code letters given in body of table are applicable when the indicated inspection levels are to be used.

Table B-3 Standard Deviation Method

Master Table for Normal and Tightened Inspection for Plans Based on Variability Unknown
(Double Specification Limit and Form 2--Single Specification Limit)

Sample size code letter	Sample size	Acceptable Quality Levels (normal inspection)													
		.04	.065	.10	.15	.25	.40	.65	1.00	1.50	2.50	4.00	6.50	10.00	15.00
		M	M	M	M	M	M	M	M	M	M	M	M	M	M
B	3	↓	↓	↓	↓	↓	↓	↓	▼	▼	7.59	18.86	26.94	33.69	40.47
C	4	↓	↓	↓	↓	↓	↓	↓	1.53	5.50	10.92	16.45	22.86	29.45	36.90
D	5	↓	↓	↓	↓	↓	↓	1.33	3.32	5.83	9.80	14.39	20.19	26.56	33.99
E	7	↓	↓	↓	↓	0.422	1.06	2.14	3.55	5.35	8.40	12.20	17.35	23.29	30.50
F	10	↓	↓	↓	0.349	0.716	1.30	2.17	3.26	4.77	7.29	10.54	15.17	20.74	27.57
G	15	0.099	0.186	0.312	0.503	0.818	1.31	2.11	3.05	4.31	6.56	9.46	13.71	18.94	25.61
H	20	0.135	0.228	0.365	0.544	0.846	1.29	2.05	2.95	4.09	6.17	8.92	12.99	18.03	24.53
I	25	0.155	0.250	0.380	0.551	0.877	1.29	2.00	2.86	3.97	5.97	8.63	12.57	17.51	23.97
J	30	0.179	0.280	0.413	0.581	0.879	1.29	1.98	2.83	3.91	5.86	8.47	12.36	17.24	23.58
K	35	0.170	0.264	0.388	0.535	0.847	1.23	1.87	2.68	3.70	5.57	8.10	11.87	16.65	22.91
L	40	0.179	0.275	0.401	0.566	0.873	1.26	1.88	2.71	3.72	5.58	8.09	11.85	16.61	22.86
M	50	0.163	0.250	0.363	0.503	0.789	1.17	1.71	2.49	3.45	5.20	7.61	11.23	15.87	22.00
N	75	0.147	0.228	0.330	0.467	0.720	1.07	1.60	2.29	3.20	4.87	7.15	10.63	15.13	21.11
O	100	0.145	0.220	0.317	0.447	0.689	1.02	1.53	2.20	3.07	4.69	6.91	10.32	14.75	20.66
P	150	0.134	0.203	0.293	0.413	0.638	0.949	1.43	2.05	2.89	4.43	6.57	9.88	14.20	20.02
Q	200	0.135	0.204	0.294	0.414	0.637	0.945	1.42	2.04	2.87	4.40	6.53	9.81	14.12	19.92
		.065	.10	.15	.25	.40	.65	1.00	1.50	2.50	4.00	6.50	10.00	15.00	
		Acceptability Quality Levels (tightened inspection)													

All AQL and table values are in percent defective.

↓ Use first sampling plan below arrow, that is, both sample size as well as M value. When sample size equals or exceeds lot size, every item in the lot must be inspected.

TABLE B-5–Continued
Table for Estimating the Lot Percent Defective Using Standard Deviation Method

Q_U or Q_L	Sample Size															
	3	4	5	7	10	15	20	25	30	35	40	50	75	100	150	200
1.10	9.84	13.33	13.48	13.49	13.50	13.51	13.52	13.52	13.53	13.54	13.54	13.54	13.55	13.55	13.56	13.56
1.11	8.89	13.00	13.20	13.25	13.26	13.28	13.29	13.30	13.31	13.31	13.32	13.32	13.33	13.34	13.34	13.34
1.12	7.82	12.67	12.93	13.00	13.03	13.05	13.07	13.08	13.09	13.10	13.10	13.11	13.12	13.12	13.12	13.13
1.13	6.60	12.33	12.65	12.75	12.80	12.83	12.85	12.86	12.87	12.88	12.89	12.89	12.90	12.91	12.91	12.92
1.14	5.08	12.00	12.37	12.51	12.57	12.61	12.63	12.65	12.66	12.67	12.67	12.68	12.69	12.70	12.70	12.70
1.15	0.29	11.67	12.10	12.27	12.34	12.39	12.42	12.44	12.45	12.46	12.46	12.47	12.48	12.49	12.49	12.50
1.16	0.00	11.33	11.83	12.03	12.12	12.18	12.21	12.22	12.24	12.25	12.25	12.26	12.28	12.28	12.29	12.29
1.17	0.00	11.00	11.56	11.79	11.90	11.96	12.00	12.02	12.03	12.04	12.05	12.06	12.07	12.08	12.08	12.09
1.18	0.00	10.67	11.29	11.56	11.68	11.75	11.79	11.81	11.82	11.84	11.84	11.85	11.87	11.88	11.88	11.89
1.19	0.00	10.33	11.02	11.33	11.46	11.54	11.58	11.61	11.62	11.63	11.64	11.65	11.67	11.68	11.69	11.69
1.20	0.00	10.00	10.76	11.10	11.24	11.34	11.38	11.41	11.42	11.43	11.44	11.46	11.47	11.48	11.49	11.49
1.21	0.00	9.67	10.50	10.87	11.03	11.13	11.18	11.21	11.22	11.24	11.25	11.26	11.28	11.29	11.30	11.30
1.22	0.00	9.33	10.23	10.65	10.82	10.93	10.98	11.01	11.03	11.04	11.05	11.07	11.09	11.09	11.10	11.11
1.23	0.00	9.00	9.97	10.42	10.61	10.73	10.78	10.81	10.84	10.85	10.86	10.88	10.90	10.91	10.91	10.92
1.24	0.00	8.67	9.72	10.20	10.41	10.53	10.59	10.62	10.64	10.66	10.67	10.69	10.71	10.72	10.73	10.73
1.25	0.00	8.33	9.46	9.98	10.21	10.34	10.40	10.43	10.46	10.47	10.48	10.50	10.52	10.53	10.54	10.55
1.26	0.00	8.00	9.21	9.77	10.00	10.15	10.21	10.25	10.27	10.29	10.30	10.32	10.34	10.35	10.36	10.37
1.27	0.00	7.67	8.96	9.55	9.81	9.96	10.02	10.06	10.09	10.10	10.12	10.13	10.16	10.17	10.18	10.19
1.28	0.00	7.33	8.71	9.34	9.61	9.77	9.84	9.88	9.90	9.92	9.94	9.95	9.98	9.99	10.00	10.01
1.29	0.00	7.00	8.46	9.13	9.42	9.58	9.65	9.70	9.72	9.74	9.76	9.78	9.80	9.82	9.83	9.83
1.30	0.00	6.67	8.21	8.93	9.22	9.40	9.48	9.52	9.55	9.57	9.58	9.60	9.63	9.64	9.65	9.66
1.31	0.00	6.33	7.97	8.72	9.03	9.22	9.30	9.34	9.37	9.39	9.41	9.43	9.46	9.47	9.48	9.49
1.32	0.00	6.00	7.73	8.52	8.85	9.04	9.12	9.17	9.20	9.22	9.24	9.26	9.29	9.30	9.31	9.32
1.33	0.00	5.67	7.49	8.32	8.66	8.86	8.95	9.00	9.03	9.05	9.07	9.09	9.12	9.13	9.15	9.15
1.34	0.00	5.33	7.25	8.12	8.48	8.69	8.78	8.83	8.86	8.88	8.90	8.92	8.95	8.97	8.98	8.99
1.35	0.00	5.00	7.02	7.92	8.30	8.52	8.61	8.66	8.69	8.72	8.74	8.76	8.79	8.81	8.82	8.83
1.36	0.00	4.67	6.79	7.73	8.12	8.35	8.44	8.50	8.53	8.55	8.57	8.60	8.63	8.65	8.66	8.67
1.37	0.00	4.33	6.56	7.54	7.95	8.18	8.28	8.33	8.37	8.39	8.41	8.44	8.47	8.49	8.50	8.51
1.38	0.00	4.00	6.33	7.35	7.77	8.01	8.12	8.17	8.21	8.24	8.25	8.29	8.31	8.33	8.35	8.35
1.39	0.00	3.67	6.10	7.17	7.60	7.85	7.96	8.01	8.05	8.08	8.10	8.12	8.16	8.18	8.19	8.20
1.40	0.00	3.33	5.88	6.98	7.44	7.69	7.80	7.86	7.90	7.92	7.94	7.97	8.01	8.02	8.04	8.05
1.41	0.00	3.00	5.66	6.80	7.27	7.53	7.64	7.70	7.74	7.77	7.79	7.82	7.86	7.87	7.89	7.90
1.42	0.00	2.67	5.44	6.62	7.10	7.37	7.49	7.55	7.59	7.62	7.64	7.67	7.71	7.73	7.74	7.75
1.43	0.00	2.33	5.23	6.45	6.94	7.22	7.34	7.40	7.44	7.47	7.50	7.52	7.56	7.58	7.60	7.61
1.44	0.00	2.00	5.01	6.27	6.78	7.07	7.19	7.26	7.30	7.33	7.35	7.38	7.42	7.44	7.46	7.47
1.45	0.00	1.67	4.81	6.10	6.63	6.92	7.04	7.11	7.15	7.18	7.21	7.24	7.28	7.30	7.31	7.33
1.46	0.00	1.33	4.60	5.93	6.47	6.77	6.90	6.97	7.01	7.04	7.07	7.10	7.14	7.16	7.18	7.19
1.47	0.00	1.00	4.39	5.77	6.32	6.63	6.75	6.83	6.87	6.90	6.93	6.96	7.00	7.02	7.04	7.05
1.48	0.00	0.67	4.19	5.60	6.17	6.48	6.61	6.69	6.73	6.77	6.79	6.82	6.86	6.88	6.90	6.91
1.49	0.00	0.33	3.99	5.44	6.02	6.34	6.48	6.55	6.60	6.63	6.65	6.69	6.73	6.75	6.77	6.78

Accreditation Program

by Sidney Colbrook, Illinois

Whenever we have a weights and measures meeting, it seems that we talk about how we need to make our programs more uniform, however, it never gets done. We see standards adopted by the Conference to Handbooks 44, 130, and 133, which should make our inspection procedures more uniform. I believe that we have less uniformity when certain requirements are adopted because many jurisdictions do not intend to follow through enforcing Conference action. An accreditation program may be the answer.

We began this process several years ago. A few jurisdictions were evaluated. It is my understanding that it was then determined a training program with modules must be created in order to establish the "tools" for evaluating a program. Now we have developed and implemented training modules. Training programs have been conducted for each of the modules developed. Now perhaps it is time to look at an accreditation program for weights and measures programs.

In the Central, we asked the states how they were testing devices. Procedures being used were in some ways rather uniform. We prepared an overview of each state in a generic form to show some basic discrepancies of the way devices were being inspected and tested.

The Central group supports in principle an accreditation program. Industry came forward supporting the program. We plan to initially evaluate a couple of the programs. Such evaluation will consist of reviewing first procedures manuals, laws, regulations, test reports, computer printouts of inspection results, and other documents such as documents for quality to get a feel for the program. Then later, testing equipment would be used in the field to determine the effects of the program. I cannot give you many specifics of the program because the program is just being developed.

As I see it, the program will accomplish at least five major objectives which are:

1. It will promote uniform testing procedures.
2. It will raise the need for more training to educate administrators and field staff.
3. It will establish a standard similar to our metrology accreditation program which will assist directors in supporting their programs. The program then may be used to increase the level of the program which would result in a higher pay scale for weights and measures and a more qualified staff.
4. Device manufacturers and packagers will benefit from this program because uniform testing procedures will be used.
5. Peer pressure will eventually force jurisdictions to buy into the program. Programs will change and be updated to maintain their accreditation. Conference action will have more impact than now, and perhaps it will make representatives at the Conference to be more knowledgeable and responsible when action is taken.

If the program is successful, it will accomplish what most have been saying for years and that is we must become more uniform in what we do. Tom Stabler was very supportive and wants to be involved in this pilot program. The Central wants industry to play an active role during the developmental and implementation stages. We also will be cautious to insure any results will not damage a program or manufacturer. We plan to result the progress of our plan to the National Executive Committee. Our plan will be modeled after the earlier plan considered at the NCWM. We expect to, in a smaller region, go through the "growing pains" associated with developing such a program. When it becomes more of a finished product, the NCWM may want to use the program as a national program. This program has the potential of being one of the most important programs ever developed. If we do not get our houses in order, some day some one will do it for us.

National Data Sharing

by Sidney Colbrook, Illinois

National data sharing is difficult to address because by collecting data we must be uniform in the processes, systems, and procedures used. Before we go any further, two major problems exist.

1. Lack of uniform testing procedures where we would be comparing apples to oranges, and

2. The method (types of information) and systems used must be compatible to enter into a national database sharing network.

Our agency has spent thousands of dollars in creating and developing our weights and measures computer system. Our recent change of going from Nomad to Paradox has taken a year to accomplish. Changing computer programs is no easy task.

What do we need? I believe we need a database network to monitor devices and packages to determine what is and what is not in compliance. For noncompliance packages, this would allow jurisdictions to focus their programs on those products found not to conform with the requirements of HB-130 and HB-133. For weighing and measuring devices, this program would allow NTEP to focus in on insuring that production equipment is conforming to type.

Concerns to the results would be how this information may be made public and could be used against either a device manufacturer or product packager. The legality of supplying this information must be researched.

One of the questions asked is can the WAMIS program be used. It seems to me that WAMIS is currently underutilized. Our computer gurus have informed me that we must now take a computer off of our network to be used for contacting outside programs because of the potential of viruses being introduced into our system. This will not be a problem because data can be downloaded from our system into the off-line computer, and then this information may be transferred into the WAMIS program. In answer to the question proposed, I believe WAMIS can be used. It needs to be made more computer friendly and more widely used.

I believe NIST should provide the technical support to each jurisdiction in developing and implementing a generic computer system. In order for this program to be successful, it must be friendly and convenient to the user. It should take just the mechanics of downloading from one system to another. Jurisdictions I do not believe will manually enter any collected data. It must be accomplished by downloading already captured information. It should be NIST's responsibility to tell us what type of hardware and software to use. It is expensive for each jurisdiction to develop its own program and it will lead to nonuniformity. Programs can be personalized for the jurisdiction using the programs. The hardware must be able to withstand hostile environments.

Now is the time to develop a generic computer program. Many jurisdictions have already or are in the process of implementing computers and computer programs in the field. We plan to purchase at least two computers after July for field use. Let's get ahead of the game by having the programs available before too many jurisdictions have differing programs and software. One thing we have to remember, we will always be outdated with computer software programs. We must bite the bullet and go with what is best at the time.

Let's develop a national database and let's do it now. This database will be useful to support our existing programs. The time to act is now!

Industry's Perspective

by Daryl Tonini, Scale Manufacturers Association

The following represents the report developed by Daryl Tonini, Scale Manufacturers Association (SMA). It is not a formal SMA position, but represents a mainstream position among the many company representatives with whom he has discussed the issue.

1. What is industry's role in helping to deliver an effective W&M program? What role should industry play with respect to education (training) of inspectors and industry service personnel?

2. What tools are needed to insure the integrity of tests performed by industry service personnel?

3. What constitutes a "strong" program for:

   a. registration of service persons;

   b. notification of device repairs; and

   c. revocation/suspension of licenses for poor or inadequate performance by service persons/agencies?

DISCUSSION:

One of the most effective roles that industry has in delivery of an effective W&M program is through participation in the National Conference on Weights and Measures (NCWM). Participation includes: involvement in national and regional weights and measures conferences; development of industry positions on items brought to the conferences through the standing committees; and constructive support of the conference, its leaders and programs. It also involves a willingness to support the Conference by accepting assignments (whenever possible) made by the Conference Chair.

This support can be technical, such has been provided by industry associations over the years on such subjects as the H-44 New Scale Code, audit trails, the NTEP Weighing and Measuring Sector Committees, the U.S./Canada Mutual Recognition Program, OIML national and international working group programs and meetings. The support can also be programmatic such as the Blue Sky and Privatization Task Forces, development of the NCWM Legal Metrology Control System, the many aspects of creating and bringing the NTEP program to reality, and direct representations to NIST and Congress in support of resources for the Office of Weights and Measures.

In addition, industry provides support to the NCWM through the Associate Member Committee. This support has been a vehicle for the public and private sector members to work together toward a common cause. The Committee has adopted a forward-looking view with regard to the financial needs of the Conference by supporting a realistic meeting registration fee structure. Industry-sponsored social events at National Conference meetings have played an important role in bringing the regulators and the regulated together in a very pleasant atmosphere. This has contributed to the mutual respect that is evident at the conference and during its proceedings.

Industry has an excelient opportunity and an important role to play in the professional/technical training of inspectors and service personnel. Industry, in a very real sense, shares a responsibility with the jurisdictions for promoting and conducting training of officials and service persons. A good example of this is the Institute for Weights and Measures which has, through its education programs, trained hundreds of officials and service persons. An example on a much smaller scale occurred during the process of developing the laboratory test procedures for the U.S./Canada Mutual Recognition program. Industry engineers and NTEP laboratory metrologists had a unique opportunity to exchange technical procedures to the mutual benefit of industry and government.

Perhaps the most critical technical problem before the Conference is training a very broad base of industry technicians and officials with respect to NTEP requirements. The success of a conformance program such as NTEP must ultimately depend on field enforcement to insure equipment standards are met. Quality assurance programs aside, the ultimate test of equipment performance and quality rests jointly in the hands of the service agencies and the field enforcement system. Industry must exert its best efforts and offices in helping the NCWM in marshalling the resources needed to make the integrity of the NTEP process a reality.

Industry also has an important role to play in influencing and heading off efforts to privatize weights and measures regulatory activities, e.g., the transfer of approval, rejection and condemnation authority to the private sector. Recent history has shown the effectiveness

of industry involvement in the privatization debate; this participation must be timely and to the point to insure that the industry view is fully considered.

The NCWM Legal Metrology Control Plan (MCP) recognizes the principle of private sector testing of devices. Registration of Service persons and Agencies Regulation model regulation (Voluntary Registration Regulation, VRR) (NIST Handbook 130, 1994, Uniform Laws and Regulations) authorizes private sector maintenance personnel and service agencies to "remove an official rejection tag or mark placed on a weighing or measuring device by the authority of the director; place in service, until such time an official examination can be made, a weighing or measuring device that has been officially rejected; and place in service, until an official examination can be made, a new or used weighing or measuring device." This, in effect, authorizes a properly registered agency or person to act as an agent with limited powers for a weights and measures jurisdiction.

Kansas, in its approach to "privatization", has created a hybrid system combining the MCP private sector testing of devices concept with a registered service agency/person approach. In Kansas, the user of a device is required to have his equipment tested annually by a registered agency/person; the state inspectors audit this work on a sample basis to insure that, statewide, the test work conducted by the private sector meets state (H-44) standards. Under the Kansas model, private sector agents do not have the authority to reject devices, thus avoiding or minimizing potential conflicts of interest which would arise if the private sector was empowered to reject/condemn equipment.

Under any of the above concepts, there is reason for concern regarding the integrity of "official" tests performed by private sector agents. Some tools used (not an all inclusive list by any means) to insure the quality and uniformity of private sector tests are as follows:

a. Agents must have available sufficient standards and equipment to adequately test devices as set forth in the Notes section of each applicable code in NIST Handbook 44 (VRR, Section 5);

b. A standardized test report form should be used and the private sector agents must be trained in its use. Both the VRR and Kansas assign this training responsibility to the W&M jurisdiction. In that service agencies/persons can and do operate in more than one jurisdiction (inter and intrastate) there is an identifiable urgent need for both standardized forms and for uniform training materials.

c. An auditing system to insure that standards are being met by the private sector. In VRR jurisdictions that require a "placed-in-service" report when an officially rejected device is returned to service, good practice suggests that for each placed in service report there should a subsequent official test when the device is sealed or again rejected. Substandard work would be revealed if a pattern of agent placed-in-service reports was followed by a pattern of official rejection of the devices. In Kansas, quality is addressed by testing a sample of approved devices. However, this approach may be limited by available official resources to audit the private sector testing. The jurisdiction that follows up each placed-in-service report with an official test would have a much better idea about how an individual agency/person was meeting his registration responsibilities.

d. A program to test/certify test equipment used by the private sector to place equipment into service. In most states, this program is managed by the state metrologist.

3. The question of what makes up a strong registration program is answered in general terms in the VRR.

a. However, when one reviews the H-130 summary of VRR adoption, there appears to be some diversity with respect to what has been adopted by the states. Three states are shown as adopting and updating the VRR on an annual basis; 29 states have a registration program based on the VRR, but from an earlier year (not a serious impediment in this case to uniformity); nine states have a program in force but not based on the VRR; 12 states have no law or regulation.

b. Regardless of the approach taken, any conceivable variation of a registration program must depend on good data regarding the work of the service agency/person. The test report would appear to be the preferred input document. This applies to devices placed in service as well as repairs. In addition, these reports appear to be essential for the jurisdiction to maintain its device population list. Furthermore, test reports when a device is initially placed in service (assuming the test is uniformly conducted using standardized procedures) become an important source of data with respect to NTEP requirements on production devices meeting type. There is no way that a manual system for keeping track of this information could be cost effective; thus some means by which these reports could enter the W&M information highway must be developed. Conceivably, this process could be automated down to the field inspector level.

c. In that revocation/suspension of licenses has a very serious impact on the ability of an agency/person to pursue its livelihood, such procedures must be able to pass a very high administrative standard. In order for the regulatory system to meet legal muster, a jurisdiction needs to be in a position to show that it has met its responsibilities by way of training and administration, i.e., adoption of NCWM model laws and regulations (VRR, NTEP, etc.). The private sector generated test report (coupled with official follow-up tests) becomes a key document in determining whether a registration should be revoked or suspended. When revocation/suspension is imposed, consideration should be given to developing a means by which this information can be communicated to other jurisdictions for their attention. This is another need for a much better W&M data system than exists today.

RECOMMENDATIONS:

1. That the NCWM request an OWM analysis of industry group/company participation in NCWM activities for some period, i.e., 5 or 10 years. This analysis should be broken down by those groups/companies who appear to have an ongoing interest and to those who appear to be single-issue oriented. Following this analysis, a member of the NCWM leadership should be assigned to meet with the leadership of each group/company and solicit their ideas as to how, in their view, the Conference can be made more effective in addressing marketplace issues. Establish their interest in participating in selected activities of the Conference, i.e., willing to provide testimony at legislative hearings, Associate Member Committee activities. Then follow up with a meaningful assignment. Let's make sure we are listening to our private sector constituents and are aware of their agendas.

2. That the NCWM make an appropriate standing committee assignment to lead the effort to develop standardized test report forms and to prepare EPOs to support the use of these forms. It is suggested that the committee given this assignment draw from the expertise of W&M jurisdictions, weighing and measurement industry associations, the Institute of Weights and Measures and the service agency/dealer interest groups in the ISWM. Also, that a model audit methodology be adopted to help jurisdictions in monitoring VRR performance quality.

3. That the NCWM establish a program to encourage W&M jurisdictions who have not done so to adopt the VRR. The priority for this effort should be directed to states (12) who have no law or regulation. Second priority to those States that have a program in force but not based on the VRR (9). Concurrently, develop an administrative procedures guide for all jurisdictions with VRR.

4. Set up an ad hoc working group to advise the standing committee tasked with VRR with respect to such matters as fees, penalties, administrative procedures for withdrawal of registrations. This group should include service industry representation.

5. In addressing the above recommendations, it must be borne in mind that, on a national scale, the issues relating to private sector service activities cannot be isolated from the effects of non-uniformity in the public sector administration of weights and measures. Private sector service agencies are often subject to the authority of more than one weights and measures jurisdiction. Some agencies conduct their business regionally; others do so nationally. Therefore, any effort to bring uniformity to the private service sector carries with it the obligation that the public sector actively develop a parallel effort to bring uniformity to regulatory and administrative activities. It is strongly recommended that this effort be pursued concurrently with the service agency uniformity agenda.

Industry's Role

by Richard Tucker, Tokheim Corporation

Industry must support weights and measures on both the State and regional as well as the national levels. The type of support is solely dependent on the level we are working on. At the State and regional level we provide technical support on our equipment. This can and would include supplying technical information (brochures), phone support, and training. since the contact person is the field inspector, the information must be geared to allow them to recognize standard features and options within the realm of requirements of weights and measures. In simple terms, does the item being inspected meet Handbook 44 and as designed by the manufacturer? We provide information to our distributors relative two eights and measures requirements. We encourage a good working relationship between the service organizations and the local inspectors.

On the national level our support is similar but different. Manufacturing must join and participate in the activities of the national and regional conferences. We still provide technical support but it is geared to the drafting of new requirements and maintaining existing ones. We must provide information to national committee members to what current technology can and cannot provide relative to weights and measures concerns. Our participation provides weights and measures an insight to the direction of the industry and industry gets feedback to weights and measures problems. Our participation creates the network for communications.

A Strong registration program for service companies must include registration, training, and follow-up. Registration and training is the commitment by the service organization to perform within a set of guidelines. The training is necessary to establish the testing procedures and set the boundaries. The follow-up would be a function of weights and measures to audit the testing process. If any one of the elements is missing, it becomes a revenue-generating program rather than enhancing the overall program.

Notification of device installation and repairs are the boundaries established during the training. To track compliance to weights and measures standards, a State needs to maintain a database of all devices. To do that you need a Placed-in-Service Report. Part of our startup procedures is to file a warranty registration card. This card starts the warranty period. You need the capability of querying the data to develop notifications for retest. Once the data base is established you can enter as much or as little information that you want. Service information could be part of the database.

A strong penalty section in your law for suspension and/or revocation of registration licenses would be nice but not necessary. If service companies are registered, you always have to option to pull the registration. Please remember that this a form of income for the service organizations.

Report of the Privatization Work Group Meeting, November 4-6, 1993, Seattle, WA

Allan M. Nelson, Chairman

Summary

The NCWM Privatization Work Group met in Seattle in order to discuss the conclusions reached by a Washington State (WA) Task Force on Weights and Measures with public and private sector members of that Task Force. The WA Task Force report clearly indicated the overall benefit of weights and measures activities in Washington. Certain findings of the study, however, did not coincide with NCWM Work Group members' experience and expectations. It was imperative that these findings be examined with the WA Task Force, since their implications may have far reaching effects on weights and measures programs in other States. The NCWM Work Group consulted with WA Task Force members to further refine the economic generalizations made in Washington, and to explore what needed to be collected in the future by any weights and measures jurisdiction to help in establishing program priorities and measuring the effectiveness of inspection activities.

Frequency of Inspection and Compliance Levels Are Correlated. -- The WA Task Force study concluded that there was no correlation between frequency of inspection and compliance. Chip Kloos, NCWM Work Group member, analyzed the WA data to show that the correlation, not obvious at first glance, exists. His report is appended to this as Appendix A.

Economic Benefit of Weights and Measures Programs Should Be Shown on a Per Business Basis. -- The WA Task Force study indicated that the per-capita benefit of the Washington Weights and Measures program far outweighs the per-capita cost. However, the NCWM Work Group pointed out that the benefit and cost per business is much more substantial than per citizen. It is a much better measure of the need for weights and measures enforcement to preserve a fair marketplace for honest businesses to compete. The cost per citizen (in allocated tax dollars) for a weights and measures program is trivial (from 25 to 50 cents per person per year); and, the savings to individual citizens in reduced errors in transactions by the existence of a weights and measures program may be several times the cost, yet the overall savings per individual citizen may amount to only several dollars per year. The savings per household attributable to a weights and measures program may be several hundred dollars per year. However, the cost to any business, even a small business, of error beyond the allowed variations, is substantial (many thousands of dollars per year). Although weights and measures agencies rightly perceive themselves as objective third parties between the buyer and seller, business can be an important ally if the regulatory agency can show business the potential for substantial economic harm to it if inequity is tolerated in the marketplace.

All jurisdictions should be collecting quantitative data on device errors outside tolerances at the time of test including the "as found" error, rather than only recording whether the device was "in" or "out" of tolerance. -- Although there is a general correlation between frequency of inspection and compliance level, quantitative data on actual error of a device or trade practice "as found" would provide estimates of the monetary benefit of weights and measures programs, because quantitative error can be converted into dollars. All jurisdictions should be recording not just whether a device is in or out of tolerance, but by how much.

In addition, it is important to record how far from zero any device is found. Most jurisdictions "sanitize" their data, by routinely allowing the device users to adjust their devices when found out of zero and not recording that the device was found off zero. The Work Group is not suggesting that jurisdictions change the practice of allowing users to adjust their devices, but that inspectors should record how far from zero the device is found before adjustment. It is logical to assume that the device likely would remain out of zero until the inspector pointed the problem out to the device user. Record the amount out of zero; this is potential economic gain or loss to the business and its customers if weights and measures inspection did not occur.

Additional information must also be gathered concerning what commodity or service is measured across the device in question (or of a small sample of devices within a jurisdiction,) and the number of times the device is used per day, week, month, or year. Alternatively, annual economic data from Supermarket News, motor fuel sales, agricultural sales, and road construction data from the local tax bureau, agricultural statistics division, and retail marketing associations can be collected so that weights and measures administrators can estimate what shortages or overages on any class of devices are worth to either buyers or sellers over time.

Background

When government must reduce costs, privatization of weights and measures has seemed a reasonable cost-saving measure, since many businesses, and even legislatures, see weights and measures as a "device testing service." The NCWM Privatization Work Group has found that most decision makers considering eliminating weights and measures agencies do not know of (1) the law enforcement

responsibilities of weights and measures; (2) the cost/benefit of weights and measures programs to their business communities; nor (3) any significant improvements in operations or management that can reduce costs in regulatory efforts and increase benefits.

The Work Group identified several questions and set several objectives at its last two meetings:

1. What are the reasons for and benefits of a weights and measures program?

   - The scope and rationale of a weights and measures program was documented in the 1993 Work Group report in order to be a resource and tool for weights and measures administrators to explain what they do and why.

   - The Work Group is now suggesting additional information collection that will assist administrators and legislators quantify the need for a weights and measures program. This will entail not just cost/benefit measurements and estimates, but logical arguments and everyday examples of benefits. For example, Dave Smith noted that weights and measures inspectors do not look only at the performance of a device in a gasoline service station; they examine price signage and other trade practices there. Weights and measures needs to explain the additional duties inspectors perform beyond device inspection.

2. How can a jurisdiction do more with less resources? There are several responses to this issue; the Work Group has not yet explored and listed all alternatives.

   - One major productivity enhancement is through additional job related training; however, State and local budgets, staff, and equipment have been so drastically reduced that they cannot continue routine annual inspections. Administrators should be reminded that productivity increases of 15-20 percent are normally reported as direct benefits of training -- therefore, weights and measures administrators can alleviate staff cutbacks by thoroughly training those who are left.

   - An additional productivity enhancement for weights and measures programs is through adopting and administering a device repair agency registration and training program.

   - Finally, there are opportunities to partner with local consumer groups and business associations. Ask for volunteers from the business and concerned consumer communities to assist the weights and measures jurisdiction in actual inspections, purchases, and alerting the enforcement agency to perceived inequities. Volunteers can be used in answering the telephones, and can be trained to speak about weights and measures to citizen groups.

3. How can a jurisdiction evaluate the effect of shifting certain traditional weights and measures responsibilities to the private sector?

   - For those jurisdictions that have already shifted a significant amount of testing to the private sector or must do so, how do they evaluate their job of auditing this "privatized" system? No study of "privatized" structures such as those operated by Kansas or New Hampshire and more traditional structures has been conducted.

   - How can a jurisdiction evaluate the impact of reduced inspections on the government's part? No independent audit of the status of compliance, equity, etc. has been done to compare a particular type of regulatory structure with another, except for the marketplace surveys conducted in California in which certain counties operate a "variable frequency of inspection" program and others do not.

   - Another question needing answer is how much government resources must be devoted auditing? It is the opinion of the NCWM Work Group that the quality of private service agencies' performance is in direct relationship to what is demanded from them by the State. The State will need the expertise and experience of its measurement specialists (and the same equipment it presently has invested) to audit service work knowledgeably. States cannot simply review the paperwork of service agencies to determine whether they are performing adequately and in more than a superficial manner.

4. How much sampling of the total population of devices can be effective in lieu of testing every device annually? Chip Kloos has offered to design a simple sampling procedure to assist jurisdictions that would like to sample the population of devices in their jurisdiction. It will require comparison against present testing schemes in order to evaluate its effectiveness (see the need to quantify data collected below).

Definition and Rationale for Weights and Measures Regulation and Defense of Programs
The NCWM Privatization Work Group has addressed several issues so far. (1) Members have met with and written State and local agencies, legislatures, and other managers to explain the need for retaining weights and measures enforcement oversight as a government responsibility in order to keep competitive forces from overwhelming honest businesses. (2) The Work Group developed a set of overhead transparencies and slides available to anyone to explain either their own program and why it is needed, or of what a complete program should consist.

On November 4, a presentation on the scope of weights and measures was provided to the members of the WA Task Force based on prior work of the NCWM Work Group (see the Work Group report in the 1993 Annual Meeting Report) in order to emphasize to the private sector representatives that weights and measures regulatory activities were not "device testing services," and to focus discussions on the cost and benefit for government to oversee a private testing force as compared with the cost of more traditionally operated weights and measures programs. Copies of the transparencies used in this presentation are included in Appendix B.

Fee Based Programs Provide Little Flexibility
A basic weights and measures program includes a State weights and measures laboratory, device inspection program, commodity inspection program, and consumer complaint handling. Weights and measures is law enforcement activity, not a device testing service. Fees, however, often mean the difference between minimal oversight and none at all. Fee-based programs are usually based on device testing, whether or not actually levied when a test is performed; thus, fee-based programs rarely allow innovations in device inspection frequency to be applied. Unfortunately, adding the fee question muddies good decision making policy. If a State decides to authorize private companies to test devices, and then the State verifies the work of the private companies, there is not a distributed base of customers upon whom to levy a fee. If a program is to be based on device fees, the fee payer demands something for the fee (e.g. device testing and approval).

Weights and Measures Administrators Must Sell Weights and Measures
Participants at this meeting agreed that better communications with industry needed to be established. Businesses need enlightenment concerning the costs to them in integrity and competition if the marketplace does not demand equity between buyer and seller. Informed businesses can then assist weights and measures agencies communicate with their legislators to maintain a program needed by business as much as by individual consumers.

An error rate that is low may only indicate that a program is working, not that resources are being expended in the wrong areas. Every government-operated program, however, competes with other programs for a portion of tax revenue. Weights and measures administrators must show more than a good return on the public investment in comparison with the relative value of other programs.

Variable Frequency of Inspection as an Alternative to Annual Device Testing
Improving service and law enforcement delivery requires creativity and teamwork. Recognizing economic realities, the NCWM Work Group has outlined what is an effective program, but also realizes that government sometime lacks the resources to deliver a complete program. One of the approaches that Washington State and Iowa Weights and Measures have been directed to study is a "variable frequency of inspection" program.

Darrell Guensler, California Director of Measurement Standards, provided a brief summary of the status of these types of programs in his State:

County governments in California enforce device and commodity laws and regulations. In the 1970's, in order to reapportion resources expended mainly in device testing more towards commodity testing, Ventura County piloted a program that is now in use in about half of the 58 California counties. Based on prior good performance, businesses are placed on extended frequency of inspection cycles. If a business does not pass one of the last two inspections, it remains on normal frequency of inspection cycle (usually annual), and if a business fails its last two inspections, it will be tested on an increased frequency. Combined with this "variable frequency of inspection" is a strong enforcement operation. Since inspection is less frequent, violations must be dealt with in a firm manner. Tools such as written warnings, followed by hearings, followed by prosecutions are linked with less frequent inspections. Less than annual inspection is routine for electric watthour and gas vapor meters based on prior studies that indicate that these devices need only be checked on cycles as long as 10 years. All variable frequency programs start with a complete evaluation of all the devices in a jurisdiction. The results of this evaluation are translated into percentage compliance figures which can then be tracked over time, to indicate that the compliance level is maintained, improves, or falls with a given level of inspection.

When variable frequency of inspection programs began in California, weights and measures programs were tax-supported programs. Now fee-based programs have proliferated. Fee-based programs generally impair variable inspection frequency programs as they often require fixed inspection frequencies.

The State of California has performed marketplace surveys on selected commodities, and selected devices. This state-wide level of compliance is a benchmark against which individual local programs can compare. It assists local administrators to identify where the problems are, and to "hoe where the weeds are" according to individual stores, types of businesses, and entire counties.

In the last 10 to 13 years, although California population has risen as a rate greater than the national average, weights and measures at the county level has shrunk 1 to 2 percent per year. Thus, California weights and measures as a whole is 25 percent behind where it was 10 years ago. The question of where to concentrate its resources must constantly be asked.

Whether variable frequency of inspection can be adopted in a particular jurisdiction depends upon the laws and regulations in place, the extent of weights and measures authority within the agency, the enforcement tools available to the agency, its business density, and the level of interaction and type of relationship maintained with the business and individual citizen level. Sufficient data must be available to assess the benefits of any given level of inspection and the risks of reduced oversight.

One of the necessary but sometimes more difficult parts of weights and measures enforcement programs is the evaluation of the integrity of an entire transaction, not just the device used in the transaction. For instance, to buy or sell scrap metal or verify household moving weights requires ingenuity and creativity in finding willing partners to assist in transaction evaluations.

Hard choices are being made in reducing weights and measures protection in California and all over the Nation. If the affected parties are able to check a measurement for themselves, the decision has been made to reduce oversight in such areas. Service based on time measurement is an example of such an area. On the other hand, consumers are not well equipped to protect themselves on over the counter direct sales and purchases of packaged products. In these areas, efforts have been made to at least maintain traditional levels of oversight. This is not always successful as these types of activities are not amenable to a fee for service; therefore, they must compete for increasingly scarce tax revenue. Background documentation of California's variable frequency of inspection activities and marketplace surveys is included in Appendix C.

Variable Frequency Inspection Programs Don't Work Without Strong Enforcement Powers

In further discussion, the Work Group generally agreed that variable frequency of inspection reduces contact with the businesses regulated, and requires a change in enforcement philosophy. When weights and measures regulators are in relatively more frequent contact with businesses, they can work with the business to improve measurement accuracy and reduce errors; reduced frequency of inspections requires heavy reliance on the deterrent effect of severe consequences if violations are found.

Registration of Service Companies Is Critical

A key to more effective use of the private sector requires that the State institute a registration or licensing of service agencies and private repair and installation firms. If these firms do not perform, the State has the power to revoke the license or registration. With a license, a firm can install devices and place them into service after repair or installation. The service agent must notify the State of all tests and are the eyes and ears of the government. On the other hand, it is the belief of the NCWM Work Group that if the State operates a good inspection program, it promotes a good maintenance program, and a good service company program.

Training Is More Important Than Ever Before

Unfortunately, in these days of reduced funding, weights and measures officials have not received adequate training and updating of test methods and criteria; the training provided by weights and measures administrations to the private sector has been even less than for government officials. Weights and measures administrators have not yet fully embraced the importance of training as a primary need to maintain and improve equity.

Guidance on Reduced Inspection When Possible

In a station having 30 pumps, should the inspector test all 30 or only 5? This decision is not simply one of sampling. There is a cost associated for the agency to get to a particular location. If the agency tests only 5 pumps, does it place seals on just those 5 or on all 30 pumps? Kristie Anderson, representing a local weights and measures jurisdiction, stated that local officials might not have the resources to test all 30 pumps, and in many years, certain stations have never had one of their pumps rejected. How should a local agent remain visible, but cut down the time in any single location? Chip Kloos volunteered to provide her and the Work Group a two-stage sampling procedure, that would look at a small sample at first, and if errors are found, expand the number of devices tested in

a single location. Chip will assist local jurisdictions to put their efforts where there is the greatest variability, that is station to station, not pump to pump. Whatever advice is provided must be used judiciously, however, since the travel, set-up, and tear-down time can be a significant part of an inspection, not the actual time devoted per pump once these factors are subtracted. For example, both North Carolina and Illinois have approximately the same number of retail motor fuel stations within wide geographic areas, whereas a city jurisdiction has less travel to factor into its testing time.

The Washington State Task Force and Its Conclusions

In 1992, the State of Washington's legislature funded a 1-year study to determine whether their State's weights and measures activities had substantial benefits as compared with the costs. Tom Geiler and Darrell Guensler of the NCWM Work Group met with the Washington survey team in early 1993, and several members of the Work Group corresponded with the team throughout the State project. The results of the project indicated that the benefits as measured were many times the costs. The Task Force appointed by the Legislature is now an advisory body tasked to explore how to fund some kind of weights and measures enforcement program. The question remaining from the Washington study was not whether to retain the program, but how to pay for it. The NCWM Work Group believed that there was a need to interact directly with another State that had considered privatization of weights and measures seriously, and to delve into the data upon which the study had been written. Many members of the WA Task Force were able to meet with the NCWM Work Group at its November meeting, but few State or local weights and measures regulatory officials participated.

Mr. Kent Sherburne, Washington Office of Financial Management, head of the Washington Task Force, provided a presentation on the WA Task Force findings on November 5. His abbreviated report is Appendix D. A copy of the full report can be obtained either from the Office of Weights and Measures or from Mr. Bob Arrington, Washington State Weights and Measures. He said that Washington's findings were that a predominant amount of the error found by annual inspection was random error; this type of error is hard to argue as economic damage to any individual. On this point, Bob Bruce pointed out that lack of maintenance was a common fallout from decreased inspection frequency; one could label this error random rather than fraud, yet "random" does not mean that the error averages out to cost neither the buyer nor the seller in the example of poor maintenance.

Mr. Sherburne argued that accuracy isn't the purpose of weights and measures, economic fairness is the purpose. Therefore, it is necessary to ask probing questions to avoid tunnel vision, to avoid "the device is there, therefore it should be checked."

Lack of Quantitative Data

Mr. Sherburne also lamented that surveys sent out by his office to other jurisdictions did not provide the assistance he needed; no other programs had the quantitative information needed to support the amount of resources expended for weights and measures enforcement. Work Group members questioned his analysis of the cost and benefit of weights and measures on a per-capita basis. Although the savings per person for some parts of the program amounted to $0.50, the savings per agricultural business, for example, in large capacity vehicle scales was approximately $17,000 apiece. Tom Geiler summarized that weights and measures has no baseline data concerning the error rate as compared with the cost to the local economy without a weights and measures program.

Citizen Complaints and Allocation of Tax Revenues

Policy questions at legislatures focus on reconciling economic shortfalls with response to business and consumer complaints. Businesses have a responsibility to fix the problems; consumers have a responsibility to use information available to them to make informed purchasing decisions. Government has the responsibility of "steering rather than rowing," and using both the carrot and stick to obtain compliance with the law. On one hand, weights and measures is in a unique position to measure its performance; no estimates of the value of a life or safety of an individual need be made. All costs and benefits are directly translatable into dollar values. On the other hand, no harm of an economic nature alone can be compared to the priority placed on the value of life or health.

States note that their largest complaint is in the area of gasoline sales. Dave Smith surmised that this might have some psychological rationale, one can't see gasoline going into one's tank, and if one doesn't like the product, one can't put it back in the retailer's tank.

More data is needed to support weights and measures and businesses contentions that overall the use of scanners has improved the pricing accuracy in retail stores. Scanners in grocery stores are a large percentage of complaints, yet people only report when they are overcharged. One must look at a variety of complaint indicators, however. In the area of scanners, for example, it has been contended that consumers can protect themselves, since they can see errors in pricing. However, potential purchasers must mark down the price displayed on shelves when individual packages are not price marked, in order to compare these prices with those charged at the checkout; this is a procedure few purchasers will follow.

It would seem to be effective to join forces with honest businesses, help them improve the overall management of their pricing systems, and report the improved statistics of compliance and overall errors to the public.

Data Collection, Review, and Assessment

Measuring cost/benefit is impossible without uniform standards concerning (1) what constitutes compliance; (2) what the actual measurement errors are; and, (3) what action is taken when errors beyond the standards are found. Although State and local weights and measures have all adopted Handbook 44, for example, as the standards for commercial measuring devices, the actual enforcement of these standards are set at varying levels; for example, rejection of devices often does not occur until the device is out of tolerance by two or three times the tolerance in Handbook 44. Since jurisdictions often do not record the amount by which many classes of devices are in error, there is no information to determine whether changes in policy or procedure improves the overall compliance rate or error rate within a jurisdiction over time. Finally, if devices are adjusted, but that adjustment is not recorded at the time of official testing, the benefit of weights and measures presence is unknown.

Neither the effectiveness of a program itself, nor the effectiveness of changes to a program can be tracked, estimated, or measured if the same standards are not used to evaluate the effects over time or in different locations. This was part of the problem encountered by the WA Task Force when they found widely varying compliance rates in different jurisdictions irrespective of the frequency of inspection. Chip Kloos has shown that a correlation does exist between frequency of inspection and compliance rate. However, if a single jurisdiction is to measure the effectiveness of its program, or to measure the effect of improvements, basic information must be collected to assess programmatic effects. Therefore, the Work Group would like to clarify what data would be useful to collect without too much effort, that can be used to measure programmatic effectiveness. All jurisdictions should be collecting the error of the device as found at the time of test, rather than only recording whether the device was "in" or "out" of tolerance.

What needs to be recorded: error "as found"

Small capacity scales:

(1) How far from zero is scale?

If inspectors weren't here, the scale would stay off zero by this amount.

Coach the owner through resetting zero if necessary and continue test, but record amount off zero.

(2) On 30 lb scale, what is error at 1 and 5 lb load?

This is the range of most common use.

(3) Other as found errors not related to measurement: wrong PLU, wrong tare, etc.

(4) What is weighed on the scale (the type of commodity or commodities) and the total number of similar devices in the store or department.

Example of how to use this information:

A delicatessen scale in a supermarket is overregistering 0.01 lb as found (it is off zero), and when 1 and 5 lb test weights are placed on the device, the scale reads 1.01 lb and 5.01 lb. We will assume all the weighings done on this scale have been in error by 0.01 lb since the last inspection by weights and measures one year ago. At average prices of $8.00 per pound (to be determined in the particular jurisdiction from supermarket sales information from the local retail grocers association), each weighing on the scale is in error 0.01 lb or $0.08 per transaction from the scale off zero and not adjusted. In this example, we do not know if every weighing operator properly deducted the tare. Supermarket News reports the average sales volume in the delicatessen departments of supermarket to be about $160,000 per year. With the average amount purchased per delicatessen weighing about 0.5 lb or $4.00 per purchase, this amounts to about 40,000 weighings per year in an average delicatessen. The particular supermarket is of "average" size and has two scales. If both scales are used about the same amount, we will assume each scale weighs items 20,000 times in the year. If one scale is off by 0.01 lb or $0.08 per transaction, this amounts to an error of $0.08 x 20,000 or $1,600 per year just from being off zero by 0.01 lb!

Large capacity scales:

(1) How far from zero is scale? Teach inspector how to use error weights.

(2) Perform routine test, record all errors, and circle largest error found during any part of test and amount of test weights at that part of test.

(3) Record capacity of scale.

Retail motor fuel dispensers:

(1) totalizer reading; which pumps are used most in a station?

(2) actual error at 5 gal (-2 cu in, for example), not just "in" or "out" of tolerance.

What additional information has to be collected:
(1) supermarket and retail motor fuel trade volumes, average prices, etc.
(2) average prices for agricultural, road construction, and other commodities per pound

When weights and measures officials find short weight packages, many jurisdictions compute the economic loss in dollars using the shortage found, and apply that shortage to the amount of that product sold by a given retailer over some period of time. For example, if a shortage of 0.02 lb is found for chicken breasts selling at $5.00 per pound, the shortage per package is $0.10. However, if the retailer sells 200 packages of chicken breasts per day, the economic shortage is $20 per day, $140 per week, $560 per month, and $6,720 per year for that one kind of package in that one store. This analysis is commonly done when determining whether to impose a fine, or take other legal action.

The same economic gain or loss can be estimated for direct sales using scales or meters. For example, if an individual truck scale is under-registering by 80 lb at approximately truck capacity, some estimate of the economic effect of that under weighing can be made. If the truck scale weighing the full truck is different than the scale used to determine the tare, or if the tare weight is a stored-tare value that was determined at some other time, the under-registration does not even partially cancel out. If, in this example, the trucks are being gross weighed only on that scale in order to sell produce, from the farm to a processor, and the commodity is worth $0.40 per pound, the potential for economic loss to the farmer is 80 lb x $0.40 = $32 per truck load. During a harvest season of 12 weeks duration, with an average of 100 trucks per day weighed on that scale, farmers are shorted $3,200 per day, or $16,000 per 5-day week, or $192,000 for the 12-week harvest season.

Standardization of Reporting
NCWM Work Group public sector members were asked to contribute copies of their report forms to determine how they might be easily modified to collect the information needed to measure program effectiveness. See Appendix E. Two conclusions can be drawn from this collection of forms: (1) the wide variety of information that is collected from jurisdiction to jurisdiction, and the differing placement of this information on a paper form; and (2) the fact that there are certain forms already containing key information that should be generally collected across all types and classes of devices. For example, the forms provided by private service companies varied greatly from the report forms used by the weights and measures government representative. Illinois report forms for meters and a few for scales generally had locations on the forms to report the "as found" condition in terms of error. Other State forms that we have seen usually have space under "remarks" to add "error as found." Errors at 1, 3, and 5 lb can be circled on small scale test reports. The maximum error under any part of a test of mid and large capacity scales can be circled; the test load must always be identified, of course.

Certainly, none of the forms that the Work Group examined appeared designed for computer data entry either in a central office or in the field. Since sufficient routine inspection data is not available, California has attempted marketplace surveys to determine the level of marketplace equity by sampling stores, devices, and practices to obtain a status of equity within the State at any given point in time. This is an effort that has been conducted above and beyond routine inspections and should be made to efficiently incorporate such evaluations into the routine activities of a weights and measures program. We do not need data of the above sort for all devices in a jurisdiction to evaluate the condition of the marketplace. We do need a stratified sampling process to assist us in evaluation. Laptop computers would greatly assist in data collection at the field level.

The Work Group believes that the weights and measures jurisdictions should take data collection seriously and that a presentation should be made at the Annual Meeting in order to get some of the fine points across in this area. A standardized report form would certainly assist in obtaining the minimum data needed to make economic estimates across jurisdictions.

Issues that were not addressed in detail by the Work Group:

1. What are the relative costs per device to do 100 percent testing as compared with sampling devices (either public agency or private business)? The cost of equipping inspectors to sample the population of devices would be equal to the cost of equipping them for 100% testing. The amount of labor cost reduction due to reduced number of devices tested within a given area would depend upon the percentage of total time contributed by travel time in an inspection. In rural States, the travel time is often a major fraction of the total inspection time. The additional time to inspect a retailer's business practices over and above testing for the compliance of the device with Handbook 44 should also be included.

2. What is the relative compliance level for 100 percent testing as compared with compliance when testing only a sample of devices? When comparing these alternatives, the type of enforcement actions when noncompliance is found must also be

factored into the comparison. Because of the varying enforcement methodologies in place at the State and local level, a comparison of these types of testing programs will need careful planning and organization.

3. How many jurisdictions target only devices that do not have high levels of compliance? We know that California counties and Wisconsin use variable frequency of inspection. We do not know if cutbacks have occurred in any jurisdiction that have required testing only of devices with low compliance histories.

4. How can jurisdictions fund package testing and investigation of other commercial trade issues when their income is based upon device testing fees? Business licenses have been proposed, but no jurisdiction has been able to implement this type of program.

5. How feasible are minimum training requirements for government agent and for service company employees? How can training requirements be linked to minimum performance standards? Can industry play a more effective role in delivering training or other necessary tools to obtain the most effective weights and measures program possible?

Privatization Work Group Participants

Kristie Anderson	City of Everett 3200 Cedar St Everett, WA 98201	206-259-8810 Fax: 206-259-8856
Bob Arrington	WA State Weights and Measures PO Box 42560 Olympia, WA 98504-2560	206-902-1856 Fax: 206-902-2086
Grant Becherini	Becherini Scale Center, Inc. E 317 Sprague Spokane, WA 99202	509-747-0181 Fax: 509-747-0808
Carroll Brickenkamp	Office of Weights and Measures National Institute of Standards and Technology A617 Administration Gaithersburg, MD 20899	301-975-4004 Fax: 301-926-0647
Bob Bruce	Weights and Measures Canada 301 Laurier Ave W Ottawa, Ontario K0A 1C9	613-952-2625 Fax: 613-952-1736
Sid Colbrook	IL Department of Agriculture PO Box 19281 Springfield, IL 62794-9281	217-782-3817 Fax: 217-524-7801
William Collins	City of Takoma 747 Market St Room 345 Tacoma WA 98402	206-591-5035 Fax: 206-591-5433
Tom Dooley	Association of Washington Business PO Box 658 Olympia, WA 98507-0658	206-943-1600 Fax: 206-943-5811

Privatization Work Group Participants		
Ron Dougal	Mettler Toledo 1057 Andover Pk E Seattle, WA 98188	206-575-0063
Dave English	Measurement Systems International 14240 Interurban Ave S Seattle, WA 98168	206-433-0199
Carter Evans	Weights and Measures Canada 1400-800 Burrard St. Vancouver, Canada V6Z 2H8	604-666-5038 Fax: 604-666-7981
Bruce Feagan	City of Seattle 805 S. Dearborn Seattle, WA 98134	201-386-1298
Jan Gee	Washington Retail Association PO Box 2227 Olympia, WA 98507	206-943-9198 Fax: 206-943-1092
Tom Geiler	Barnstable Consumer Affairs PO Box 2430 Hyannis, MA 02601	508-790-6250 Fax: 508-778-2412
Darrell Guensler	CA Division of Measurement Standards 8500 Fruitridge Sacramento, CA 95826	916-387-4241 Fax: 916-387-4260
Mary Jacobsen	Oil Heat Institute of Washington 3820 Stone Way No Seattle, WA 98103	206-548-1500 Fax: 206-548-1515
Chip Kloos	Hunt-Wesson, Inc. 1645 W. Valencia Dr. Fullerton, CA 92714	714-680-1098 Fax: 714-449-5166
Allan Nelson	Connecticut Department of Consumer Protection, Weights and Measures 165 Capitol Avenue Hartford, CT 06106	203-566-4778 Fax: 203-566-7630
Julie Sandberg	Washington Department of Agriculture PO Box 42560 Olympia, WA 98504	206-902-1851
Kent Sherburne	Office of Financial Management State of Washington PO Box 43113 Olympia, WA 98504	206-753-1811

Privatization Work Group Participants		
Ken Simila	Oregon Department of Agriculture Measurement Standards Division 635 Capitol St. NE Salem, OR 97310	503-373-0964 Fax: 503-378-6525
N. David Smith	NC Department of Agriculture PO Box 27647 Raleigh, NC 27611	919-733-3313 Fax: 919-715-0524
Daryl Tonini	Scale Manufacturers Association 932 Hungerford Dr #36 Rockville, MD 20850	301-738-2448 Fax: 301-738-0076
Richard Tucker	Tokheim Corp 1600 Wabash Ave PO Box 360 Fort Wayne, IN 46801	
Tim Tyler	City of Everett/Weights and Measures 3200 Ceder St Everett, WA 96201	206-259-8810