**Suggestion for Analysis of Inspection Results for RMFD Meters**

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I think that the most effective justifications for weights and measures programs are to use the actual inspection results for the jurisdiction. The first step is to analyze the meter accuracy test results for over delivery versus under delivery (i.e., meter underregistration versus overregistration). Second, the rejection rate for inaccuracy can be compared to the rejection rates obtained by other jurisdictions. Third, if sales figures are available and the errors for rejected meters are in a database or can be estimated in a reasonable way, then the economic impact of the meter errors for the inaccurate meters can be estimated (calculated). One suggested method of analysis is provided below.

Nebraska Weights and Measures recorded all meter errors for their inspections of RMFDs in a database. Below is a histogram of their inspection results for 2008.



1. The first assessment is the rejection rate for inaccuracy, which is 1.5%. **This rejection rate for inaccuracy is very low and can serve as a benchmark against which to compare results from other jurisdictions**. It is unrealistic to expect 100% compliance. The law of diminishing returns applies in that above a certain compliance rate, it takes a considerable increase in inspection effort to reduce the number of inaccurate meters in the jurisdiction. I think that the Nebraska results illustrate about the highest level of accuracy compliance for RMFD meters that can realistically be achieved.
2. Next, the rejection rate for meters out-of-tolerance for under delivery (meter overregistration) should be compared to the rejection rate for over delivery (meter underregistration). The Nebraska data shows that a slightly larger percentage of meters were rejected for over delivery than for under delivery; however, the values are nearly equal. This is an excellent result. **If a much larger percentage of meters was rejected for under delivery than for over delivery, then this would indicate a need to increase inspection and enforcement efforts for RMFDs.**
3. Now an estimate of economic impact assessment can be made for the meters that were found to be out of tolerance. Sales figures for gasoline stations are needed to identify that dollar value of product sold by service stations. Various sources may be available to obtain the sales figures. In this example, the Economic Census data for 2007 are used, which are the latest currently available for Nebraska. Data from the 2012 Economic Census should be available later this year. Estimated average errors for the meters that were out of tolerance both plus and minus deliveries are also needed. A spreadsheet has been created for these calculations.

Total sales for Nebraska gasoline stations in 2007 were $4,275,079,000.

The total number of RMFD meters tested by Nebraska in 2008 was 21,616.

Excluding extreme outliers, the percentage of meters that under delivered beyond the tolerance limit was 0.6708%.

The average error for these meters was -10.7 in­3 on a 5-gal test draft. This represents an error of -0.9279%.

**Based on the total sales in 2007 and assuming that the meters delivered the average amount of gasoline for one year, the total dollar amount of the measurement errors for the meters that were out of tolerance for under delivery in 2008 was $266,096.** The consequences of these sales were against the consumer.

The same calculation can be performed for the meters that were out of tolerance for over delivery.

Excluding extreme outliers, the percent of meters out of tolerance for over delivery: 0.7032%

Average error for these meters: 10.3 in3 or 0.8937% on a 5-gal test draft.

**Based on the total sales in 2007 and assuming that the meters delivered the average amount of gasoline for one year, the total dollar amount of the measurement errors the meters that were out of tolerance for over delivery in 2008 was $268,664.** The consequences of these sales were against the owner of the service station.

**The total economic impact for the measurement errors for the out-of-tolerance meters was $534,760.**

Below is the spreadsheet layout for these calculations.



Now calculations can be done to look at hypothetical situations (i.e., “what if” scenarios) to estimate the economic impact or benefits of the Nebraska program. What if Nebraska had a rejection rate for RMFD meters that was about 5% instead of 1.5%? A rejection rate of 5% for inaccuracy is relatively common for RMFD meters. Assume that half of the rejections are for under delivery and half are for over delivery. The normal distribution of meter errors will be spread out more for a 5% rejection rate than for the 1.5% rejection rate. This means that the average error for meters outside of tolerance will be larger than for the 1.5% rejection rate. We need some basis for an estimate of how much these average error values can change.

Based on data that I have for a jurisdiction, the average meter error for under deliveries for the out-of-tolerance meters is -12.9053 in3 on a 5-gal test. The average meter error for over deliveries for the out-of-tolerance meters was 15.8477 in3. I suspect that this jurisdiction has a rather high rejection rate for RMFD meters, so the range of the average values for Nebraska and this jurisdiction provide a reasonable initial estimate of how much the average meter errors can vary for the out-of-tolerance meters.

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|  | Average Error for Under Delivery for Out-Of-Tolerance Meters (in3) | Average Error for Over Delivery for Out-Of-Tolerance Meters (in3) |
| Nebraska | -10.7 | 10.3 |
| Other Jurisdiction | -12.9 | 15.8 |

Suppose that (1) for a hypothetical higher rejection rate of 5% for Nebraska and (2) suppose that the average errors for meters out of tolerance increased by 1 in3 for both the under and over delivery errors for the meters. Then, using the same spreadsheet as above, we can calculate (estimate) the economic impact of the measurement errors for the out-of-tolerance meters, which would now be $2,130,373. The spreadsheet layout for this calculation is shown on the last page.

The difference in the dollar amounts in the calculations for the 1.5% rejection rate ($534,760) and the 5% rejection rate ($2,130,373) represents the economic impact if Nebraska were to allow its compliance rate to decrease by 3.5%. This difference is $1,595,613.

On the other hand, if the unnamed jurisdiction mentioned above had to goal to improve its compliance rate by 5%, then the jurisdiction could estimate the economic impact of the improved compliance rate by using the sales figures for gasoline stations in its jurisdiction. This could be used as justification for modifying its inspection and enforcement practices and increasing staff to improve its inspection and enforcement.

This calculation approach (and spreadsheet) to estimate economic impact can be used for each type of meter, such as, RMFD meters, high-speed diesel fuel dispensers, VTMs, loading rack meters and LPG meters. The rejection rates vary among these types of meters, but these estimates can help with management decisions to identify where programs can obtain the most benefit for their enforcement efforts.

This calculation approach can probably be used to estimate the economic impact for price verification inspections. The error distributions and the values of the pricing errors must be known for each type of retail segment (e.g., supermarkets, department stores, sporting goods stores, auto parts stores, etc.). Jurisdictions that perform price verification inspections should have this information available. However, each type of retail segment must be analyzed separately, because the cost of items offered for sale, the percentage of pricing errors found and the values of pricing errors may vary significantly from one type of retail segment to another.

