A Framework for

Improving Whole Sale Metering and Billing Equity Among Users of the Seattle Regional System

Water Operating Board Metering Subcommittee Report

Seattle Public Utilities and its whole sale customers have expressed a mutual interest to improve the performance and reliability of whole sale meters through a voluntary and cooperative partnership. To that effect, the Seattle Water Operating Board (OB) has convened a Metering Subcommittee, and has tasked it with developing recommendations.

The subcommittee recognizes that accurate metering is an economic compromise whereby the achievement of "perfect metering" can be very costly, while erratic and inaccurate metering creates "winners and losers", and compromises fairness of cost distribution. The goal would be to define parameters of a "happy medium" to operate within.

The Subcommittee proposes to the Operating Board the following set of tiered measures that would be expected to improve significantly over the status quo.

1. **Billing Meter Performance Monitoring within a given year**

   The subcommittee recognizes that in spite of best efforts meter malfunctions would still occur. However, the impact of a malfunctioning meter on billing could be minimized by detecting the failure as early as possible.

   Many whole sale customers operate meters of their own immediately downstream of SPU's billing meters. Such meters may not be nominally as accurate as the billing meters but typically are within a few percent. Having two meters in series creates the opportunity to verify one against the other on an on-going basis, and detect problems early on.

   The subcommittee recommends that each whole sale customer pro-actively monitor it whole sale purchases from SPU against its own master meters, and alert SPU as soon as possible of any changes or discrepancies indicative of a billing meter malfunction. It is understood that not all customers have meters downstream of the SPU meter, so some may not be able to do such comparisons. Over time, though, the tendency would eb for any gaps to be filled as more and more customers install master meters at their feeds from SPU.

   As a longer term goal, a more structured voluntary monitoring framework may be developed whereby SPU and each whole sale customer coordinate the meter read date so that both SPU and the customer's meters can be read on the same date, and the results shared.

2. Annual monitoring

The Subcommittee recognizes that the monthly tracking recommended above may not capture all meter malfunctions. Specifically, there are still whole sale services where the customer does not have a meter downstream of SPU's billing meter. A second tier monitoring and reconciliation approach on an annual basis would be therefore appropriate.

Such approach could be based on Distribution System Losses (DSL):

- Utility specific recent year data for DSL could be used to back-calculate likely deliveries from SPU over a year when meter malfunction occurred;
- Alternatively, next year's DSL for that utility could be used (if all SPU meters worked normally during that year) to calculate or verify deliveries missed by malfunctioning billing meters during the prior year;
- If neither prior year's DSL or future year's DSL are available, typical and reasonable values of DSL in the 4-6% range could be used.

DSL Sidebar

DSL is calculated as the untracked and unknown distribution system losses expressed as a percentage of water produced. This typically includes (i) leaks from water mains, services, reservoirs, hydrant seats, etc., (ii) retail meter inaccuracy (more water passing through retail meters than registered on them), and (iii) theft.

For a whole sale customer, water produced means water purchased from SPU, plus any water produced from own sources.

In a real system, the water produced exceeds the water sold retail by the amount of DSL, plus any tracked non-revenue uses, such as reservoir cleaning and overflows, hydrant flushing, large breaks, WQ sample stands, etc.

It is not uncommon for SPU whole customers without own sources to report retail sales higher than purchases form SPU, which is a physical impossibility and therefore acknowledged by all.

However, whole sale purchases must exceed retail sales due to inevitable distribution system losses. In other words, the lowest value for DSL is not ZERO but a number greater than zero. The minimum feasible value for DSL is very much system specific, and appears to be in the 4-6 percent range, even higher for some systems.

Experience has shown that lowering DSL is typically a slow process that takes years rather than months. A program to lower DSL typically would include (a) Retail meter exchange and testing program; (b) enhanced tracking of authorized but not revenue generating uses; and (c) leak detection and leak repair program. While theoretically possible to make significant progress in a given year, that is rarely the case as it would require a major commitment of resources.

Good guidance for the lowest feasible level of DSL for a given system at a given time, or "min DSL", could well be found in that system's own historic record. Looking back at its DSL over the past several years when supply meters functioned normally would be a good point of reference. Such historic DSL "peg" could be somewhat adjusted if the customer has implemented a more or less aggressive DSL reduction program in the year when a supply meter failed.

Alternatively, next "good" year's DSL could be used to adjust the previous year's consumption if DSL numbers for the past several years are all suspect. In this case, the adjustment would be done a year later, following the completion of a full year of operation with all supply meters functional. It should be noted that if both recommendation 1 and 2 are applied consistently, there should be no big gaps in DSL numbers, i.e., one would only need to go back a year to two to get utility specific DSL guidance.

Recommendation

There is interest in setting up a routine process for annual review and, if appropriate, adjustment to annual sales based on utility specific DSL trends. The process could involve the following steps:

- Each whole sale customer determines its DSL percentage for the prior year, and shares the information with SPU. This step is already in effect at present, and is typically concluded by end of March of each year.
- SPU reviews each customer's DSL percentage for the prior year in light of its trend over the years, and takes into consideration any known or suspected meter malfunctions throughout the year.
- Customers with DSL trend changes indicative of likely billing meter malfunction, or with DSL percentage less than 4 percent, are notified, and discussions initiated to determine if a billing adjustment should be applied. The customer would be expected to provide detailed supporting information to justify DSL below the four (4) percent level, and/or for a significant drop in DSL over prior year(s). Most recent SPU whole sale meter testing results would be take into consideration, and if necessary meters re-tested.
- The DSL assumptions used in calculating a billing adjustment would be clearly documented, and verified against future "clean" values of DSL. If next year's DSL value is reliable and different from the value assumed when calculating the billing adjustment, a recalculation may be performed and a final adjustment processed.

The methodology for calculating the annual consumption adjustment based on a certain DSL percentage is included in an appendix to this report. Wherever possible the annual adjustment volume would be broken down by month and the applicable monthly water rates used to calculate the dollar value of the adjustment.

3. Meter Maintenance and Renewal Strategies

The Subcommittee reviewed SPU's current whole sale meter testing and maintenance practices and recommends the following improvements:

Krohne Electromagnetic (Mag) Meters. Majority of the billing issues over the last several years were caused by Krohne Mags, consequently, the subcommittee recommends the following two actions:

- *Retain Krohne or Krohne-approved contractor to refurbish the meters, including making them fully submersible to avoid intermittent moisture intrusion into the delicate low voltage signal connections in the junction box of the flow tube.*

- *Retain Krohne or Krohne-approved independent contractor to perform annual confidence testing and re-certification of the Krohne Mags.*

- *If practical and available at reasonable cost, consider contracting out to Krohne any meter repairs in-between annual certification events.*

FM-CT (Protectus) meters, Compound meters, and Metron meters.

- *Continue the annual meter testing program currently in effect, and consider testing the top 10 meters twice a year.*

Turbine Meters (Sensus Rockwell). These meters cannot be tested on site. The current approach to periodic testing is to (a) remove the measuring element; (b) install a different one that has been tested on the bench; (c) test the removed measuring element on the bench to identify past performance.

New federal regulations limiting the use of leaded brass components in contact with drinking water in water systems have been recently promulgated, and take effect in 2014. It appears that these regulations will preclude the current meter testing strategy for the Rockwell/Sensus turbine meters as the measuring elements are made of leaded brass. As such, under the new rules, once removed from the water system, they could not be installed back. This would render the existing turbines non-testable, which in turn would trigger their replacement with new battery powered electronic meters. On a positive note, such replacement can be accomplished at a fairly low cost since the new meters are less expensive and shorter than the turbines.

Whole sale customers expressed interest in having the option to perform possible future meter replacements themselves, with SPU oversight. Following the replacement, SPU would "take back" the meter installation to operate and maintain.

Appendix

Calculation of the Annual Adjustment Based on Certain DSL Value

By definition: ***DSL = (Produced – Sold – Authorized non-revenue uses)/Produced***

"Produced" means "purchased from SPU" + "Produced from Own Sources", let us call it "***SPU***"

Authorized non-revenue uses: "***NRW"***

Combine the water sold retail with authorized uses not generating revenue into one term: "***Retail***". These are all well known to the wholesale customer.

The above formula would then look like this: ***DSL = (SPU – Retail)/SPU***

DSL captures non-discretionary and unknown water losses, including the following:

- Watermain leaks
- Retail meters under-registration
- Reservoir leaks
- Fire hydrant seal leaks
- Theft and illicit connections

Since SPU's meters malfunctioned and measured less than actual deliveries, it is necessary to distinguish between the amount that was actually delivered through the SPU meters "***SPU actual***", and the amount that was recorded by them "***SPU measured***".

SPU actual is unknown, this is what we are looking to calculate.

SPU measured is known, and once SPU Actual has been found, will be used to calculate the correction, i.e., the amount missed by the SPU meters due to the malfunction.

We are looking to calculate what ***SPU actual*** is, based on likely or minimum value of ***DSL.*** This DSL value would be selected based on the wholesale customer's DSL track record from previous years, or the DSL value form the next future year when SPU meters worked normally. (Refer to the report for more detailed discussion on this.)

So the formula above becomes:

DSL = (SPU actual – Retail)/SPU actual

The known variables are ***DSL*** (say, 6%) and ***Retail***. The unknown is ***SPU Actual***.

Solving for ***SPU actual*** we get: ***SPU Actual = Retail/(1-DSL)***

Numerically, if DSL=0.06, you'd take your retail sales and divide by ***1 – 0.06 = 0.94*** to get to all the water SPU delivered.

Now that ***SPU actual*** has been calculated, we can figure out the amount that SPU's meters missed, ***SPU missed***:

SPU missed = SPU Actual – SPU measured

Now that we know the total unbilled water for the year, it needs to be converted to dollars using a water rate. Peak rates are in effect from May 15th through September 15th of each year, with lower off-peak rates the rest of the time. Essentially, peaks rates apply 1/3 of the year, whereas off-peak to 2/3.

Monthly retail sales information, or ***SPU measured*** by month could be used to break out ***SPU missed*** by month so that appropriate seasonal rates could be applied to calculate ***SPU$ unbilled***.