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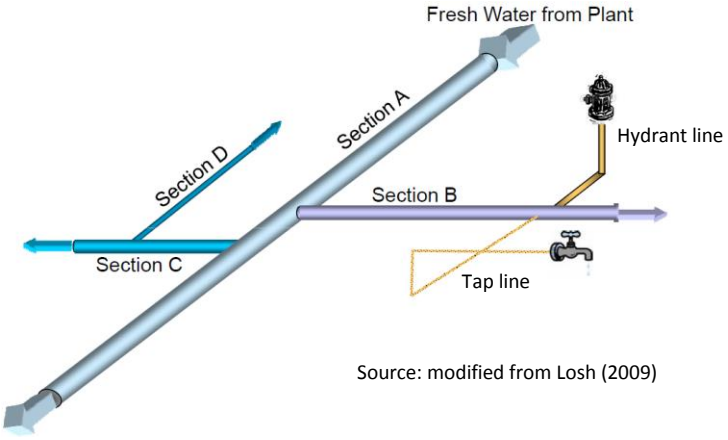
PUBLIC HEALTH ENGINEERING GUIDELINE: COLLECTING REPRESENTATIVE DISTRIBUTION SYSTEM SAMPLES

INTRODUCTION

When sampling distribution water quality, we want to collect representative samples without interference from the piping and fixtures materials at the hydrant, blowoff, sampling port, or residential tap or hose-bib. This guideline covers recommended procedures for flushing the line, and sample collection.



Source: modified from Losh (2009)

Figure 1. Water quality changes as it moves through the distribution system.

The objective is to collect representative sample of water from Section B watermain (**Figure 1**). We need to flush enough water to purge the stagnant water in the hydrant line or tap line, but not so much that we are getting water from Section A main.

FLUSHING

Avoid scouring the lines by opening hydrants fully without flow restrictor. Build a sampling device (Losh, 2009) with a flow control (Dole valve) and ball valve to limit flow (20 gpm for hydrants, 2 gpm for taps - **Figure 2**). A temperature probe is optional, but recommended. Flow control valves limit the flow to a designated maximum (**Figure 3**). If you cannot obtain a flow control valve, control the flow with the ball valve and measure the approximate flushing rate with a bucket and stopwatch.

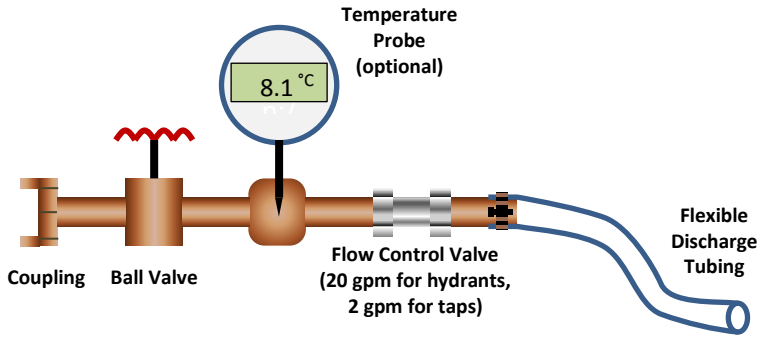


Figure 2. Recommended Flushing/Sampling Device.

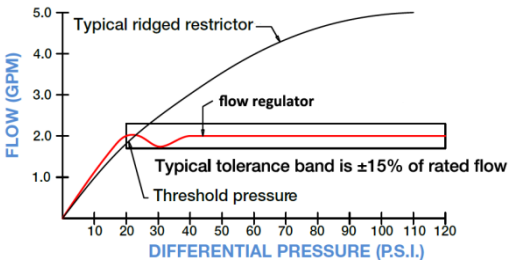


Figure 3. Pressure-Discharge Curve for Flow Control Valve (typical).

There are three acceptable approaches to flushing (Sekhar and Dugan, 2009): (a) Calculated Volume (b) Rule-of-Thumb (c) Temperature Stability. Use whichever method works best for you, but always document the flushing and sampling procedure you adopt.

(a) Calculated Volume

Calculate the approximate volume (V) of water in the line to be flushed.

$$V\ (Litres) = \frac{0.785 * D(mm)^2 * L(m)}{1000}$$

where: V = volume of water in the line (Litres)
D = diameter of pipe (mm)
L = total length of pipe (m)

Flush ***double*** the calculated volume.

(b) Rule-of-Thumb

Hydrants: If the pipe diameter from the main to the hydrant is 150 mm (6 inches) or less and the pipe length is less than 6 m (20 feet) – typical of a hydrant that is on the same side of the street as the main – the line will flush in less than 2 minutes at 80 L/min (**20 gpm**). For this configuration, use a ***3-minute flush time*** (240 L or 60 gallons total).

Taps: Service lines are typically 19 mm (¾ inch) or less in diameter and less than 30 m (100 feet). The line will flush in less than 1 minute at 8 L/min (**2 gpm**). For this configuration, use a ***2-minute flush time*** (16 L or 4 gallons total).

(c) Temperature Stability

If pipe diameters or lengths are unknown, flush until temperature stabilises within 0.2 °C on a digital temperature probe. Record the flushing time and volume.

SAMPLE COLLECTION

Control flow to fill a 1L sample bottle in 10 to 15 seconds (4 to 6 L/min; 1 to 1.5 gpm). This is about the flow rate people normally use to fill a glass of water (USEPA, 2016). Ask the lab to analyse for *total* lead, and if the result exceeds 0.005 mg/L (5 µg/L), to analyse for *dissolved* lead.

INTERPRETATION

Suspended or particulate lead = total lead minus dissolved lead. Particulate lead can be managed by watermain flushing, while dissolved lead cannot.

REFERENCES

Losh, DE. (2009). *Collecting Representative Distribution System Samples*. U.S. Environmental Protection Agency, Office of Ground Water and Drinking Water, Technical Support Center, Ohio AWWA. Powerpoint presentation. Distribution Committee Seminar. 7 July 2009. www.oawwa.org/Distribution%20Presentations/2009/Derek%20Losh.pdf

Sekhar, M., & Dugan, A. (2009). Collect Representative Distribution System Samples. *Opflow*, 35(1), 20-23.

USEPA. (2016). *Memo Clarifying Recommended Tap Sampling Procedures for the Lead and Copper Rule*. www.epa.gov/dwreginfo/memo-clarifying-recommended-tap-sampling-procedures-lead-and-copper-rule

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