

**Attachment I –
Basis for the Iron Testing Approach**

Attachment I

Seattle Public Schools Drinking Water Quality Program

Summary of Testing and Remediation Approach for Iron in Drinking Water

September 15, 2005 (updated October 13, 2005)

Background

- Approximately 80 schools in the District are either fully or partially plumbed with older galvanized steel pipes.
- Over 40 of these schools are 40 years or more old.
- Many of the service lines to schools are older unlined cast iron pipes.
- As galvanized steel ages, the interior zinc layer diminishes, leaving bare iron upon which forms scales of iron oxides (rust) that can enter the water column.
- Iron is an aesthetic concern. The World Health Organization (WHO) has not established a health-based guideline for iron. USEPA has established a secondary maximum contaminant level (SMCL) for iron of 0.3 mg/L (ppm) in source water supplied to customers. By definition, substances with an SMCL are not health threatening. The SMCL does not apply to the quality of water at taps within buildings.

SPS Board Water Policy as it Applies to Iron

- The intent of the Water Policy as it applies to iron is to ensure plentiful supplies of aesthetically pleasing water throughout each school, but it is acceptable to have some drinking water sources in each school that exceed iron standards because other acceptable sources within a school are available.
- The action level for iron is 0.3 ppm. Remediation shall be implemented when more than one-half (> 50%) of a building's drinking water sources exceed 0.3 ppm (as confirmed by two sampling events).
- For sources with iron levels greater than 0.5 ppm (as confirmed by two sampling events), remediation of the piping to that source shall be performed.

Iron Testing Approach

- Intent of iron testing in 2004 and 2005 was to determine if the piping in a building and/or the service line should be refurbished to improve the aesthetic characteristics of the drinking water.
- The testing program was designed to obtain an indication of the contribution of iron from a building's supply piping laterals, as well as from the service pipe. To do this,

2-minute flush samples (250 mL in volume) were collected at all drinking water sources and at the building service entrance.

- In addition to the 2-minute flushed samples, at least one-quarter of the sources in each school were tested for iron in first-draw and 30-second flush samples (250 mL in volume). A first-draw sample represents water from the bubbler/faucet and immediate connecting pipe, and a 30-second flush sample represents water from portions of the connecting pipe and the lateral pipe, depending upon the length of the connecting pipe and the lateral pipe diameter (see building piping schematic, attached).
- If first-draw samples only were used to determine the iron piping conditions, it would not provide a complete indication of the conditions of the lateral pipes.

Rebound Effect

- The “rebound” effect of increasing lead levels after flushing has been previously researched by the District for lead, which “rebounds” in just a few hours after flushing, and thus requires flushing multiple times a day in order for a high lead source to be safe. Such an approach has been rejected by the District as unreliable for health-related criteria.
- Industry research (Clement et al. 2002. *Development of Red Water Control Strategies*, AWWA Research Foundation, Denver, CO).and information from Seattle Public Utilities (B. Hoyt) indicates that the “rebound” rate for iron is much slower, by perhaps a factor of 10. This means that a fountain that has high iron in a standing sample but passes the flushed standard will take several hour or up to an entire day to return to the iron level in a standing sample.

Testing Results

- At this time, over 4000 iron samples have been analyzed in all categories of schools, including both standing (over 1600 samples) and two-minute flushed (over 2400 samples) – please see tables on attached sheet. The number of samples is not a direct reflection of the number of locations tested, because locations that exceed the 0.5 ppm standard are retested.
- For all samples taken, approximately 35% of the standing samples and 24% of the flushed samples exceeded the 0.3 ppm standard. Approximately 24% of the standing samples and 14% of the flushed samples exceeded the 0.5 ppm standard.
- For the Group 2 and the Classification Pending schools, the percentages of samples that exceed the iron standards are generally higher than the percentages for all schools.
- Of all first-draw samples collected in the 2004 sampling program, about 27% had iron above 0.3 ppm and 13.5% of the first-draw samples had iron above 0.3 ppm and lead above 10 ppb. All drinking water sites with lead above 10 ppb have subsequently undergone replacement of old end-use plumbing components with new components that do not contribute to iron levels.

Conclusions

- Sampling for iron is performed for two purposes: 1) to provide an indication of the conditions of galvanized steel piping in schools so that planning and implementation of refurbishment of piping can proceed, as required; and 2) conform to Board policy for overall iron water quality.
- The use of flushed samples is a better indicator of overall building piping conditions than are first-draw samples. If first-draw samples only were used to determine the iron piping conditions, it would not provide a complete indication of the conditions of the lateral pipes.
- First-draw samples do provide an indication of the iron levels in end-use plumbing after standing stagnant over night, i.e., it is an indicator of water quality only for the initial use of the day at particular fixtures. However, a flushed sample that is collected early in the morning prior to much water movement through a school building is a better indicator of the overall iron levels in water that has been standing in pipes throughout the building and then appears at fixtures during the school day.
- About one-half of the drinking water sites that had iron levels above 0.3 ppm in first-draw samples have had all end-use plumbing replaced because of lead levels exceeding the standard. The end-use plumbing repairs are removing old steel pipes and hence significantly reducing iron levels in standing water at these sites.

