Key Highlights from Water Quality Technology Conference (WQTC), Dallas, TX , Nov 2019

Executive Summary

AWWA WQTC was held in Dallas last month. WQTC is the largest and the most prestigious technical water conference in North America, well attended by researchers, regulators (EPA, Health Canada) and water industry's decision makers. As in the past few years, the key topics at 2019 WQTC were current status, challenges and developments in lead control for public water distribution systems. Contrasting to the previous years, a special session, titled "Understanding Phosphate and Silicate Optimal Corrosion Control Treatment (OCCT) practices" was launched at WQTC this year. Six silicate papers that resulted from PQ sponsored university corrosion research were presented in this session. In the addition, as the PQ sponsored research is ending this year, a separate PQ wrap–up meeting with the researchers was also held. The key conference and meetings highlights are presented below.

Regulatory Changes – Lead control for drinking water systems

Proposed Lead and Copper Rule Revisions in USA

On Oct. 10, 2019, the U.S. Environmental Protection Agency (EPA) released the proposed Lead and Copper Rule Revisions. The sector has 60 days from the proposal's publication in the Federal Register to prepare comments.

The proposed LCR maintains the current Maximum Contaminant Level Goal (MCLG) of zero and the Action Level of 15 ppb. The proposed rule will require a more comprehensive response at the action level and introduces a trigger level of 10 ppb that requires more proactive planning in communities with lead service lines. It focuses utilities on replacing lead service lines in their entirety, regardless of ownership and requires more effective lead sampling program for schools and child care centres. More details on proposed LCR improvements can be found in the EPA fact sheet in the link below.

https://www.epa.gov/sites/production/files/2019-10/documents/lcr_proposal_vs._current_chart_draft.pdf

Health Canada

Health Canada has released revised Canadian Drinking Water Guideline in March 2019. The new maximum acceptable concentration (MAC) for total lead in drinking water is 0.005 mg/L (5µg/L). Previous guideline for lead was 0.010 mg/L (10µg/L). Health Canada stated that every effort should be made to maintain lead levels as low as reasonably achievable (ALARA). It is anticipated that the revised guideline will be fully enforced in 3 years. In interim, water utilities must present their programs for lead control for a review and approval. According to the industry sources, a number of water utilities may now be out of compliance for lead.

Phosphate for lead control.

Although orthophosphates were still featured as the most effective treatment for lead control, several important issues associated with phosphate use were reported by water utilities and confirmed by various researchers.

The important challenges are as follows:

- Majority of water utilities report using phosphate in 1-3 mg/L as PO4 dosage range. Establishing optimal phosphate dosage still appears to be a challenging task for a number of water utilities, given complexity of their treatment process. Some reports showed that reaching a "sweet spot" for effective phosphate dosage was difficult at best. It turned out that a common approach practised by water utilities was to significantly increase the phosphate dosage if the lead levels in the water were increasing. This approach was often found counterproductive and resulted in other treatment issues e.g. less effective disinfection process. Moreover, phosphorus discharge levels at wastewater plants could have been negatively impacted. Clearly, US EPA was not in favour of utilities using this approach, as more research is required to study the effect of higher phosphate dosages on the stability of pipe scales and its impact on subsequent processes.
- Ortho/polyphosphate blends were found not effective for lead control. Still, many utilities are using the blends for a various reasons.
- Aluminum residual level fluctuations often experienced by water utilities due to a varying aluminum based coagulant dosages were found to have detrimental effect on the effectiveness of phosphate treatment for lead control. Stability of aluminum solids was negatively impacted and increase in particulate lead release was observed.
- Controlling iron levels (also organic matter) plays an important role in lead control. Reducing iron release to the water would be imperative to curb down lead release. The reports on phosphates clearly lacked to address the effectiveness of phosphate to control iron.
- Growing concern over increased phosphorus discharge from wastewater plants in environmentally sensitive areas e.g. Lake Erie (Buffalo Water)

Lead release from galvanized iron pipes

Current practises in controlling lead in drinking water distribution are primarily focused on controlling lead release from lead service lines and from galvanic connections (copper lead soldered pipes) at premise plumbing. Full or partial lead service line replacement is executed by water utilities as a part of the program to reduce lead concentration levels along with a corrosion control treatment used by some.

The new data has shown that lead is also readily released from the scales from galvanized iron pipes, which most water distribution networks are built on. Clearly, lead control becomes a much bigger challenge than was accounted for. Comprehensive research must be done to develop effective protocols to control lead release from galvanized pipes as well.

Silicate for lead control

Silicate corrosion research was conducted on pipe loop systems constructed from harvested lead pipes from water distribution system and also on pipe loop systems made of new lead conditioned pipes.

As mentioned earlier, six silicate papers were presented during the conference at the special session "Understanding Phosphate and Silicate Optimal Corrosion Control Treatment (OCCT) Practices".

Key lessons learned from silicate research can be summarized as follows:

- More consistent results were obtained from silicate research conducted from lead harvested pipes as compared with new lead conditioned pipes. Harvested pipes scales from actual distribution systems are product of the decades of treatment; hence their composition is broader than scales formed during a few months of conditioning of new lead pipes.
- In the experiments with lead harvested pipes, silicate effectively reduced lead concentrations at pH of 7.7 and 8.8 with effective silicate dosages ranging 20 mg/L SiO2 and above. Total and dissolved lead reduction did occur after six weeks of silicate treatment. Lead concentrations for pipes receiving sodium silicates were lower than those in the control pipes.
- Pipe scale characterization analysis showed that silicate did not form lead silicate solids, silicate got distributed throughout the scale and also reported to aluminum rich layer, hence the proposed mechanism by which silicate acts in lead control is that silicate up-take by the scale can be potentially strengthening the barrier to a lead release.
- Silicate can effectively control aluminum fluctuations and improve stability of aluminum solids; both issues found to negatively impact the effectiveness of phosphate treatment for lead control.
- Research has shown that silicates have the ability to effectively control iron levels in the water. Good iron control is important part of an effective lead control. By controlling iron, silicate can assist in mitigating lead release from galvanized iron pipes, a recently discovered challenge in distribution systems. EPA's key recommendation for PQ was to pursue corrosion control opportunities for silicates emerging from galvanized iron market.
- Initial research from Dalhousie University indicated that orthophosphate/silicate blends performed much better than ortho/polyphosphate blends, which are still in use by many water utilities. Furthermore these phosphate blends are underperformers for lead control. Evaluating effectiveness of orthophosphate/silicate blends in harvested pipe loops for/with a particular customer (e.g. Buffalo Water) may be worth our consideration.

Conclusions

In view of the fact that water utilities have broadly adopted phosphates for lead control and there are emerging treatment challenges associated with phosphate use, also factoring in some limitations for silicate used alone, silicate/ phosphate blends can be a valuable option to pursue going forward.