

SUBJECT

BOARD RESOLUTION NO. 15-681

Pertaining to an agreement with the Board of Regents of the University of Minnesota to provide further investigation of microbial communities in water mains and their possible link to pipe failure.

BACKGROUND INFORMATION

Staff is seeking approval of a 2-year, \$179,873.89 professional services agreement (PSA) with the University of Minnesota to continue its work in providing data and analysis to determine the type and extent of microbial communities in SPRWS distribution system and their possible role in pipe failures. The results of the analysis could lead to strategies for reducing corrosion and will likely be a critical component in the ongoing development of the utility's Distribution System Operations and Rehabilitation Plan.

Following Board approval, City Contracts and Analysis will prepare and execute a Professional Services Agreement, which will include the City's standard terms and conditions, liability and insurance language unique to the University, and the following:

- Scope of Work:
- 1) investigate the effects of disinfectant type and concentration on the bacterial community composition
 - 2) investigate the impact of microbial-influenced corrosion in SPRWS distribution system

The work is further detailed in the University's December 1, 2014 Proposal.

Cost: Not to exceed \$179,873.89

Term: May 1, 2015 - April 31, 2017

See attached Report and Proposal.

RECOMMENDATION

Approval is recommended.

REPORT

Microbial Communities Study Agreement with The University of Minnesota

April 14, 2015

Previous Work

The previous work of 2012-2014 identified the composition of bacterial communities growing in biofilm attached to pipe surfaces in the distribution system.

Major findings of that \$176,462 2012-2014 study:

- Pipe wall biofilms were dominated by the bacterial genera *Desulfovibrio* and *Mycobacteria*
- The *Mycobacteria* species in SPRWS distribution system are not pathogenic
- *Desulfovibrio* were prevalent underneath pipe tubercles (areas of protruding, solidified corrosion byproducts) and may be accelerating pipe corrosion

Desulfovibrio are known to cause corrosion of pipe surfaces. They utilize sulfate, a compound common in SPRWS distribution water, to create conditions that create iron pipe corrosion and corrosion by-products such as pipe tubercles. Corrosion is of interest to SPRWS staff as it can cause aesthetic problems for our customers as witnessed by yellow or brown water complaints, which are common in the summer months.

Also of interest is how deep the corrosion is penetrating the interior surface of the pipe and the rate this is occurring, as deeper corrosion could weaken a pipe. Different types of pipe corrode at different rates, and some do not corrode at all due to modern fabrication techniques. Examples are shown in attached Figure 3 from the 2012-2014 study.

Proposed Work

The proposed agreement provides for a graduate student under the direction of a graduate school professor to continue the work over a period of two school years.

Primary objectives of this next phase of the work:

- 1) investigate the effects of disinfectant type and concentration on the bacterial community composition, and
- 2) investigate the impact of microbial-influenced corrosion in SPRWS distribution system.

To accomplish those objectives, the following work will be performed:

- Compare biofilm composition from three distribution systems, two with different chlorination practices and one system that does not contain any chlorine
- Collect and analyze biofilm from areas in the SPRWS system that are prone to disinfectant loss and suffer from degraded water quality
- Provide more genetic sequencing work to look for other previously unidentified bacteria species that could be contributing to pipe corrosion
- Quantify the rates of pitting and corrosion on pipe surfaces by reproducing distribution system conditions inside bench-top reactors in the laboratory

The cost of the proposed two-year agreement is not to exceed \$179,874, of which \$25,000 is laboratory materials and services.

From 2012-2014 Study



a.

b.

c.

Figure 3: Sampled pipe types

- a. Tuberculated unlined cast-iron pipe
- b. Non-tuberculated unlined cast-iron pipe
- c. cement mortar-lined cast-iron pipe