

WSSC COPPER PIPE PINHOLE LEAK INVESTIGATION

SUMMARY

BACKGROUND

- In response to increasing reports of copper pipe pinhole leaks in spring / summer of 2000, WSSC launched an aggressive investigation.
- Task force was formed – WSSC, copper and master plumbing associations, County representatives and copper corrosion experts, including: Dr. Marc Edwards of Virginia Tech, Dr. Steve Reiber of HDR Engineering and Richard Lewis of Richard Lewis Engineering.
- To date, more than 5,000 customers have reported copper pipe pinhole leaks and have completed questionnaires. Observations on data from questionnaires include:
 - Majority of pinhole leaks being reported are in cold water horizontal copper piping.
 - Majority of pinhole leaks being reported are in the older areas of Montgomery and Prince George's Counties.
 - Nearly 80 percent of the reports received thus far involved homes built prior to 1970.
 - Customers living in older areas are reporting the most occurrences of pinhole leaks in copper pipes.

OUTREACH

- Through a variety of activities, we've been updating customers and urging them to contact us if they have experienced a pinhole leak. Efforts include:
 - mailings to our entire customer account base via bill inserts;
 - regular and proactive updates to media outlets;
 - update letters to customers who have reported pinhole leaks to us;
 - letters updating local elected officials; and
 - briefings to homeowner, community and apartment associations, home inspectors, real estate agencies, elected officials and county staff.

CORROSION EXPERTS' WORK

- Experts have been focusing on water chemistry, previous copper corrosion research, comparing pinhole leak occurrences in the WSSC service area to other areas of the country, water treatment modifications that may minimize copper pipe pinhole leaks and metallurgical examinations of copper pipes.

KEY FINDINGS

- Drs. Edwards and Reiber reviewed records of WSSC's finished water chemistry and water treatment practices. They could not find any obvious reason why WSSC customers should experience high levels of copper pipe pinholes.
- Metallurgical examinations of copper pipes with pits revealed deposits of aluminum hydroxide, silica, and iron hydroxide on the interior surfaces.
- Sources of aluminum include raw water, coagulant used in water treatment process and new / recently cleaned water mains.
- Potomac plant's median residual aluminum level is 1/3 less than the median observed nationally, and the Patuxent Water Filtration Plant's level is about 2/3 less than that observed nationally.
- In lab tests, orthophosphate and polyphosphate effectively stopped pitting.
- Phosphates are completely safe, federally approved water additives used by more than 50% of utilities nationwide (Rockville, Carroll and Fairfax counties) to combat corrosion-related problems.

(over)

RESEARCH

- Dr. Edwards used off-the-shelf copper pipe (soft copper, hard copper and copper couplings) and "synthetic" water. His man-made water contained approximately the same dissolved salts (hardness, alkalinity, sulfate, etc.) as does water at WSSC. The water meets all federal EPA regulations and was actually "cleaner" than federal standards as it did not contain any natural organic matter (NOM). Some NOMs are natural corrosion inhibitors.
- The combination of high pH, aluminum and chlorine levels, and no NOM gave every indication of initiating pitting of copper in the lab for the first time. (Note: this does not mean a pinhole leak formed in the pipe, although the extent of corrosion observed in just 20-28 days testing was considered impressive by Dr. Edwards.)
- His work indicates that EPA requirements coupled with best industry practices including: NOM removal, possibly cleaning/lining and installing new cement-lined pipes, traces of aluminum in water, and improved general corrosion control by raising pH, may promote copper pipe pinhole leaks.
- NOM includes many different organic chemicals in rivers and reservoirs from sources such as decaying leaves. As part of ongoing efforts to improve water quality and enhance public health, the Environmental Protection Agency (EPA) required water utilities nationwide to optimize treatment processes in the mid-1990s to remove more NOM. Corrosion experts believe that some of the chemicals making up the NOM act as corrosion inhibitors and protect metal piping. With the EPA ruling requiring utilities -- including WSSC -- to remove more NOM, Dr. Edwards theorizes that this has increased copper corrosion and pinhole leak activity across the country.
- Of specific interest to WSSC is his work that raises questions of the effectiveness of orthophosphate to slow or stop copper pitting corrosion at higher pH levels.
- Dr. Edwards is testing the effectiveness of orthophosphate and water at different pH levels. Tests were complete in Spring 2003.

NEXT STEPS

(Complete):

- Received approval from Maryland Department of the Environment to add orthophosphate and adjust Patuxent Water Filtration Plant pH.
- Reported results / recommendations to Commissioners.
- Reported results / recommendations to Bi-County Leadership.
- Briefed EPA officials on research.
- Began adding orthophosphate at water filtration plants (Nov. '03).

(Ongoing):

- Continue customer outreach activities.
- Construct permanent orthophosphate facilities.
- Participate in statewide copper pipe pinhole leak task force.

LONG TERM:

- In light of Dr. Edwards' latest research indicating federal water chemistry regulations may play a role in this problem, and since similar kinds of copper pinhole leaks have occurred, and are occurring, elsewhere in Maryland, the Country and the world, EPA and other national research institutions are being urged to get involved in this national issue.

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