Solids Precipitation and Water Quality in a Home

City of Bismarck

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June 4, 2019

Presentation Outline

- Water quality is important to the Utility
- What we found
- What can be done, and how that affects Water Quality in the home
- Questions and observations from home owners

Water quality is important to the Utility

We work with the ND Dept. of Environmental Quality to ensure we are providing safe reliable drinking water to our community.

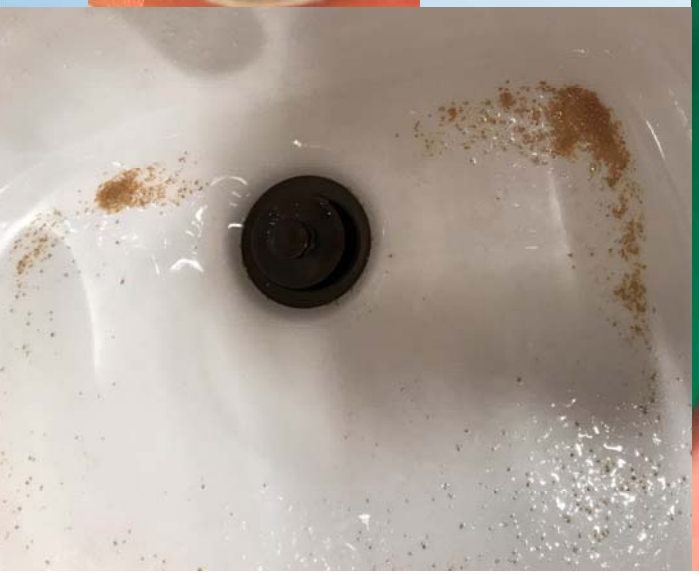
Federal Safe Drinking Water Act requirements include:

- Compliance with the Lead and Copper Rule
- Compliance with the Disinfection by-Product Rule
- Compliance with Total Chlorine Residuals
- Compliance with the Coliform Rule
- Compliance with cryptosporidium and Giardia disinfection and removal

State contact, Greg Wavra - Drinking Water Program Director with the ND Dept. of Environmental Quality

What we found

Solids precipitation



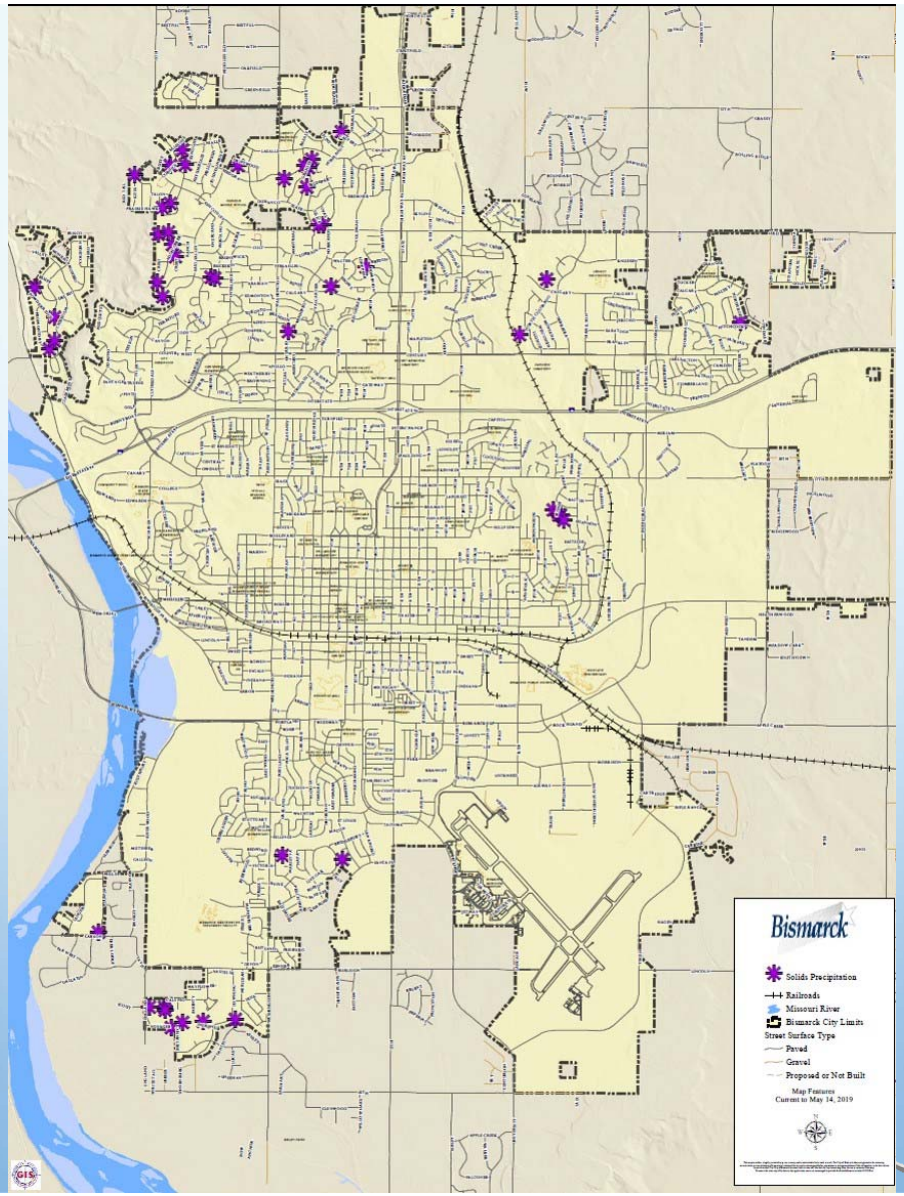
What we found

1) **Not affecting all residents,** and affecting some homes to a much greater degree than other homes. Primarily affecting newer developments (64 confirmed out of 19,914 homes in Bismarck).

We are still asking for those who have issues to contact us and we can keep them posted with any new information.

Issue primarily affecting newer developments

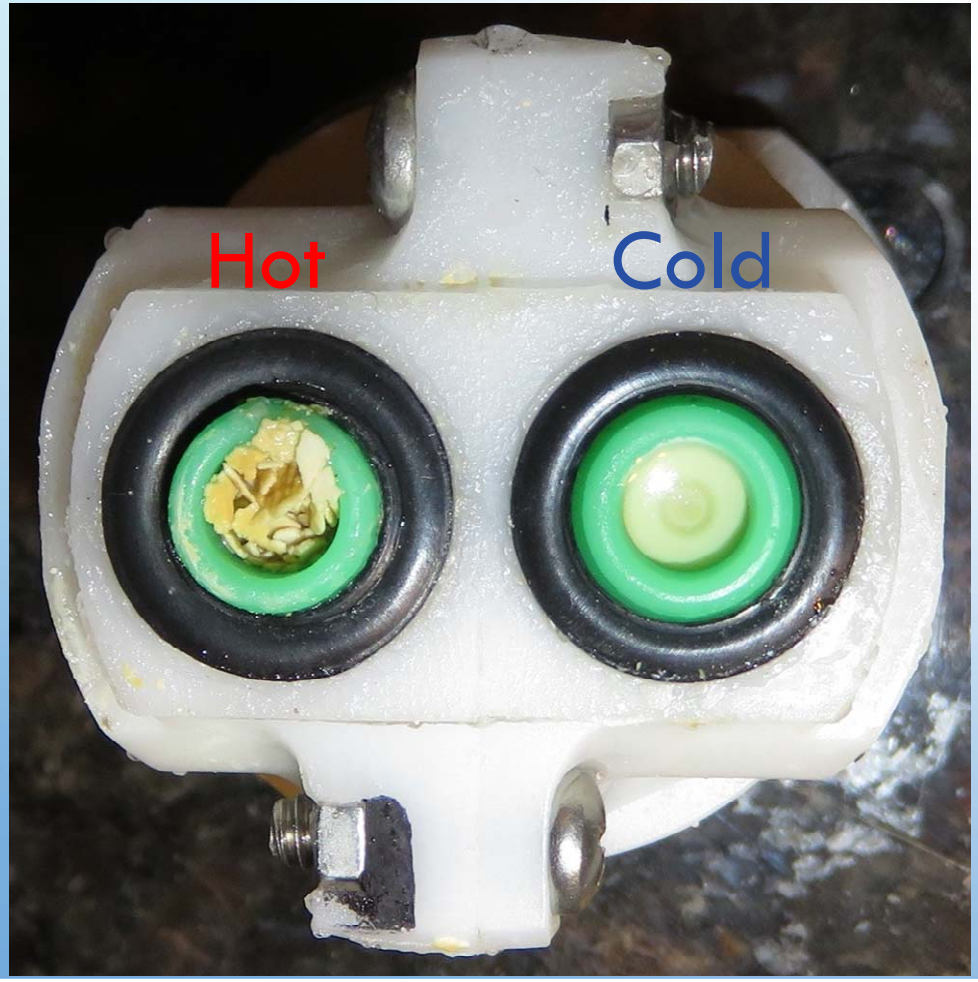
Purple bursts mark homes that reported solids precipitation within Bismarck.

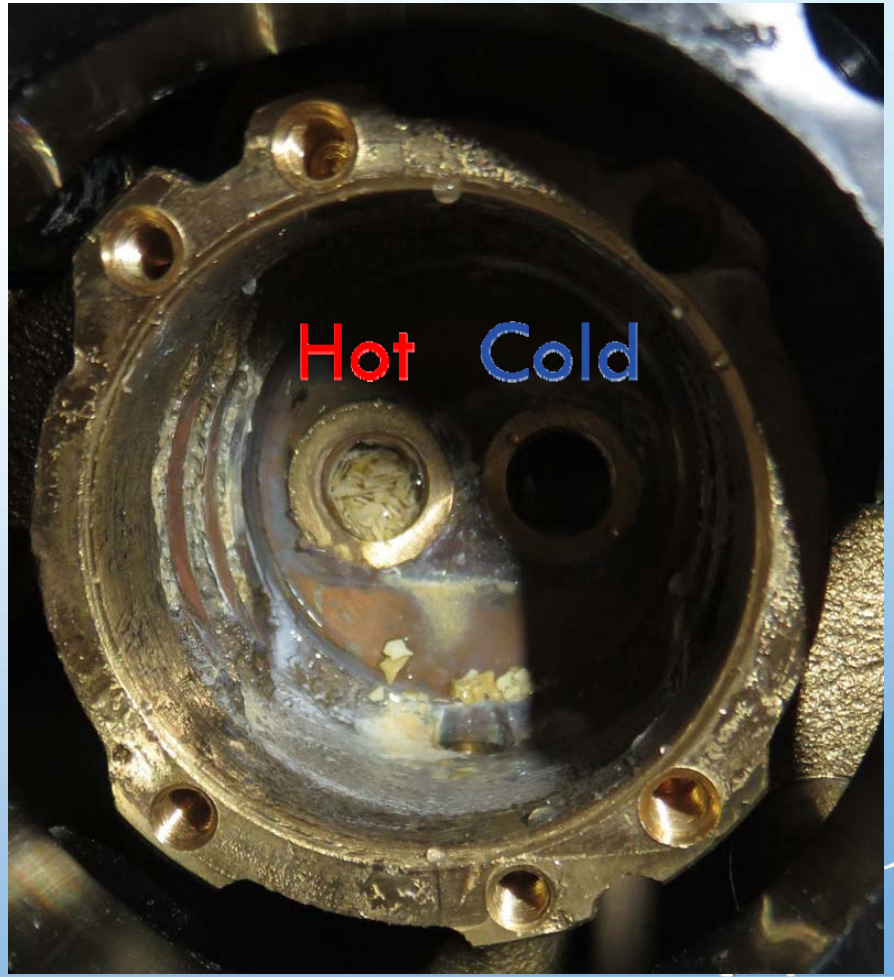


What we found

1) Not affecting all residents
2) **Not affecting cold water side.** Only showing up on hot water side, and some cases much more dramatic than others. Indicated solids were not coming from the water mains.

Solids NOT affecting cold water side (shower cartridge)

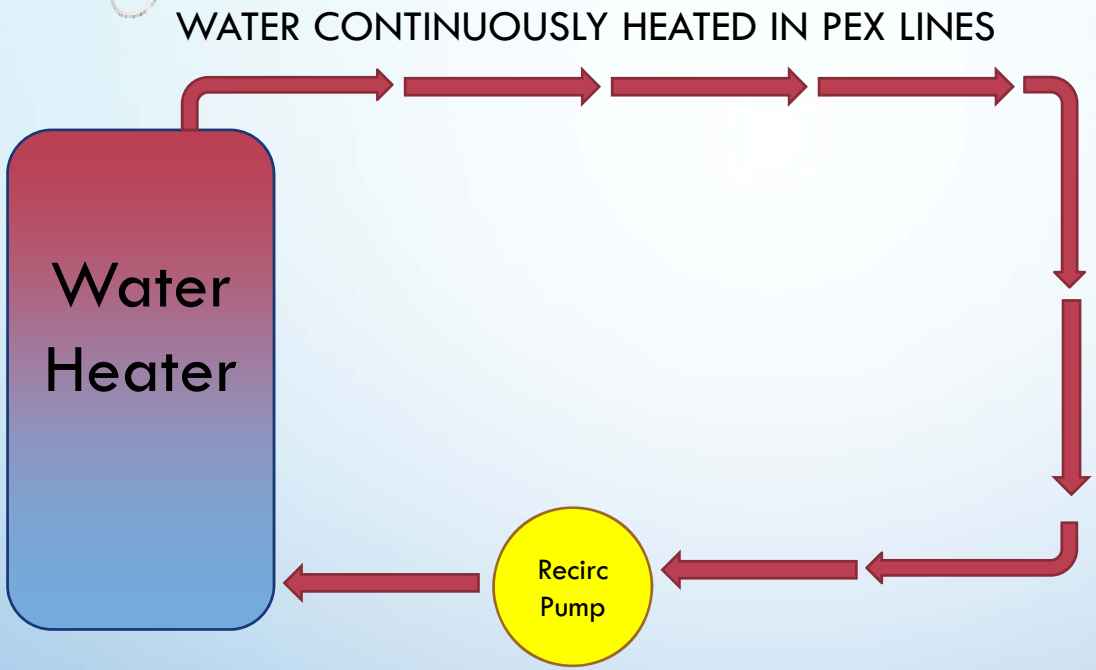




What we found

3) Our discussions with home owners and plumbers revealed **common links for homes with issues.**

- Recirculation pump moves water through the water heater continuously which keeps water in the lines hot (added heat)
- Magnesium (Mg) anode in the water heater
- Higher temperature on water heater (added heat)
- PEX water lines in the home



Recirculation pump

Homes reporting solids precip

Early information indicated 45 of 49 responses have recirculation pumps, the other 4 have a gravity or a geothermal pump, which does the same thing

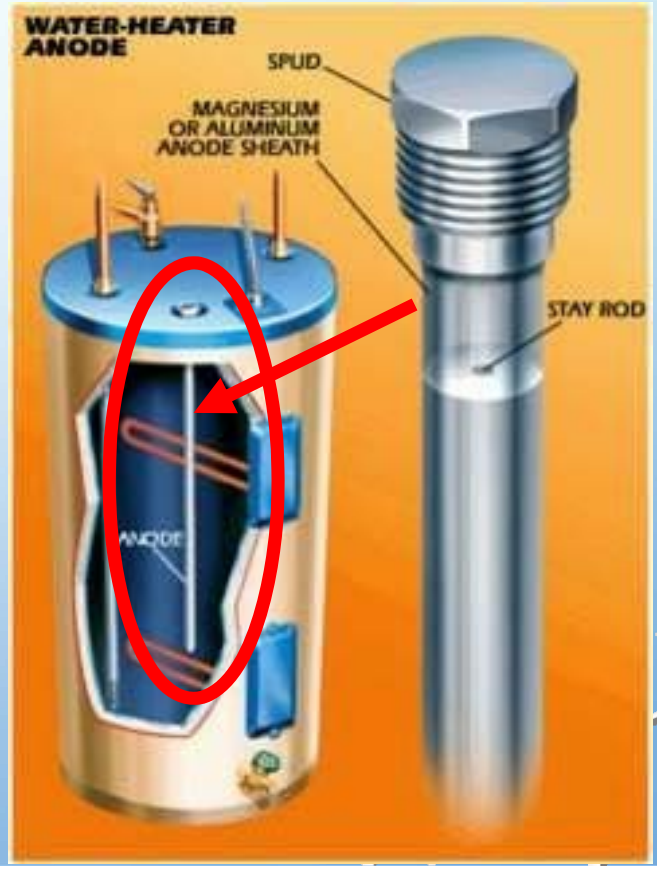
What we found

1) Not affecting all residents
2) Not affecting cold water side
3) Common links: recirc pump, Mg, high water temp, PEX
4) **Lab testing** confirmed chemical reaction forming solids is taking place when our drinking water is exposed to **magnesium and higher heat.** Research supports more solids precip forms with higher temperatures.

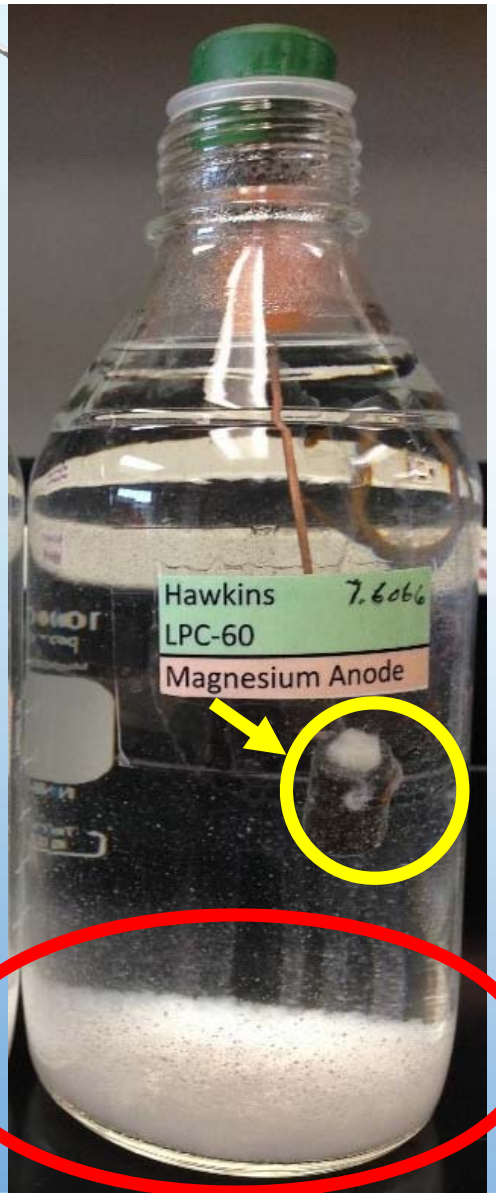
Water heaters have a replaceable "sacrificial anode" to protect the metal tank. The anode is added to purposely corrode first to protect the tank metal.

If magnesium is used for the anode, solids precipitation will form faster and to a greater extent. Our drinking water reacts with magnesium.

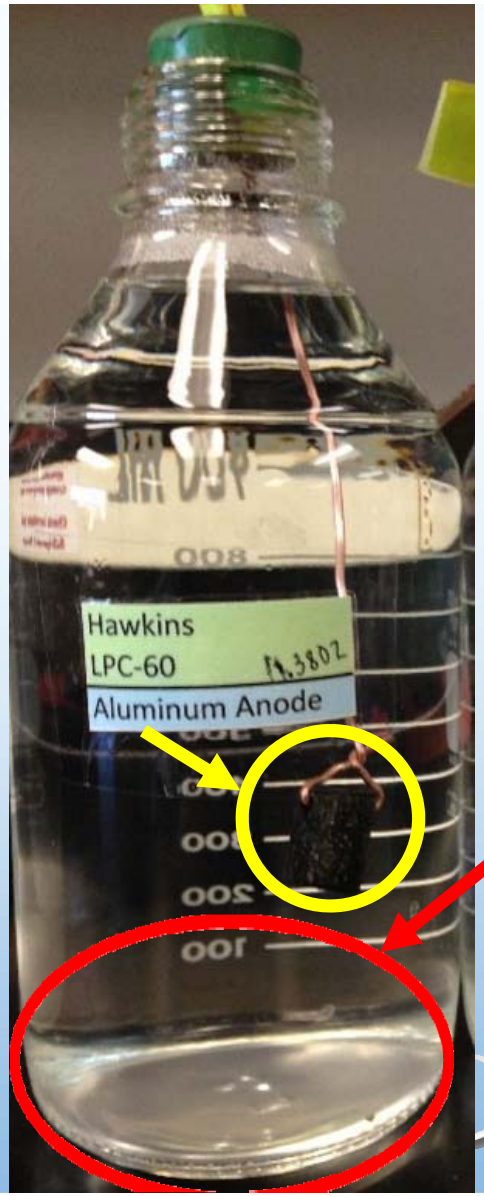
Aluminum anodes provide the same protection for the tank. They do not corrode as quickly and do not react as strongly with our drinking water.



Utility completed lab testing to understand the impact of magnesium anodes

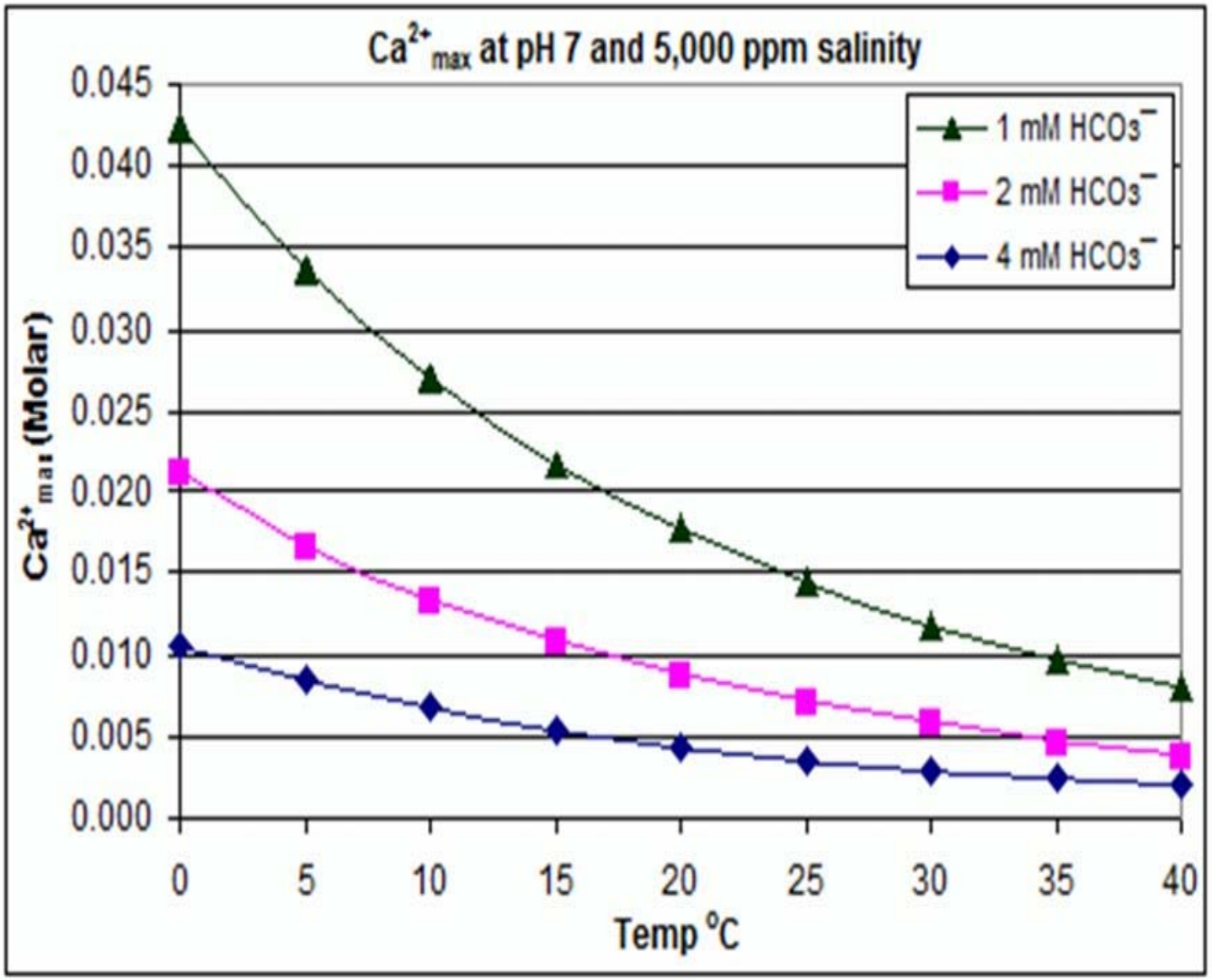


Solids precip greater



Solids precip with **Aluminum is far less** than solids precip with Magnesium

(after one week of incubation at about 190°F, testing city water)



The higher the temperature, the less calcium will stay in solution.

In other words, the hotter the temperature the more solids precip that is formed.

Lowering the temperature at the water heater and reducing continuous recirculation of water through the heater, will reduce precipitation.

This will also reduce the scaling being formed on the pex lines.

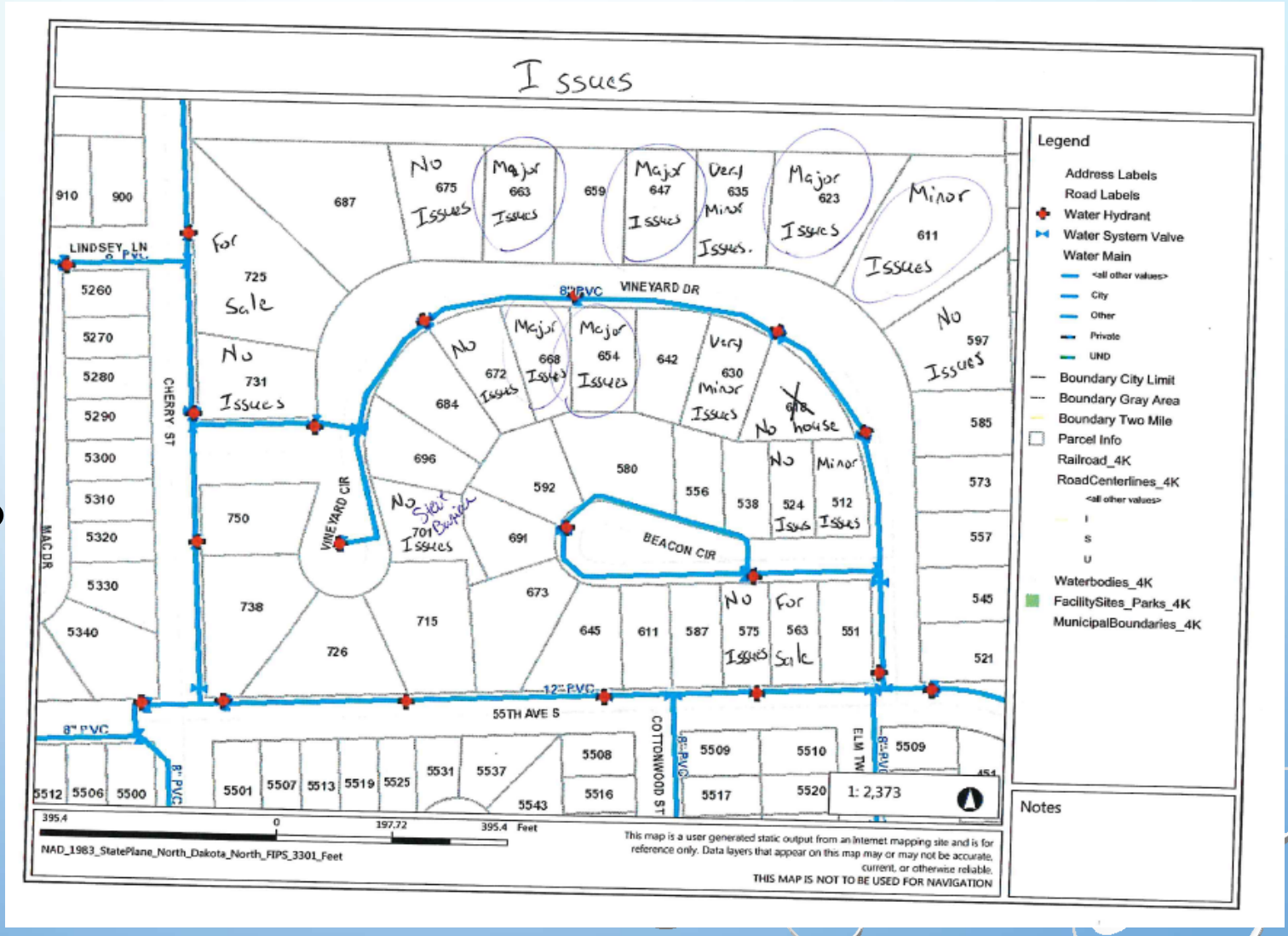
Heat is a large factor, but we are not hearing of large solids issues without also having a recirculation pump continuously moving the water through the water heater.

What we found

3) Common links: recirc pump, Mg, high water temp, PEX
4) Lab testing confirmed more solids with Mg and higher temp
5) **Showing up in other communities** including Grand Forks. They found large variation in amount of solids precip between neighboring homes. Also linked with newer construction, recirculation pumps and hot temperatures on water heaters.

Issue is not affecting every home, primarily affecting newer construction but to different degrees

In Grand Forks, their map shows neighboring homes not affected equally.



What we found

1) Not affecting all residents
2) Not affecting cold water side
3) Common links: recirc pump, Mg, high water temp, PEX
4) Lab testing confirmed more solids with Mg and higher temp
5) Showing up in other communities
6) In more discussions with homeowners and plumbers, also understanding scale formation in **PEX recirculation lines behave differently** from other materials used for indoor plumbing.

Scale formed on PEX hot recirc pipes is flakey and comes off easily. In comparison, copper has a stronger bond.

The water system is required for public health to provide a protective scale for all pipelines within the water system.

We are hearing the scale on PEX hot water recirculation lines is flakey and comes off easily with minimal disturbance.

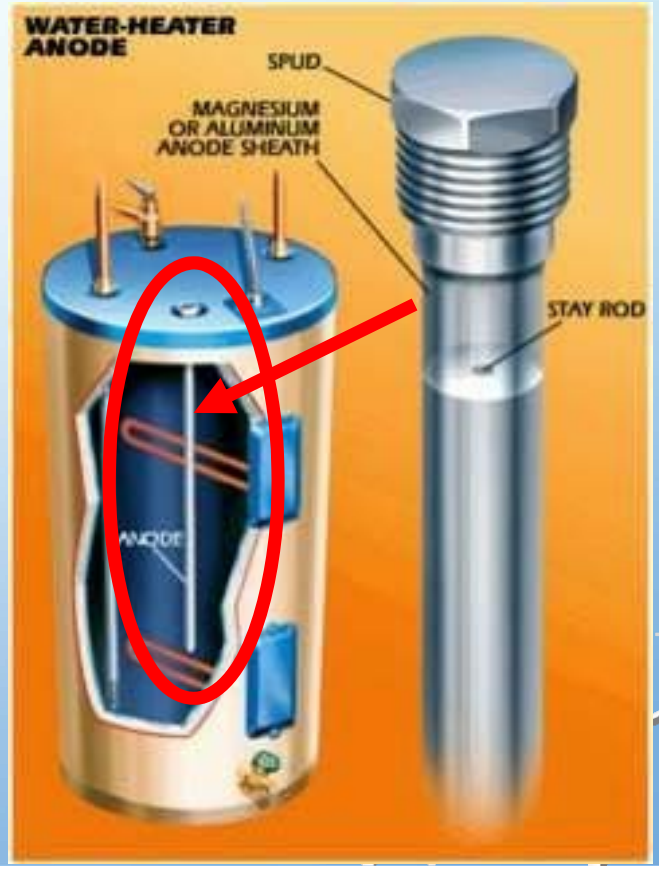
This flaking of scale is not occurring with other piping materials.

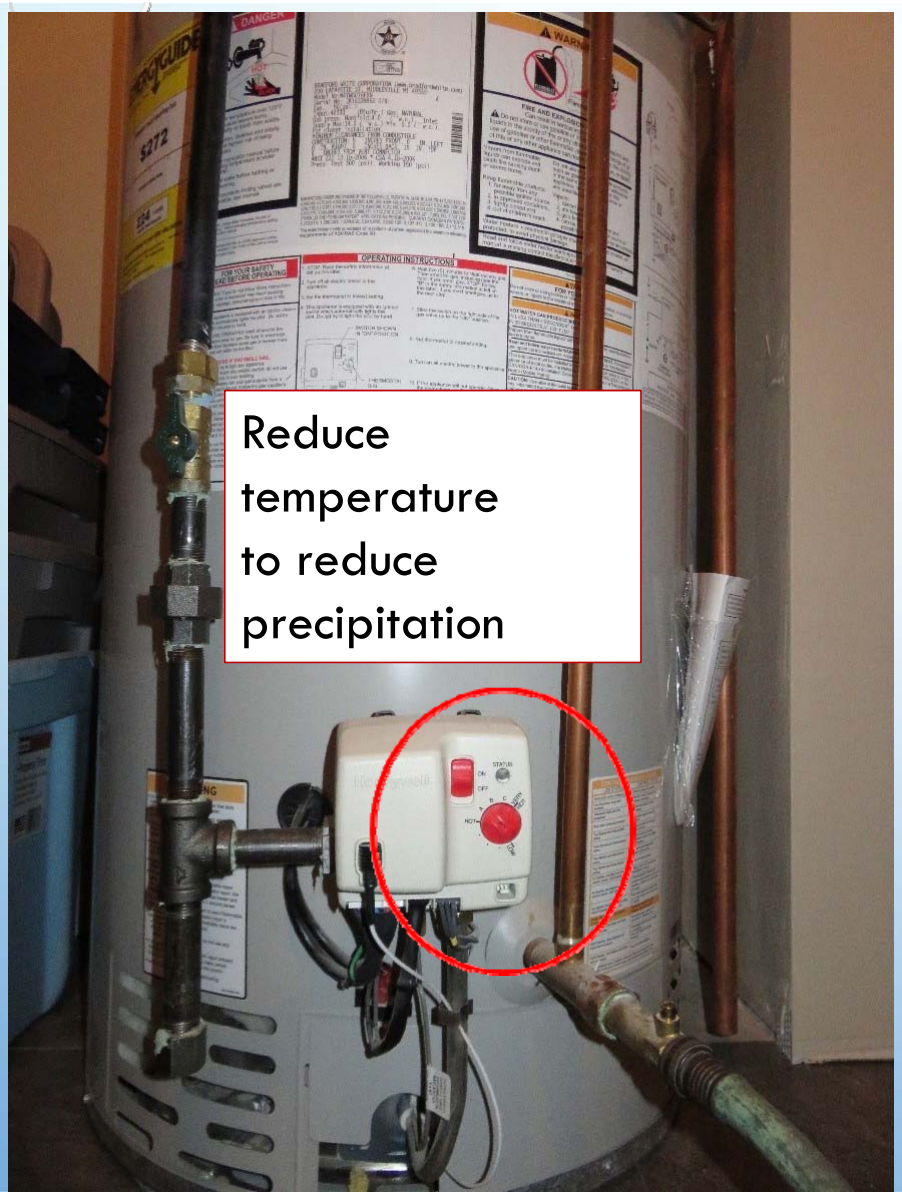
What can be done, and how that affects Water Quality in the home

- Lessons being learned – things home owners have tried

We have been working with plumbers over that last couple of years and there is a greater awareness that our water is reactive with magnesium. A lot of the magnesium anodes have been replaced and no longer being installed.

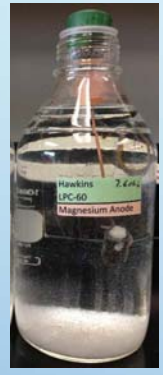
If you still have a magnesium anode, **changing it out with an aluminum anode** will greatly reduce the solids being formed in the water heater. Not making this change, the anode will just be used up quickly forming solids precip and no longer protect the metal tank from corrosion.

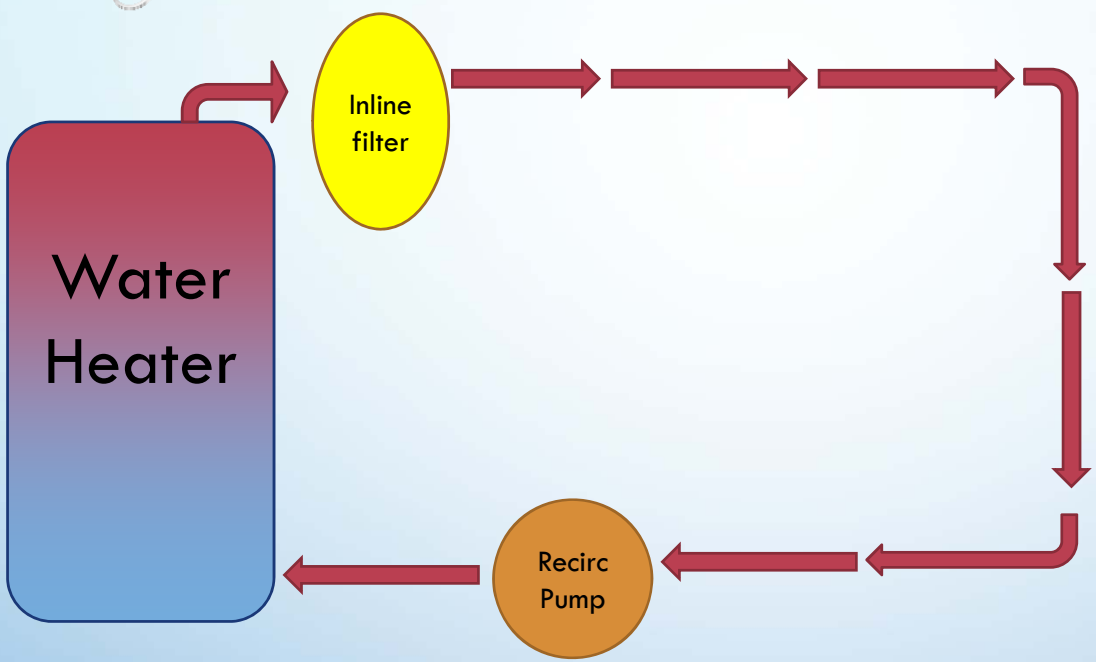




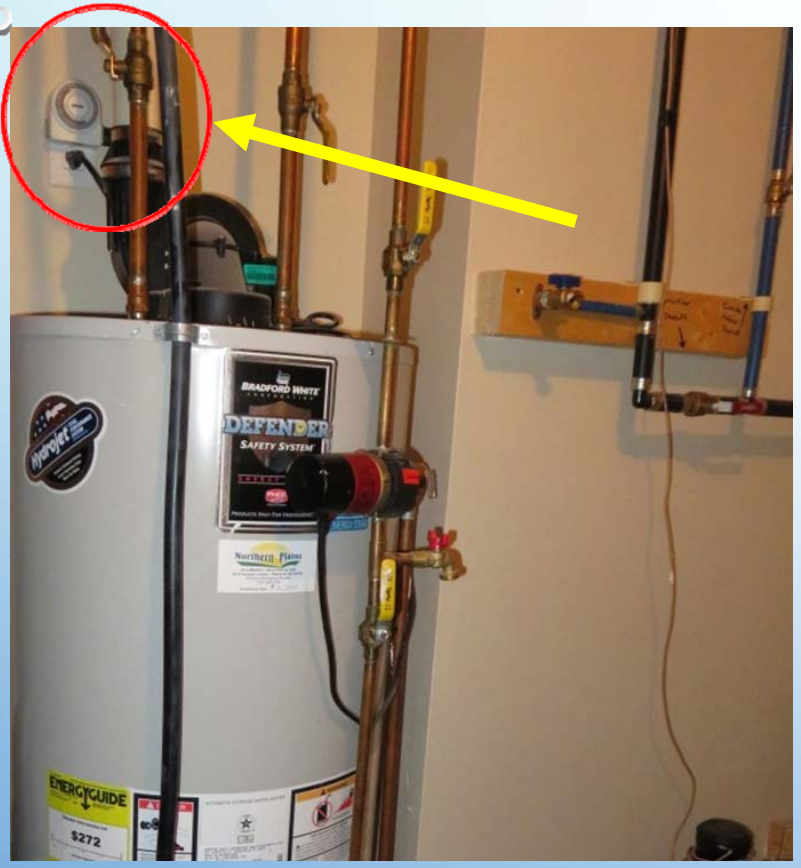
Reducing water heater temperature to between 120-130 degrees has seen good improvement in reducing solids precip and reducing formation of flakey scale in PEX recirc lines.

Have you tried this?





19 homes added an **in-line filter** to have a place to remove solids from their water heater. With the recirc pump, the solids are continuously moved and do not settle in the bottom of the water heater for normal flushing. The inline filter catches the solids, however it does not reduce the creation of solids in the water heater and it does not prevent the flakey scale on the PEX lines.

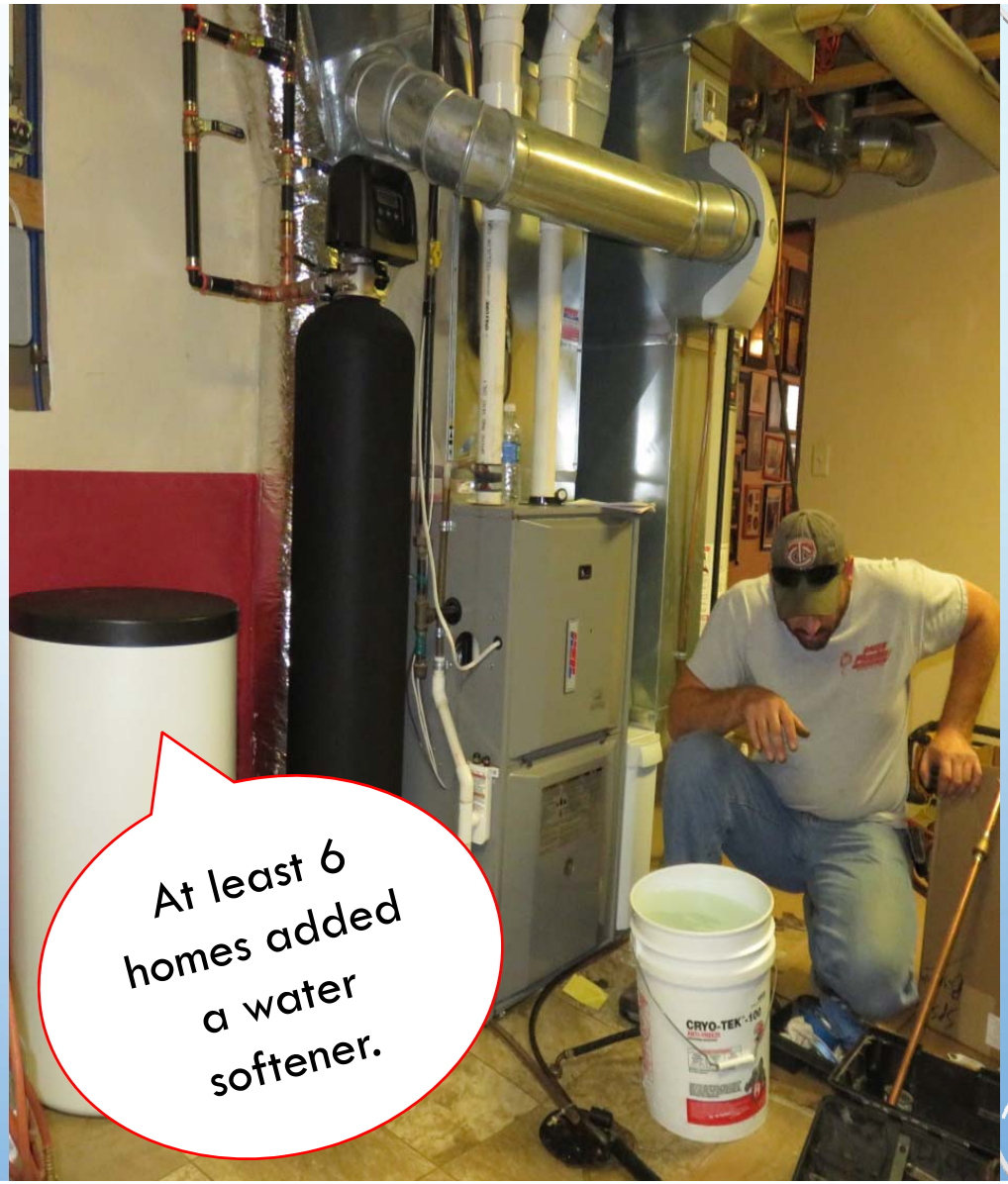


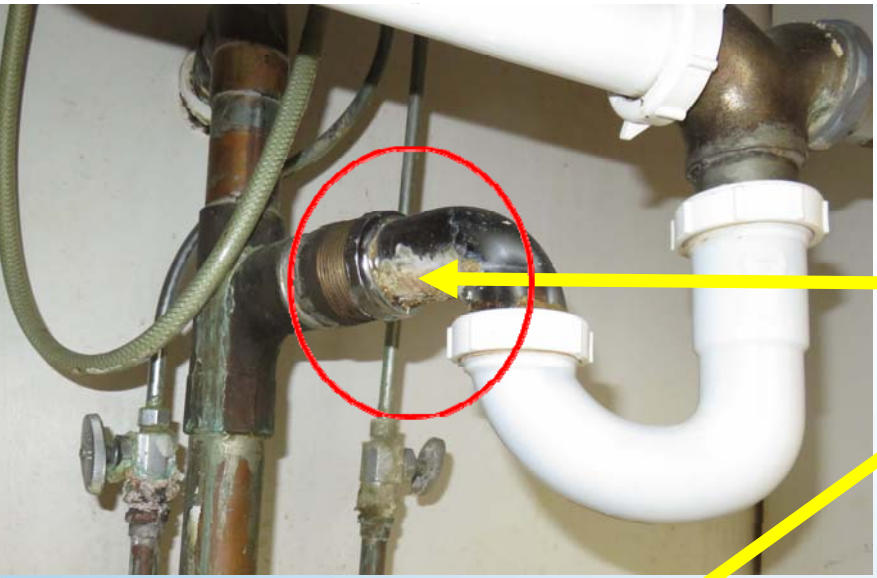
11 homes added a **timer on the recirc pump** to only run when needed for showers. Some have **unplugged the recirc pump.** This will reduce heat and should reduce the formation of the flakey scale on the PEX hot water lines.

Have you tried this?

A water softener can reduce solids precip and scaling. However it will also affect the water quality in the home, both in removal of disinfection and corrosion control. Place only on the hot water side, and not on any lines where corrosion control is required.

As always, only drink and cook with water from the cold water side.





It is known that connection of unlike metals can cause corrosion and scale formation. This may be a contributing factor, however we are not hearing of homeowners addressing this issue.

Dealkalizer – lowers pH. Again only use on hot water side, and should not be used with materials that need corrosion control. Expensive, but may be option if not seeing good results with the reduction of heat and reducing use of recirc pump.

As always, only drink and cook with water from the cold water side.

Consider what you are trying to accomplish in your home. Are your showers a long distance from your water heater? Have you considered unplugging your recirc pump for a couple of weeks to see if the convenience of instantaneous hot water is important enough to you that it makes sense to install additional equipment to treat the precip and scale?

As always, only drink and cook with water from the cold water side.

In Summary -What we found

1) Not affecting all residents
2) Not affecting cold water side
3) Common links: recirc pump, magnesium, high water temp, PEX
4) Lab testing confirmed more solids with Mg and higher temp
5) Showing up in other communities
6) PEX recirculation lines behave differently
7) Water Quality for drinking water is complex

In Summary -What we recommend

- **Decrease the temperature** to reduce solids precipitation in the water heater and scale formation on pipes.
- Use an **aluminum anode** to reduce solids precipitation.
- Use a timer to **reduce use of the recirculation pump** to decrease solids
- **Flush the hot water lines and water heater** after taking the steps above
- As always, **only drink and cook with water from the cold water side**

Open for questions and observations from home owners to help other home owners