



The Discovery and Assessment of Lead in a Modern Residential Plumbing System

SETTING

- 🌐 **Modern Residential Complex-Built 2008**
- 🌐 **13 Structures/254 Units (1-3 BR/1-2 BA)**
- 🌐 **Dedicated Hot Water Heaters (HWH)**
- 🌐 **Dedicated HVAC Systems (Comprised of Hydronic Heaters)**


BACKGROUND

- 🌐 **TENANT**
 - 🌐 Couple w/ new child born with complications
 - 🌐 Facing eviction due to persistent rent default
 - 🌐 Noted a black particle in water during tub draw-oily smear when touched-requested management to assess water quality/safety







BACKGROUND (cont.)

LANDLORD

-  Hired an environmental consultant to determine actuality, source and nature of the apparent black particle.







INITIAL CONSULTANT

-  Assess system/Quantify water quality-2 samples
 -  MBA tub tap (Apparent source of particle)
 -  HWH (Service drain)
-  Submitted samples as “Drinking Water”

BACKGROUND (cont.)

INITIAL CONSULTANT (cont.)

“Drinking Water” analyses performed:

-  Title 22 Metals (EPA 7000 series)
-  Residual Chlorine
-  pH
-  TDS/TSS/Turbidity
-  Total Coliforms/E.Coli
-  Aggressive Index

BACKGROUND (cont.)

INITIAL CONSULTANT (cont.)

Assessment Findings:

- Qualitative-Noted deteriorated rubber gasket on HWH-out
- Quantitative-All results unremarkable except:
 - HWH sample revealed lead at 200 ug/l-in excess of EPAs *Lead & Copper Rule Action Level* of 15 ug/l (aka MCL)







LANDLORD

- Shares data with tenant

BACKGROUND (cont.)


TENANT

-  Performs web research
-  Acknowledges elevated lead
-  Alleges landlord caused baby's problems
-  Initiates complaint

INITIAL CONSULTANT

-  Withdraws from project-cites lack of expertise in drinking water issues

LANDLORD

-  Contacts legal counsel-refers matter to "toxic tort expert"

OBJECTIVES

Clearly “Risk Management”

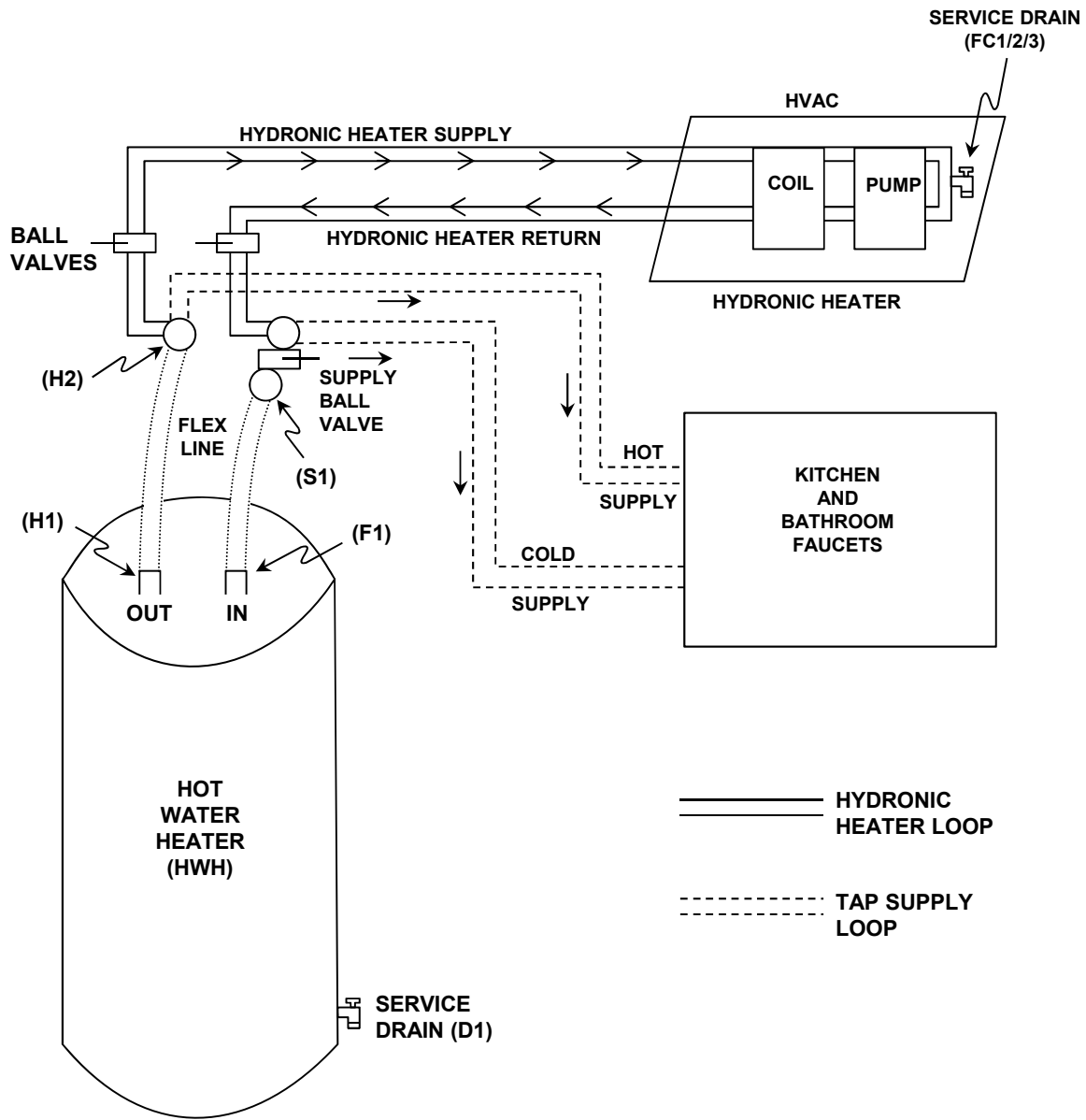
- 🌐 Qualify the actuality and source of the elevated lead
- 🌐 Assess if the lead finding equates to a reasonable exposure potential to tenant/all tenants
- 🌐 Produce defensible data to support existing complaint and possible subsequent cross-complaints

SCOPE

- **Quantitative reassessment of prior sample using EPA approved method (200.8)**
- **Qualitative assessment of apartment complex and plumbing features**
- **Quantitative assessment of lead in water at varying points in system (Details of scope to depend on findings of above)**
 - **Tap water from faucets**
 - **Water w/in hydronic loop**
 - **Municipal supply**

FINDINGS

- Reanalysis of HWH water sample using 200.8 revealed lead at 286 ug/l (>prior)-Elevated lead confirmed
- Qualitative assessment of complex/unit
 - Municipal supply/typical copper plumbing
 - Rubber gaskets deteriorating at HWH-Smearing duplicated
 - Hydronic system shares HWH-Aside from HWH, hydronic system independent (=“Loop”)



FINDINGS (Cont.)

- Quantitative assessment of water-15 units
 - Scope influenced by Qualitative findings (i.e., “source isolation” objective)
 - Taps (146 samples)-Kitch/BA, Hot/Cold, Initial draw/Flushed
 - Hydronic “Loop” (73 samples)
 - HWH
 - Service drain
 - Cold supply in (Hydronic loop out)
 - Pre flex line
 - Post flex line





FINDINGS (Cont.)

- Quantitative assessment of water (Cont.)
 - Scope ... (Cont.)
 - Hydronic “Loop” (73 samples) (cont.):
 - Hydronic Heater
 - Service drain:
 - First Draw/Pre-flush
 - Flushed-Idle heater
 - Flushed-Operating heater
 - Municipal (1 sample)
 - Exterior spigot



FINDINGS (Cont.)

- Quantitative assessment of water (Cont.)
 - Preliminary Findings?
 - Black particle found-smear-matched rubber gasket
 - No lead above the MCL in the municipal water
 - No lead above the MCL in any of the 146 taps
 - 110 (75%)=ND
 - 36 (25%)>MDL
 - Lead >MCL in 33/73 (45%) w/in hydronic loop
 - Hydronic loop water is not “drinking water”

PRELIMINARY CONCLUSIONS

- 🌐 Elevated lead, and its catalyst, is limited to the hot water/hydronic heater loop, and that the condition has not adversely altered the quality of the tap water in the units
- 🌐 Tap water is “considered safe to drink” (Ref. CA EPA-OEHHA-Guide to Public Health Goals [PHGs] For Chemicals In Drinking Water, 2015) and there is no basis to support a conclusion that the tenants have been exposed to lead beyond any permissible levels

SOURCE OF LEAD?

- Retained a Forensic Plumber and Forensic Metallurgist to dissect loop. Metallurgist suggests:
 - The “dezincification of high-zinc, leaded-brass components” within the hydronic heater system loop were the most likely catalysts to the elevated lead. “Dezincification,” or selective leaching, is the preferential corrosion of zinc from the copper-zinc microstructure.
 - Such components typically contain 38% zinc/2% to 4% lead” and that dezincification, accelerated by repeat exposure to recirculating hot water in the hydronic system, was allowing microscopic lead particles to be drawn out of the brass into the circulating heater water
 - Considering the specific gravity of lead (11.34), such particles would settle quickly and accumulate at low points in the system (e.g., the bottom of the hot water heater tank) and/or within small cavities of the system (e.g., couplings).
- Based on this info, entire loop removed, disassembled and sent to lab for analysis

LEAD SOURCE FINDINGS

- The following components were found to be made of high zinc, leaded brass and displayed varying evidence of dezincification: Crown Flex water heater supply line nuts (chromium plated), pipe unions, meter unions, ball valve housings and balls, and circulator spigot fittings (drains).
- The following components were found to be made of low zinc brass and, thus, would not be susceptible to any significant dezincification, but did contain lead: Taco® recirculation pump housing and water heater T&P valves.
- The flex lines/nuts were not comprised of brass.
- The HWH did not contain brass components.

LEAD SOURCE FINDINGS (Cont.)

- 🌐 The flex line washers were a sulfur cured ethylene propylene diene monomer (EPDM). They were cracked, embrittled, distorted and had lost carbon black filler. San Diego water is chloramine treated, and EPDM-sulfur is sensitive to chloramines. Elevated temperature also enhances the degradation. EPDM-peroxide washers would degrade less than EPDM-sulfur types.
- 🌐 Safety Data Sheets for EPDM polymer products do not indicate an ingestion hazard associated with the polymer.
- 🌐 Constant recirculation hot water systems are aggressive to high zinc brass and cause enhanced dezincification. Lead particles, added for enhanced machining, can exit the microstructure during dezincification.

FINAL CONCLUSIONS

- Same as “Preliminary Conclusions” Also...
- The black particles were deteriorated fragments of the EPDM washers from the HWH flex lines
- There is no known ingestion hazard associated with the EPDM-sulfur polymer
- The identified brass components located within the hydronic loop are the sole source of the elevated lead detected in the water samples obtained from within the loop and that the condition has not adversely altered the quality of the tap water in the units

RECOMMENDATIONS?

- Though not substantiated by any regulatory mandate, any desired elimination of lead from the hydronic loop would require removal of all high zinc, leaded components and replacement with dezincification resistant, low zinc, brass with no lead.
- Do nothing
- Periodically flush system/HWH

Thank you!

