CASE STUDY

Prevention of Limescale Deposits in Residential Water Heaters Using ScaleRX®

Issue Date: July 16, 2020

SUMMARY:

In June 2019, two Gas Tank 40 Gallon Hot Water Heaters were installed by the same contractor in two residential homes.

The test homes were both located in Houston, TX and had similar usage rates.

After one year, the unit installed without ScaleRX® produced 500 ml (320 g) of scale deposits. Whereas the unit installed with ScaleRX® produced zero scale deposits.

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METALLURGICAL TEST REPORT

Ref. 332143 Rev. 1* **Date:** June 23, 2020 **Page** 1 **of** 5

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Purchase Order #: Credit Card

Test Procedure

Hardness	☐
EDS	☒
XRD	☒

Material: Water Heater Deposits

Specifications: None provided

Test Results

Two colorations of deposits were observed inside water heater Unit B. Both samples were analyzed using energy-dispersive spectroscopy (EDS) and x-ray diffraction (XRD). There were no observable deposits in Unit A. The deposits collected from Unit B had a volume of approximately 500 mL and an approximate mass of 320 g.

EDS (ASTM E1508-12(2019))

The spectra for both deposits exhibited peaks at carbon, oxygen, silicon, and calcium. The presence of iron, nickel, and aluminum is likely the result of shavings from the water heater tank. Spectra for both samples are shown in Figures 1 and 2.

XRD

The samples were analyzed by x-ray diffraction (XRD) per ATS Procedure 962 Rev. 4, ASTM D 934-13 as a guide, and standard powder diffraction techniques using Cu Kα radiation. The resulting x-ray patterns are shown in Figures 3 and 4. Aragonite ($CaCO_3$) was observed in both samples. Magnesium and silicon dioxide was observed in the lighter deposits, while aluminum oxide and silicon carbide were observed in the darker deposits.

Other elements present were either in too small of concentration as compounds to be detected by XRD, substitutional in the identified phases, or present as amorphous phases.

* Revised to add information regarding the mass and volume of collected deposits

ISO 9001

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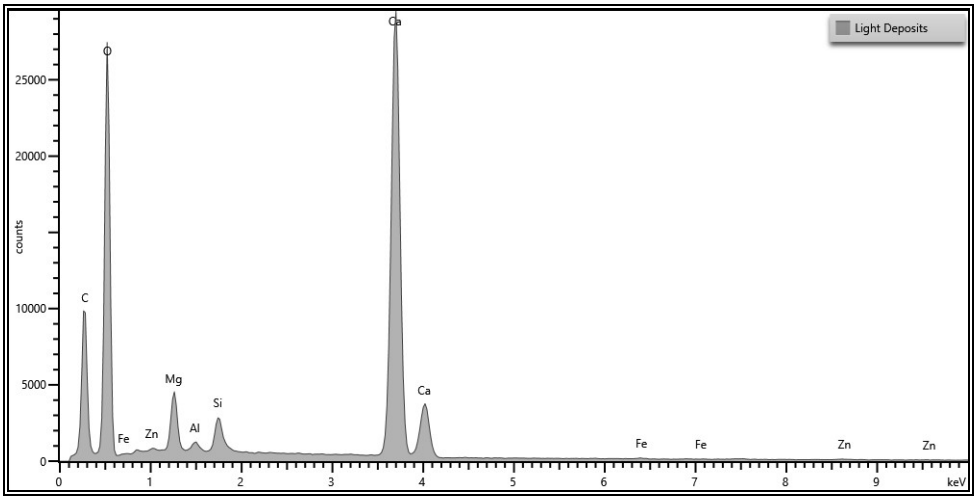


Figure 1: EDS spectrum of the lighter deposits exhibiting peaks at carbon (C), oxygen (O), iron (Fe), zinc (Zn), magnesium (Mg), aluminum (Al), silicon (Si), and calcium (Ca).

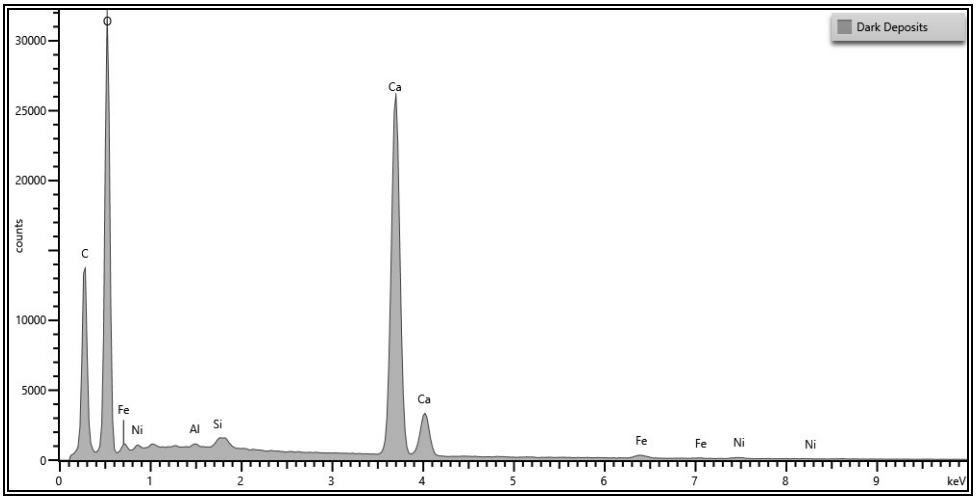


Figure 2: EDS spectrum of the darker deposits exhibiting peaks at carbon (C), oxygen (O), iron (Fe), nickel (Ni), aluminum (Al), silicon (Si), and calcium (Ca).

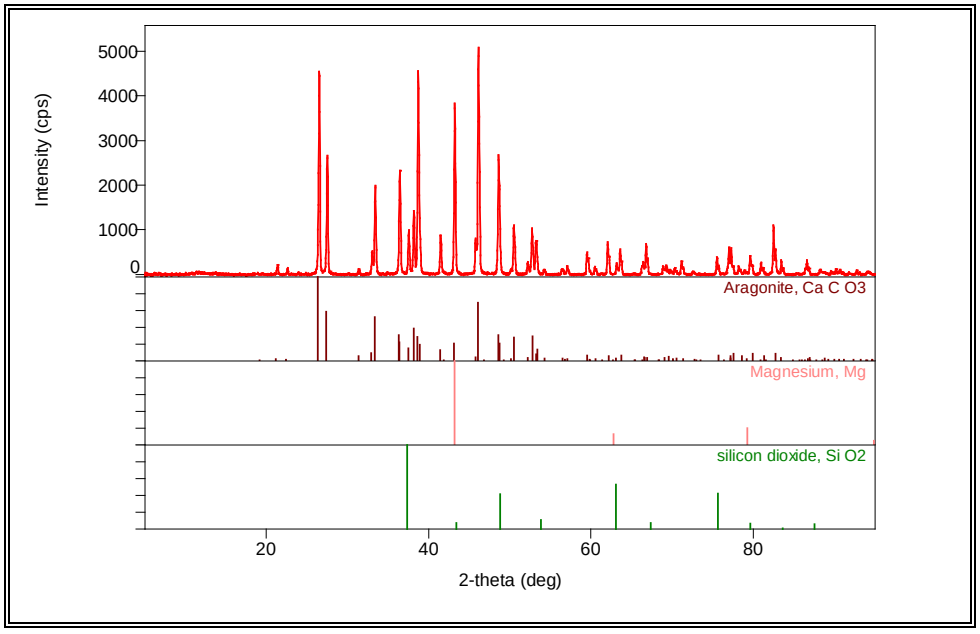


Figure 3: XRD pattern (top) and reference patterns (bottom) of the lighter deposits.

Aragonite ($CaCO_3$), magnesium, and silicon dioxide (SiO_2) were observed.

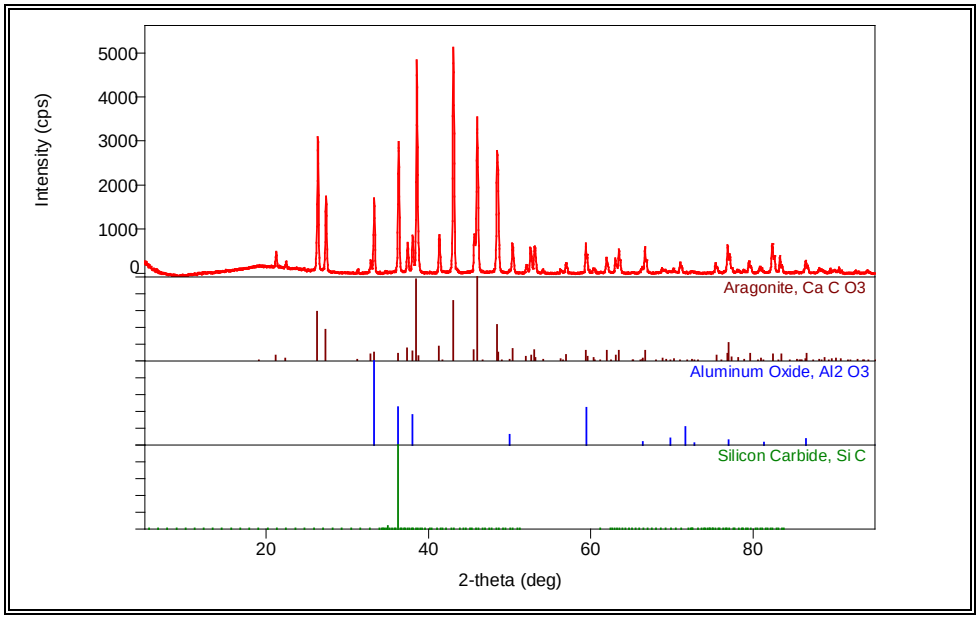


Figure 4: XRD pattern (top) and reference patterns (bottom) of the darker deposits.

Aragonite ($CaCO_3$), aluminum oxide (Al_2O_3), and silicon carbide (SiC) were observed.

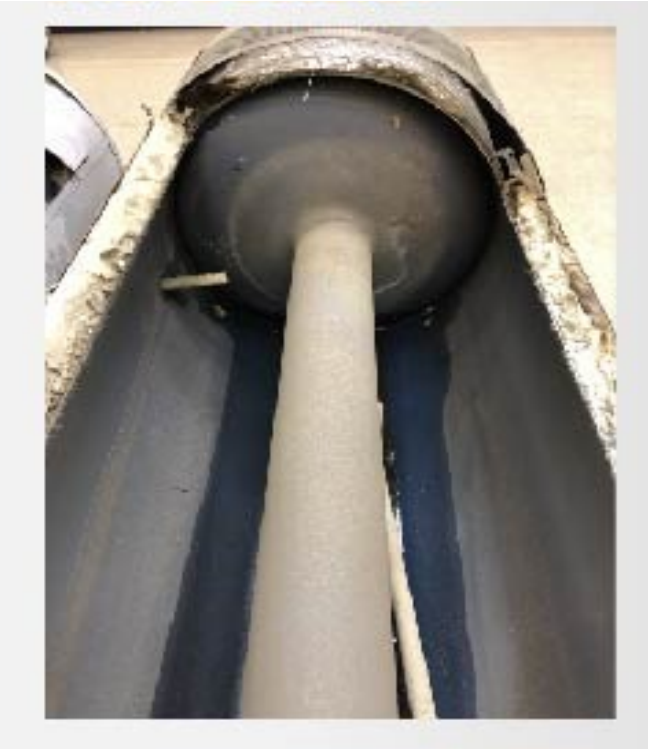


Figure 1: Test Unit A with ScaleRX® installed



Figure 2: Test Unit B without ScaleRX® installed



Figure 3: 1 liter or 320 g of scale deposit removed from Test Unit B (without ScaleRX®)



Figure 4: Test Unit A with ScaleRX® installed



Figure 5: Test Unit A with ScaleRX® installed



Figure 6: Test Unit B without ScaleRX® installed



Figure 7: Test Unit B without ScaleRX® installed