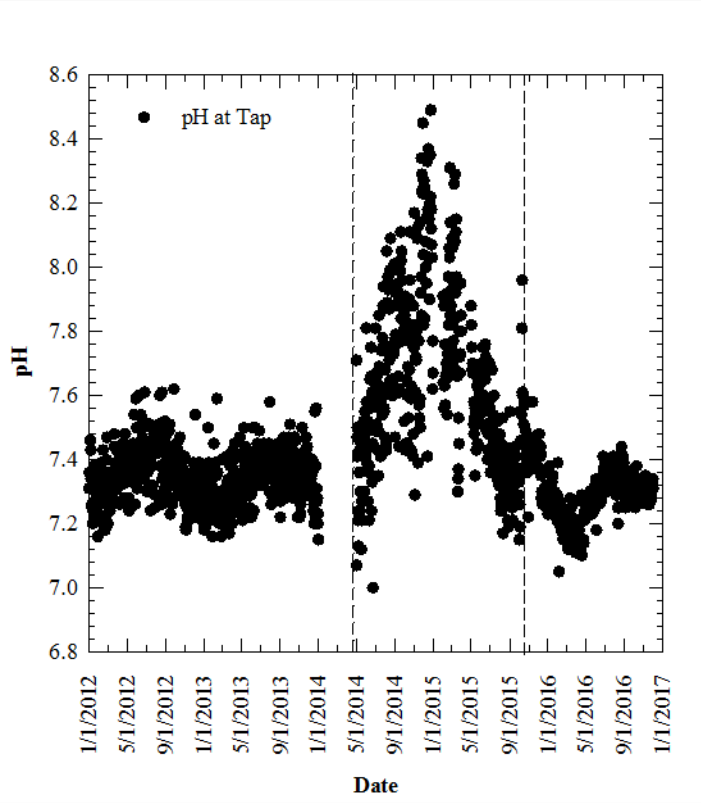
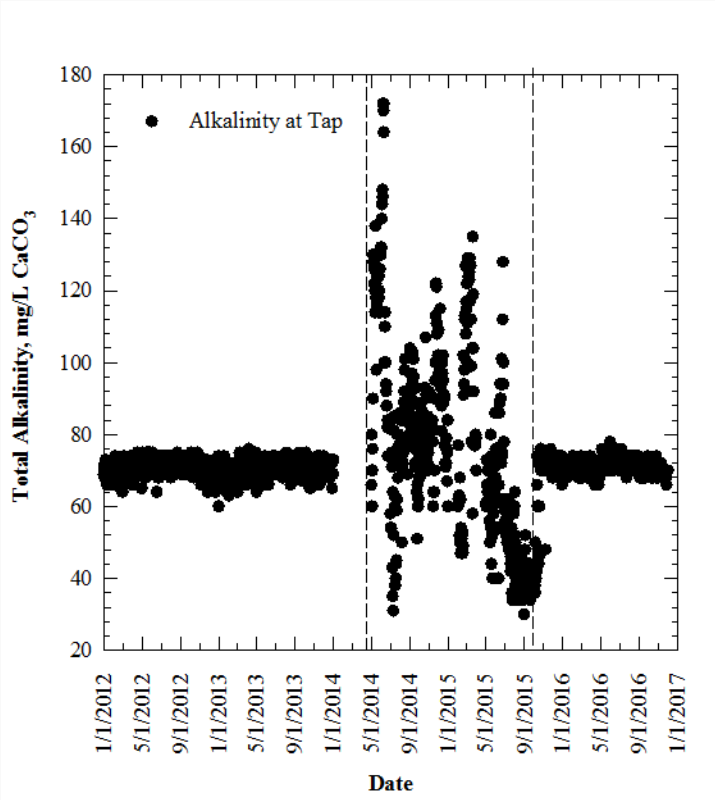
EPA Region 5 Flint Data Summit

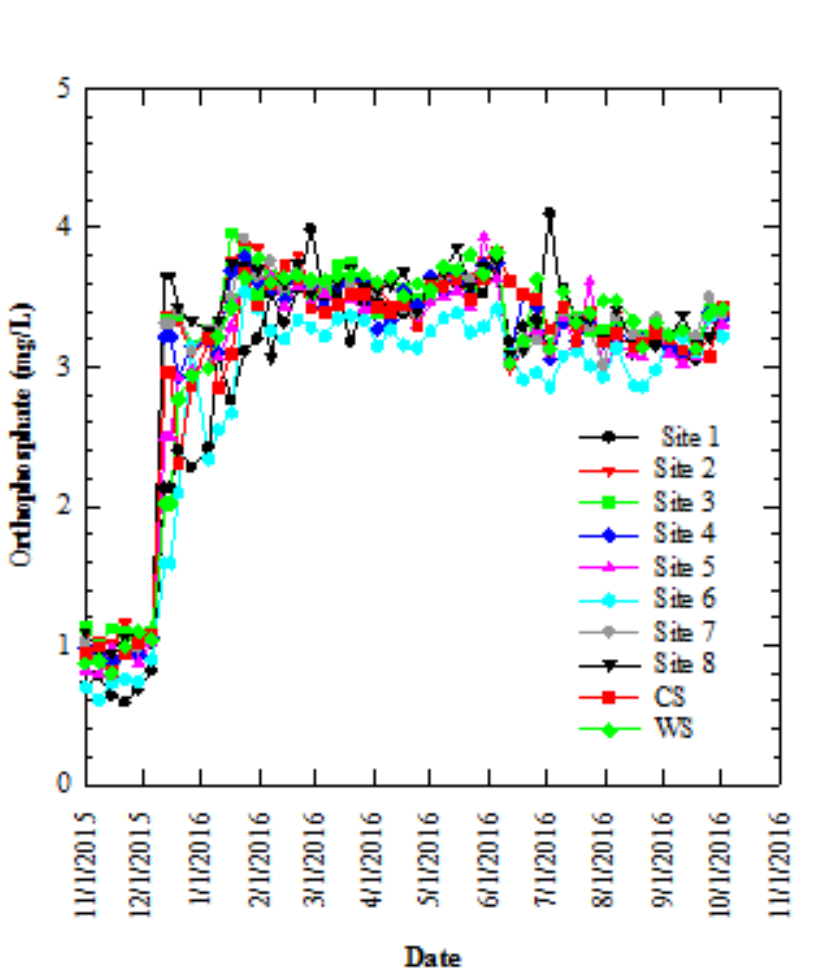
January 10, 2017
Chicago, IL

“Tap” Water Quality: pH and Alkalinity





DS Water Quality: Orthophosphate



5.2 Corrosion Control Treatment Optimization Evaluations

- 5.2.1 Short-Term (Current) Lead Release Optimization Evaluation.
- 5.2.2 Simultaneous Compliance Optimization Pilot Testing Prior to Flint Water Plant Treatment of KWA Water

Exhumed pipes to pipe loop rigs

Pipe rig design/construction

- Pipe loop rigs (4) built by EPA in Cincinnati from previous work (Jan. 25-Feb. 4, 2016)
  - Constructed PVC, unistrut frame, tubing, etc..
  - Flow meters
  - Chemical feed ports
  - Lead pipe from Flint DS
- Delivered and installed (w/o lead pipe) in Flint WTP (Feb. 18 and Feb. 24, 2016)
- Location in plant gets finished water after phosphate supplementation
- Primary focus
  - Observe current CCT performance under best conditions
  - Anticipate/simulate KWA source changeover impacts in future

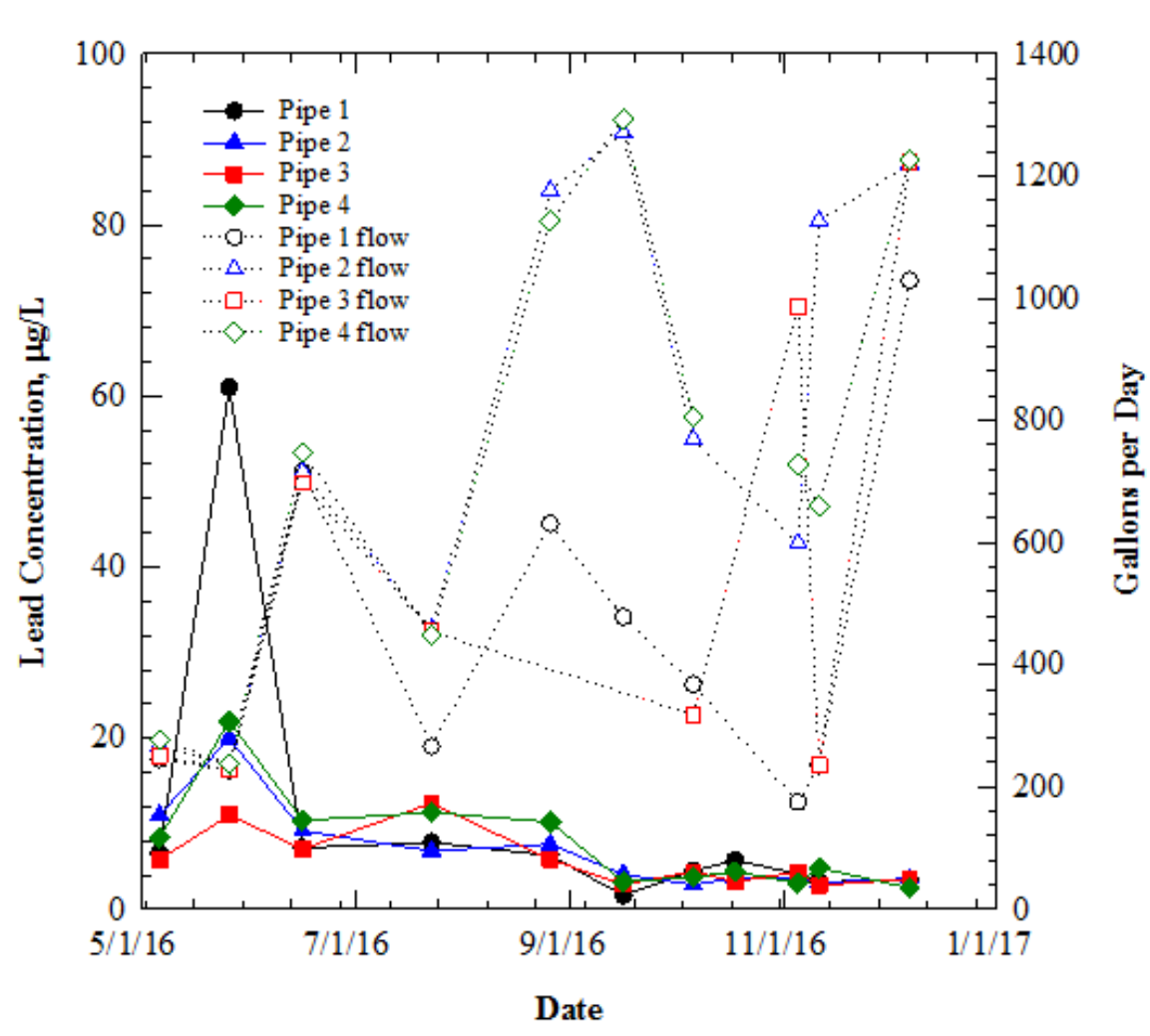
Pipe rig design/construction

- Lead pipes removed from 4 different homes (March 7-18, 2016)
  - 2 homes from “high” DS chlorine zone and 2 homes from “low” DS chlorine zone
  - Pipes cut into four 4 foot long sections in field
  - Pipes sealed, transported
  - Additional sections preserved for solids/surface analysis

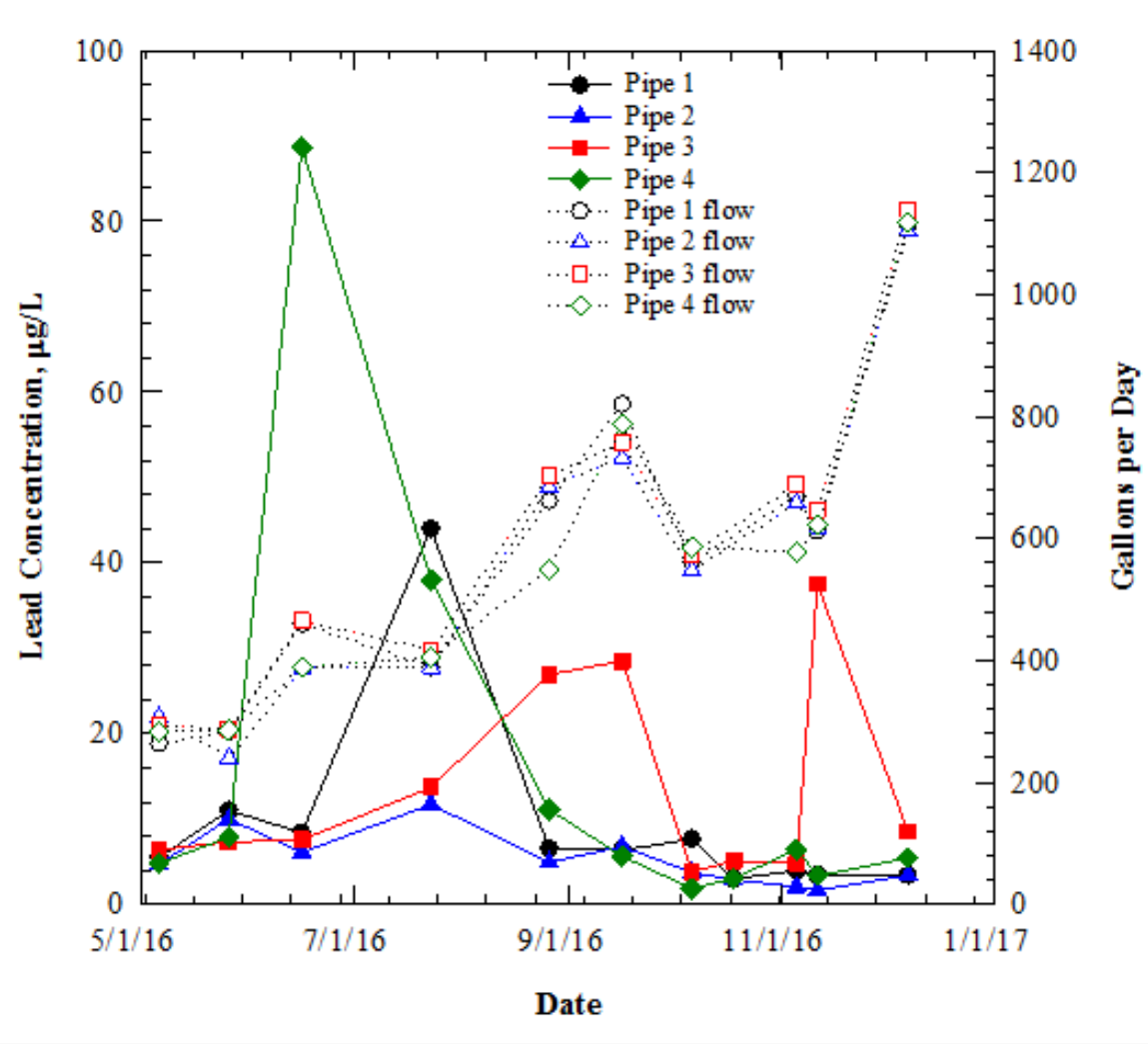
Pipe rig operations

- Loops were operated under continuous flow
  - Solenoids installed on each pipe (April 18-19, 2016)
  - On/off cycling (6 cycles)
- Target total run time 3.5 hours at 1 gpm (210 gpd)
- 8 hour stagnation time
- Periodic sampling started in May

Overlay of 8 hour stagnation total Pb/flow: Rig C

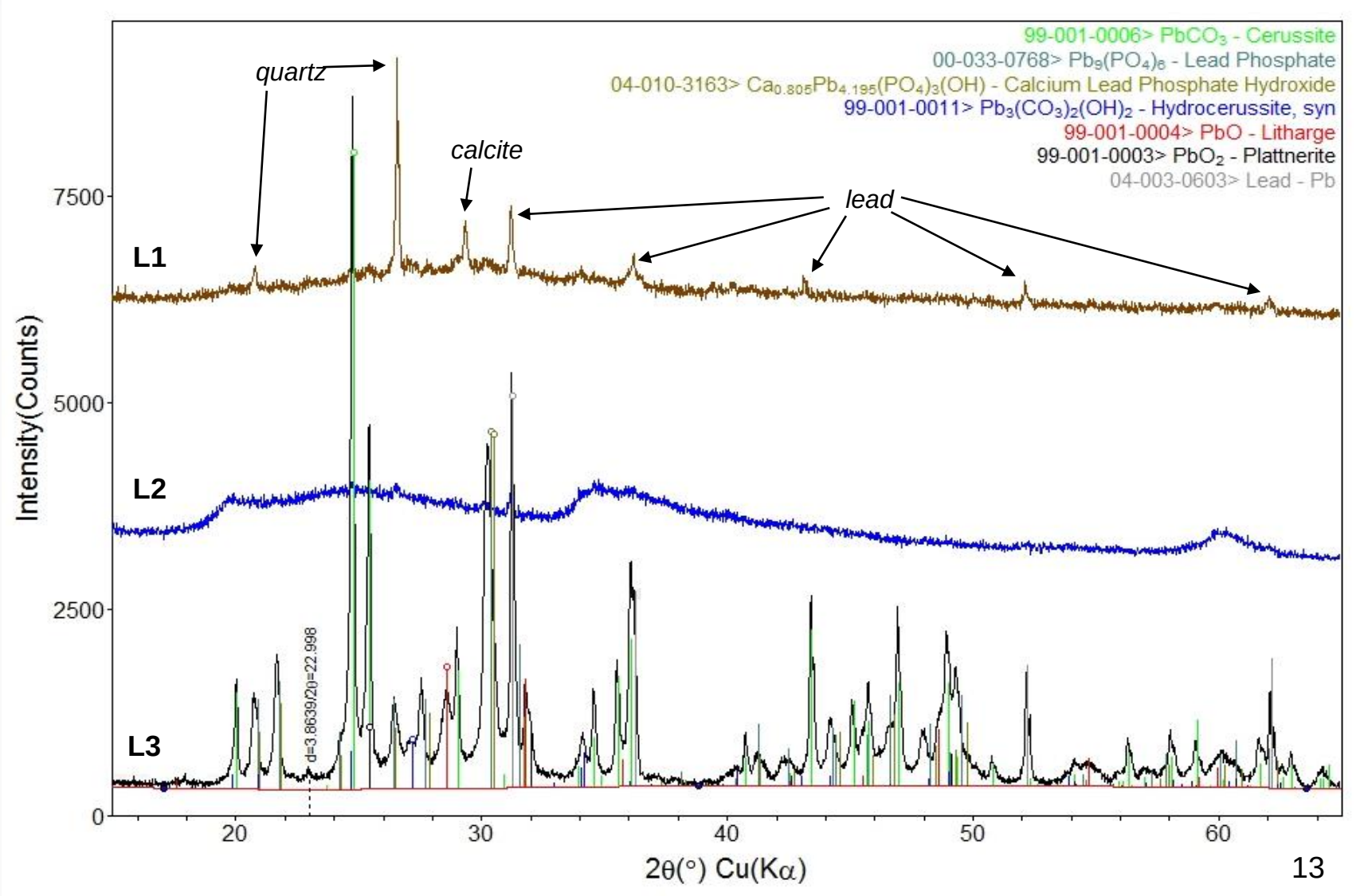


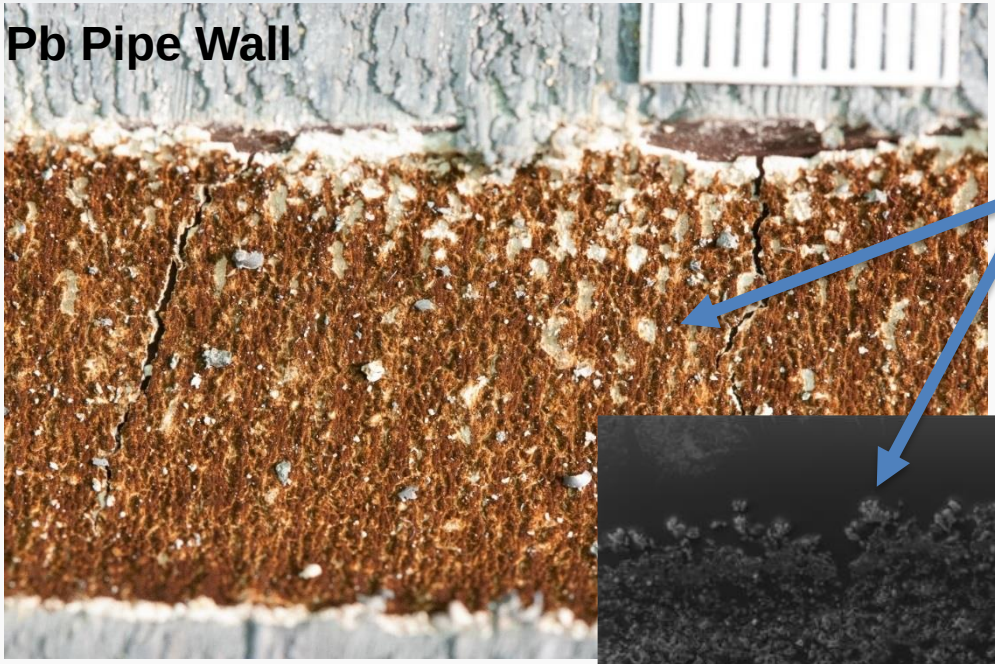
Overlay of 8 hour stagnation total Pb/flow: Rig B



Scale analysis for long-term mechanism of corrosion control strategy

Flint initial samples (March-April 2016)


99-001-0006> PbCO3 - Cerussite
00-033-0768> Pb9(PO4)6 - Lead Phosphate
04-010-3163> Ca0.805Pb4.195(PO4)3(OH) - Calcium Lead Phosphate Hydroxide
99-001-0011> Pb3(CO3)2(OH)2 - Hydrocerussite, syn
99-001-0004> PbO - Litharge
99-001-0003> PbO2 - Plattnerite
04-003-0603> Lead - Pb
quartz
calcite
lead
L1
L2
L3
d=3.8639/2θ=22.998
Intensity(Counts)
7500
5000
2500
0
20
30
40
50
60
2θ(°) Cu(Kα)

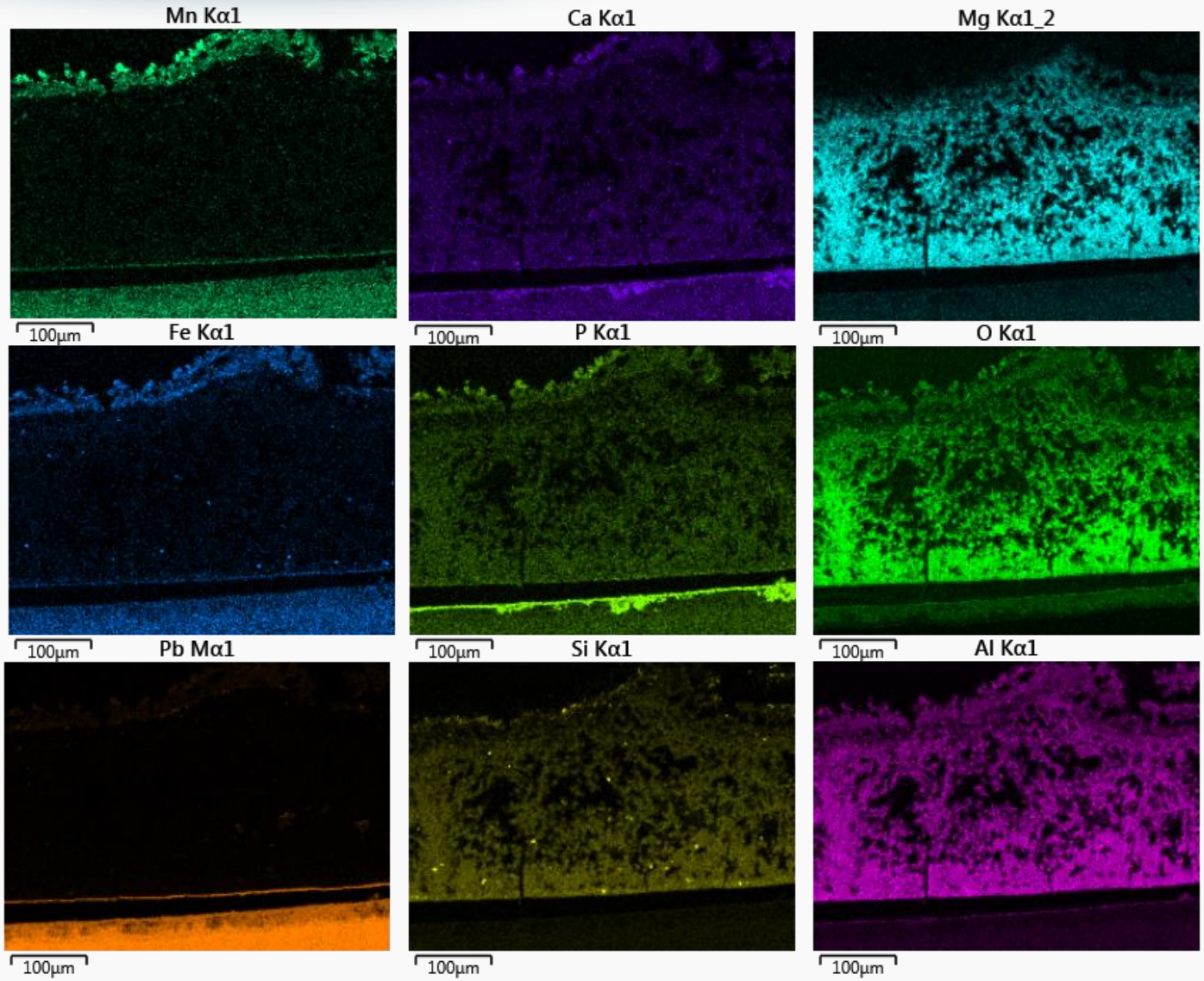


Scale Surface

Micrograph

Macro Photo

Void filled with epoxy


Mn Kα1
Ca Kα1
Mg Kα1_2
100µm
100µm
100µm
Fe Kα1
P Kα1
O Kα1
100µm
100µm
100µm
Pb Mα1
Si Kα1
Al Kα1
100µm
100µm
100µm

Scale Compounds Summary

L1 Amorphous layer rich in Fe and Mn, some quartz and calcite?

L2 Amorphous layer rich in Al, Mg, and Si

L3

Compound	Relative Amount
cerussite ($PbCO_3$)	Major
lead phosphate ($Ca_xPb_x(PO_4)_3(OH)$?, $Pb_9(PO_4)_6$?)	Major to moderate
plattnerite (PbO_2)	Moderate to trace
litharge (PbO)	Minor
hydrocerussite ($Pb_3(CO_3)_2(OH)_2$)	Trace

Acknowledgments

Mike DeSantis, Jennifer Tully (ORISE)

Andrea Porter, Val Bosscher, Miguel DelToral (Region 5)

Dan Williams, Chris Parrett, Christy Muhlen (ORD/NRMRL/WSWRD)

Kelly Cahalan, ORAU program