

Approaching ISCO Application Differently:

Lessons Learned over 15 Years of “Low-Volume Chemical Oxidant Injection” Systems

June 4, 2024, 12:10-12:35

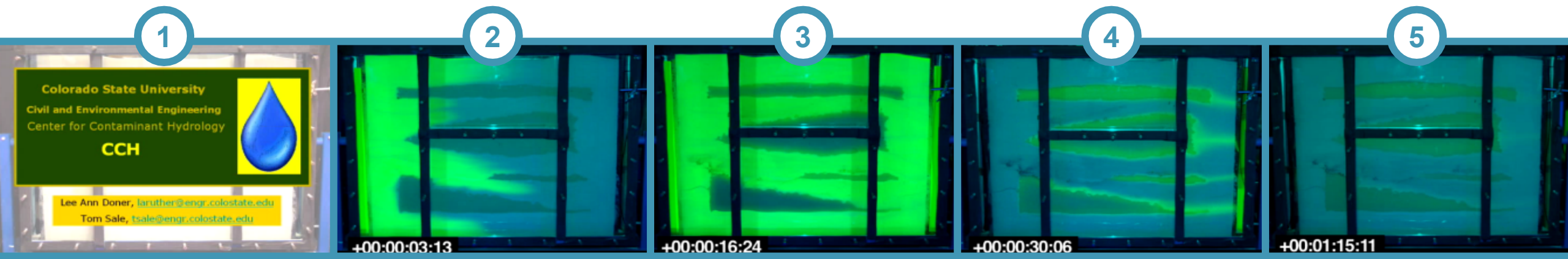


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Remediation Services



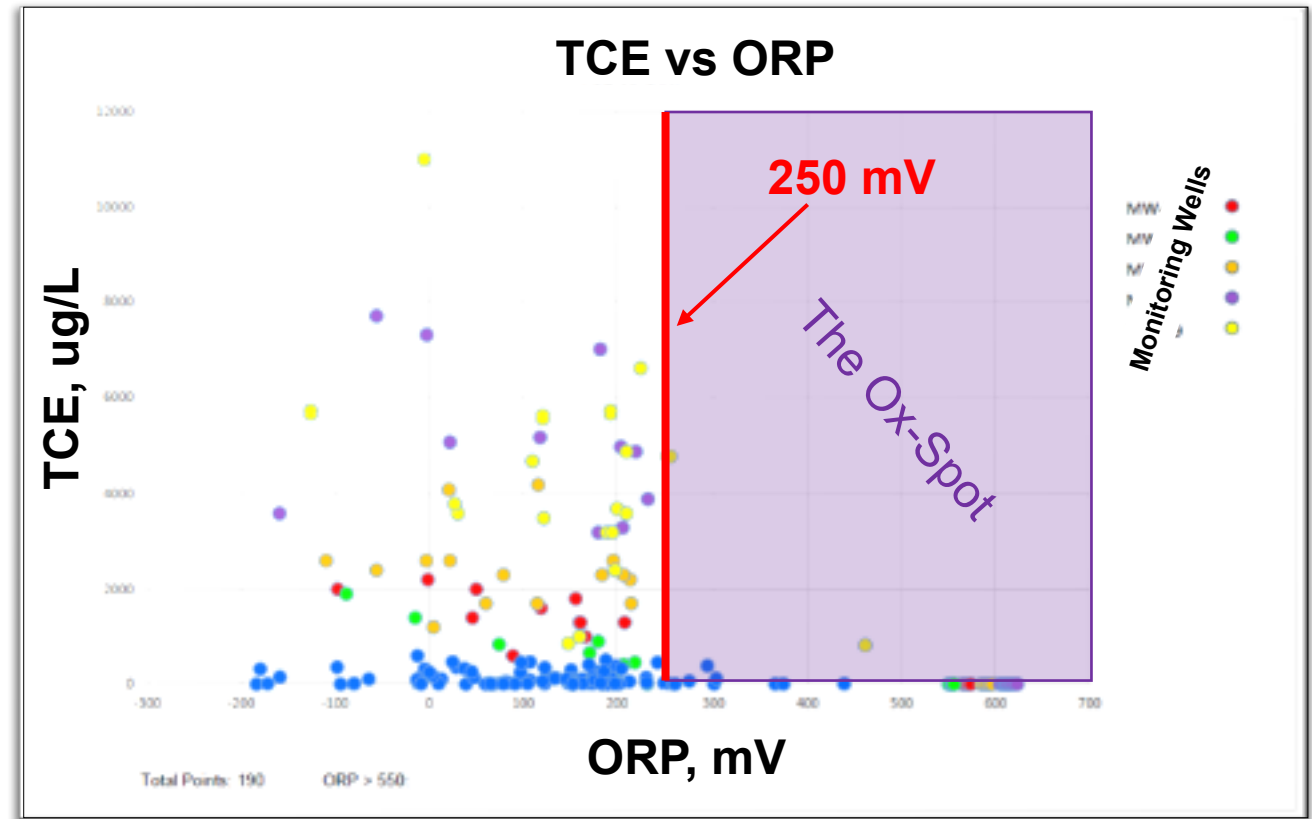
Technology Overview

- Designed specifically to develop and sustain optimal in-situ oxidizing conditions
- Macro-level lateral & vertical distribution of oxidant for micro-level penetration into lower permeability units
- Automated system metering low volumes of high concentration oxidants daily



Technology Overview

- Highly oxidative treatment zones continue to expand with ongoing oxidant application via LVCOI
- ORP front further expands and migrates down-gradient



Technology Overview

Low-volume

Applications of 1 to 100 gallons per day

Versatile

Flexible / Adaptable / Scalable

Continuous

Reliable & Predictable Application

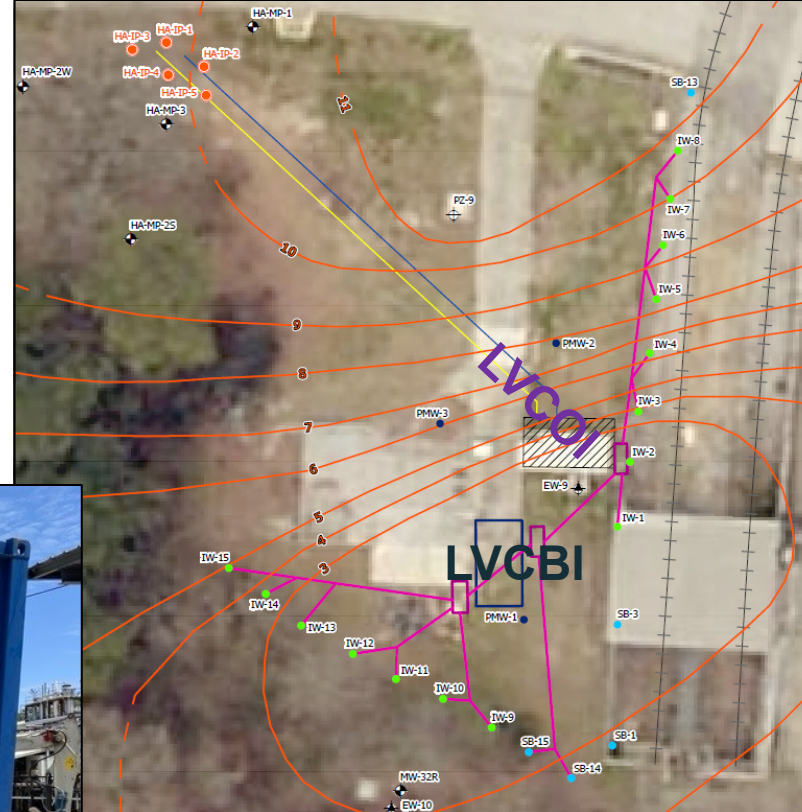
Oxidant

Or Other Suitable Amendment

Injections

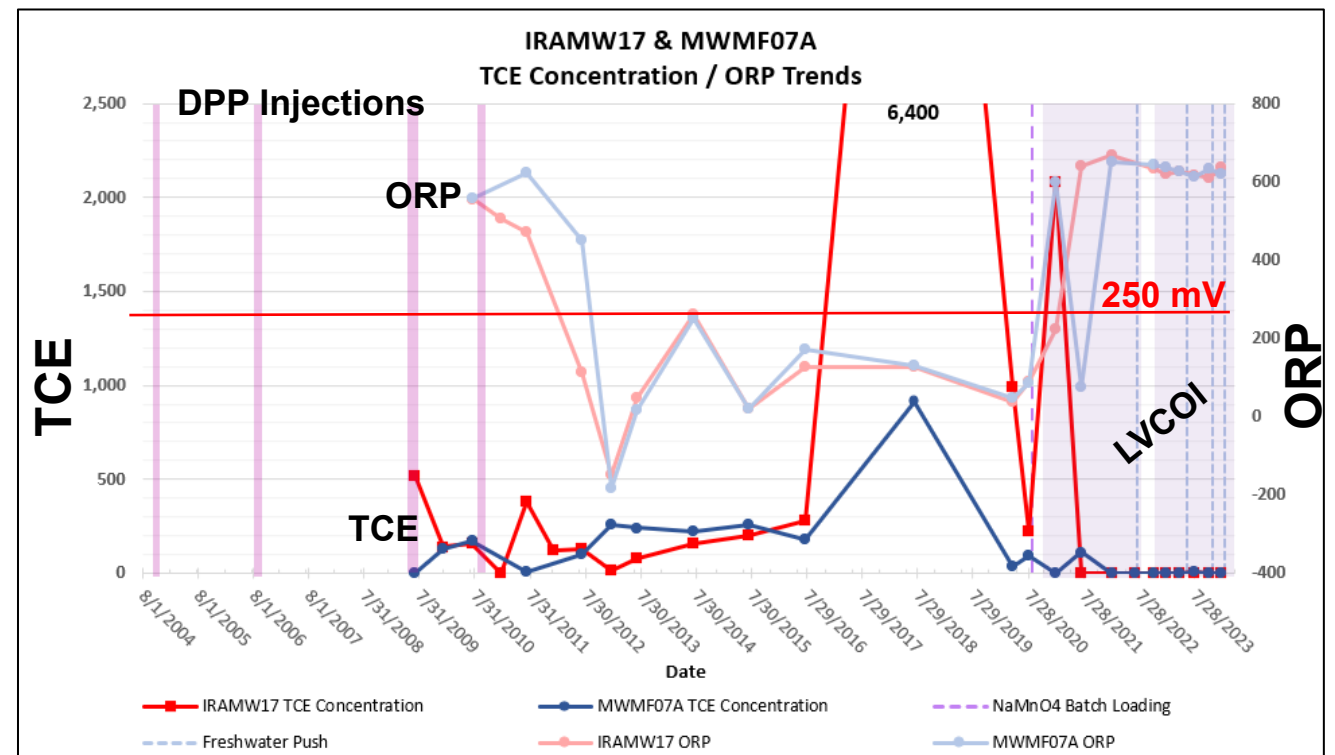
Dedicated Subgrade Infrastructure

Technology Overview



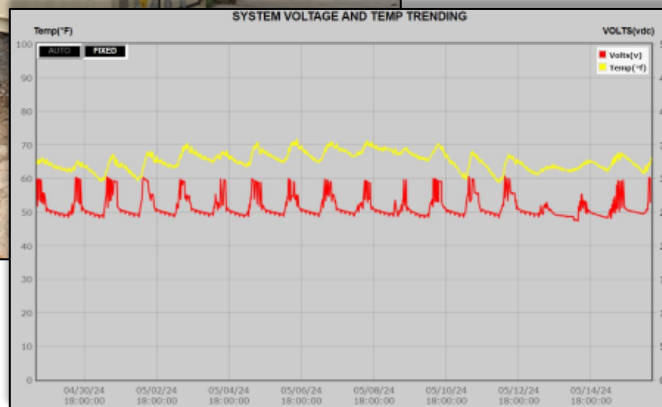
Lessons Learned

- ① Can LVCOI systems drive oxidant into low permeable units to reduce and/or mitigate matrix diffusion?



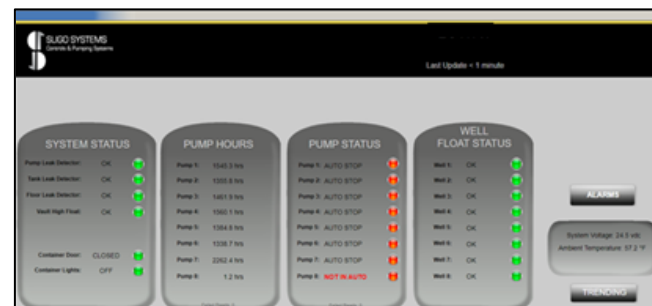
Lessons Learned

② Can LVCOI systems be deployed in remote environments without electrical infrastructure?



Lessons Learned

③ Are LVCOI systems individualized, scalable, and adaptable in response to treatment or site conditions?



Lessons Learned

- ④ Can LVCOI systems be deployed in cold environments and successfully operate through winter?



Lessons Learned

⑤ Can ISCO injections be safely controlled remotely using LVCOI systems?



Lessons Learned

⑥ Are regulators familiar with LVCOI applications and/or supported by regulatory agencies?

- *“The LVCOI systems using solar collection panels as the primary source of power have operated and enabled delivery of chemical oxidant reagent in impacted areas without the concern for available electricity. The incorporation of renewable solar energy into the design of the chemical oxidation system **demonstrates creativity, innovation and a commitment to environmental stewardship.**” – USEPA Region VIII*
- *“The chemical oxidation injection program implemented at Hangar 4 demonstrates **a proactive approach to remediating groundwater in our State.** In particular, over the last four years, the system has been successful in reducing contaminant mass source concentrations in groundwater associated with a historic release of TCE.” – KS DPHE*
- **2014 NGWA “Outstanding Groundwater Project” Award**



Lessons Learned

⑦ Can LVCOI systems address my recalcitrant area without the capital costs?



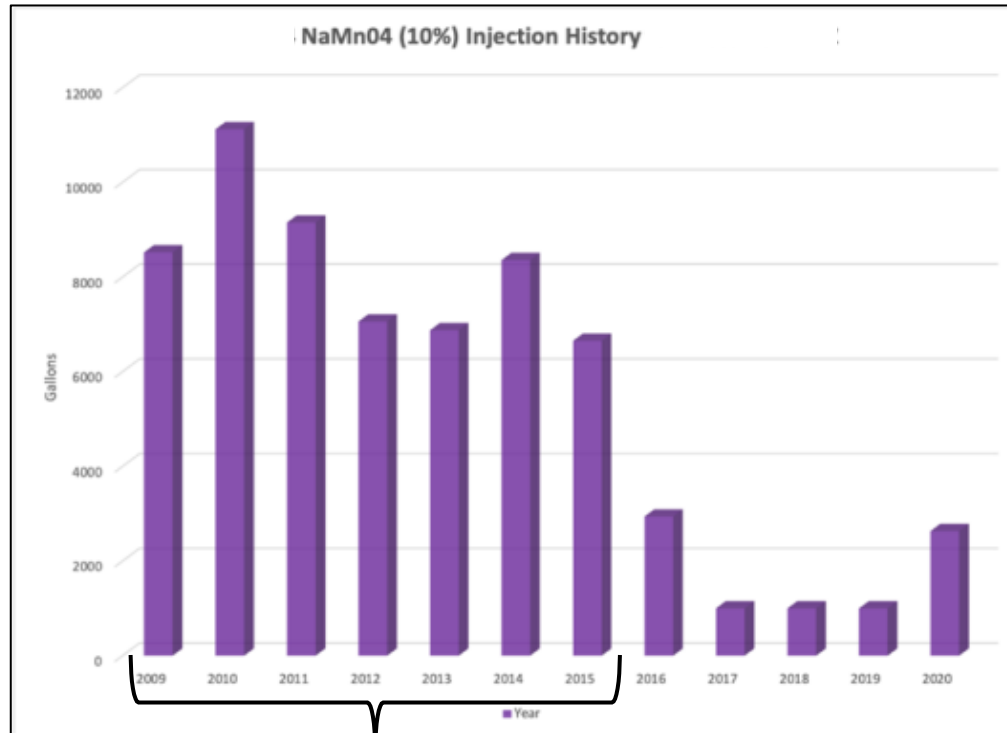
Lessons Learned

- ⑧ Does pre-treatment of supply water for oxidant injections have a noticeable effect?

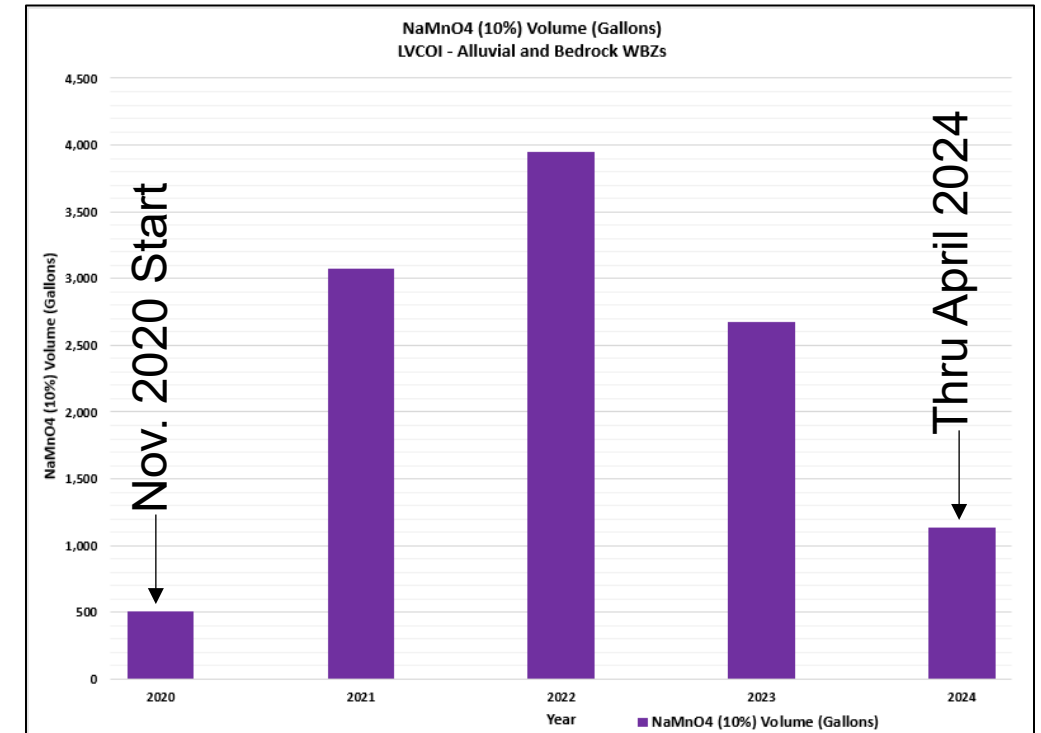


Lessons Learned

⑨ Do LVCOI systems optimize oxidant distribution?



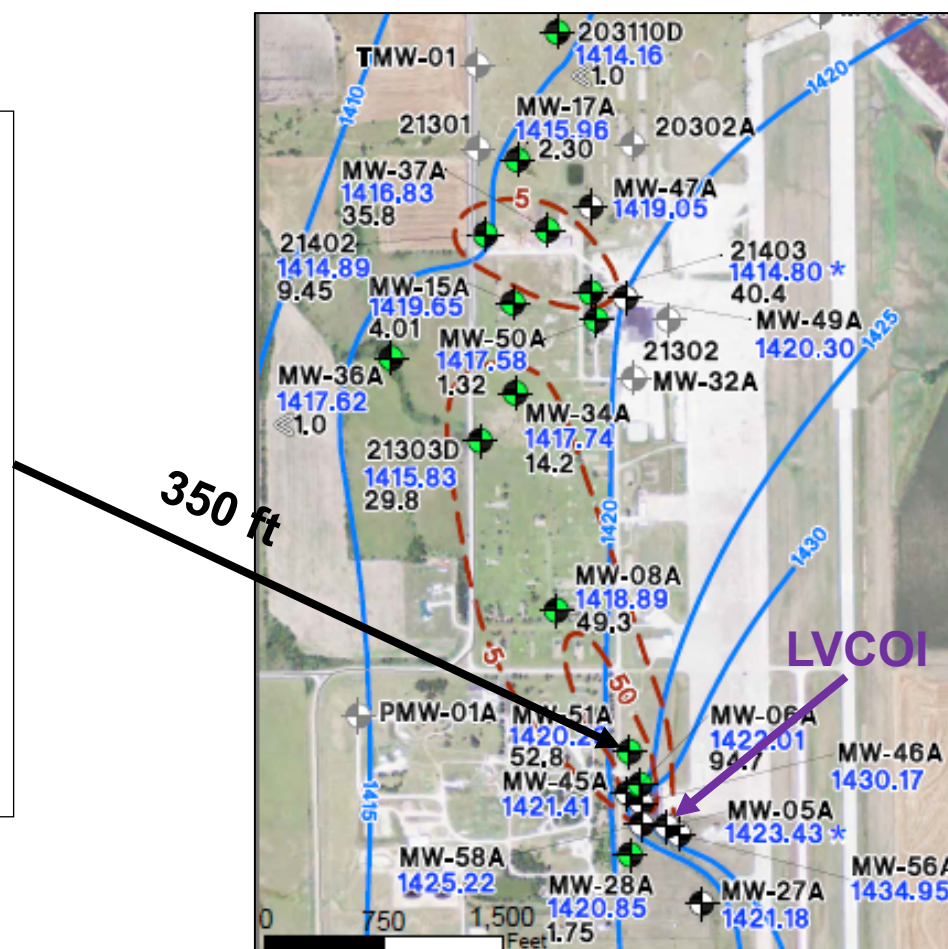
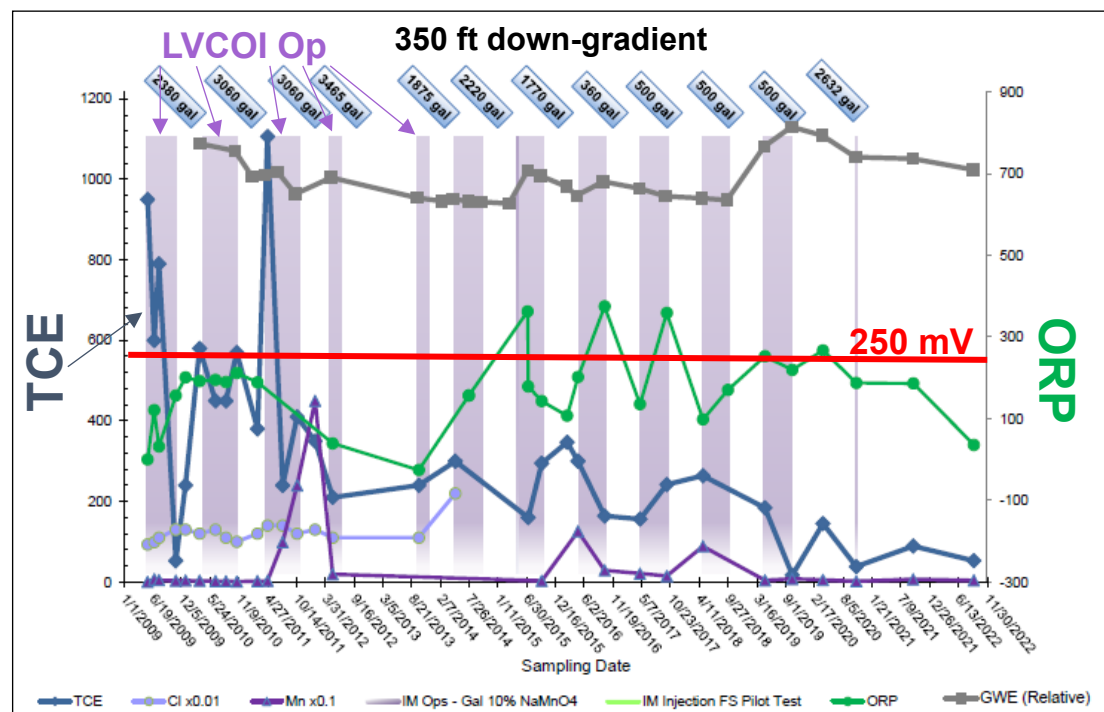
WBZ 1 ~7,500 gallons 10% per year
WBZ 2 ~2,300 gallons 10% per year



~3,000 Gallons 10% per Year

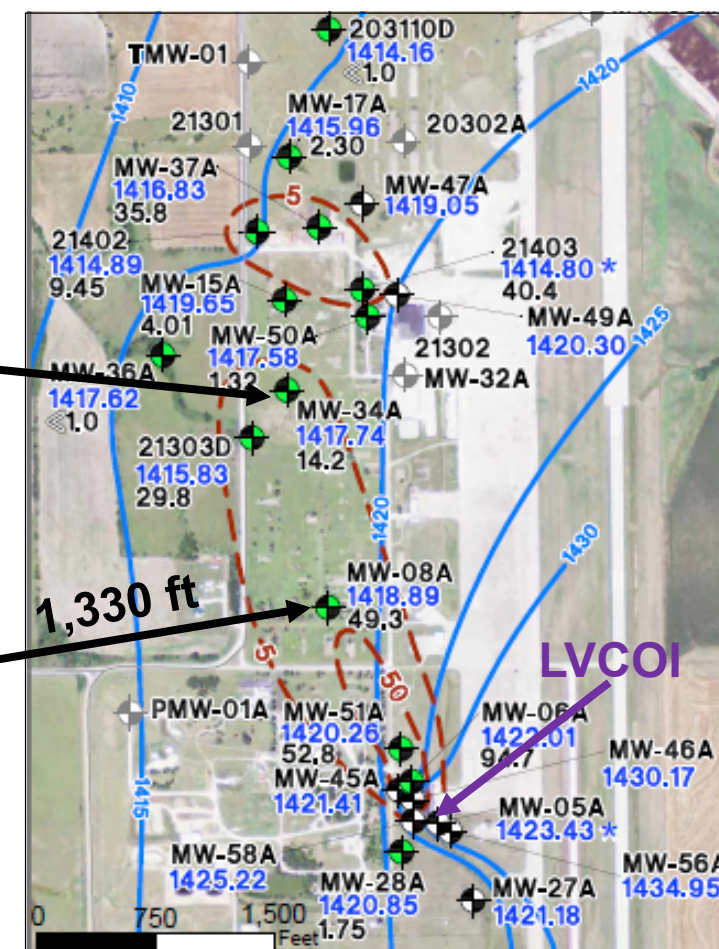
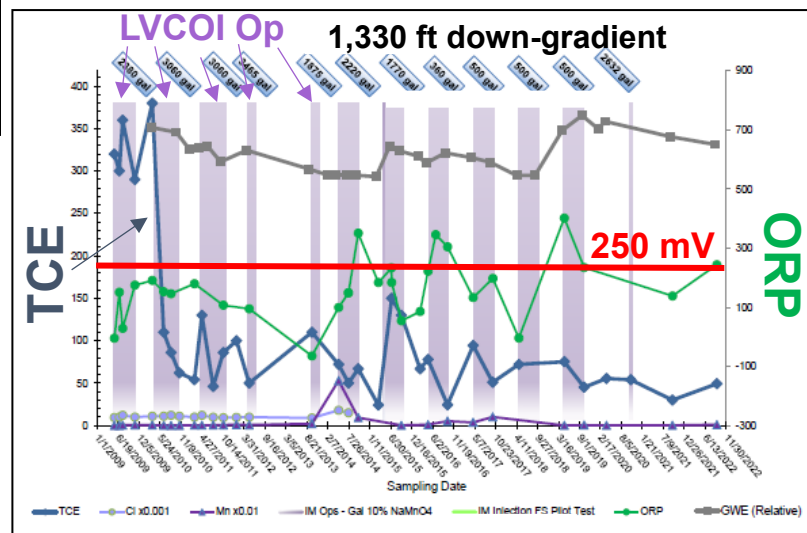
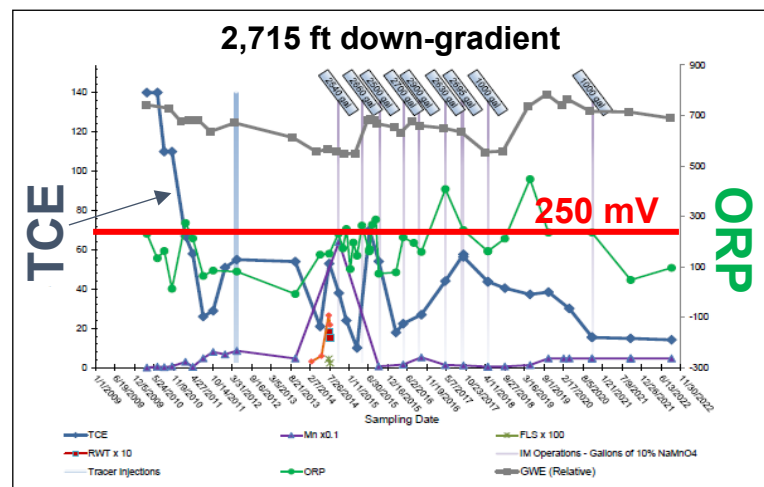
Lessons Learned

10 Do LVCOI systems achieve typical batch injection ROIs?



Lessons Learned

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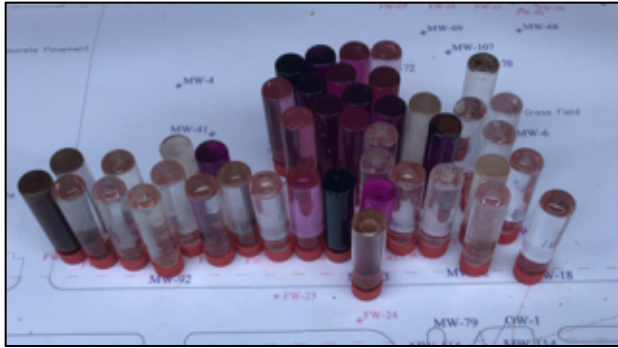


2,715 ft

1,330 ft

Lessons Learned

⑪ Are more-robust performance monitoring programs warranted?



Lessons Learned

- ⑫ Do LVCOIs disrupt existing owner/tenant operations with a large footprint or frequent access needs?



Thank You!

Questions?

- **WCG**

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WCG Locations



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