

# Distribution System Monitoring for VOCs and SVOCs After the Marshall Fire

February 13, 2023

# Louisville Water System Overview

- Two treatment plants
  - South Plant impacted by the fire and initially offline due to loss of power
  - North Plant able to maintain operation throughout the disaster
- Louisville maintained pressure for most of the fire, but began receiving reports of low pressure
- Determined tank levels had reached critical levels – to avoid full pressure loss, opened valves to send untreated reservoir water into distribution system

# Water System Impacts

- Throughout the fire, water system staff worked to shut curb stops and valves to destroyed homes and isolating neighborhoods to reduce water loss
- Estimated that Louisville was losing between 50% to 90% of the water they were producing





# Initial Water System Recovery

- Assessment and flushing of distribution system
  - Boil water advisory issued
  - Flushing began at treatment plants moving to the terminal mains in the system
  - Operations staff, together with mutual aid from neighboring communities, completed full flush of distribution system in 4 days (typically requires up to 6 weeks)
  - Boil water advisory lifted upon successful flushing and no detection of coliforms



# VOC and SVOC Concerns

- Recent California and Oregon wildfire-impacted utilities had widespread occurrence
- Testing methods difficult to nail down and get labs to perform with quick response
- Hundreds of samples collected, analyzed, shared
- Results indicated limited occurrence but legitimate concerns
- Flushing demonstrated to mitigate concerns
- Sampling program developed in collaboration with national experts and CDPHE

# Why VOCs?

- Volatile organic compounds have become an area of concern in the aftermath of wildfires
- VOC contamination of water systems discovered after wildfires in California and Oregon (USEPA 2021; FEMA 2020)
- Several public water systems have experienced wildfire related benzene contamination since 2017 (Proctor et al. 2019; Odumayomi et al. 2021)
- Potential sources of VOC contamination include:
  - Heating of pipe materials and direct leaching
  - Depressurization or fire fighting demands allowing contaminated materials to enter infrastructure (Whelton et al., 2023)

# Louisville Analytical Plan

- Laboratories

- 6 laboratories contacted - difficult to find a lab capable of handling sample volume and required turnaround time (< 5 days, 2-3 days ideal)
- Bottle shortage



- Methods

- VOCs - EPA Methods 524.2, 524.4, and 8260C were applied by different labs with varied chemicals included in the method – determined a list of required chemicals in collaboration with CDPHE and other experts
- SVOC - EPA Method 8270E





# Louisville Sampling Plan

## 1. Distribution system

- Sampling from hydrants and blow-offs prior to opening curb stops



## 2. Standing structures

- Sample habitable structures in burn areas upon clearing the mains



# Louisville Sampling Plan

## 3. Burned structures

- Investigate contamination in service lines to burned structures



## 4. Meter pits

- Sampling at structures under construction before connecting meter





# 1. Distribution system sample methods

- Representative locations selected throughout burn area
- 1<sup>st</sup> sample – stagnant
- 2<sup>nd</sup> sample – flush for ~5 minutes and check chlorine
- Flush and resample as necessary dependent on results
- Hydraulically isolated from undamaged areas until acceptable VOC results
- Precautionary sampling is ongoing





## 2. Standing Structure sample methods

- Upon receiving cleared samples from the main, move to sampling standing structures in the burn area
- Curb stops opened by City staff
- Samples taken from kitchen sink
- 1<sup>st</sup> sample – stagnant
- 2<sup>nd</sup> sample – flush entire home for ~30 minutes, check chlorine
- Curb stop closed again until VOCs are cleared





### 3. Burned Structure sample methods

- After clearing habitable structures, move to investigating subset of burned structure service lines
- Sample from service line to determine required excavation during rebuild process
- 1<sup>st</sup> sample – stagnant
- 2<sup>nd</sup> sample – flush for 5 minutes, check chlorine
- Excavated and resampled as needed



## 4. Meter pit sample methods

- Meter pit sampling included in permitting and inspection process
- No VOCs detected so far
- May be discontinued upon sampling statistically significant number of locations
- 1<sup>st</sup> sample – stagnant
- 2<sup>nd</sup> sample – flush for 5 minutes, check chlorine
- Meter installed after receiving acceptable results





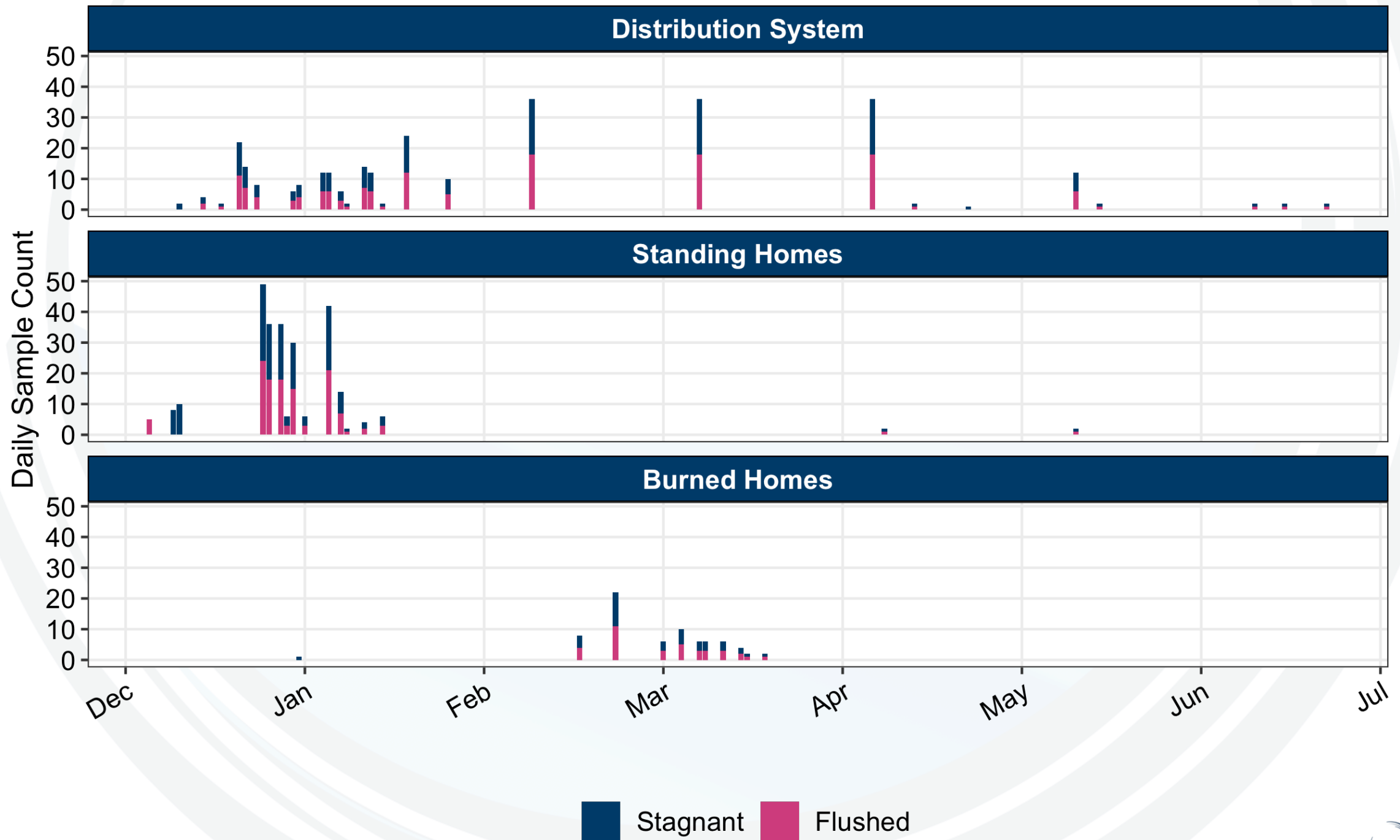
# Results

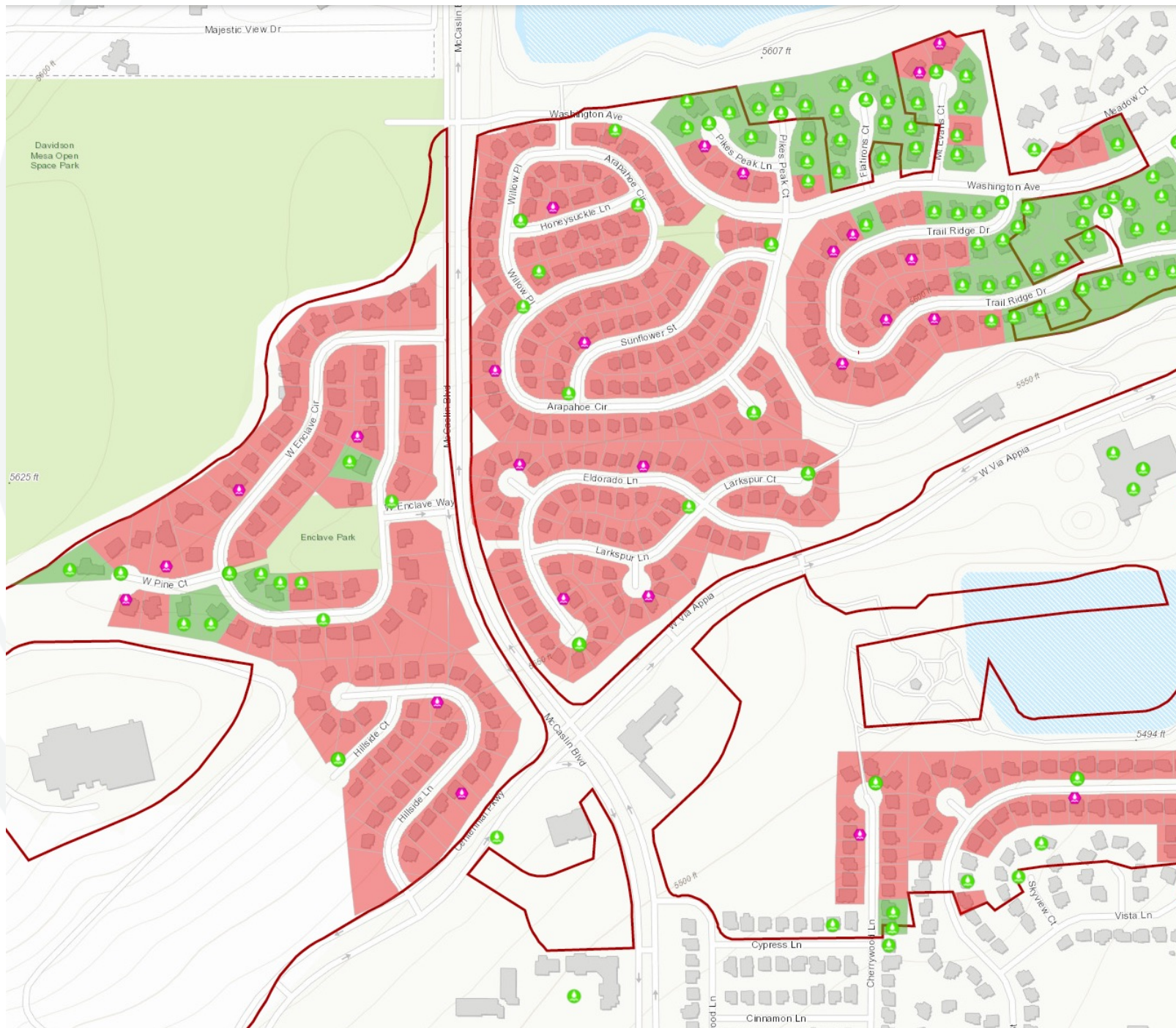
- Total number of samples: ~700 (not including some in process)

Sample Type	Number of Stagnant	Number of Flushed
Distribution System	145	144
Standing Structures	118	117
Burned Structures	37	36
Meter Pits	~30	~30
TOTAL	~350	~350

Some additional samples not included in these categories (didn't follow flush/stagnant protocol, etc)

Total number of individual analyses performed: > 80,000





Legend

Water Sampling

Sample Noncompliant

Sample Compliant

Sample Pending

Historic Noncompliant Sample

Historic Compliant Sample

Burned Structure Water Sampling

Property Water Sampling

No Water Service

Sample Scheduled

Sample Pending

Sample Cleared to Resume Water Service

Sample Retest

Water Main Off

Water Off

Water On

Louisville Wildfire Burn Scar

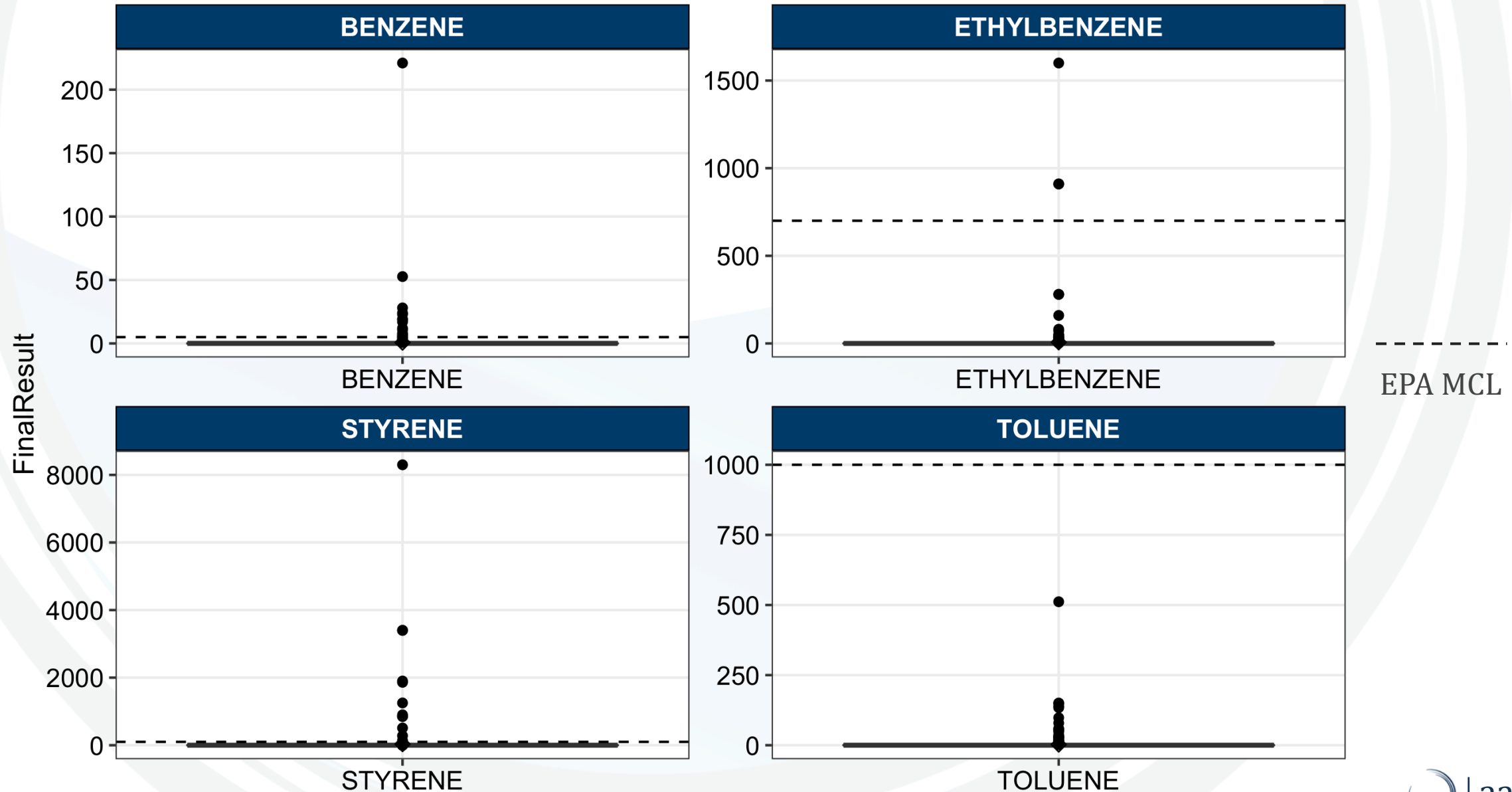


# Results

- 912 analyses (~1%) were above the MDL
  - Not including THMs
- 30 analyses (<0.1%) exceeded an MCL
  - VOCs: ethylbenzene (3), benzene (15), styrene (12)
  - Follow up samples found that flushing rapidly reduced chemical contamination

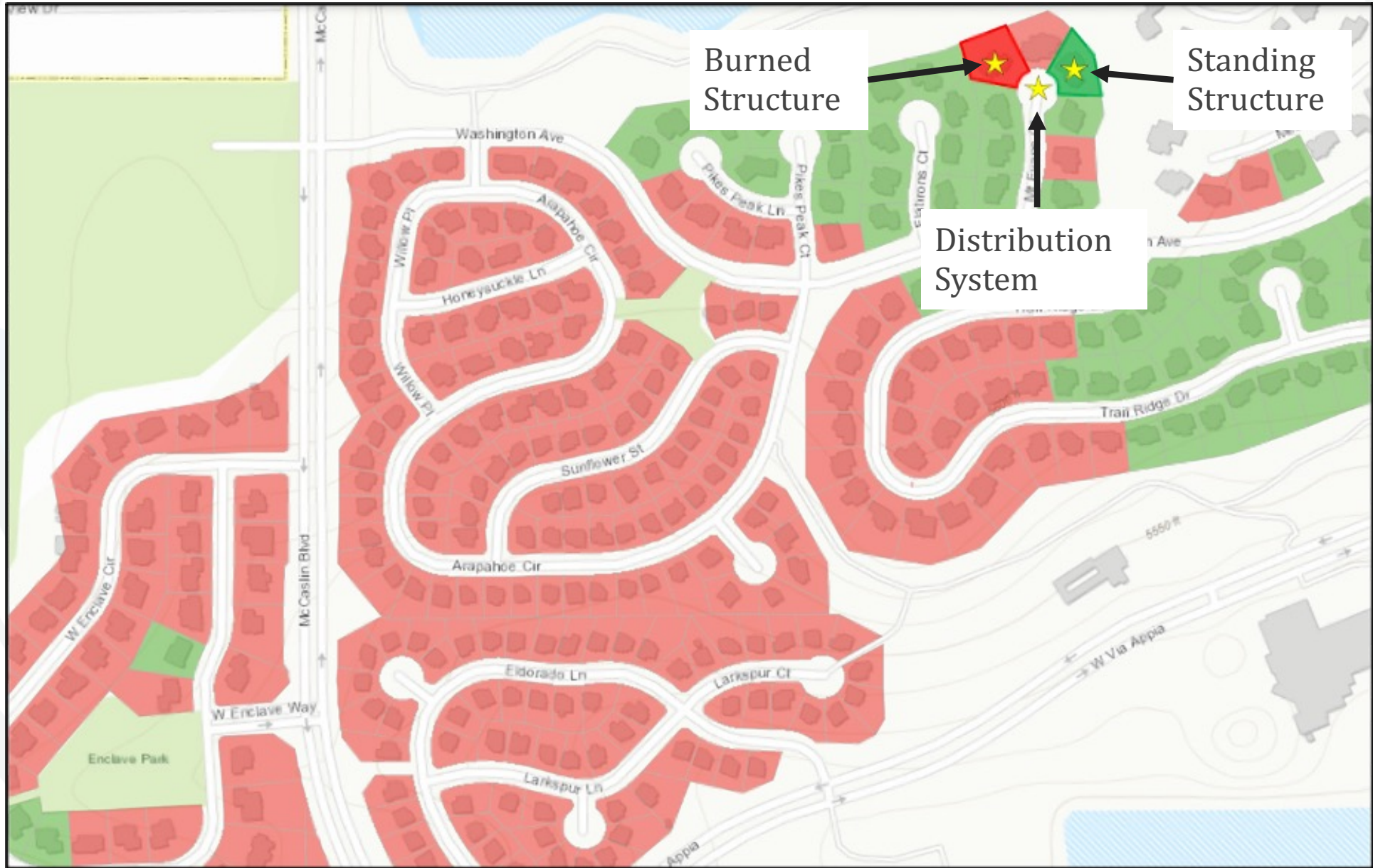
**Does not include meter pit sampling**

# Most frequently above MDL



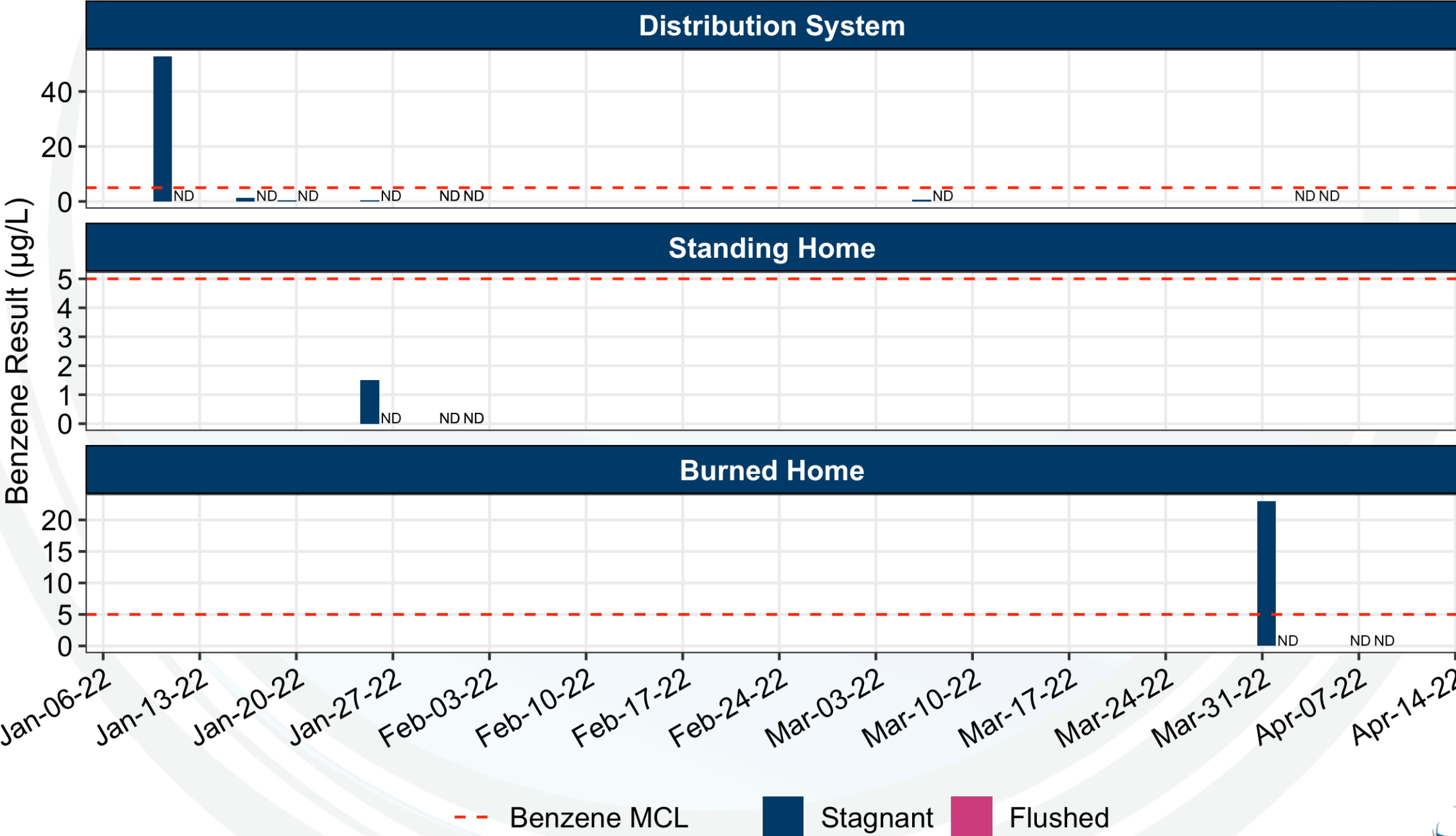
# Snapshot of a Neighborhood

- Mt Evans Court – collected samples from distribution system, standing structures, and burned structures
- Hydrant sample:
  - Detected benzene, ethylbenzene, toluene
  - Benzene above MCL in stagnant sample - ND after flushing
- Standing structure:
  - Detected benzene below MCL in stagnant, ND in flush
  - Repeated sample after 72-hour stagnation – no benzene detected
- Burned structure
  - Benzene exceeded MCL in stagnant sample, ND in flush
  - Repeated sample after 72-hour stagnation – no benzene detected





# Benzene at Mt. Evans Court



# Summary

- One of the most comprehensive sampling efforts for chemical contamination in a distribution system post-wildfire
- Possibly the first confirmation of this type of chemical contamination in Colorado
- Maintaining distribution system pressure is hypothesized to prevent contaminants from entering distribution system during fire related disasters
- Where possible, determine sampling methods and laboratories before they are needed
- Flushing significantly reduced contaminant levels and is a critical part of the recovery process



# Acknowledgements

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# Questions?

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