

Implementation of Wisconsin's Preferential Pathway and Conduit Vapor Intrusion Guidance, RR-649

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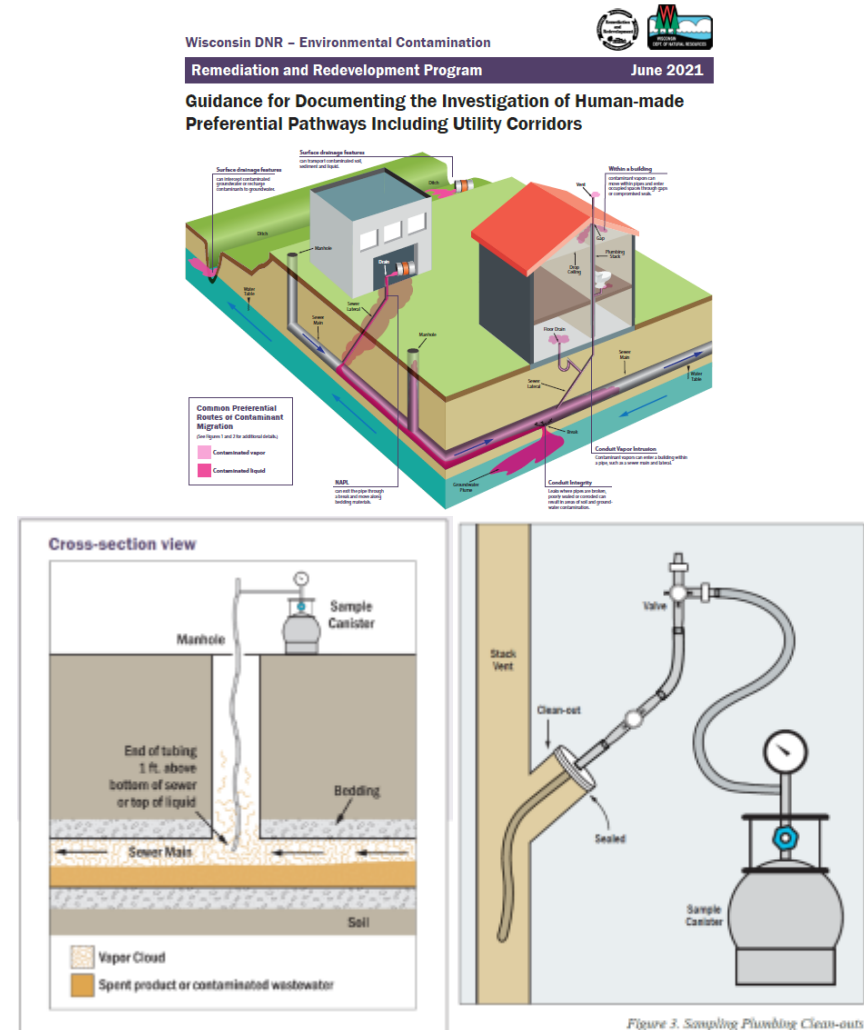
Outline

- Wisconsin Regulatory Setting
- Snapshot of conduit data from Wisconsin investigations
 - 558 samples from manholes, cleanouts, plumbing, sumps
- Highlight two investigations
- Discuss lessons learned and remaining challenges

RR-649 (2021) Key Recommendations

Collect grab canister conduit vapor samples

- Source property (manholes (MHs), cleanouts, etc.)
- Sewer Main
- Sanitary Sewer Gas Screening Level (SSGSL) using 0.03 Attenuation Factor and Target Indoor Air Concentration (*Sanitary Main MHs only*)
- Connected buildings



NR-700 Rule Series Investigations

- “One Clean-up Program”
- Self-implementing with required steps (detailed guidance documents)
- Responsible Parties (causers & possessors) – WI Admin. Code requires investigation of all pathways including conduits
- 2,700 Open Cases (about 885 with TCE)
- 28,000 Closed cases (estimated 1,600 with TCE)
- 1,000s of properties with chlorinated solvent use never reported

Conduit Sample Type and Setting* (6/2019 – 5/2024)

Sample Type	Sanitary Sewer MH	Cleanout	Sump	Floor Drain	Plumbing	Storm Sewer MH
Canister	219	69	37	7	11	25
Beacon Passive	70		8			
Waterloo Membrane Sampler (WMS) Passive	24		7		4	
Gas Chromatograph	69	3		1	4	
Total	382	72	52	8	19	25

* May not include all data

Conduit Sampling Statistics (6/2019 – 5/2024)

Year	2019	2020	2021	2022	2023	2024
# Samples	46	49	51	78	269	59

Statistic	#
Consulting Firms	33
Dry Cleaners	34
Manufacturing	33
Petroleum	2
Landfills	1
Total Sites	70

Interior Plumbing and Sump Statistics - Vapor

Statistic	No. Locations	No. Samples	Det Freq (%)*	10 th (µg/m ³)	Median (µg/m ³)	90 th (µg/m ³)	Maximum (µg/m ³)
CO, FD, P Source	43	57	68	0.2	2.3	1,506	58,400
CO, FD, P Off-Source	22	42	76	0.6	16	230	410
Sumps	45	53	68	0.2	10.7	1111	3,700

Detection Limit used for statistics if not detected

CO = cleanout FD = floor drain P = other plumbing TCE unless noted * = % of samples

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Detection Limit used for statistics if not detected

↖
PCE

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Sanitary Sewer Manhole Statistics - Vapor

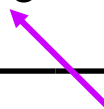
Statistic	No. Locations	No. Samples	Det Freq. (%)*	10 th (µg/m ³)	Median (µg/m ³)	90 th (µg/m ³)	Maximum (µg/m ³)
SA Up-flow MH (all)	57	88	58	0.3	1.3	26	484
SA Down-flow D	60	73	55	0.3	1.6	51.7	1,240
SA Down-flow D PCE	60	73	70	0.4	12	764.2	33,000
SA Down-flow M/L	137	210	79	0.3	15.3	564	7,660

SA = sanitary MH = manhole D = dry cleaner M = manufacturing L = landfill
TCE unless noted * = % of samples

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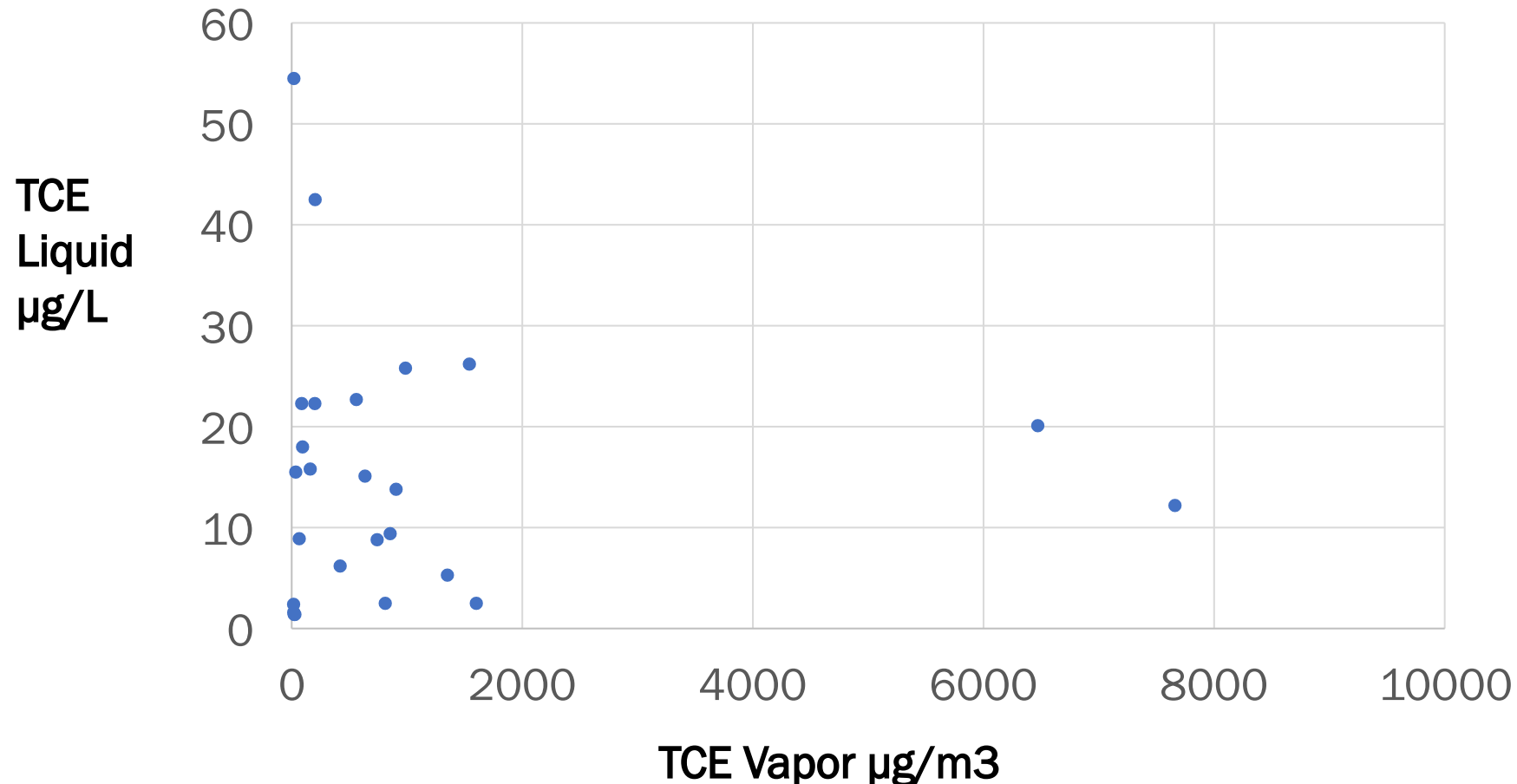
68% of Manholes



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Liquid vs Vapor Concentrations

25 Sanitary Sewer Manhole Samples



24 other samples (not shown) with <0.76 µg/L liquid had vapor concentrations averaging 106 µg/m³ and a maximum of 960

Short-term Concentration Variation (Passive/Canister)

P = passive sampler

C = canister

G = grab

J = J flag

< = not detected

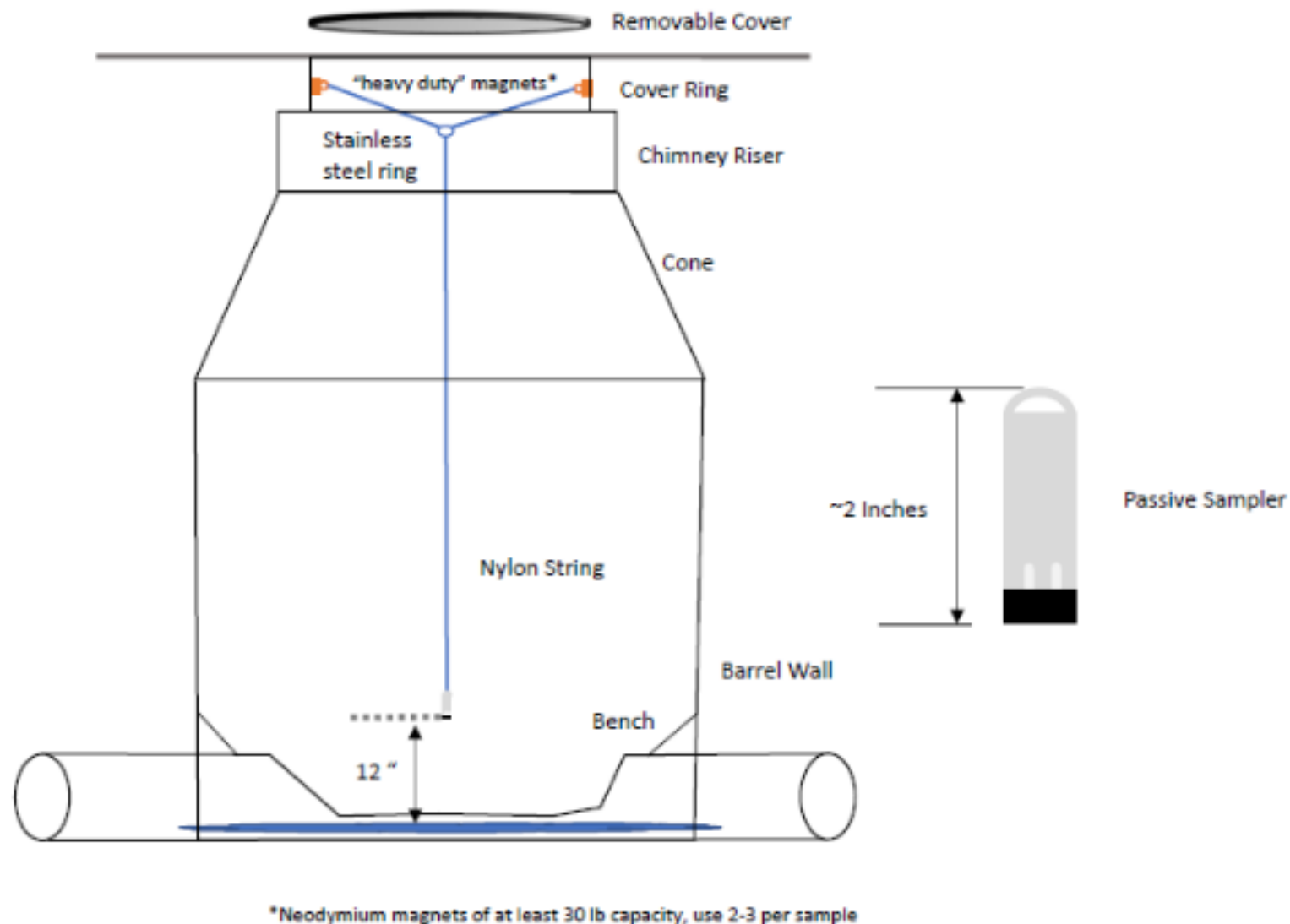
All sanitary sewer MHs

ID	Sample Type	Duration (Days)	Date/End Date	TCE µg/m3
86	P	6	11/22/22	2.68
86	C	G	11/16/22	0.64 J
87	P	6	11/22/22	8.24
87	C	G	11/16/22	0.46 J
88	P	6	11/22/22	4.59
88	C	G	11/16/22	<0.45
89	P	6	11/22/22	0.065 J
89	C	G	11/16/22	0.46 J
111	C	G	1/26/23	<10.7
111	P	7	1/26/23	<31.9
112	C	G	1/26/23	<10.7
112	P	7	1/26/23	<31.9
245	P	7	11/3/23	230
245	C	G	10/27/23	110
248	P	7	11/3/23	300
248	C	G	10/26/23	130

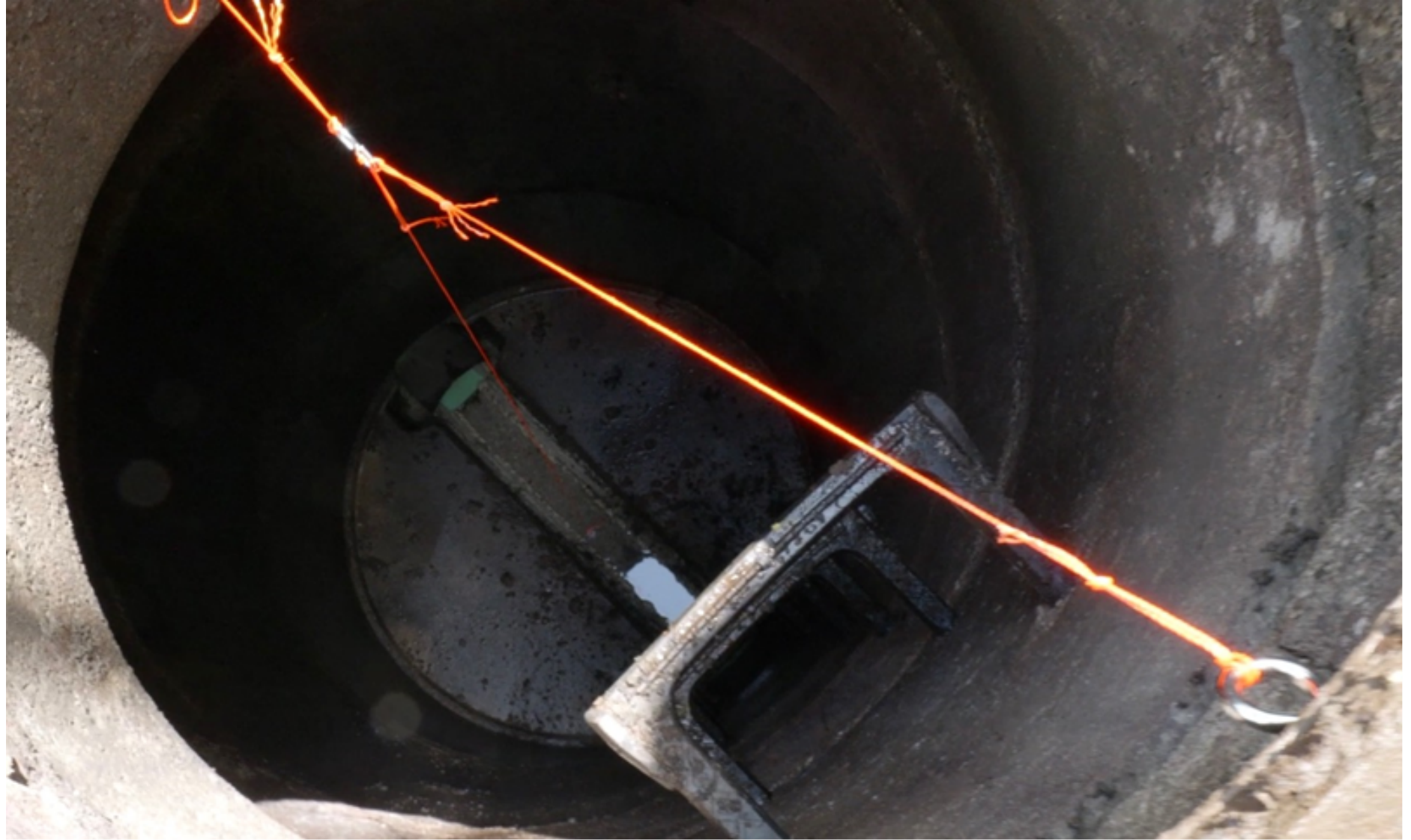


Manhole Sampling Protocol

Figure 1. Sewer Diagram



Manhole Passive Sampling



Site A Investigation

A photograph of a construction or investigation site. In the foreground, two large, dark-colored metal drums are visible. In the background, a worker wearing a high-visibility yellow vest and a hard hat is operating a drilling rig. The rig is mounted on a trailer and has a long, vertical drill bit extending into the ground. The scene is outdoors, and the background shows some trees and a clear sky.

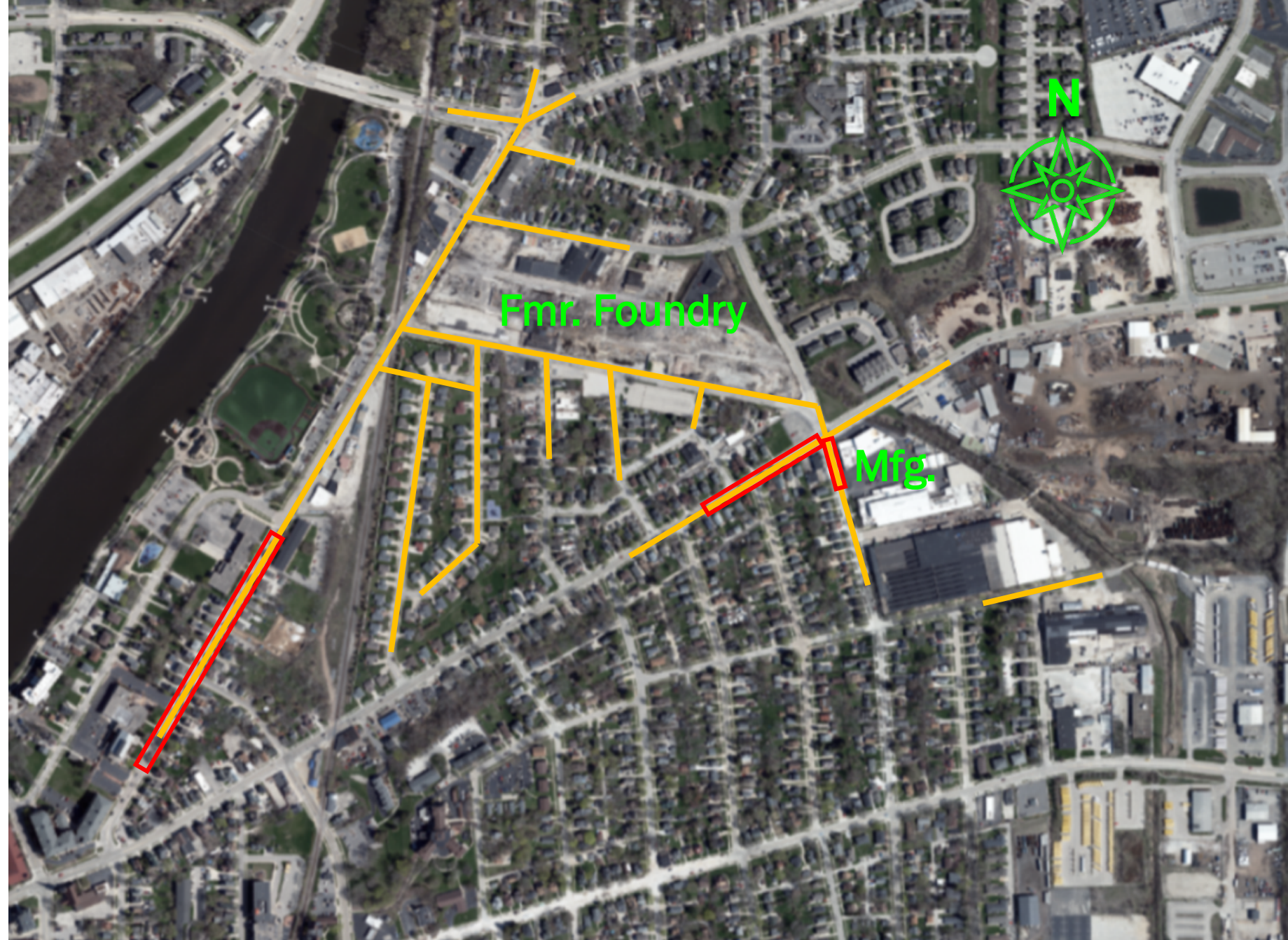
State Funded Sewer Investigation (fall 2023)



Sanitary
Sewer
Manholes



Passive
Soil Gas



Investigation Details

65 Manholes & Apt. Bldg.
COs: TCE with Gas

Chromatograph

13 MH WMS passive

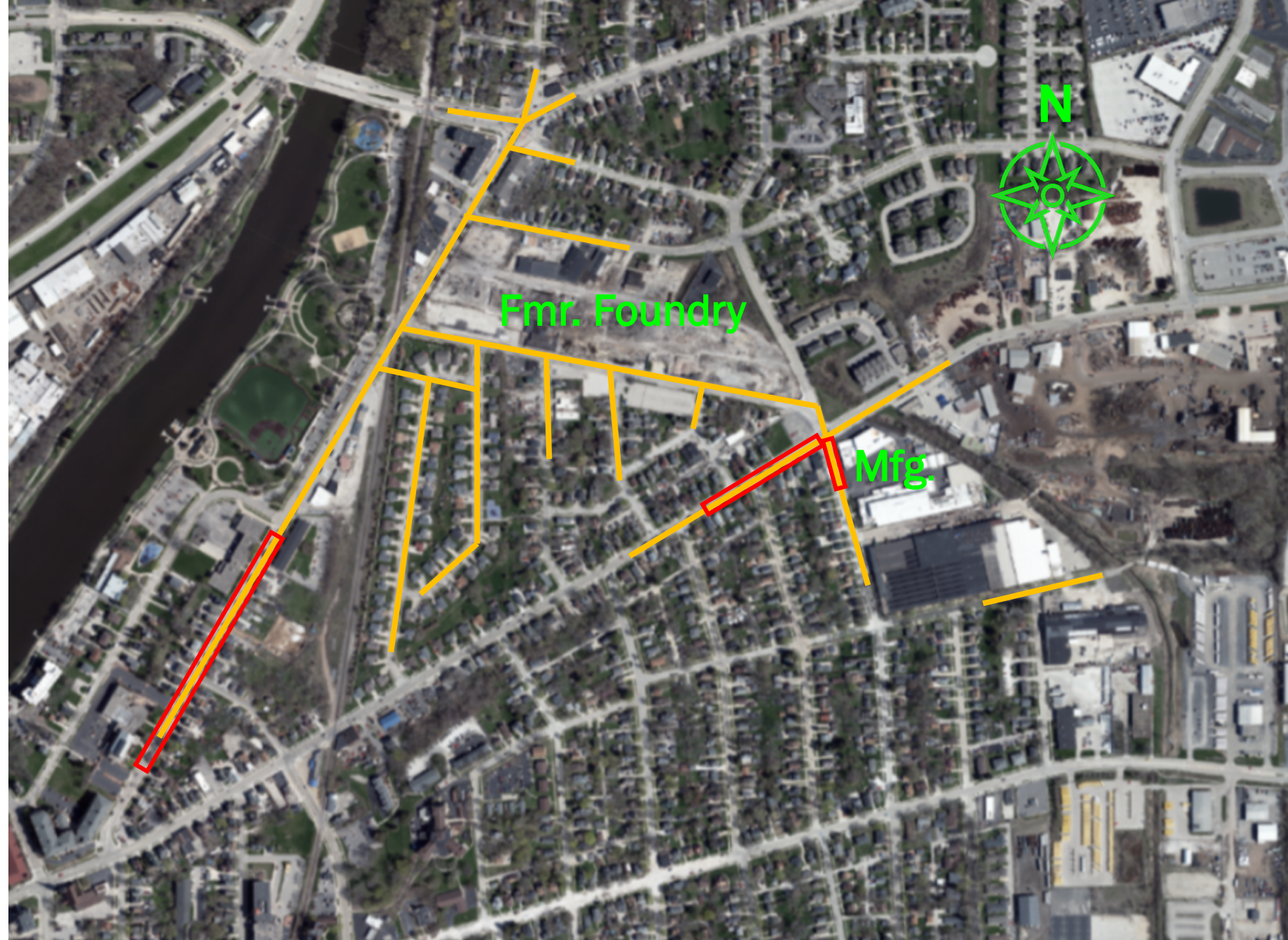
5 MH Beacon passive

7 Day duration

8 MH Liquid sample

30 Beacon passive soil
gas samples (3' deep)

11 Day duration



Passive & Grab Comparison Sanitary Sewer MHs

All TCE in µg/m3

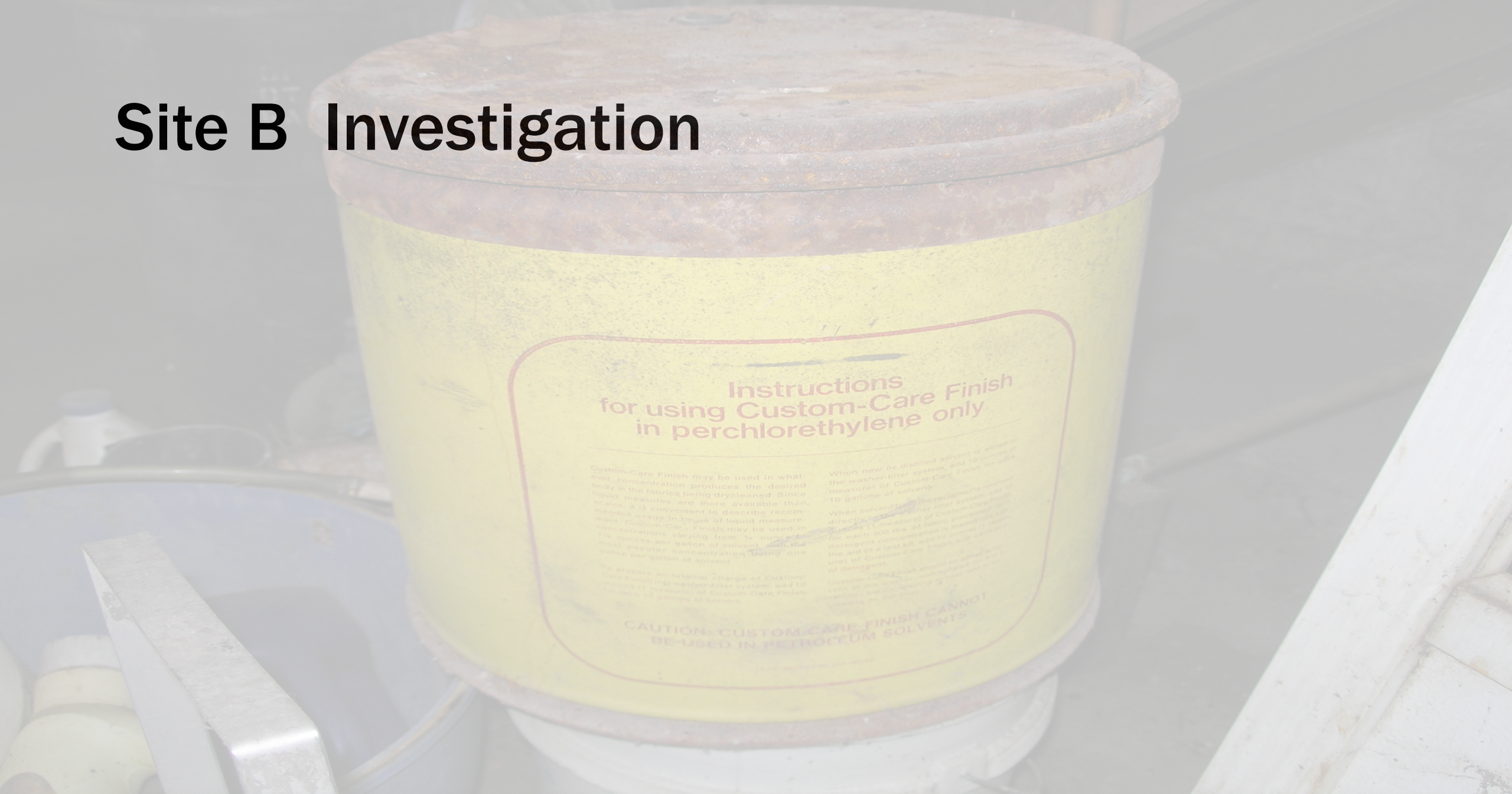
NS = not sampled

Passive samplers 7-day duration

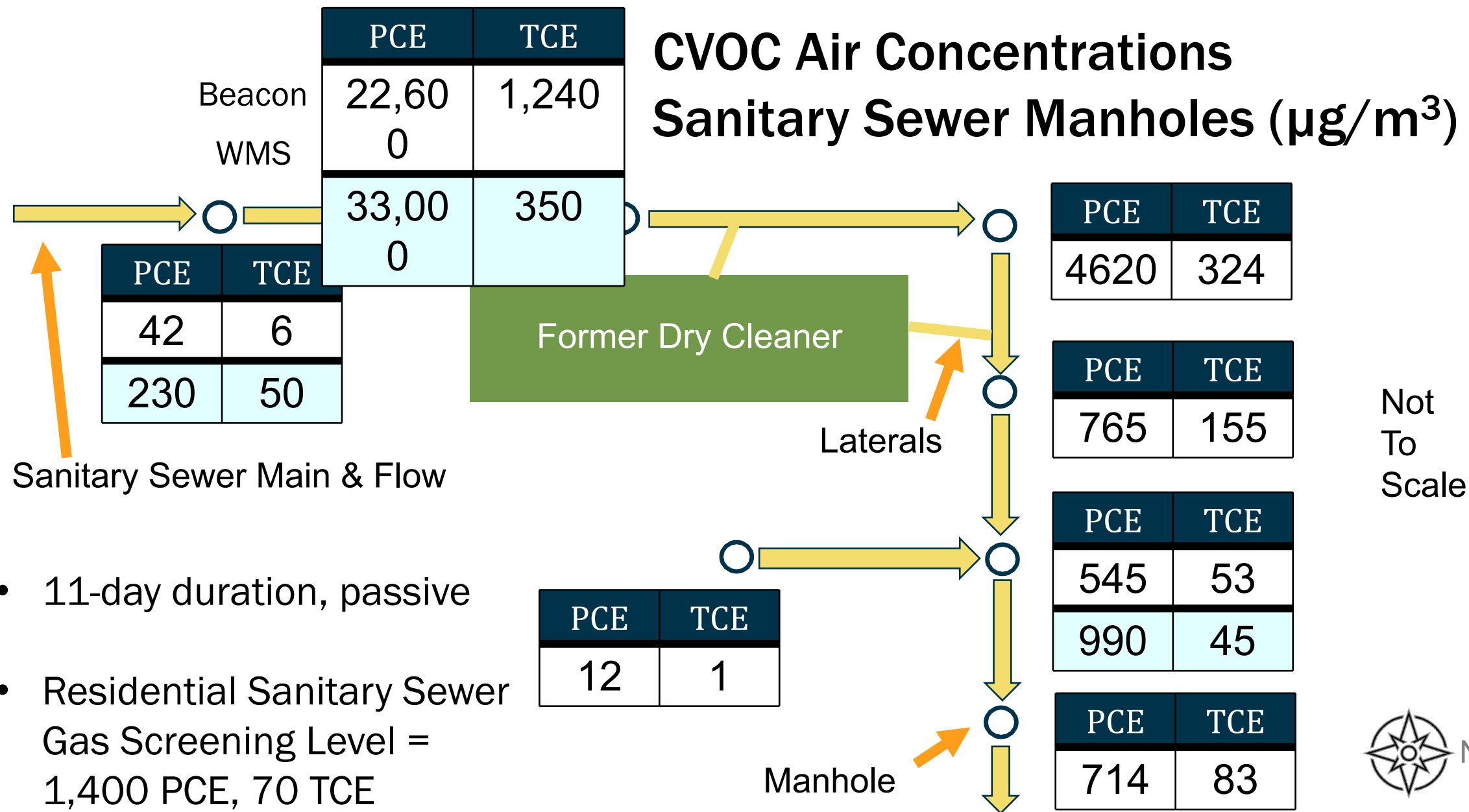
Grab sample collected on first day of
passive sampling

Location ID	Beacon	WMS	Grab GC
196	<3	<1.9	1.2
197	86	200	47
200	NS	740	1.4
209	19.5	70	<1.0
213	NS	210	5.3
214	NS	520	3.8
215	NS	420	<1.0
216	941	450	1.4
218	NS	450	<1.0
222	NS	7	3.7
234	811	1,600	87
236	NS	1,300	92
237	NS	390	21

Site B Investigation



CVOC Air Concentrations Sanitary Sewer Manholes ($\mu\text{g}/\text{m}^3$)



- 11-day duration, passive
- Residential Sanitary Sewer Gas Screening Level = 1,400 PCE, 70 TCE

State Funded Sewer Sampling Costs (2023)

Site #	1	2	3	4	5	6	7	8
# MHs	3	5	3	2	5	7	61	7
\$/MH	4499	2434	1400	1250	1793	1045	975	2000

All passive sampling except site 7 which was grab sampling at 61 MHs and passive sampling at 13 MHs

* Includes all costs: samplers, professional services, permits, traffic control, reporting, travel

Issues (Beyond Investigation Practices)

- Communicating Results/Community Engagement
- Responsibility
- Mitigation
 - Evaluating
 - Options
- Institutional Controls

Takeaways - General

- RR-649: Conduit sampling has increased substantially following publication
- Unsealed sumps are a common risk pathway, both in source buildings and off-site building overlying a groundwater plume
- Need to develop better sampling practices for collecting sampling from building plumbing: handful of WI sites (30 times temporal, 500 times spatial), 3 to 4 orders of magnitude elsewhere. Options? Active or passive sorbent?

Takeaways – Source Buildings

- At 4 of 9 dry cleaner buildings, conduit vapor concentrations exceeded target indoor air (IA) concentrations, as much as 40,000 times*
- At 12 of 17 manufacturing/other buildings, conduit vapor concentrations exceeded target IA, as much as 1,100 times*
- In at least 6 buildings TCE or PCE IA exceeded target IA (although the pathway not always certain).*
- Conduit sampling recommended for most source buildings

* Not all investigations are complete

Takeaways - Sanitary Sewer Mains

- At 2 of 25 dry cleaner sites, vapor concentrations in manholes exceeded the SSGSL for TCE or PCE*
- At 8 of 25 manufacturing or fill sites, vapor concentrations in manholes exceeded the SSGSL for TCE (mostly) or PCE, sometimes over thousands of feet of the sewer*
- Vapor plumbing samples in 8 buildings near contaminated sanitary manholes exceeded target IA.*

* Not all investigations are complete

Takeaways - Sanitary Sewer Mains

- The limited paired vapor sampling of sanitary sewer main and connected building plumbing collected to date are insufficient to draw conclusions regarding vapor attenuation from sewer mains
- Contaminated groundwater penetration is a major risk factor
- Large portions of Wisconsin have a water table close to sewer elevations, especially areas with large numbers of former industrial metal degreasers
- Longer duration passive sorbent sampling within sewer mains provides more representative results than grab samples

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"WILD WISCONSIN:
OFF THE RECORD"