Industry Perspectives on the Objectives of TCR Monitoring

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Primary Objectives of TCR

- Primary goal is compliance with regulation and delivery of safe water to customers
- Detection of major failures/upsets that might lead to fecal contamination, such as:
  - Large main breaks
  - Major cross-connections
  - Extensive biofilms (?)
  - Water treatment failure
- Not to capture every coliform that enters the distribution system, may miss:
  - Transient events
  - Small main breaks
  - Household plumbing issues

Secondary Objectives of TCR

Additional uses for the data collected as part of the TCR include:

- Overall monitoring of distribution system
  - Not just for microbial contaminants
- Basis for operational adjustments
- Troubleshooting
- Response to complaints

Limitations of TCR Monitoring

- Many coliform entry pathways involve areas with limited control by utility
  - Construction, main breaks
  - Household plumbing
- Accessibility requirements for sample sites
- Upstream/downstream sampling requirements limit site selection
- Sampling logistics (holding times, staffing)
- Dedicated vs. customer taps
- Complexity of rule requirements, variances, follow-up sampling, notifications, etc. can be confusing to implement

Interpreting TCR Results

- Difficult to determine cause for many coliform positive samples
- Single positive sample:
  - Lab or sampler error?
  - Short duration event?
- Multiple positive samples in an area:
  - More information provided but still difficult to pinpoint cause, location of problem
- Catastrophic failure:
  - Likely captured if the event is of long duration and/or with high microbial concentration

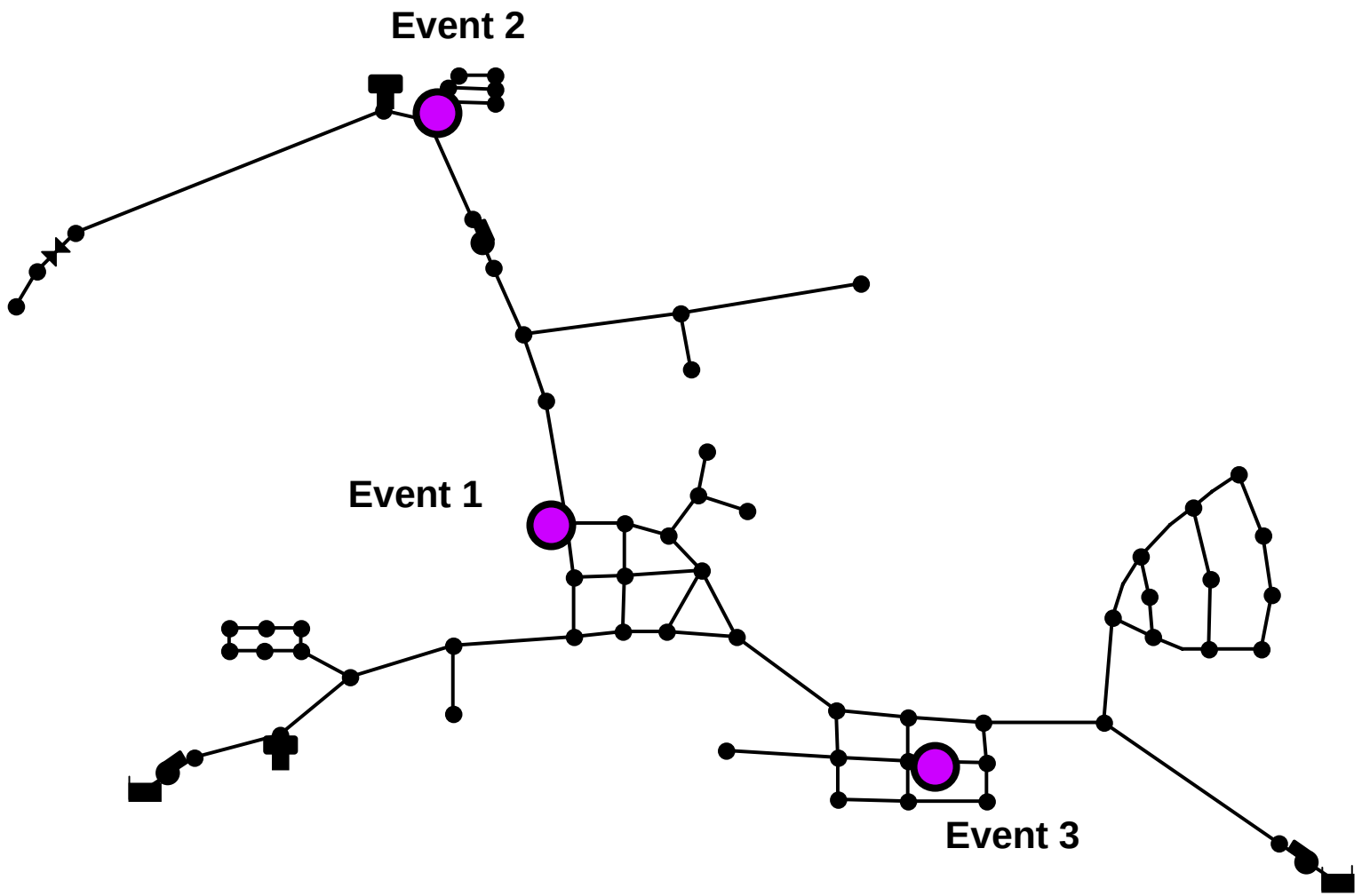
Example from Ongoing Research

- Three different coliform entry events

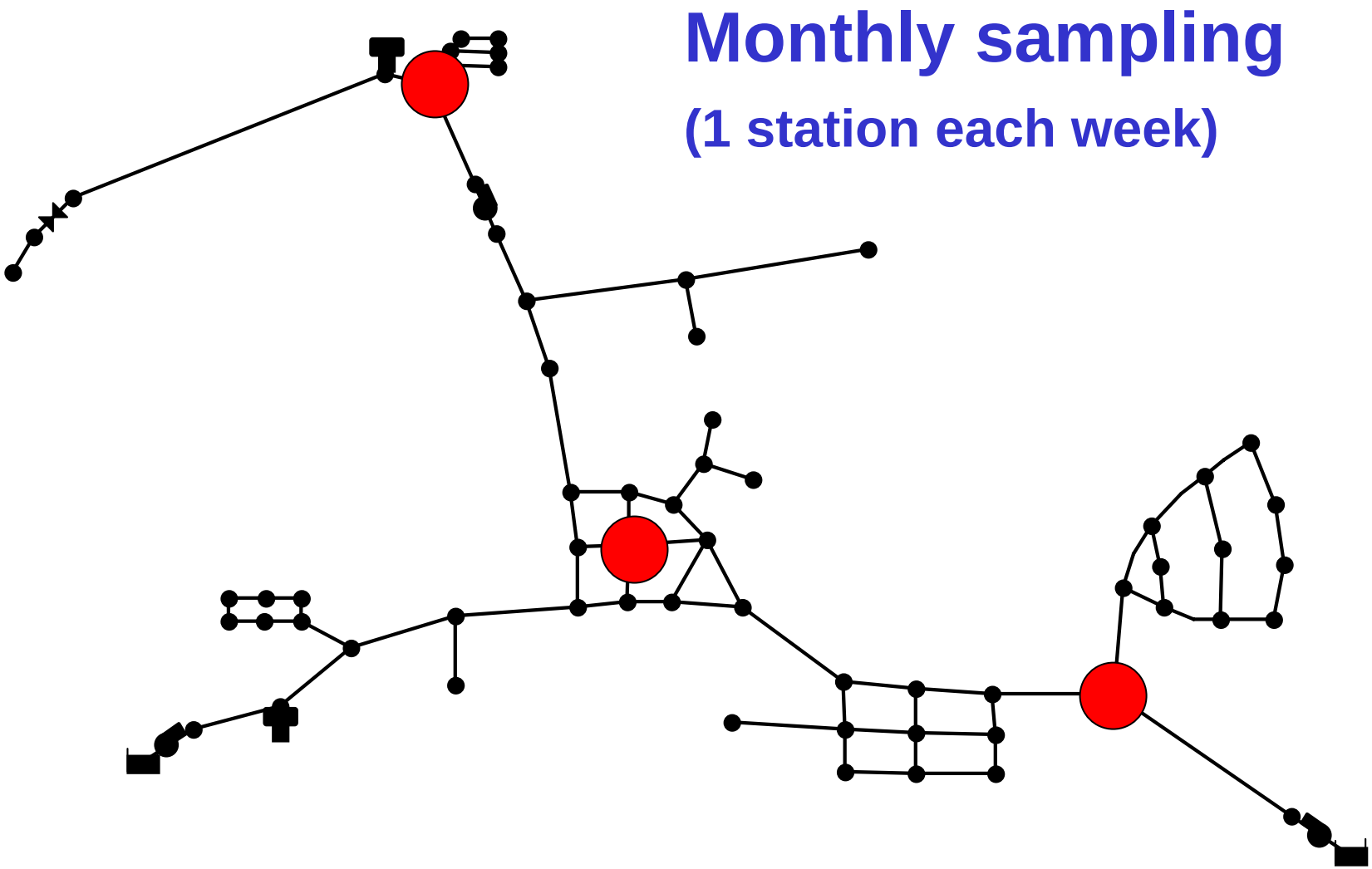
	EVENT 1	EVENT 2	EVENT 3
Date/ time	June 7 at 0800	March 21 at 1430	August 6 at 1100
Duration (hrs)	2.25	0.5	1.5
Magnitude (organisms/min)	16000	5000	8000

AWWARF Project 3017: Methodologies for Assessing and Improving Water Quality Sampling Programs in Drinking Water Distribution Systems

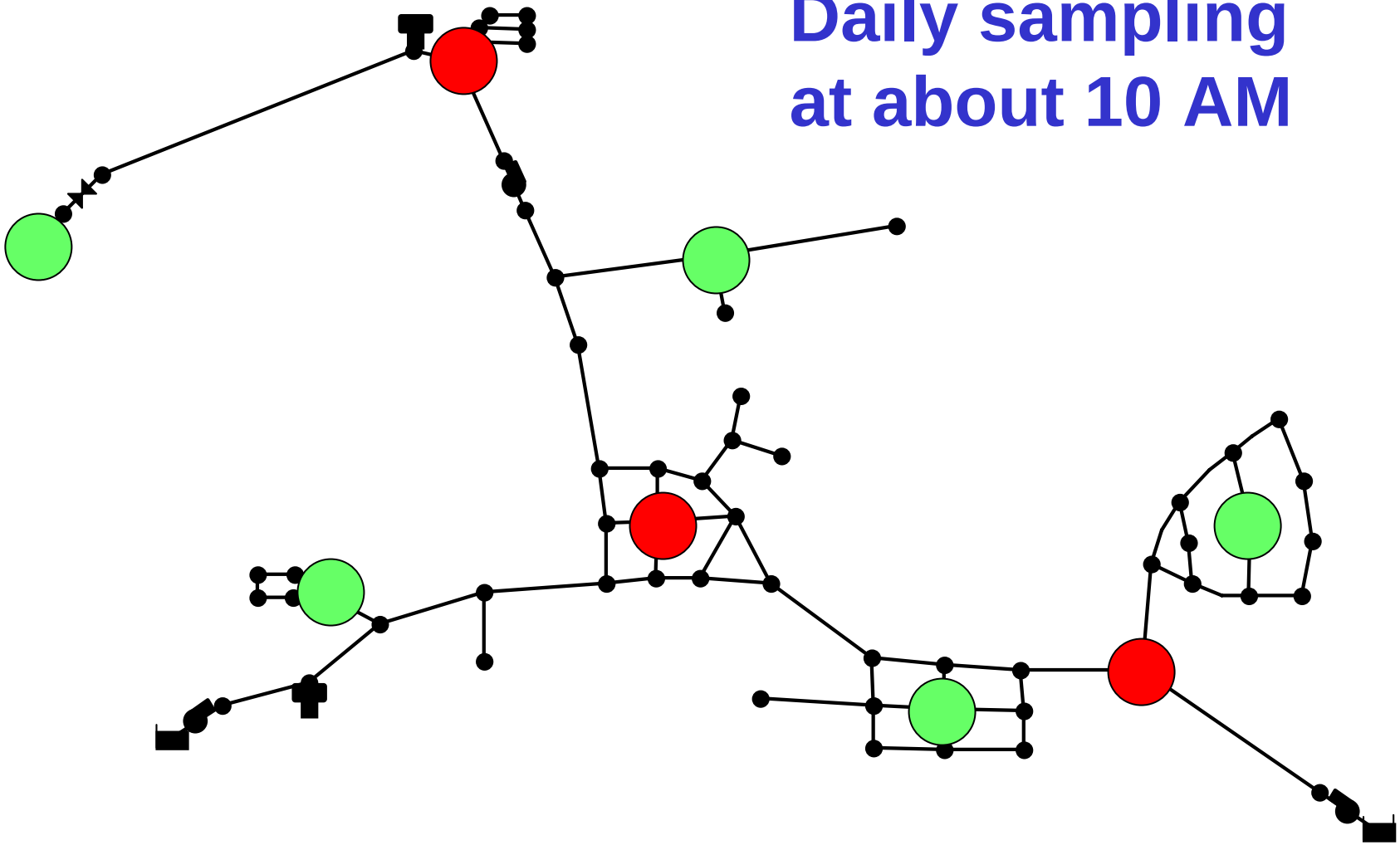
Event Locations



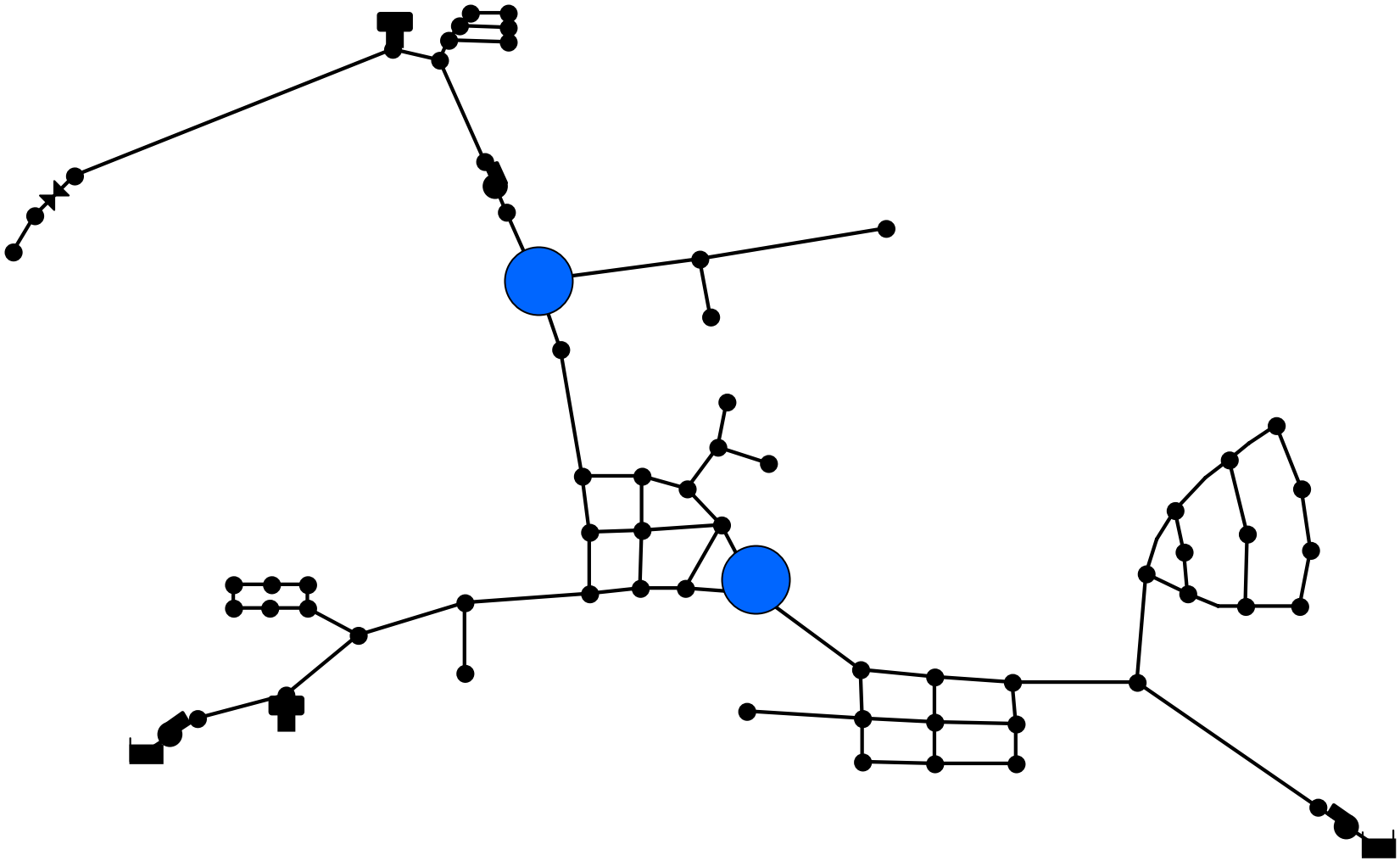
Option 1: Current TCR Sampling



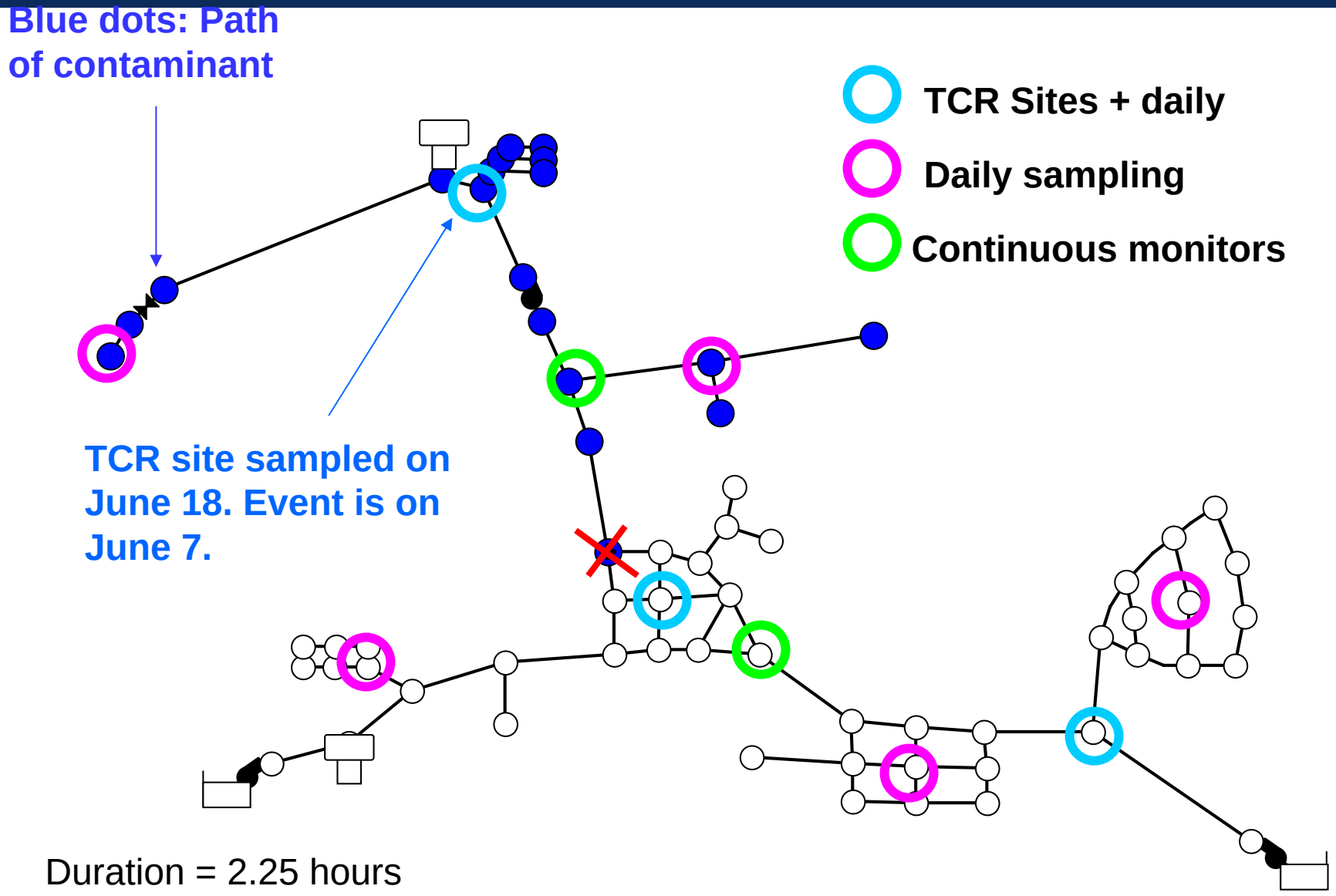
Option 2: Expanded Manual Sampling



Option 3: Continuous Monitors

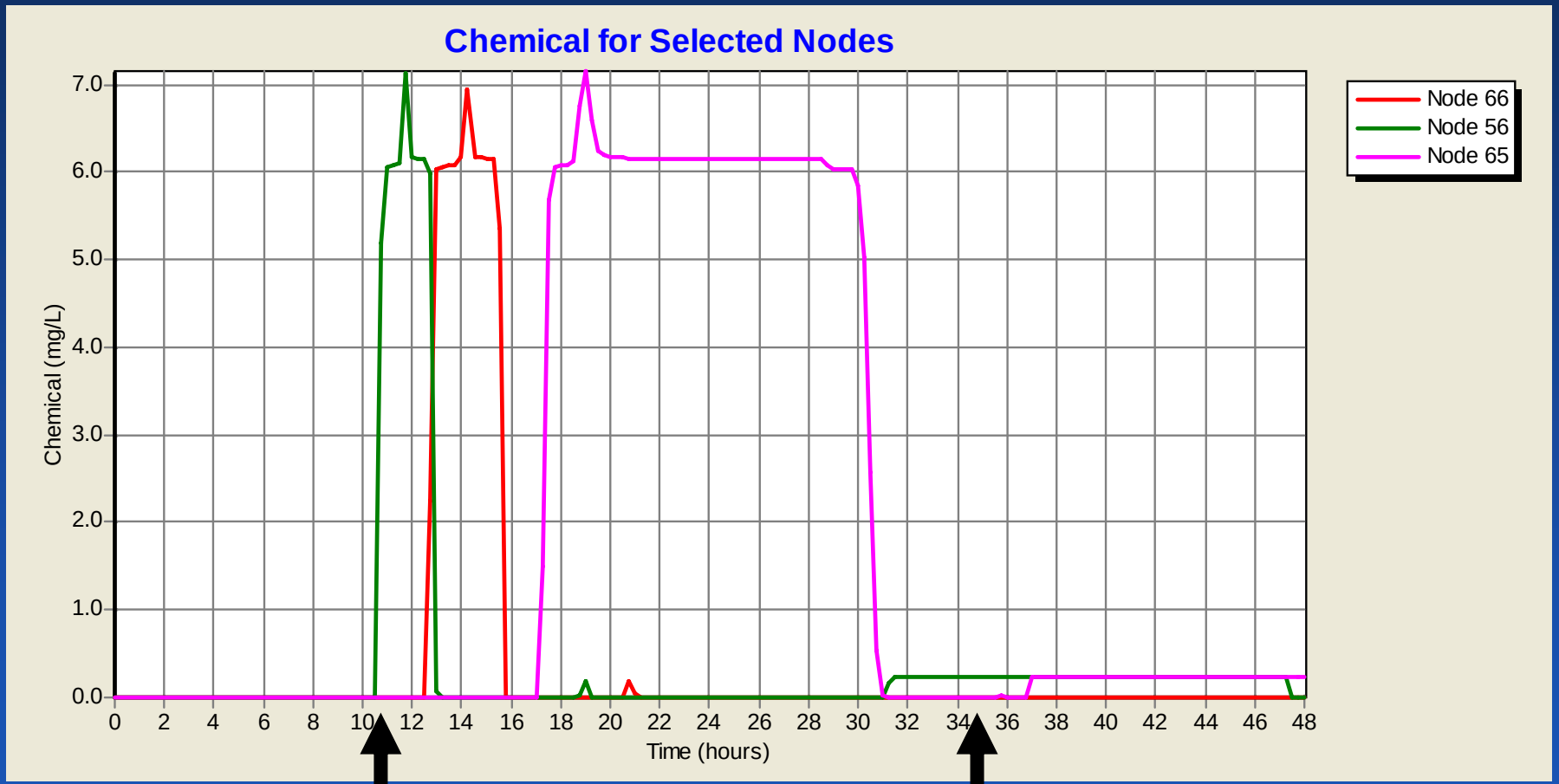


Event 1



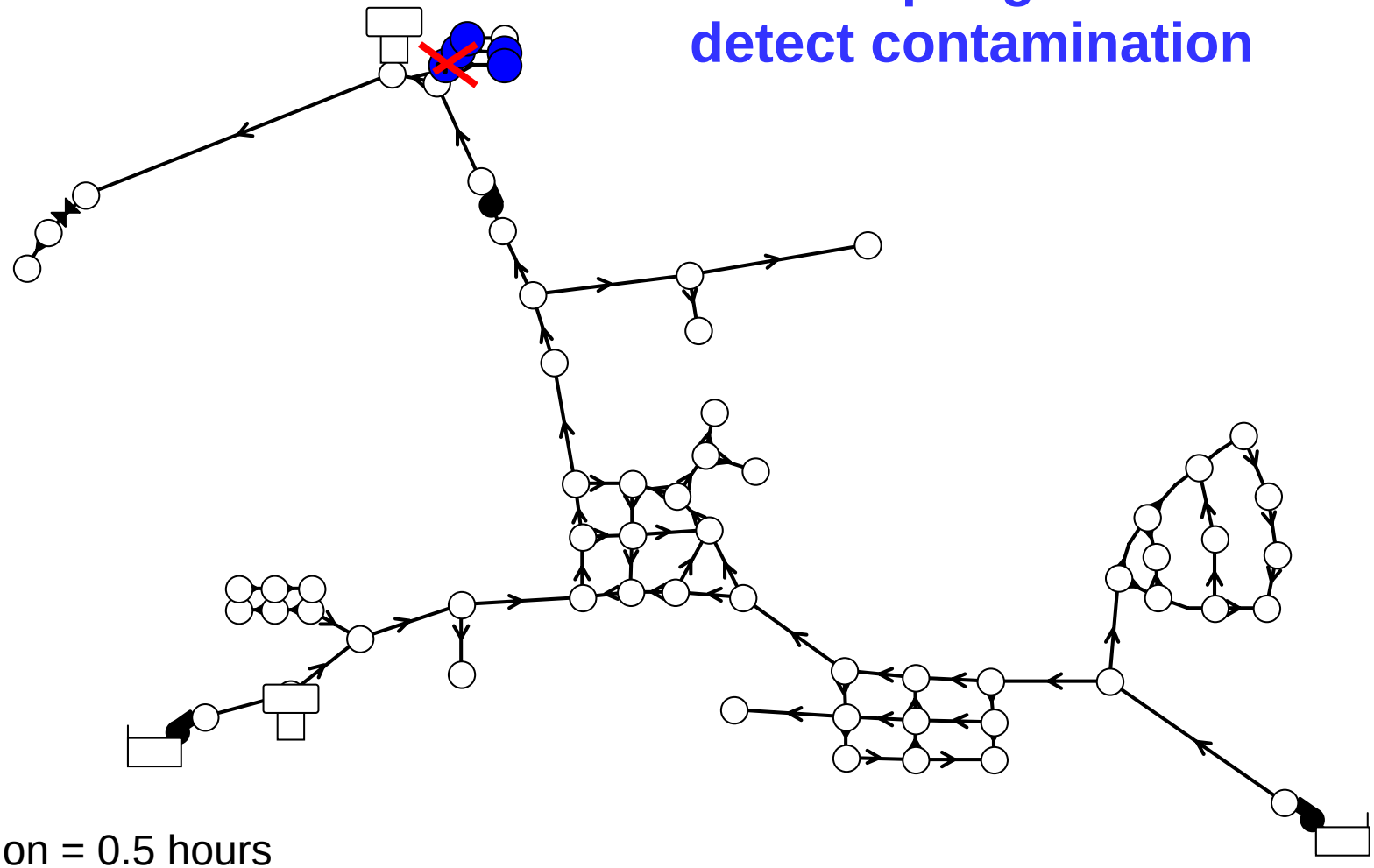
Duration = 2.25 hours
Magnitude = 16000 mpn/min

Daily Samples



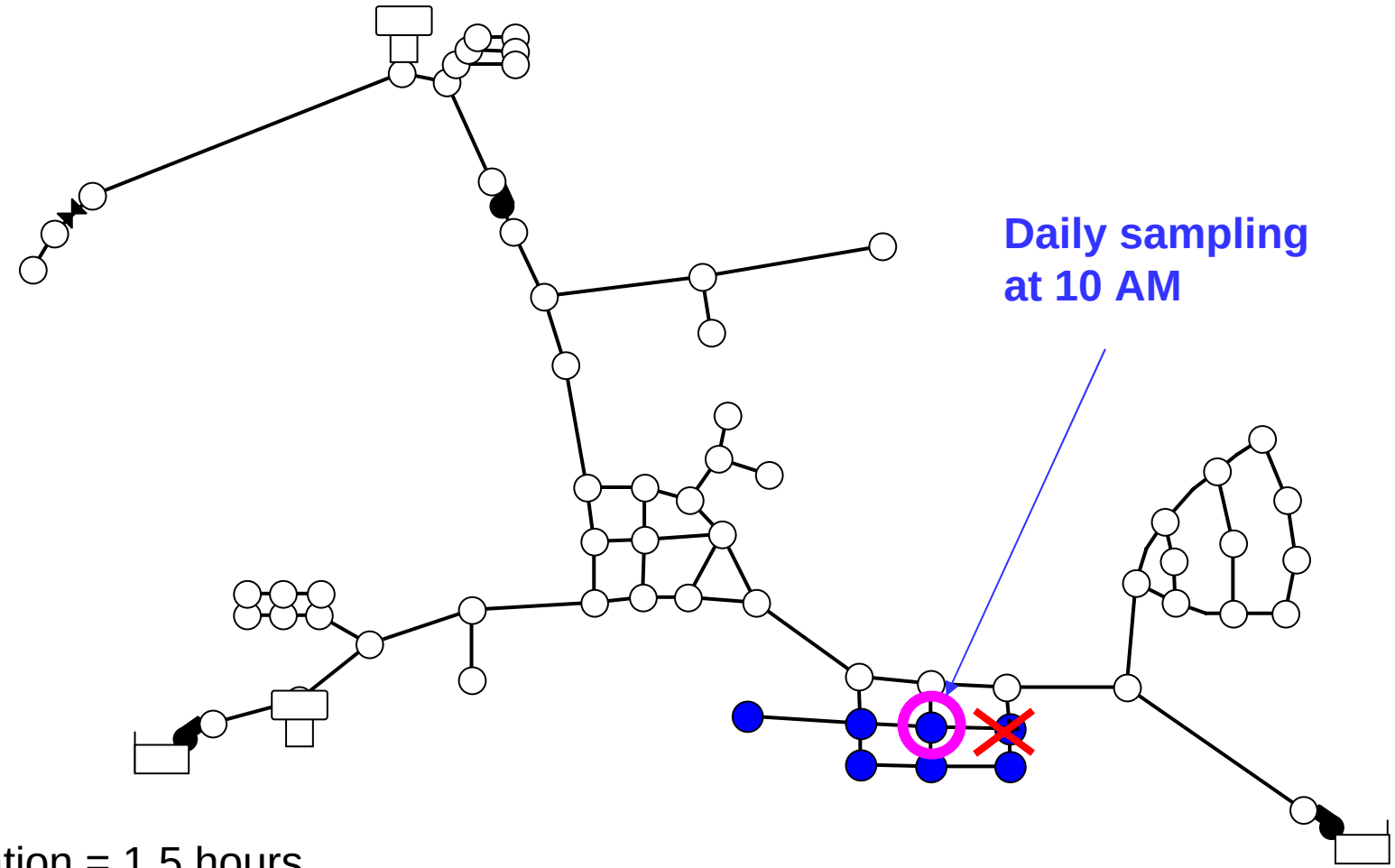
Daily sample at 10 AM **Daily sample at 10 AM**

Event 2



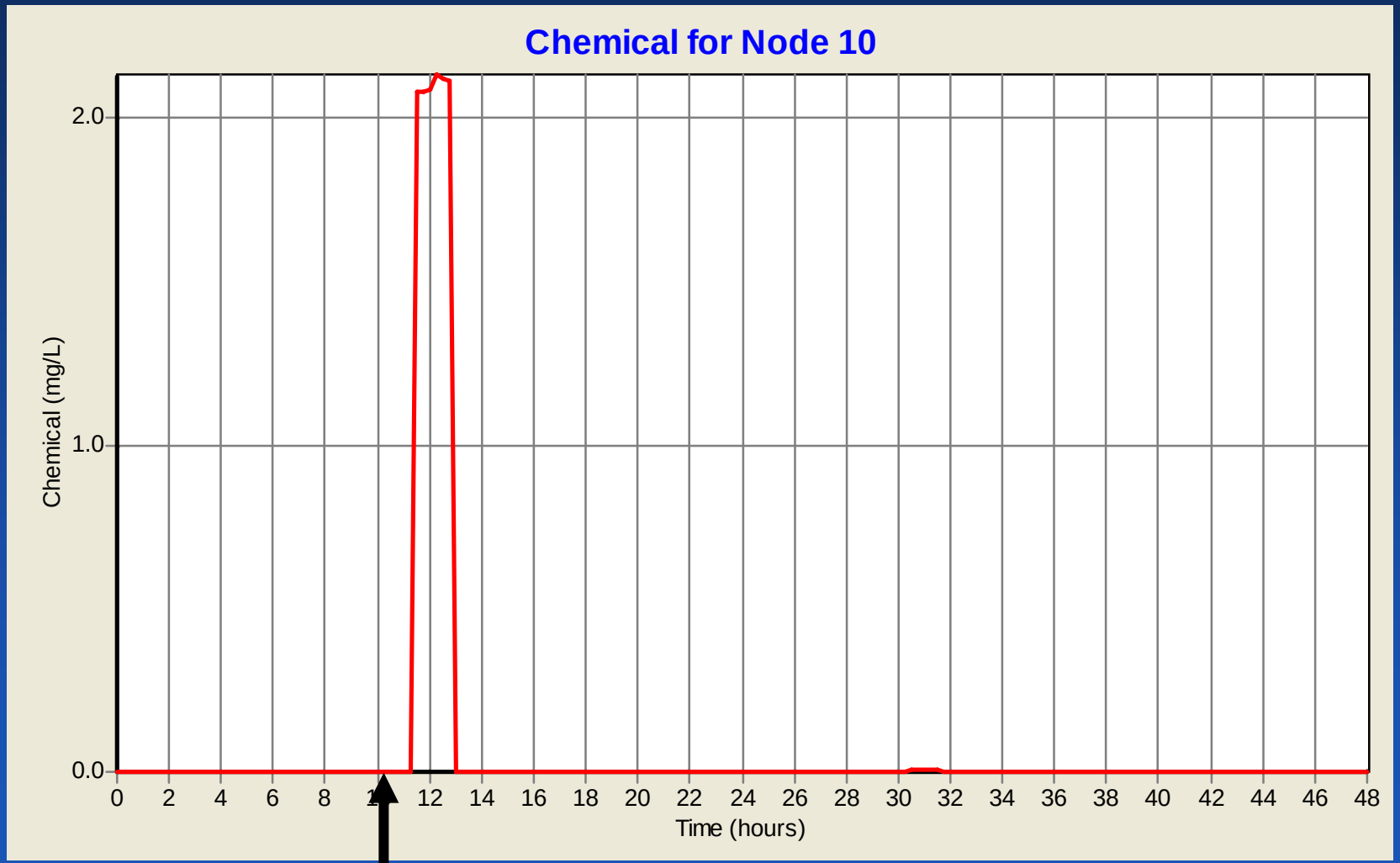
Duration = 0.5 hours
Magnitude = 5000 mpn/min

Event 3



Duration = 1.5 hours
Magnitude = 8000 mpn/min

Daily Sampling Site



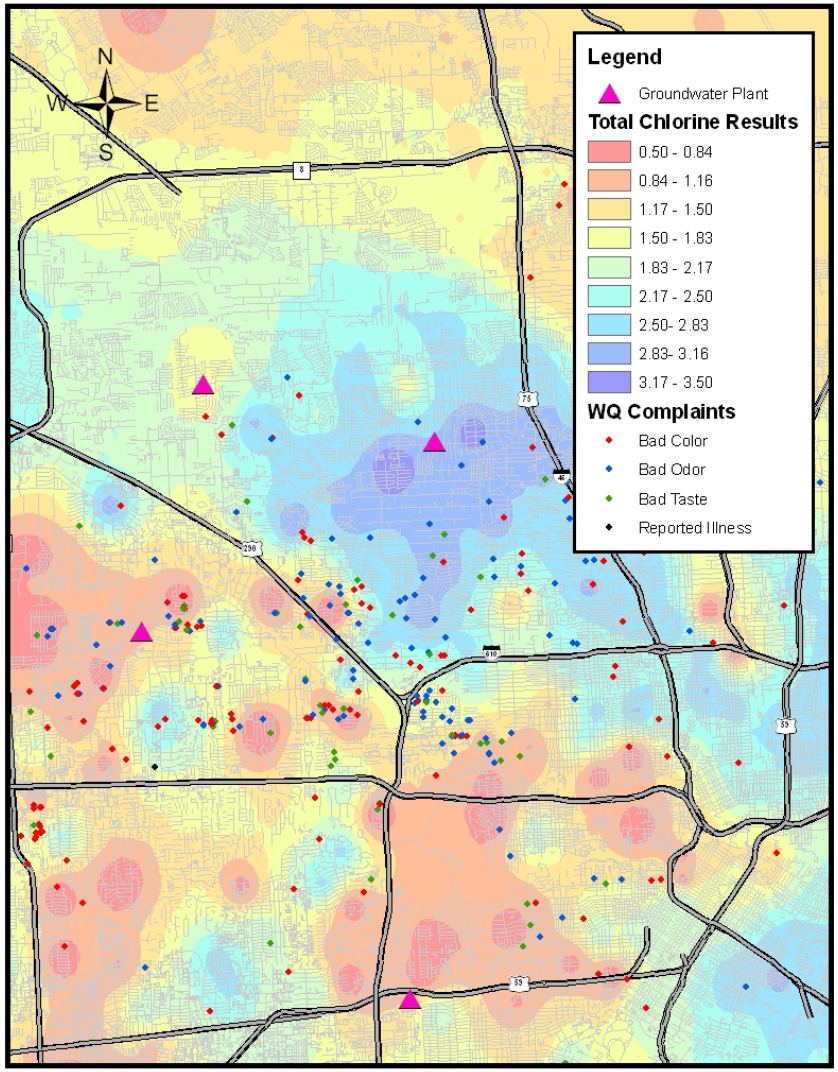
Daily sample at 10 AM

Detection Results

	TCR Sites	Daily Sampling	Continuous Monitor
Event 1	NO	MAYBE	YES
Event 2	NO	NO	NO
Event 3	NO	NO	NO

Related Indicators - Chlorine

- Most widely used and trusted in industry
- Reliable and fast measurements, inexpensive
- Online measurement available and becoming more affordable
- Ability to map data, look for trends



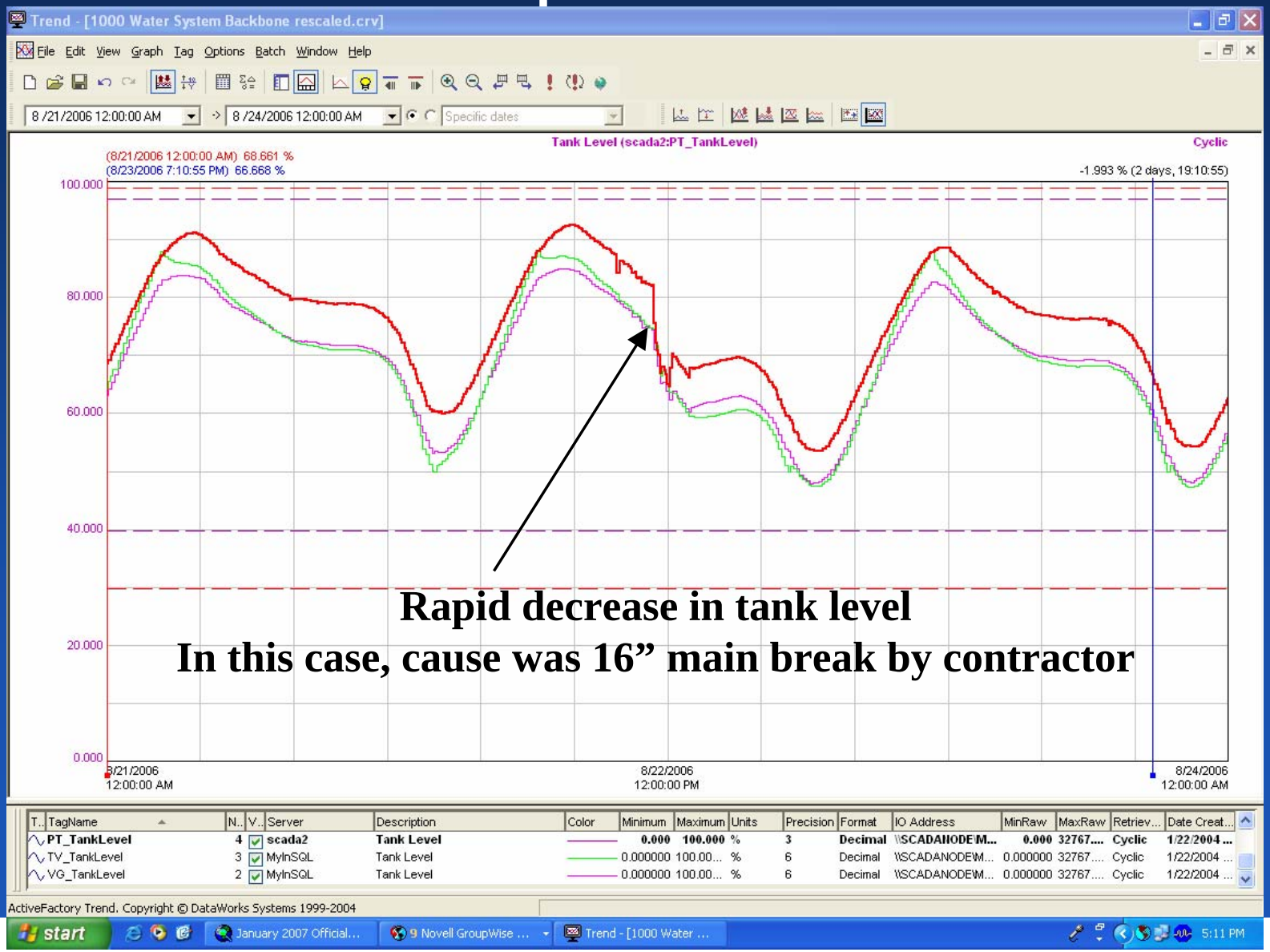
Related Indicators - Chlorine

- Meets secondary TCR objective by providing indicator of problem in distribution system, but does not necessarily indicate microbial contamination
- Does not always provide ability to find cause, pinpoint location of problem
- Able to take many follow-up measurements quickly
- Already widely used in cases with coliform positives to help in investigation

Related Indicators - Other

- Security
  - Potential for information from online chlorine, pH, etc.
  - Expensive, R&D stage, difficult to interpret
  - No direct link to microbial contamination
- Other microbial indicators
  - Rarely detected
  - Most often used as a follow up to initial total coliform positive (e.g. E. coli)
- SCADA
  - Routinely measured flows, tank levels, etc. can be used to help identify that a problem has occurred
  - No direct link to microbial contamination

SCADA Example



Related Issues

- Frequency of Sampling
  - Space versus time coverage of distribution system
  - Differences in state requirements
- Sampling Location Selection
  - Depends on indicator and objective
  - Need to consider logistical factors
- Research Needs
  - Need better understanding of fundamental processes to design better monitoring plans
  - Public health risks