Potomac Aquifer Recharge Monitoring Laboratory (PARML)

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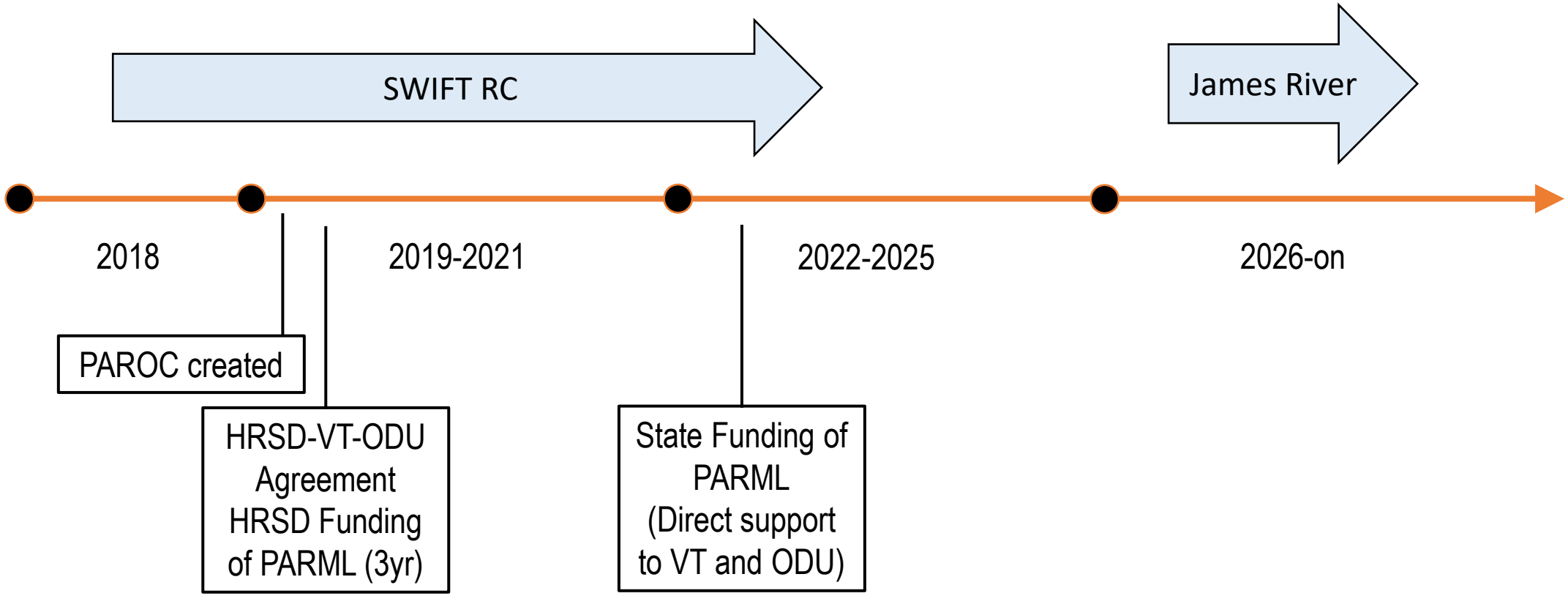
PARML Co-Directors

September 26, 2022

PARML Updates

1. Groundwater Monitoring – James River
   - Public-Sector Partnerships
2. PARML Funding
3. Long-Term Planning
4. Groundwater Chemistry
   - Aquifer Monitoring
   - Analytical Method Development

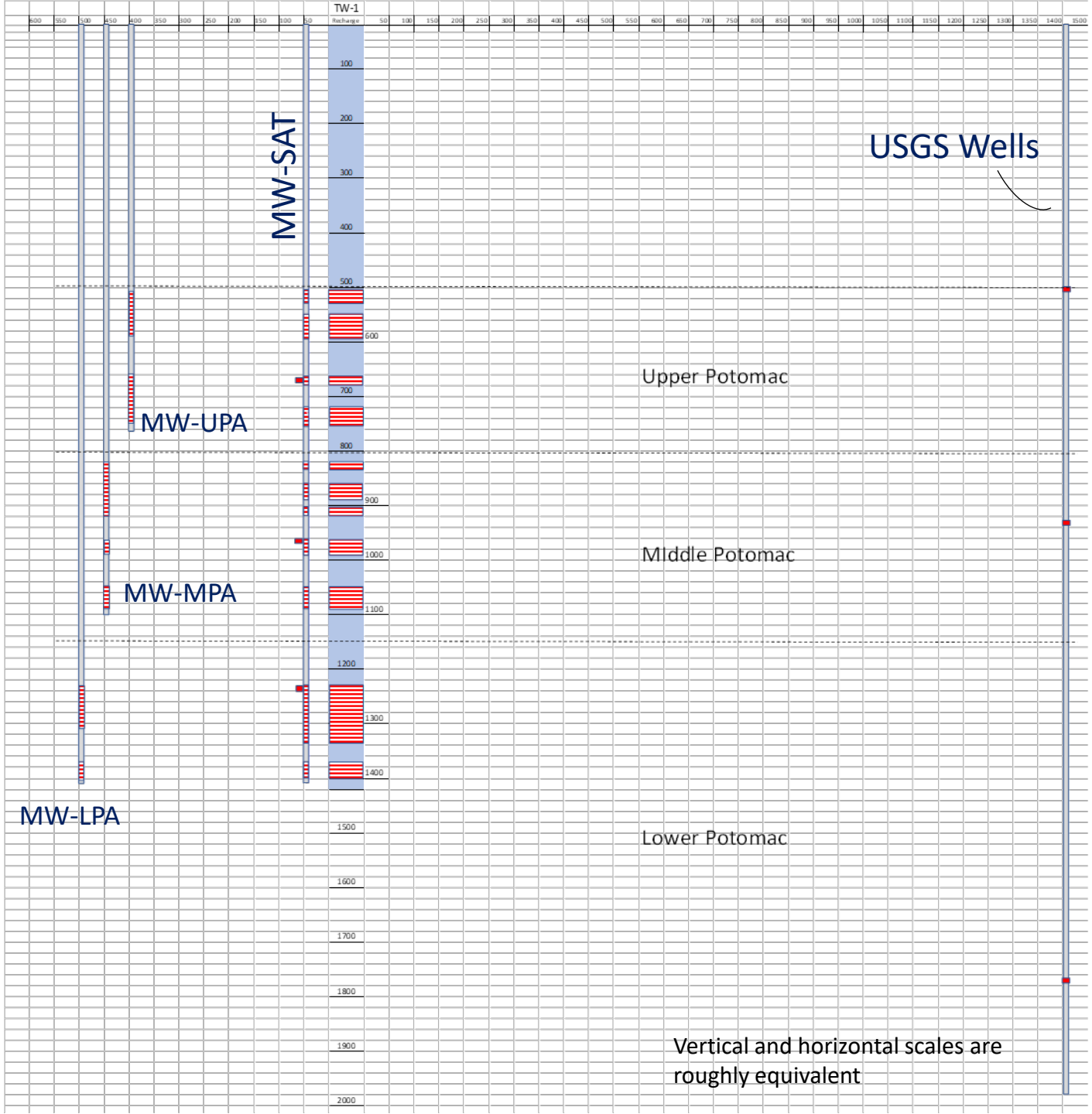
PARML Planning Concepts



Aquifer Isotope Ratio Monitoring

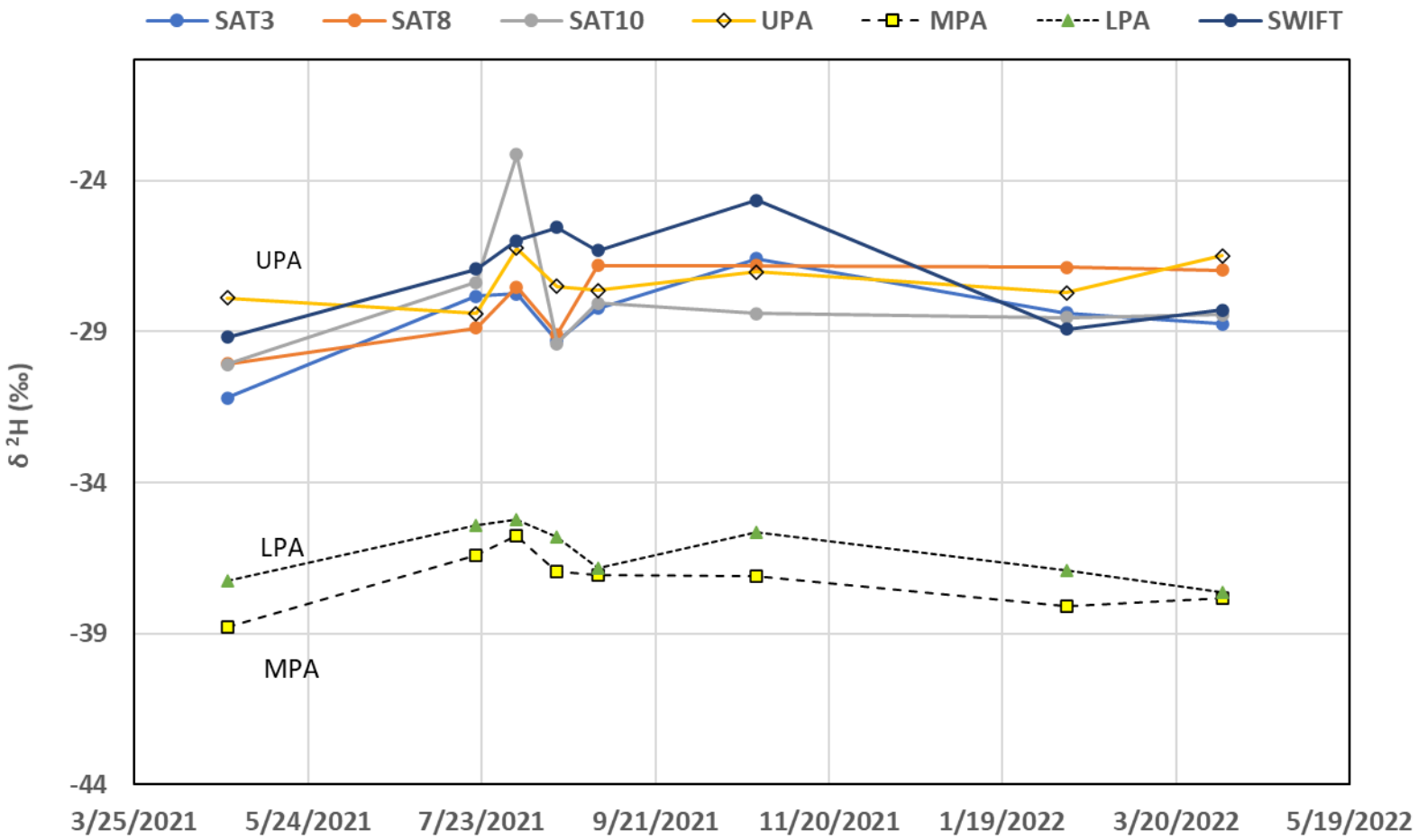
Oxygen ($^{18}O/^{16}O$) and Hydrogen ($^{2}H/^{1}H$) Isotope Ratios May Serve as a Groundwater Tracer Helping to Movement of Recharge Water

- Develop as a tool to monitor the movement of recharge water in the Potomac Aquifer
- Essentially unaffected by geochemical reactions



Recharge and Monitoring Wells at the SWIFT Research Center and USGS Wells

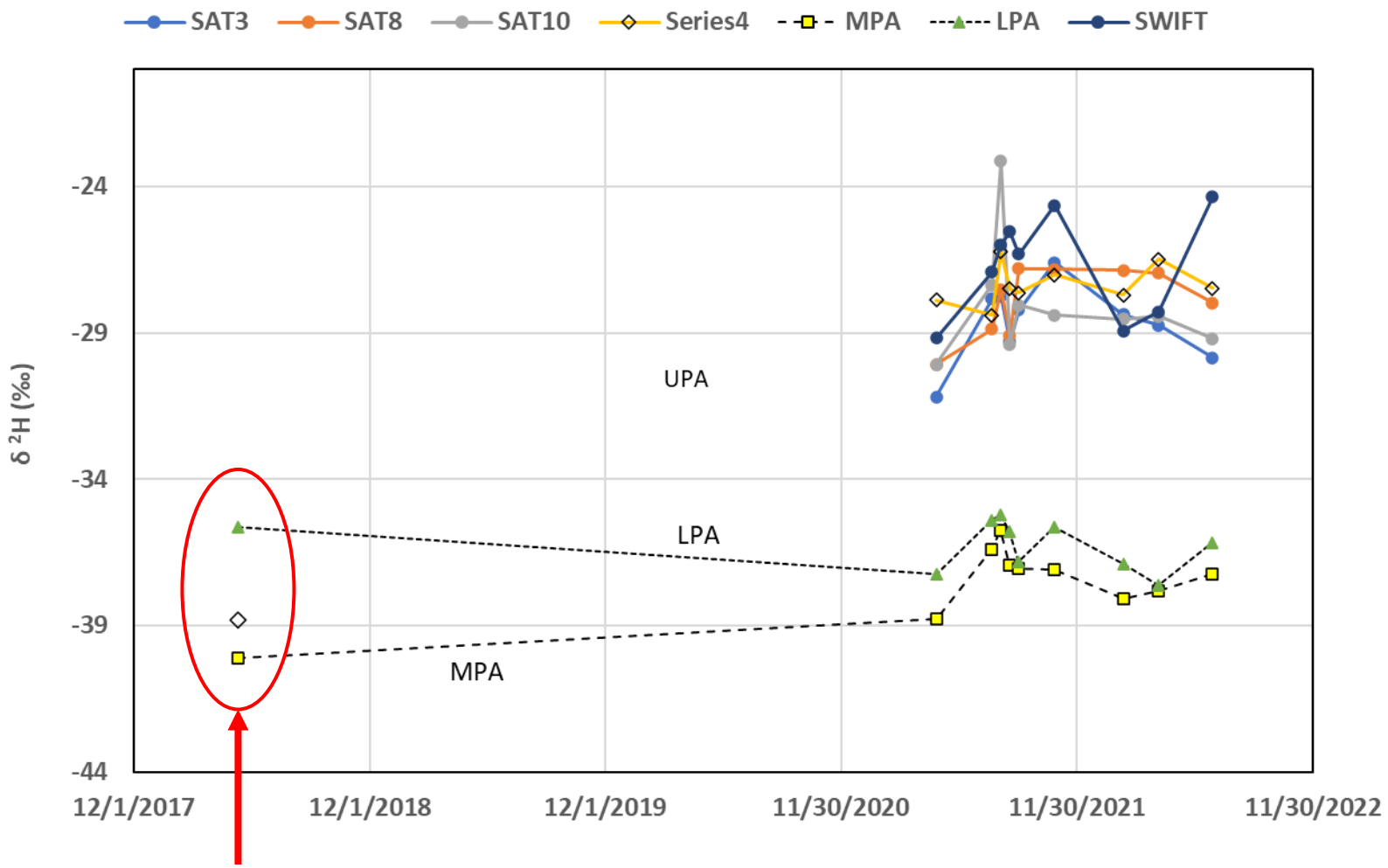
Isotope Ratio in SWIFT Water and in HRSD Monitoring Wells



At the previous PAROC meeting this figure was shown and it was interpreted as manifesting that UPA and MW SAT were fully influenced by recharge and LPA and MPA were not.

However, no pre recharge isotope data were available for comparison

Isotope Ratio in SWIFT Water and in HRSD Monitoring Wells

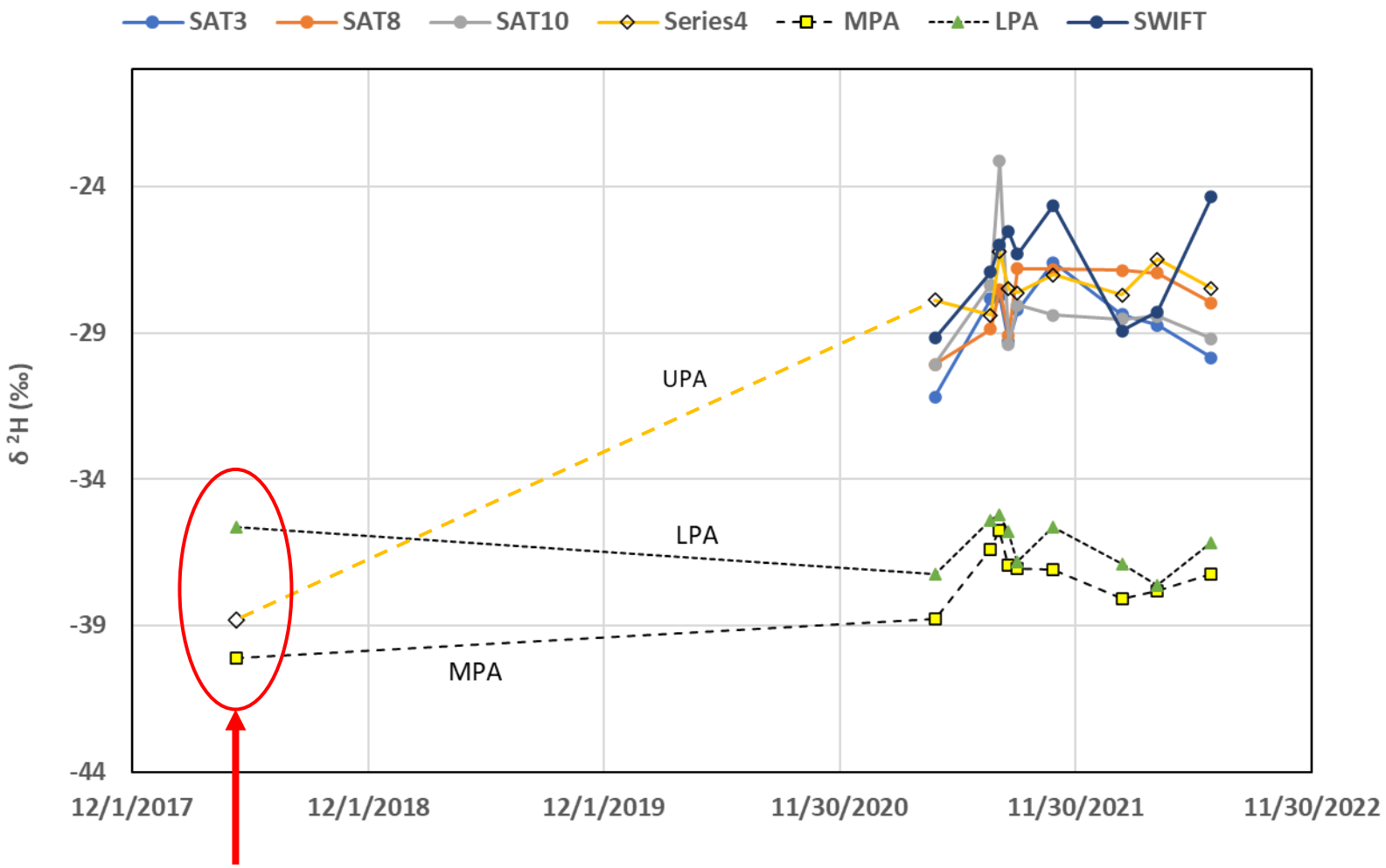


Isotope ratio vales of archived samples collected prior to recharge

Archived samples at SWIFT RC analyzed

Lack of significant influence of recharge on MPA and LPA

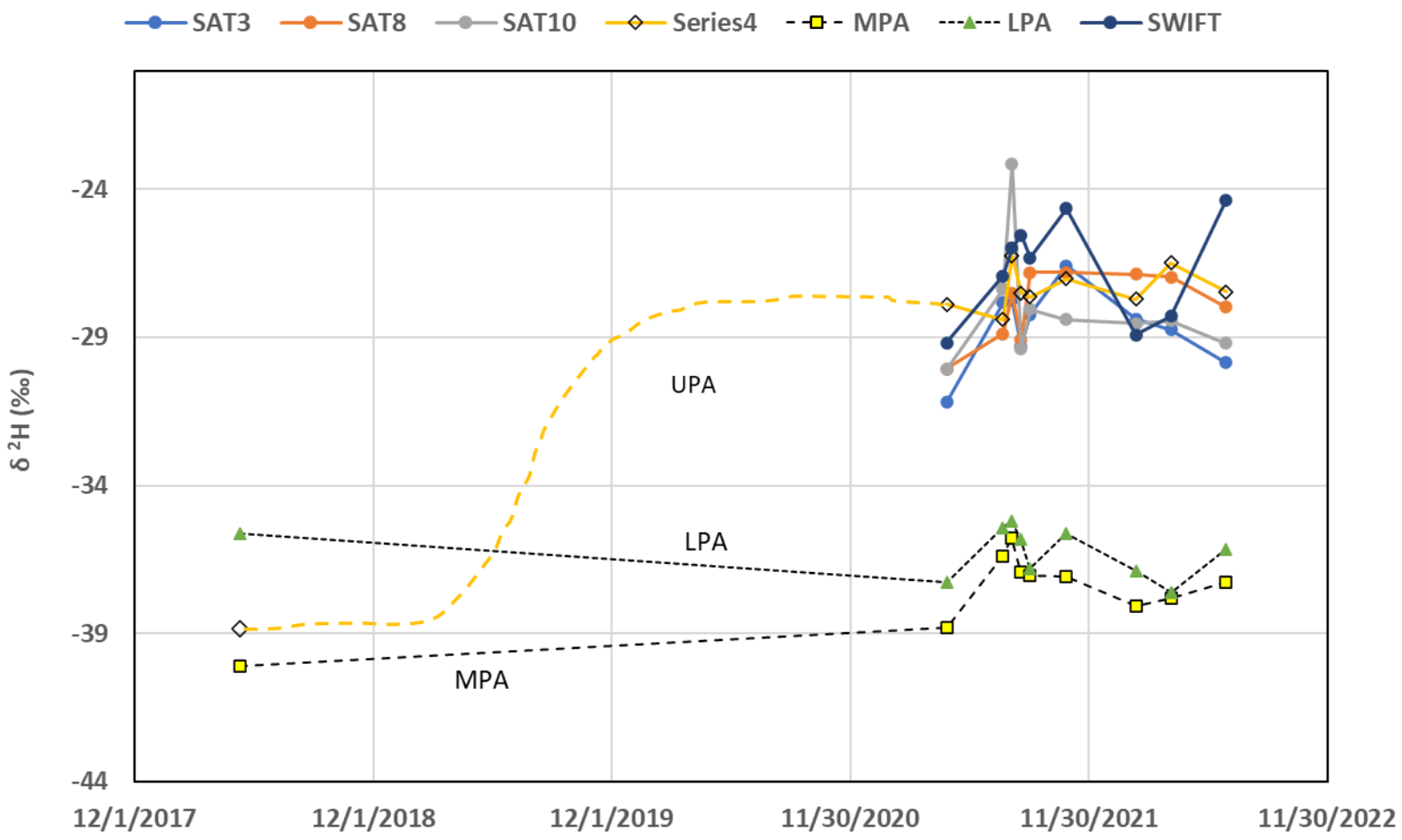
Isotope Ratio in SWIFT Water and in HRSD Monitoring Wells



Isotope ratio vales of archived samples collected prior to recharge

The influence of SWIFT recharge is clearly evident at UPA but not likely a linear trend

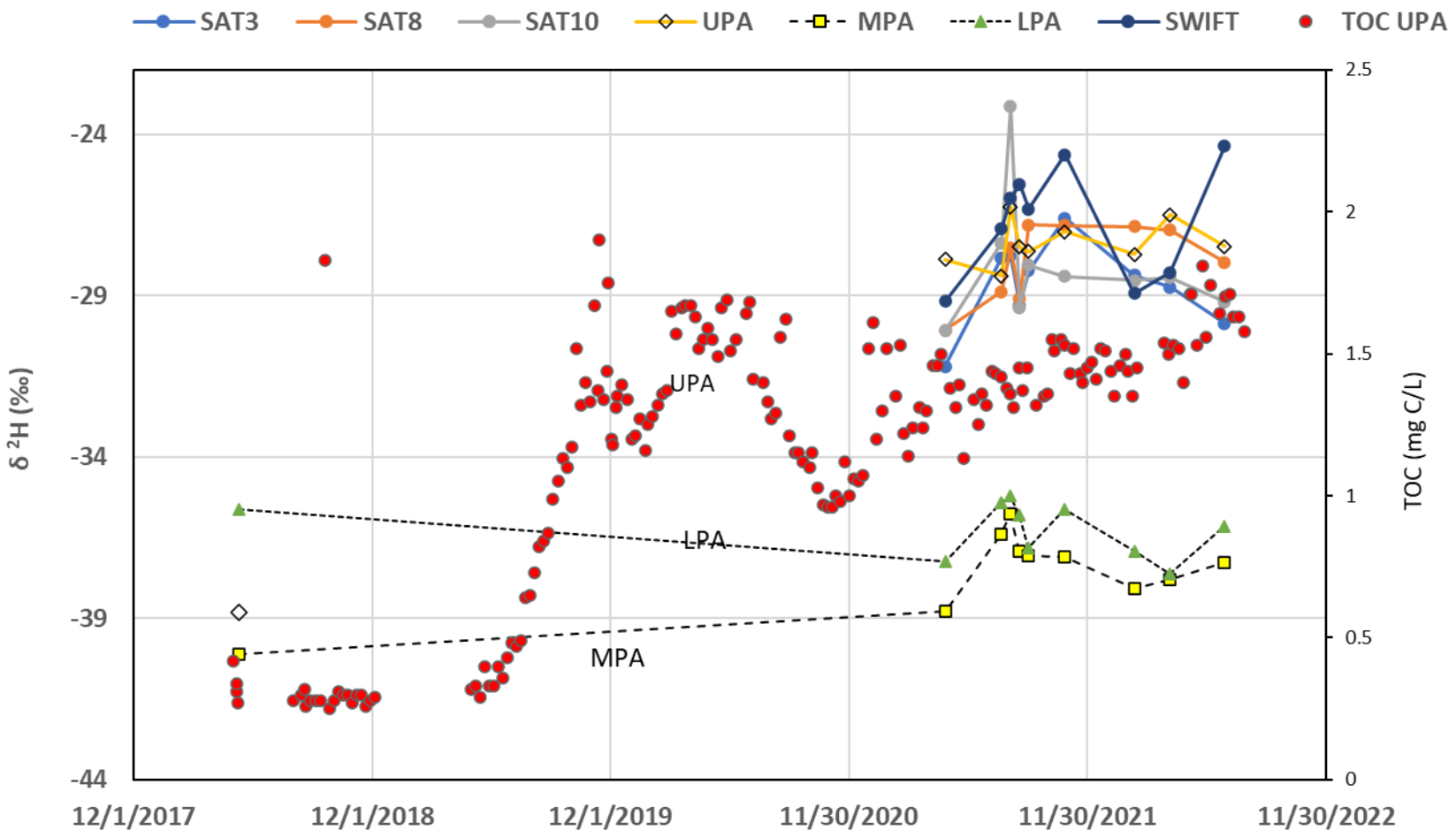
Isotope Ratio in SWIFT Water and in HRSD Monitoring Wells



Based on both computer modeling and chemical monitoring a rapid rise in isotope ratios would be expected.

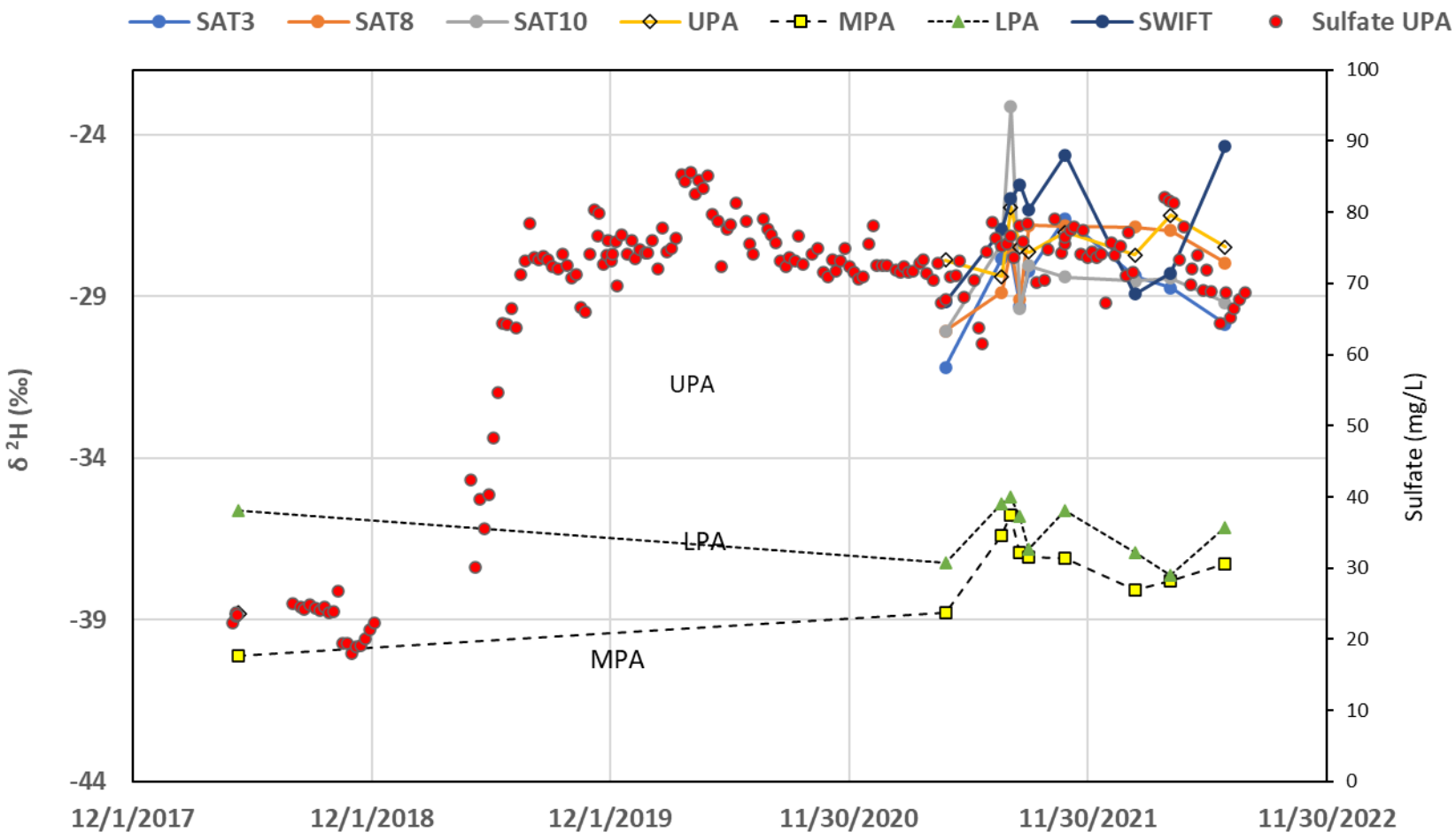
Chemical monitoring parameters to help assess recharge influence

Isotope Ratio in SWIFT Water and in HRSD Monitoring Wells



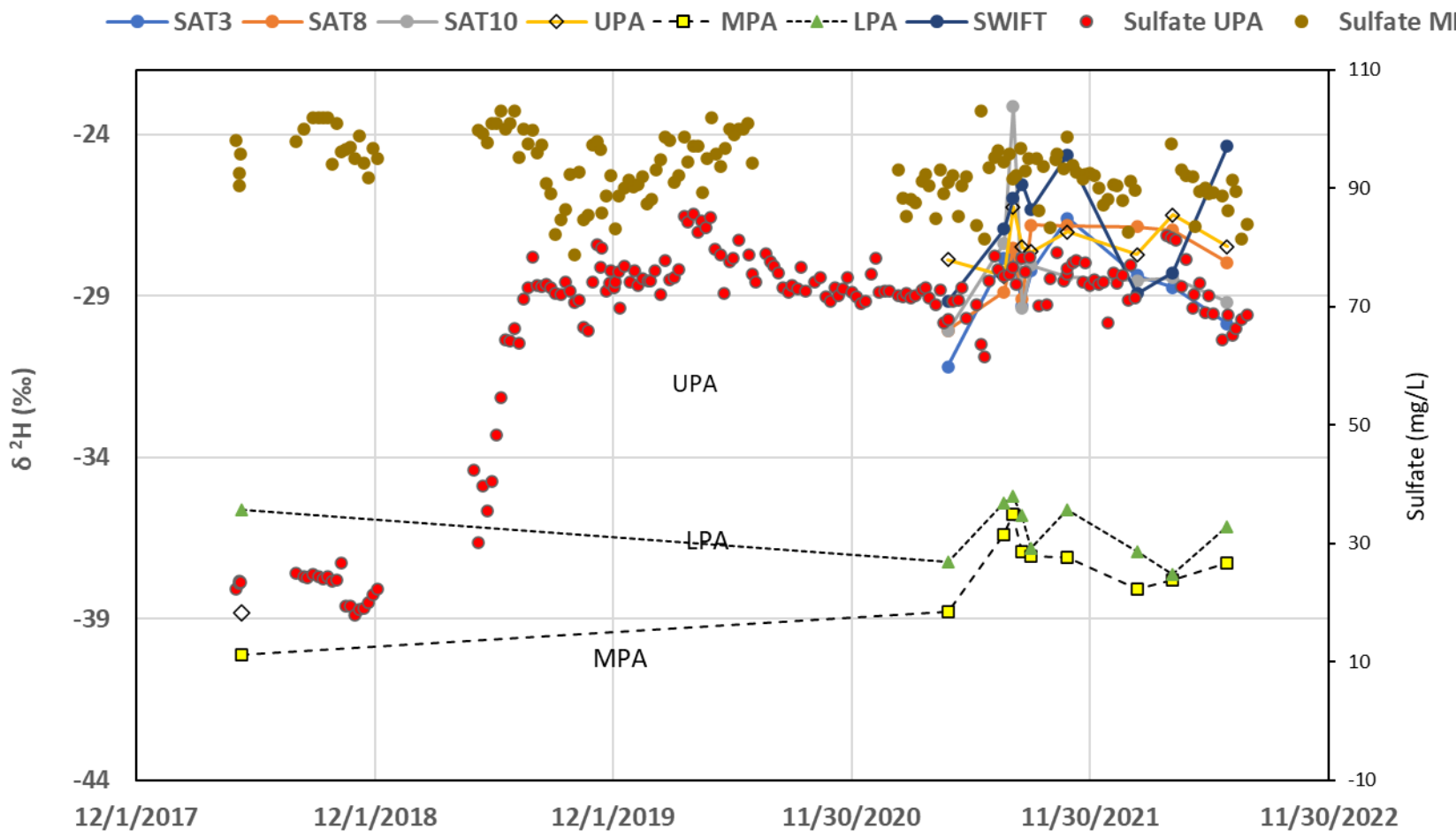
HRSD TOC UPA monitoring data illustrate the rapid rise expected

Isotope Ratio in SWIFT Water and in HRSD Monitoring Wells



Sulfate appeared an even better tracer

Isotope Ratio in SWIFT Water and in HRSD Monitoring Wells



In MPA, sulfate shows less variation consistent with MPA isotope values.

It can be seen that under full influence of SWIFT recharge, sulfate concentration change would be small compared to isotope ratio

Analytical Determination of 1,4-Dioxane and Nitrosamines in Water With a Single Method

Currently two separate methods are utilized to measure these constituents:

- USEPA Method 521 – Nitrosamines
- USEPA Method 522 – 1,4 Dioxane

Seyyedhadi Khatami

PARML Development of a Single (Combined) Method to Analyze both Nitrosamines and 1,4 Dioxane in a Single Analysis

Benefits:

- Greater number of analyses per time
- Greater number of samples per time
- Increased productivity
- Reduced solvent use (less hazardous waste generation)

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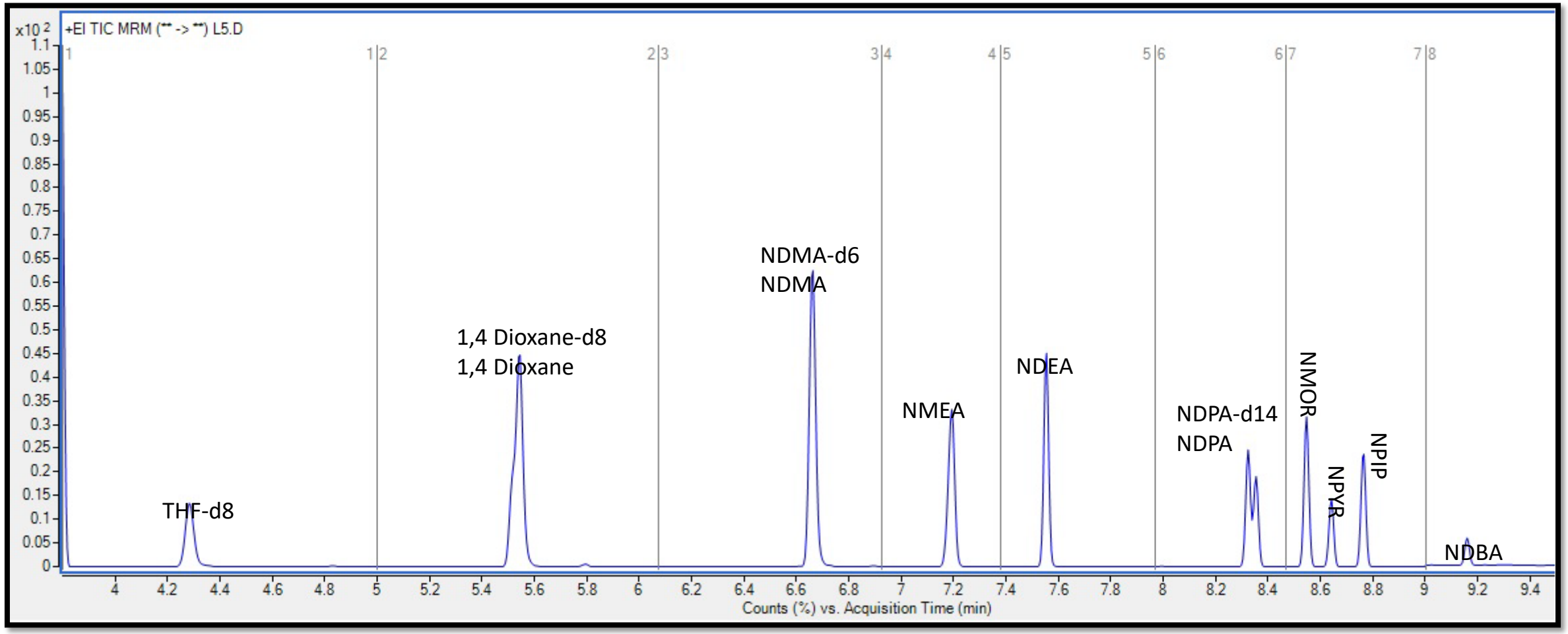
New Method for Simultaneous Analysis of Organic Compounds Corresponding to EPA521/522

SWIFT Sample – September 20, 2022



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1,4 Dioxane

SWIFT Sample – September 20, 2022

Compound name (1,4 Dioxane) R2=0.991	Conc (ug/L) LOQ= 0.008	Recovery % by 1,4 Dioxane-d8
INF	0.45	86.5
FS	0.49	73.0
O3	0.34	92.2
BF	0.19	65.2
C GAC	0.18	85.8
SWIFT	0.19	88.3
UPA	0.35	82.3
MPA	0.11	75.5
LPA	0.01	77.3

NDMA

compound name (NDMA) R2=0.992	Conc (ng/L) LOQ = 2	Recovery % by NDMA-d6
INF	2.28	83.7
FS	3.30	71.4
O3	114.96	89.4
BF	0.54	62.3
C GAC	0.38	82.9
SWIFT	0.72	82.7
UPA	1.02	79.6
MPA	0.50	72.7
LPA	0.24	72.3

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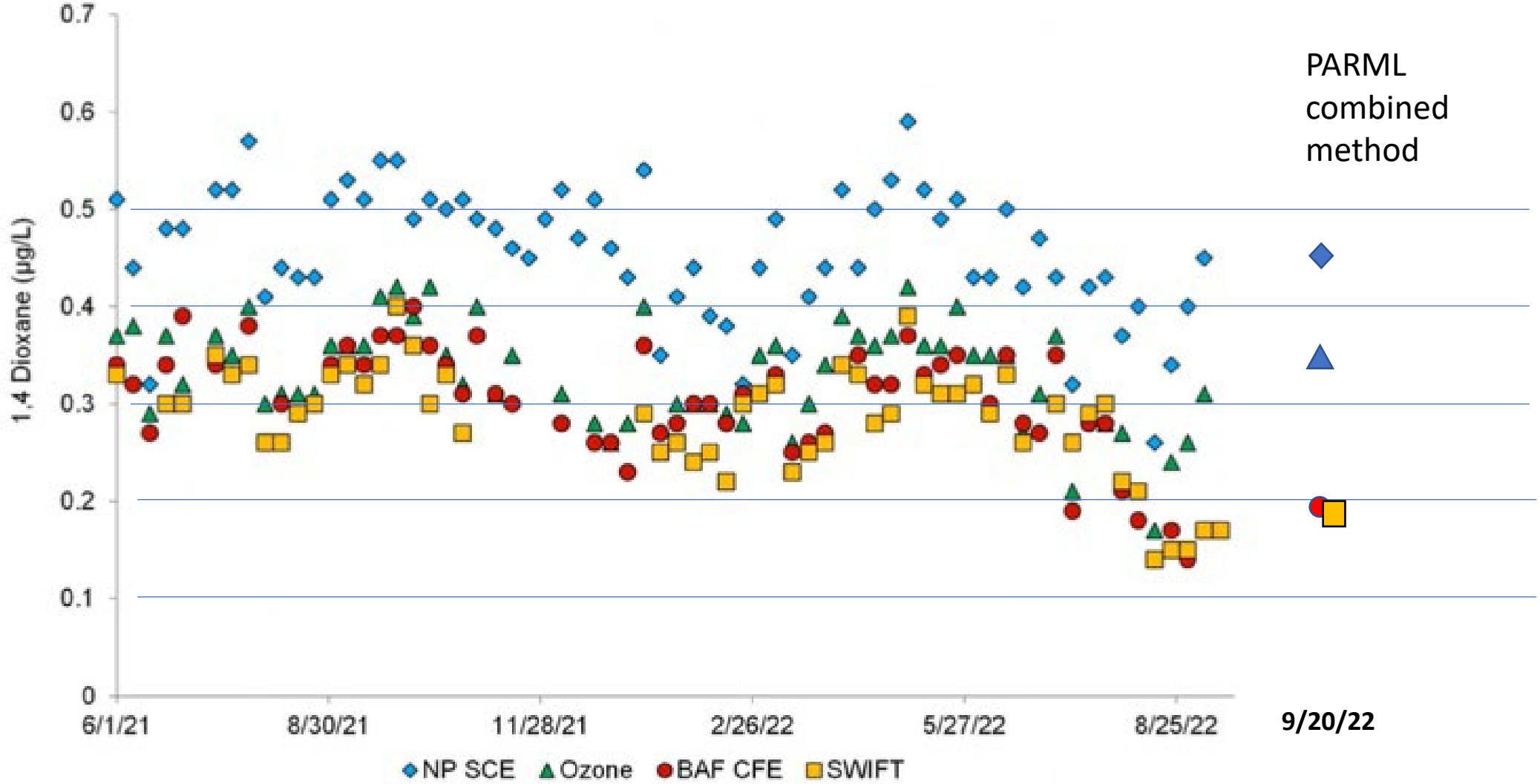
SRC 1,4-dioxane



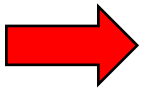
NDEA

Compound name	Conc (ng/L)	Recovery % by NDMA-d6
(NDEA) R2= 0.993	LOQ = 2	
InF	0.80	83.7
FS	0.72	71.4
O3	2.30	89.4
BF	0.42	62.3
C GAC	0	82.9
SWIFT	0.48	82.7
UPA	0.42	79.6
MPA	0	72.7
LPA	0	72.3

NMOR

Compound name	Conc (ng/L)	Recovery % by NDMA-d6
(NMOR) R2= 0.992	LOQ = 2	
InF	5.82	83.7
FS	6.12	71.4
O3	5.16	89.4
BF	6.20	62.3
C GAC	6.98	82.9
SWIFT	0	82.7
UPA	0	79.6
MPA	0	72.7
LPA	0	72.3

Removal appears fully to be associated with UV photolysis



Other nitrosamines are quantified too!

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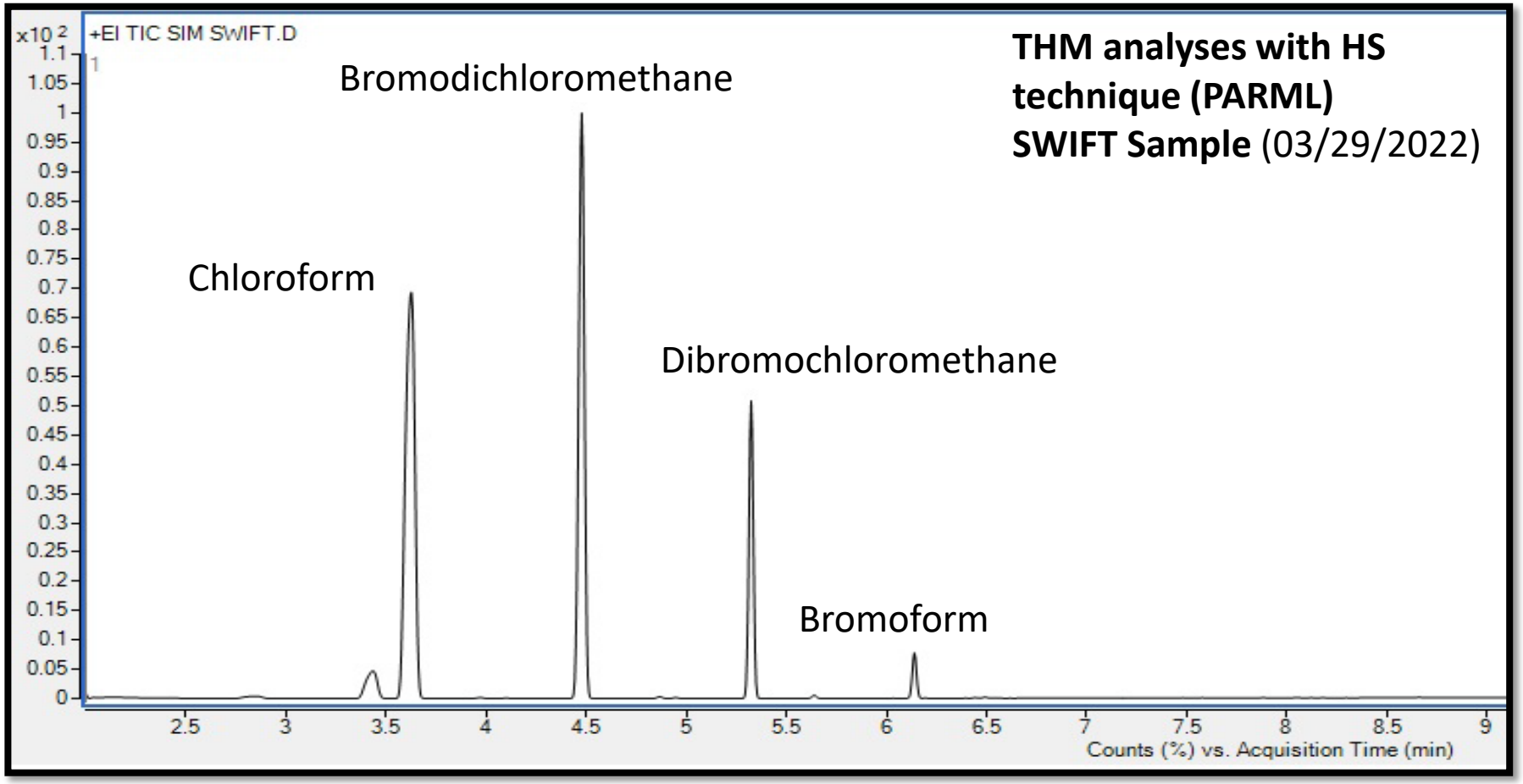
Application of EPA Method 524 (Volatile organic compounds, 54 analytes) by ITEX HS GC/MS.

Method is applicable to a wide range of organic compounds, with sufficient volatility to be analyzed by purge and trap. Includes four THMs regulated in drinking water (below).



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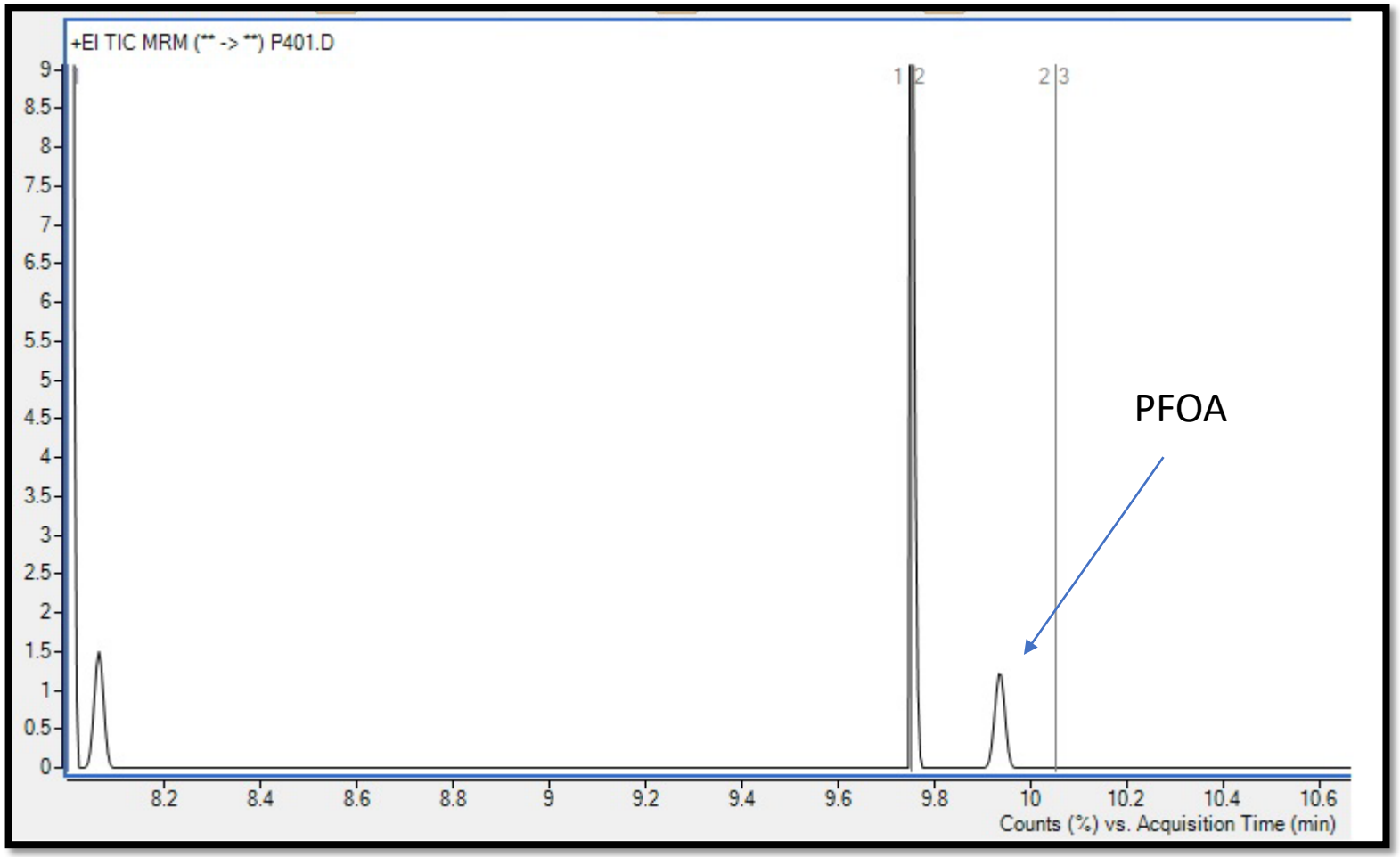
PARML Development of a New Method for Simultaneous Analysis of PFAS (PFCAs, PFOA) and HAAs by GC/MS



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Summary

Continuing to monitor isotope ratios in PAS to evaluate potential for use as a tracer to monitor movement of recharge water at Research Center and future SWIFT sites.

Continue monitoring of SWIFT RC for 1,4 dioxane and nitrosamines. Planned publication of this method after additional comparison efforts.

Continue application of other organics methods by GC MS and “challenge” the analyses with more complex waters of varying TOC concentrations and ionic content to assess any aqueous matrix affects

Questions?