Australian Government
Department of Defence
Defence Science and Technology Group

Deployed Chemical Sensor Data

Chemical Detection Team | CBRN Defence Branch | DSTG

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Introduction | CBRN Defence Branch | Chemical Detection Team

Chemical Detection S&T Capability

- Application of chemical and materials sciences to assess current equipment performance and identify development concepts to address gaps
- Areas of focus:
  - Performance evaluation of in-service & commercial (COTS) detectors
  - Provide operationally relevant advice to ADF and National Security clients
  - Low technology readiness level (TRL) sensor chemistry and technologies
  - Prototype detector development and assessment with industry/academia
  - Deployed chemical detection (including UxV integration)

‘High Performance’ vs ‘Low SWaP-C’ Sensors

- Low SwaP-C = Low Size, Weight, Power and Cost

Parameter	High Performance	Low SWaP-C
Size	Large (handheld or bigger)	Small (circuit board to wearable)
Weight	>500 g, upwards	<100’s g
Power	Multiple and/or large batteries	Small batteries or platform power
Cost	High (typically >$10k)	Low (< a few $100s)
Sensitivity	Good (typically)	Can be good
Analyte Range	Targets analytes of interest	Either very limited, or indiscriminate
Selectivity	Good (noting interferents)	Varies, often poor (e.g. MOX)
Identification	Yes (potentially only by class)	No (unless a very specific detector)
Response Time	Typically <30 seconds to identify	Varies, but can be fast (~1 sec)

Chemical Detection Challenges

Real world issues

- Plumes are highly variable (at edges, in interior, and over time)
- Chemical detector limitations (response time, swamping, hysteresis/clear-down, sampling rate)
- Outdoor releases will use simulant/s rather than highly toxic materials (lab only)
  - Release locations have low variability – generally flat, open with stable wind conditions
  - Reference instruments / ground truthing – what is real?
  - Limited spatial distribution and density of sensor grid

Data needs

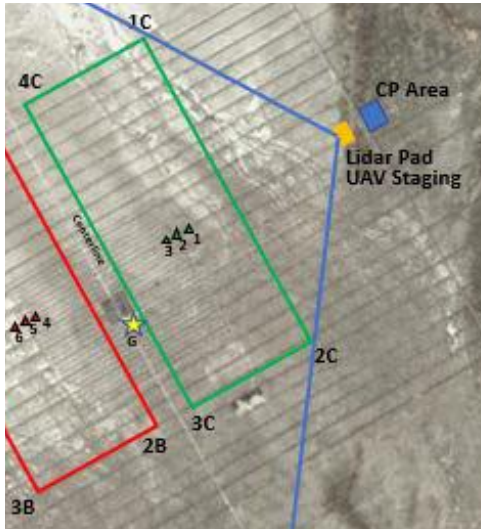
- Collect real-world plume datasets to direct laboratory testing or *in silico* detector response modelling
  - DSTG has datasets that could be shared from TECFT 23

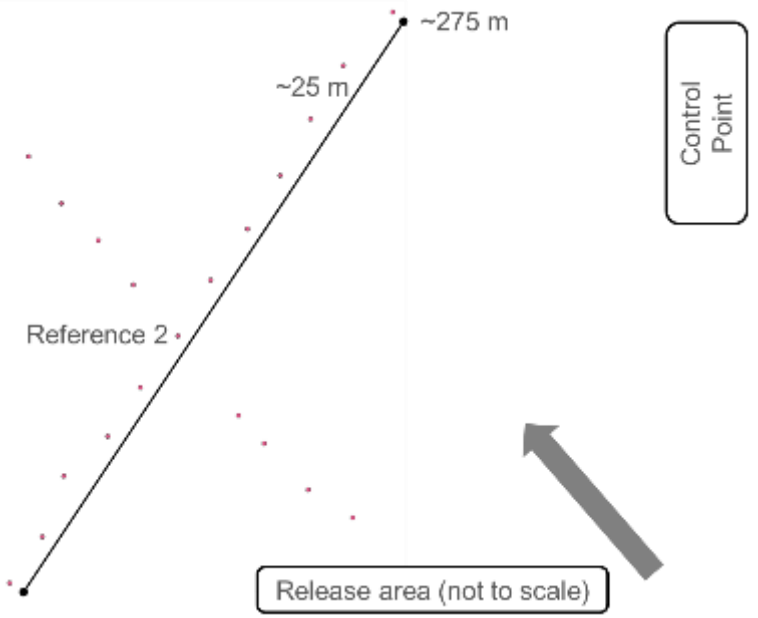
Real World Data

Dugway Proving Ground – TECFT 2023

Target S – Multiple open air releases over a week (typically night for stable weather)

- Two Chem simulant release ‘lanes’ (1,600 m x 300 m)
- Three reference points per lane (with referee instrumentation)
- Truck-mounted dissemination rigs (moveable release points for wind compensation)
- Chemical simulant release: Typically 8-25 L over 10-20 min
- DSTG instrumentation at ‘Site 2’





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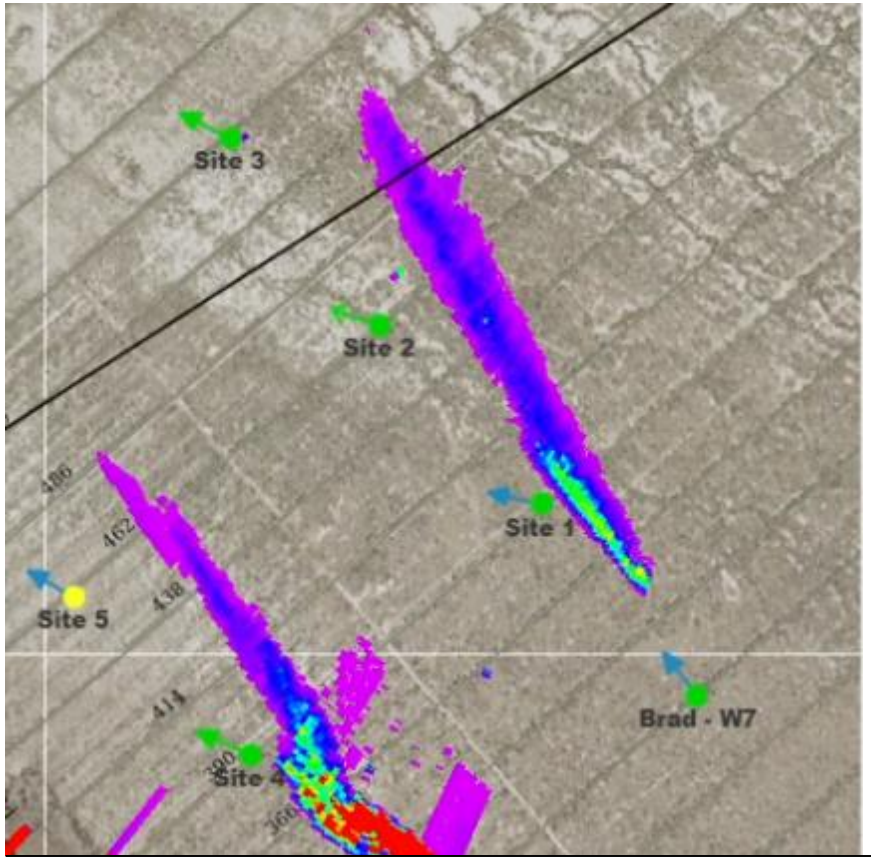
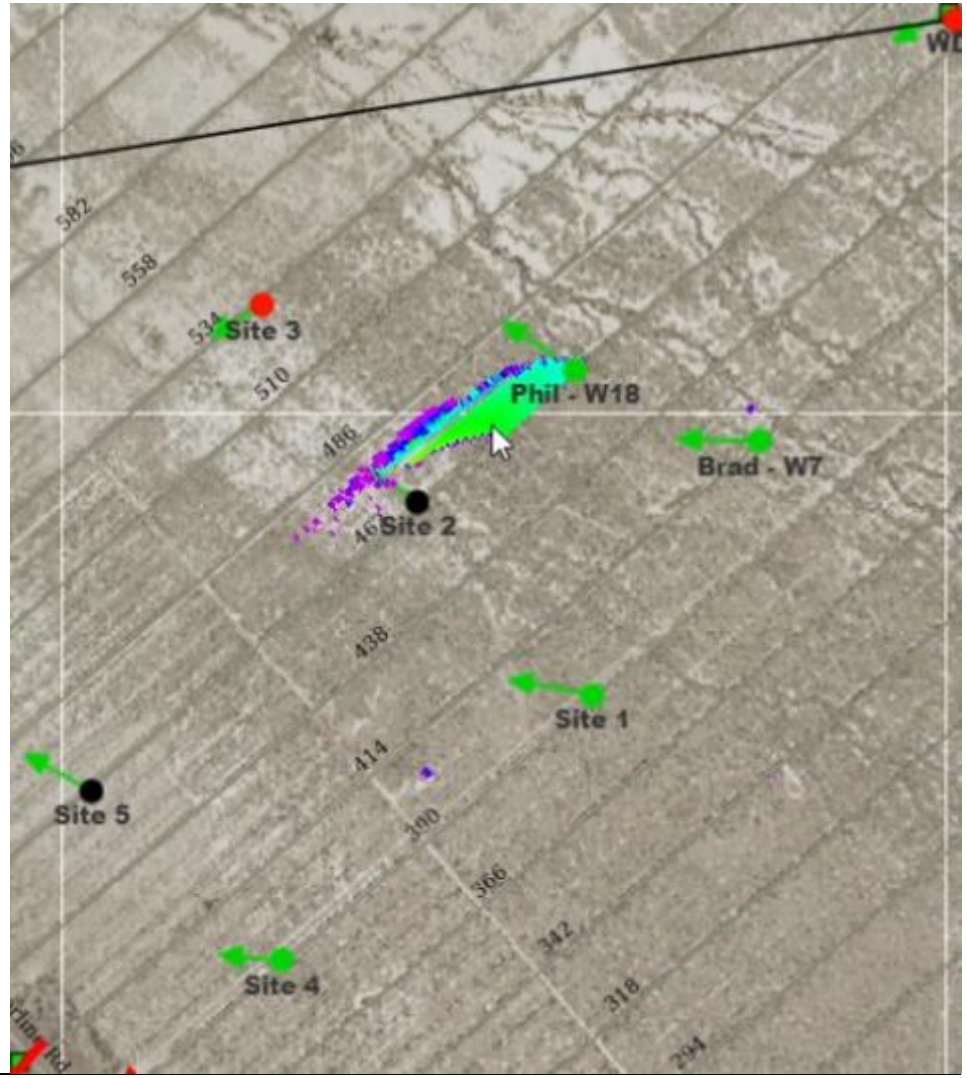
Dugway Proving Ground – TECFT 2023 (open air release)





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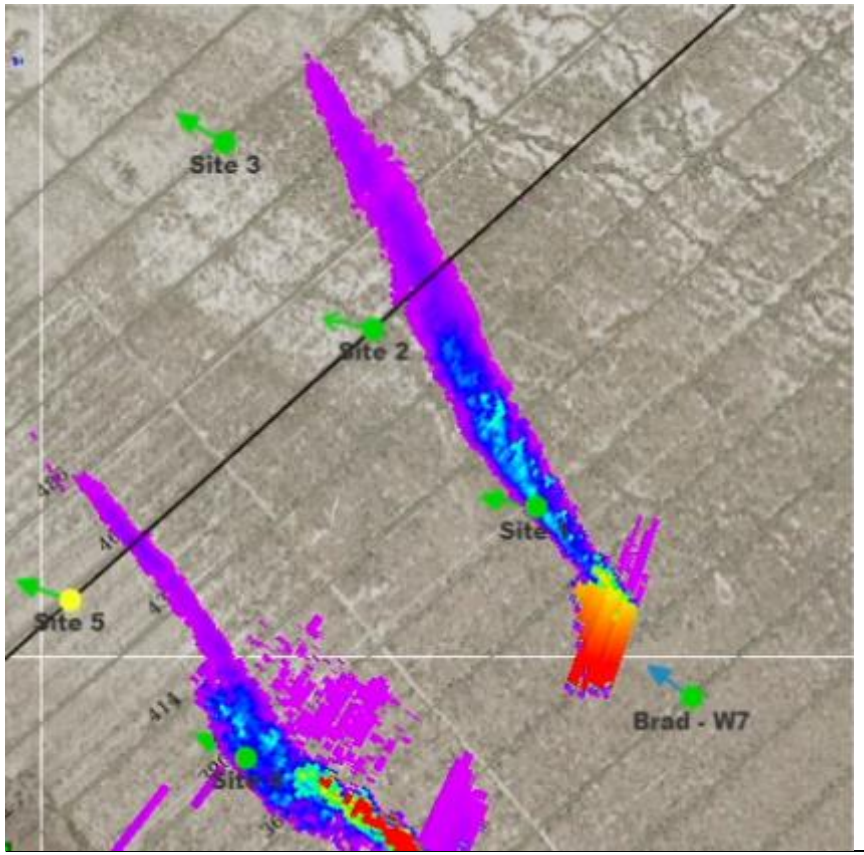

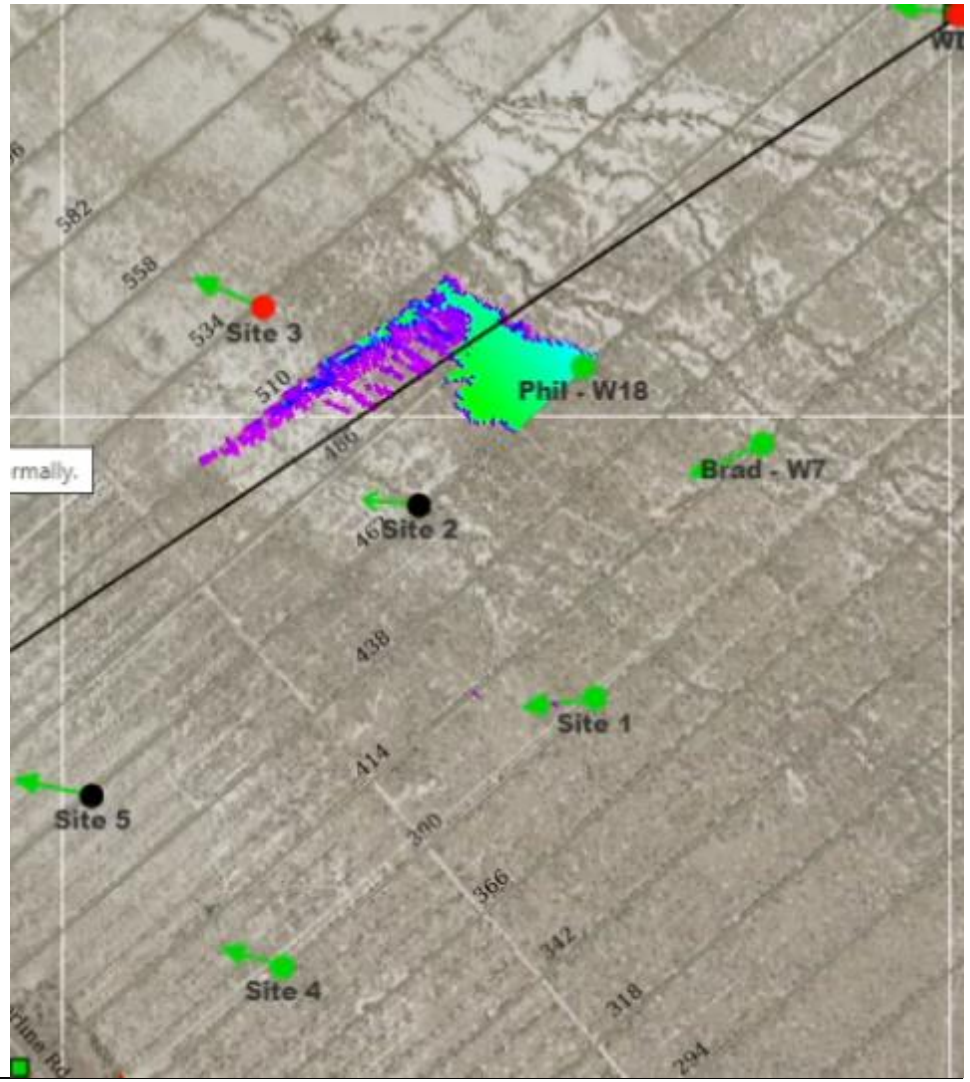

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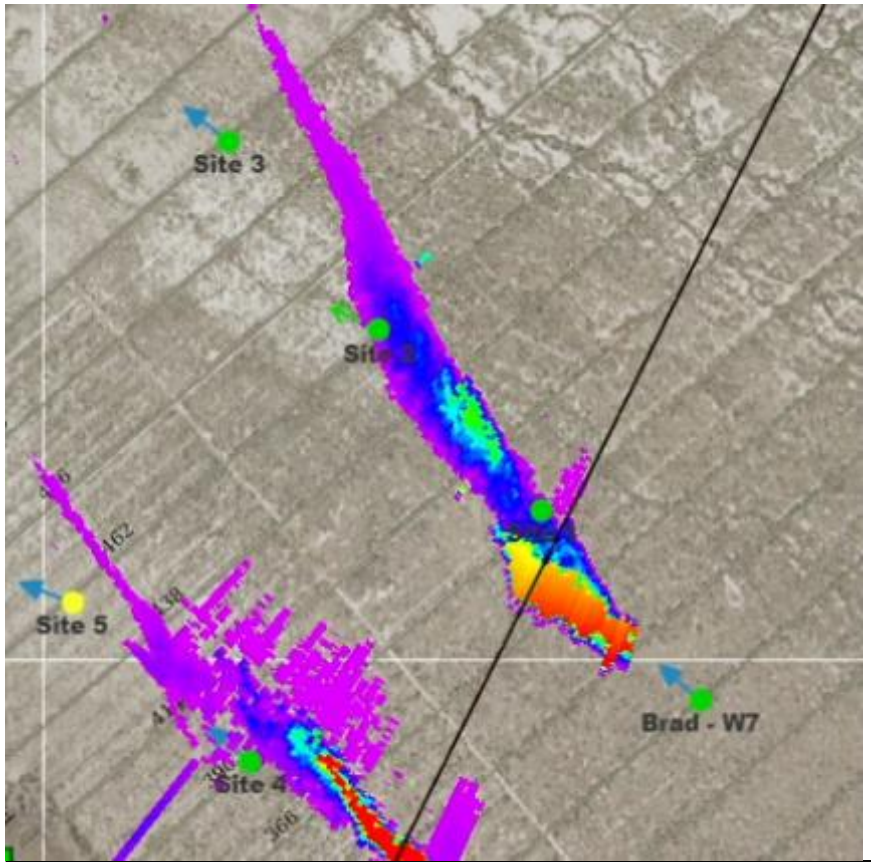

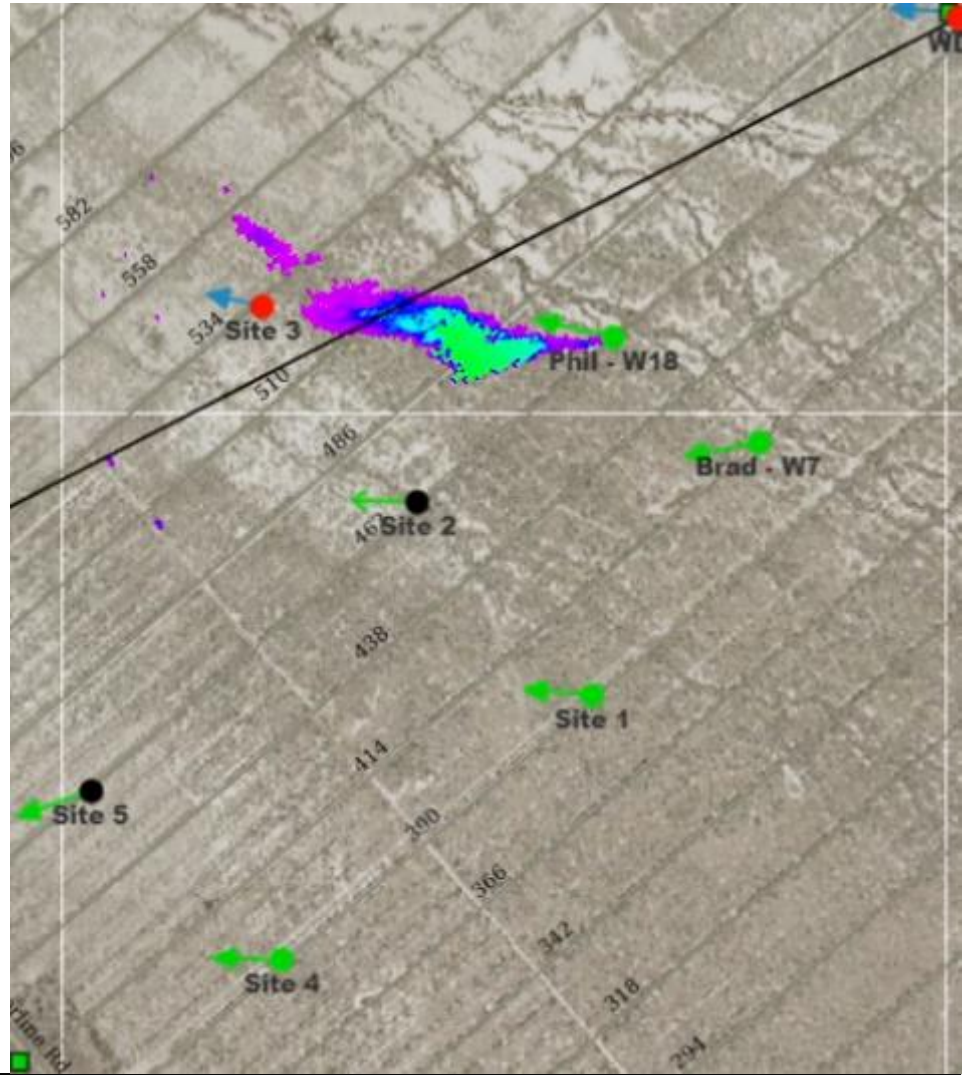

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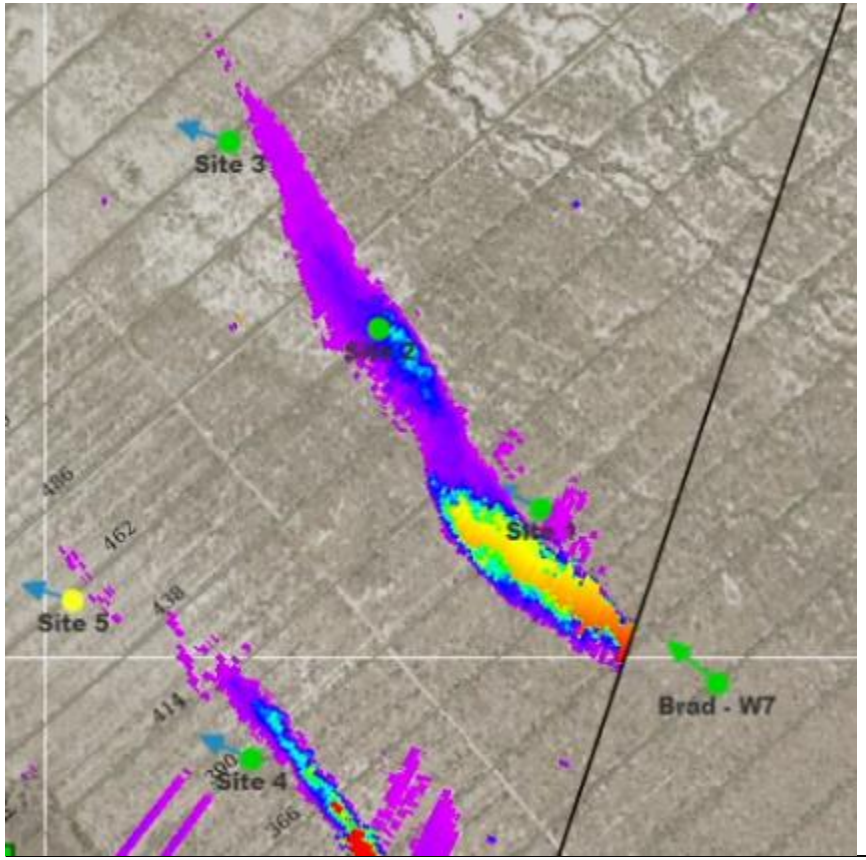

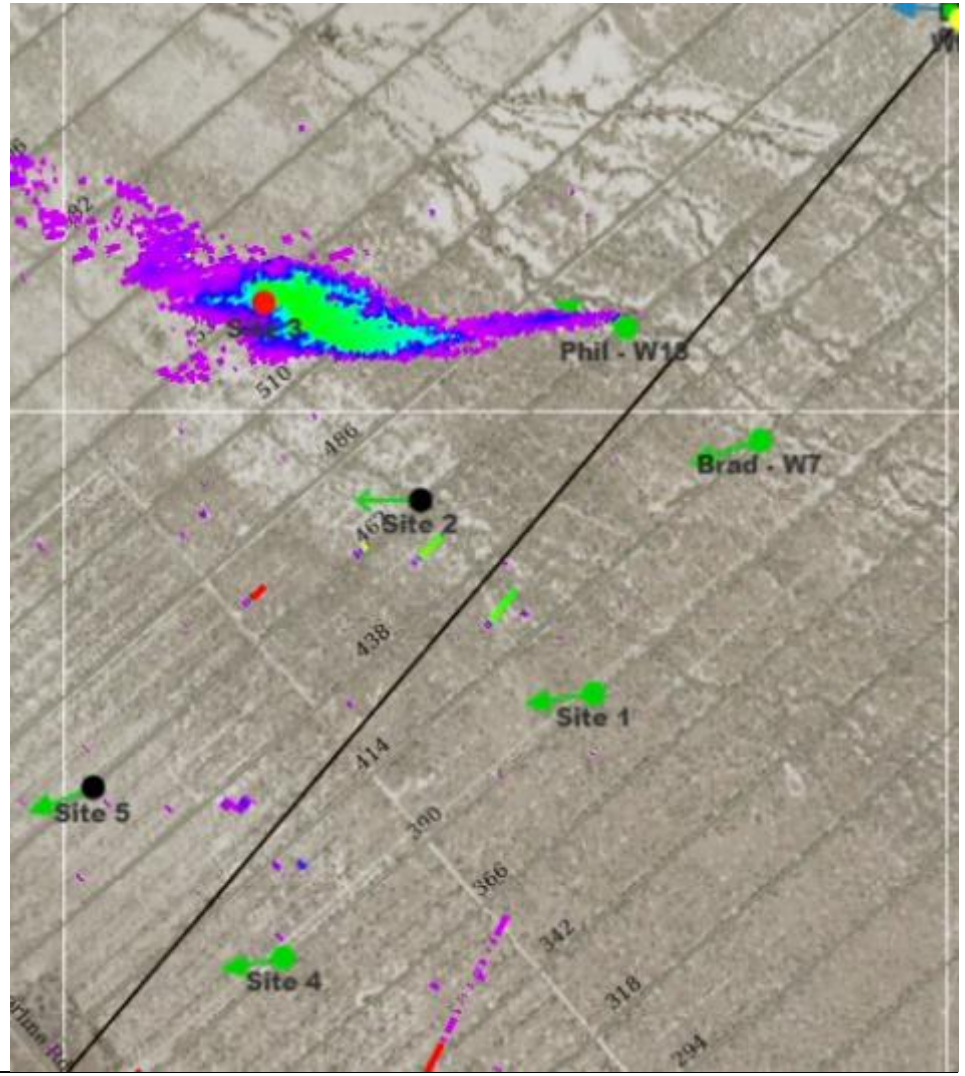

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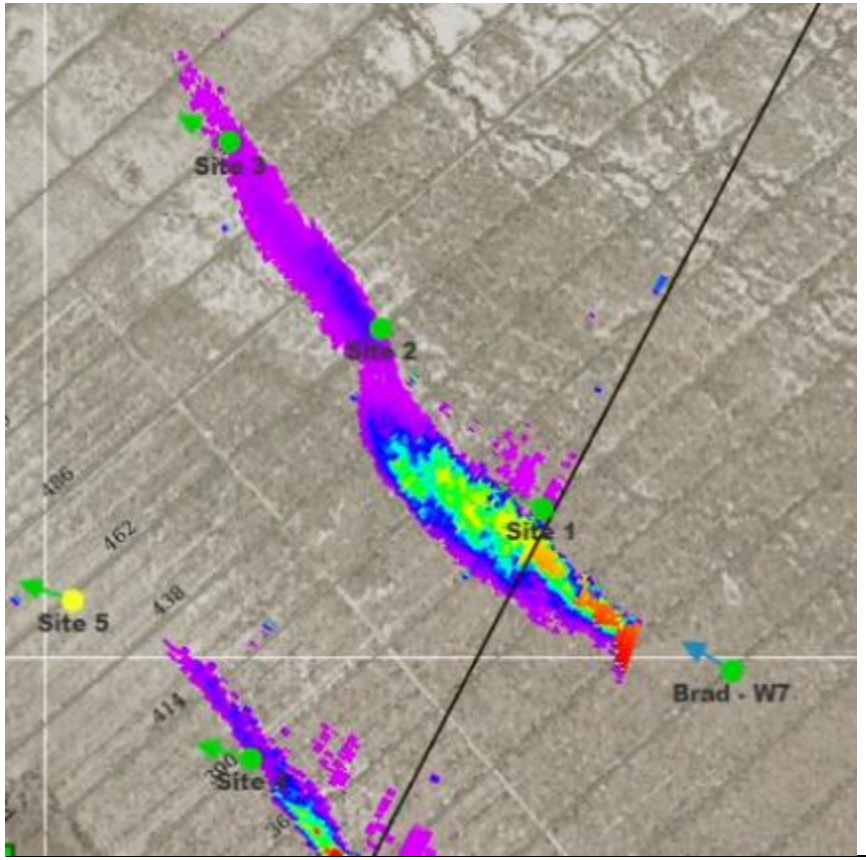

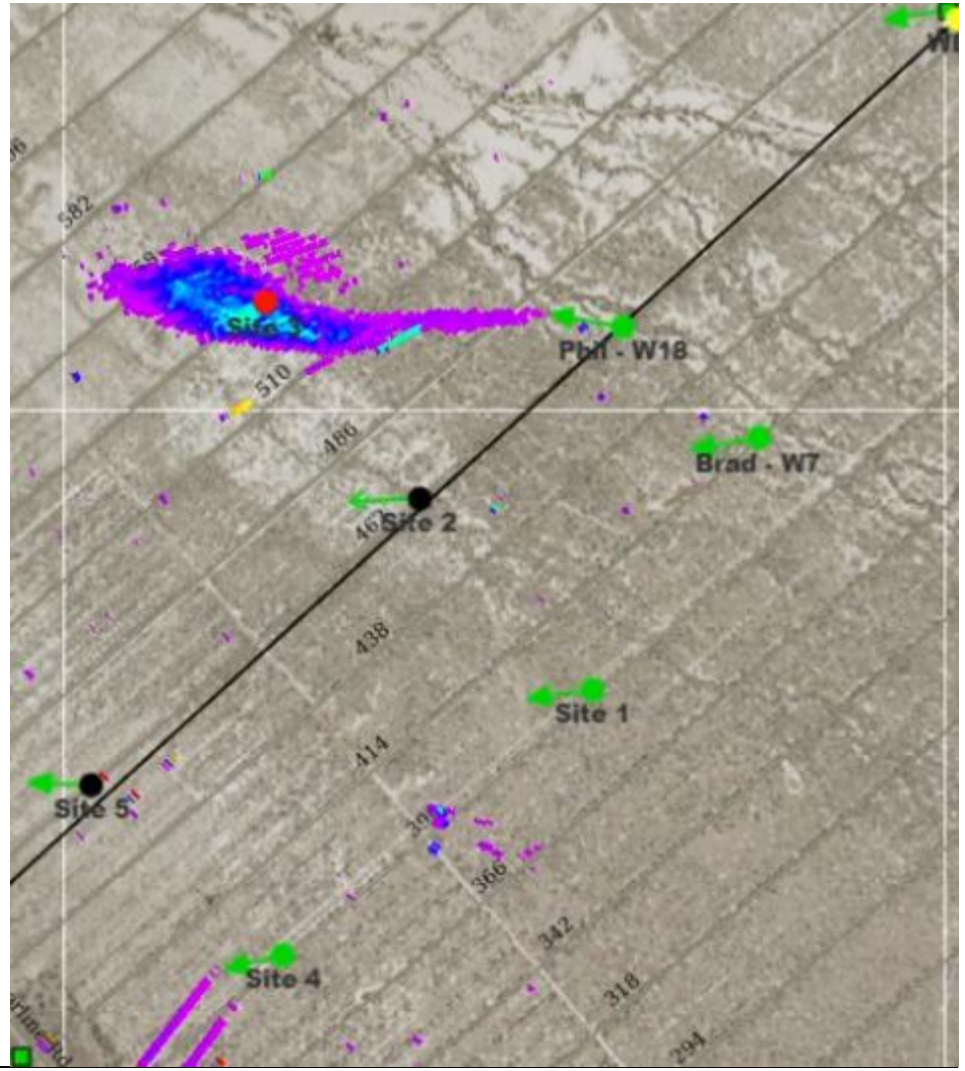

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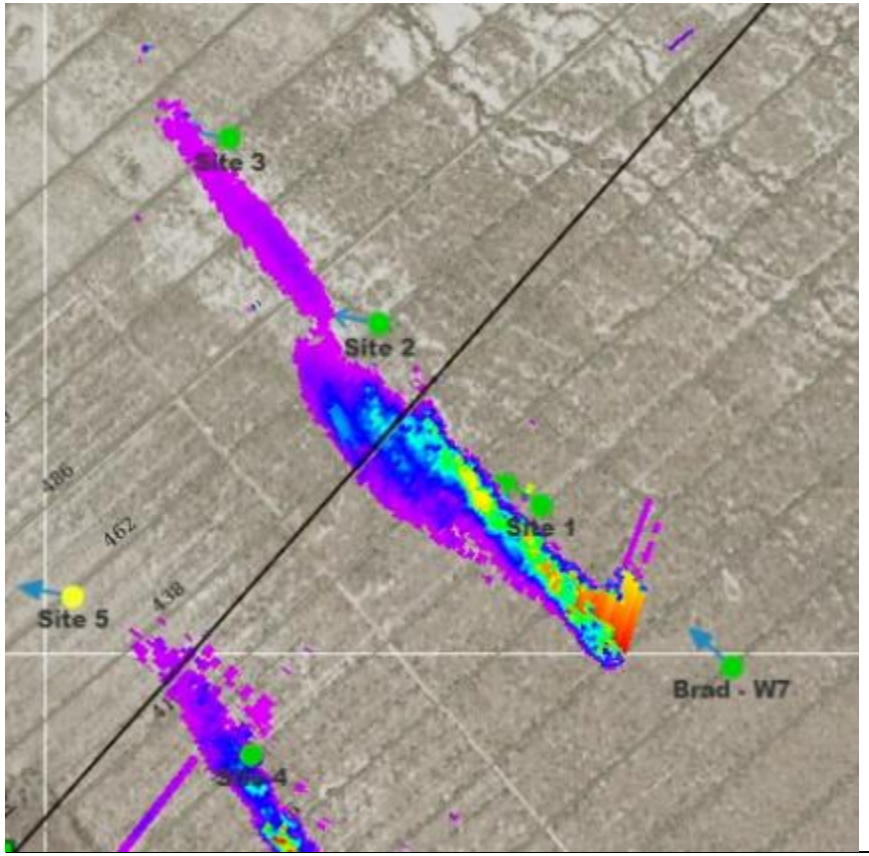

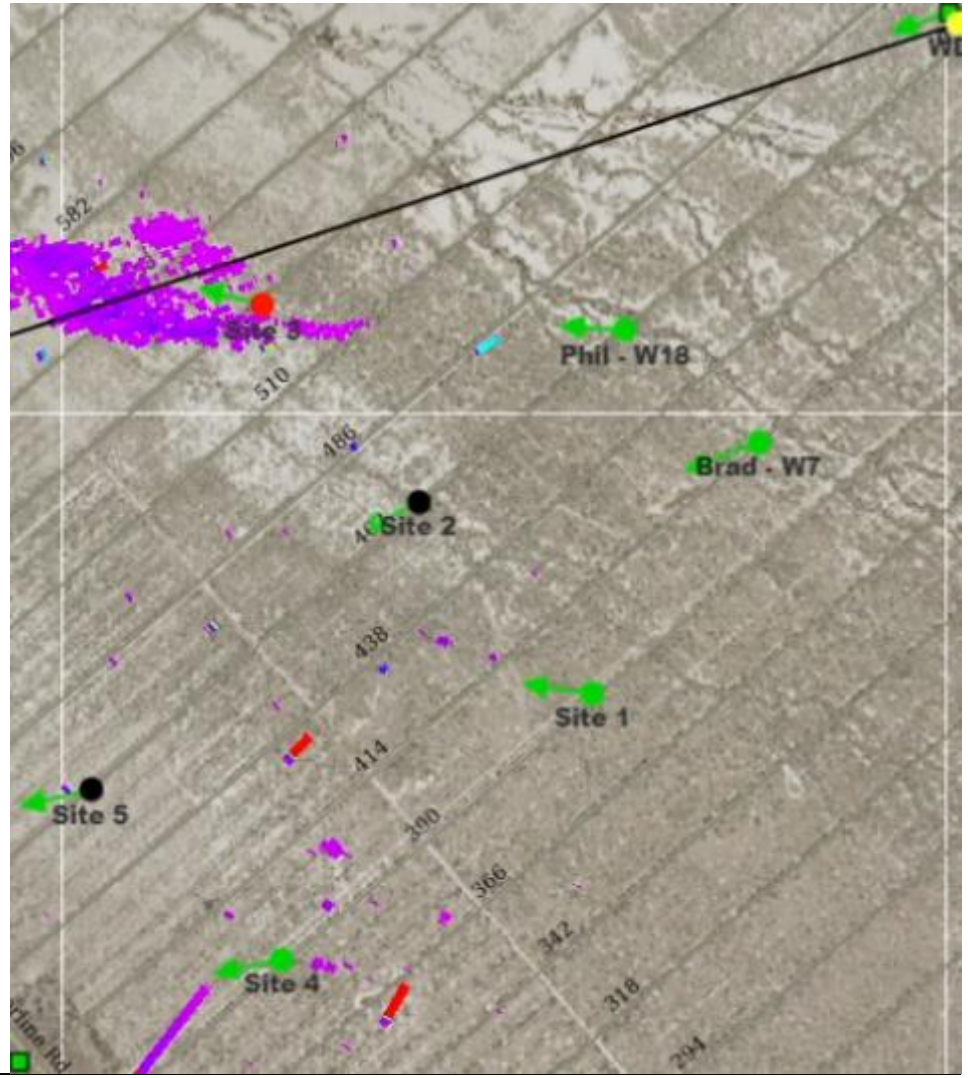

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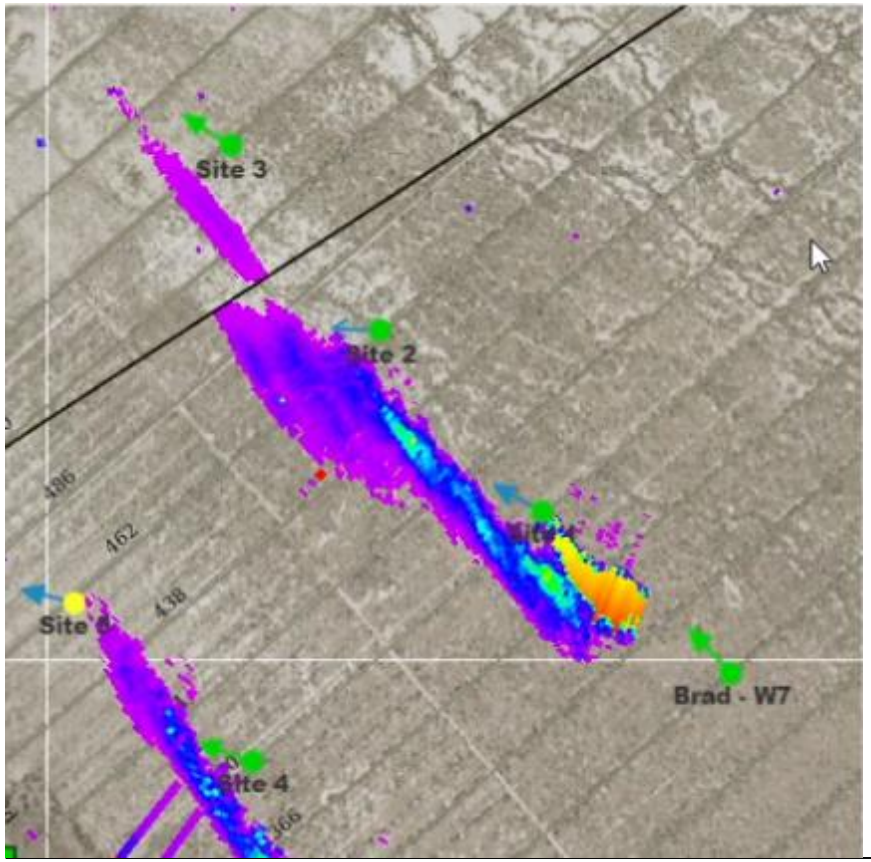

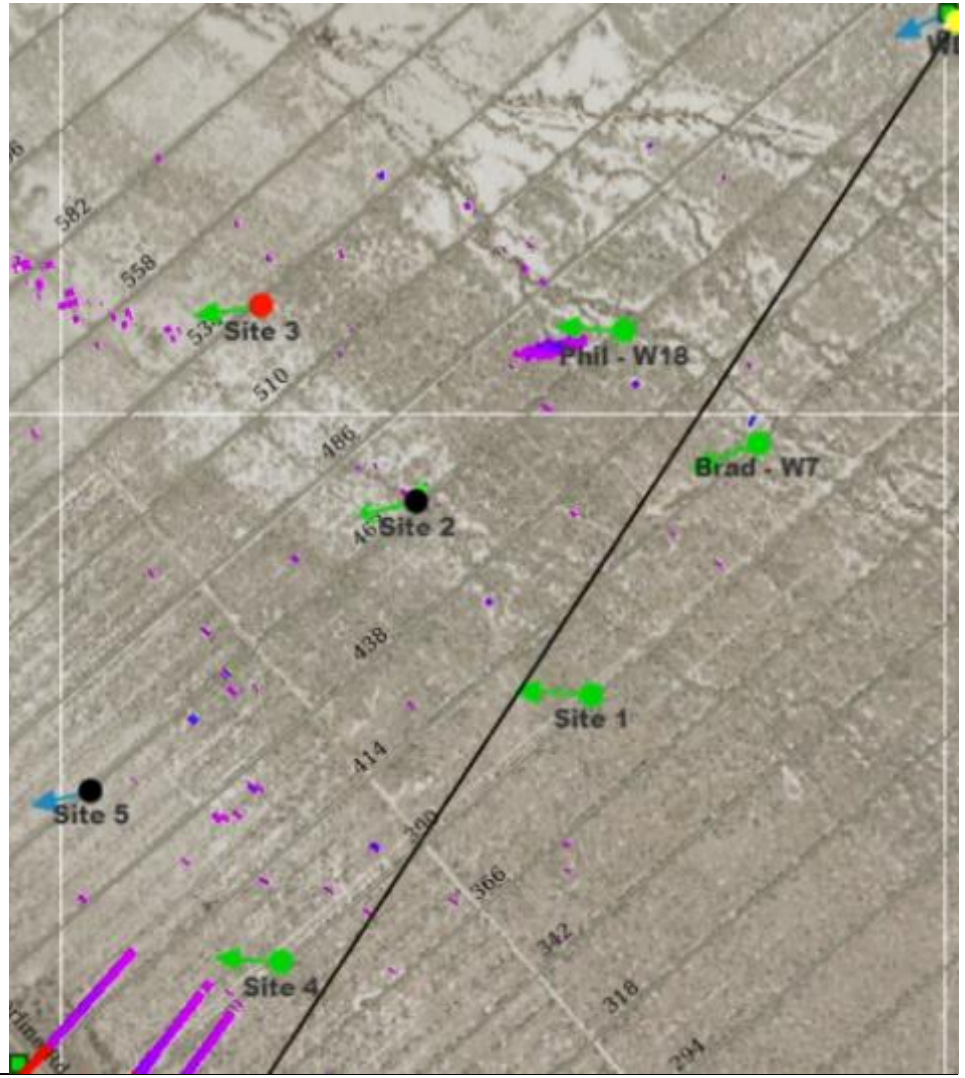

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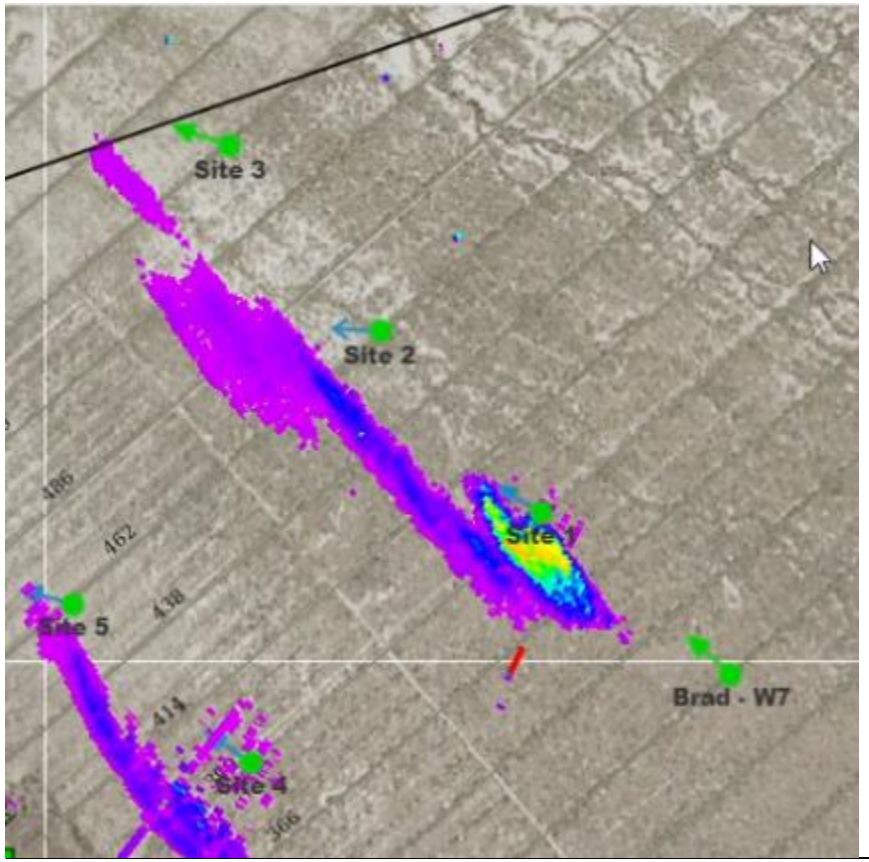

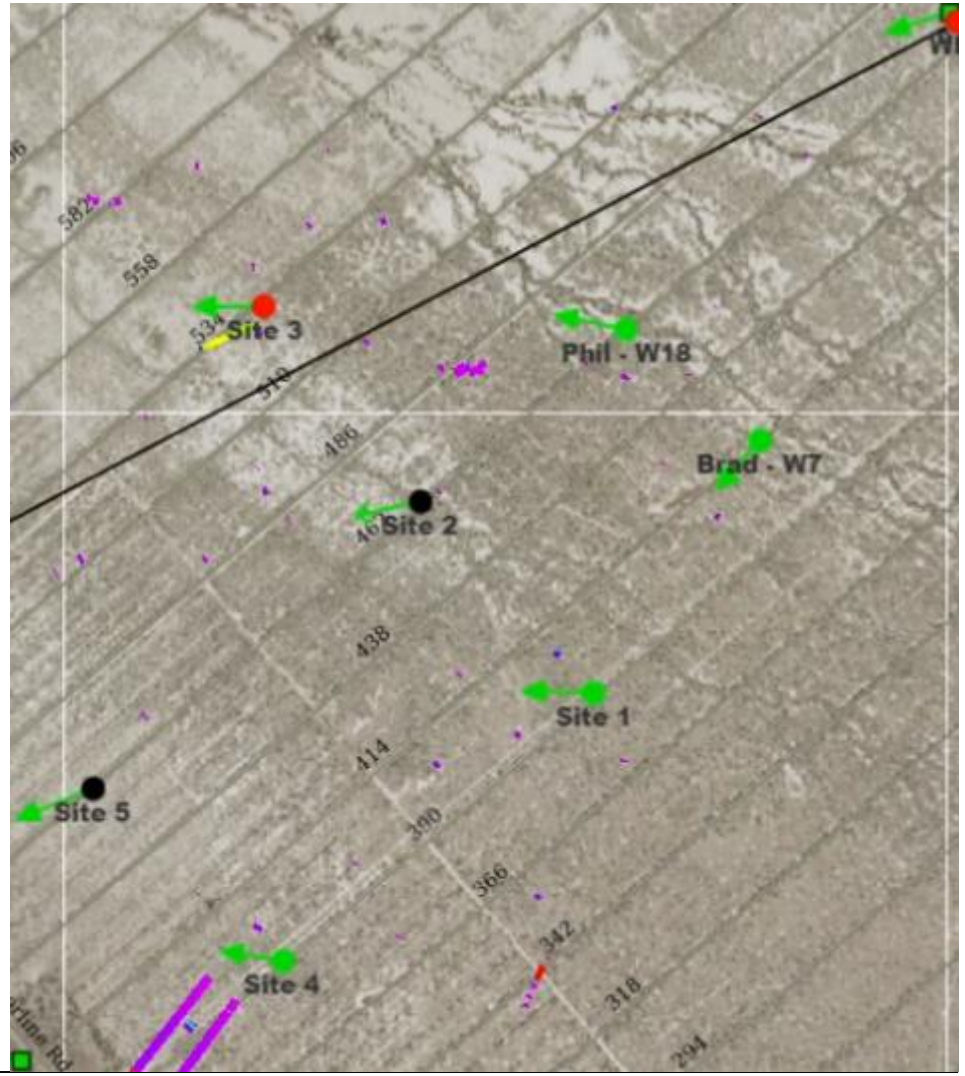

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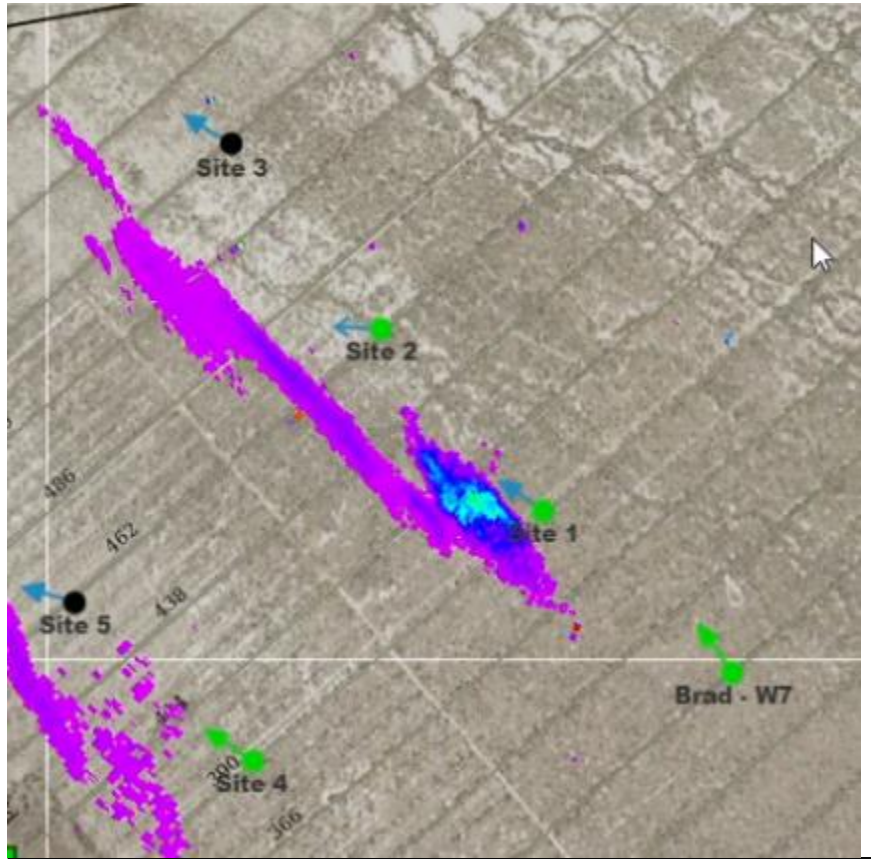

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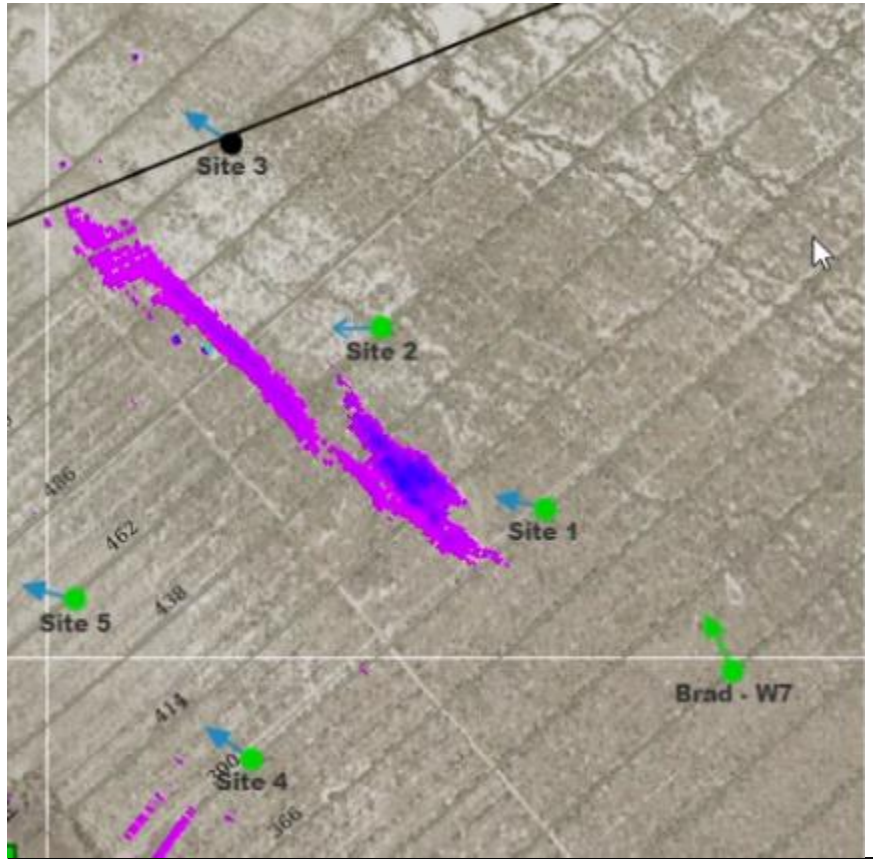
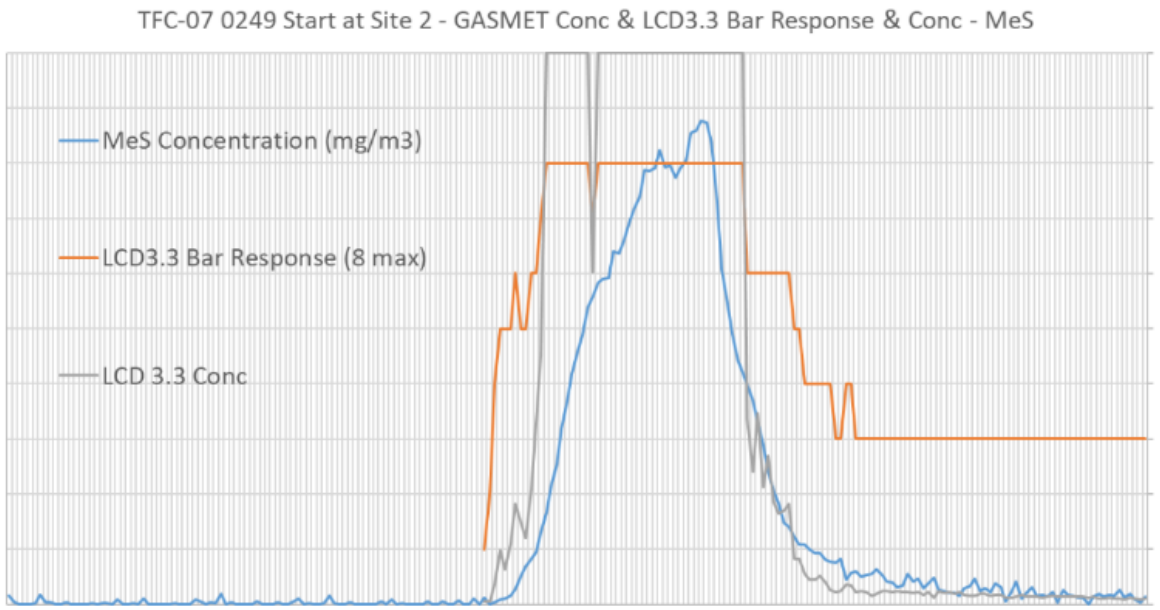


Real World Data

TECFT plume: LCD v's GASMET

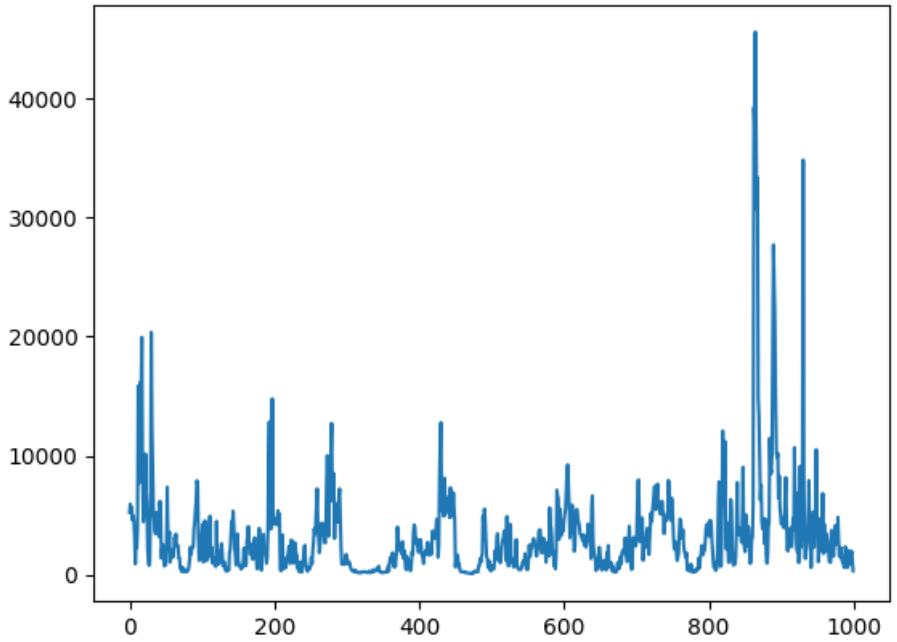


Real World Data

COANDA plume movie

Real World Data

COANDA plume Fixed location concentration time series



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- Chemical Biological Protection Team
- Aerosol Science Team

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Questions?