TCEQ's Mobile Monitoring Capabilities and Findings From Texas Monitoring Trips

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Ambient Air Monitoring

- Ambient air monitoring uses:
  - Air quality standard compliance
  - Air quality modeling
  - Evaluate potential health effects
  - Chemical release impacts
- Multiple monitoring platforms:

  stationary, handheld, and mobile

Mobile Monitoring Vehicles

- Analytical instrumentation measures instantaneous chemical concentrations in ambient air while in motion
- More information than stationary monitors during an investigation or emergency response
- Provide more continuous spatial coverage and specificity than handheld monitors

TCEQ's Mobile Monitoring Instrumentation

Duvas DV3000 Ultraviolet (UV) Spectrometer

- Semi-quantitative analysis of 14 compounds including benzene, 1,3-butadiene, styrene, toluene, and sulfur dioxide (SO_2)
- Dedicated tablet creates real-time maps for data visualization
- Limit of Detection: low ppbv

TCEQ's Mobile Monitoring Instrumentation

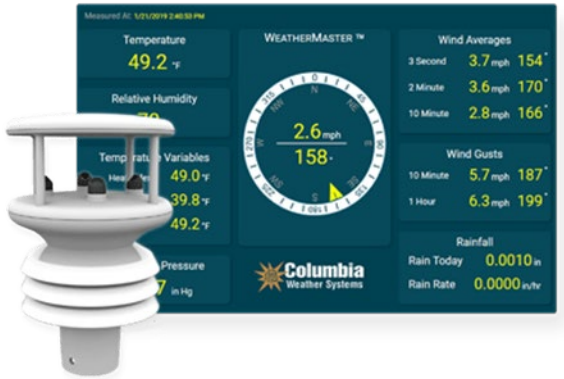
Selected Ion Flow Tube – Mass Spectrometer (SIFT-MS)

- Current calibrated methods:
  - BTEX, styrene, 1,3-butadiene, and hydrogen sulfide (H_2S)
- Can add uncalibrated analytes for qualitative analysis
- Can perform full mass scans to help identify unknown compounds
- Library of over 1,000 analytes
- Limit of Detection: low ppbv

TCEQ's Mobile Monitoring Instrumentation

Ambilabs Dual Wavelength Nephelometer

- Estimates concentrations of particulate matter with an aerodynamic diameter of 10 micrometers or less, and 2.5 micrometers or less (PM_{10} and $PM_{2.5}$)



Magellan MX500 Weather Station

- Global Positioning System (GPS) coordinates, temperature, wind speed, and wind direction
  - Can account for vehicle speed and direction up to 20 miles per hour (mph)

TCEQ's Mobile Monitoring Instrumentation

Picarro G2204 Cavity Ring Down Spectrometer (CRDS)

- Real time H_2S and methane (CH_4) monitoring
- Limit of detection:
  - H_2S: Low ppbv
  - CH_4: Low ppmv

Picarro G2920/PI2920 CRDS with Zero Reference Module

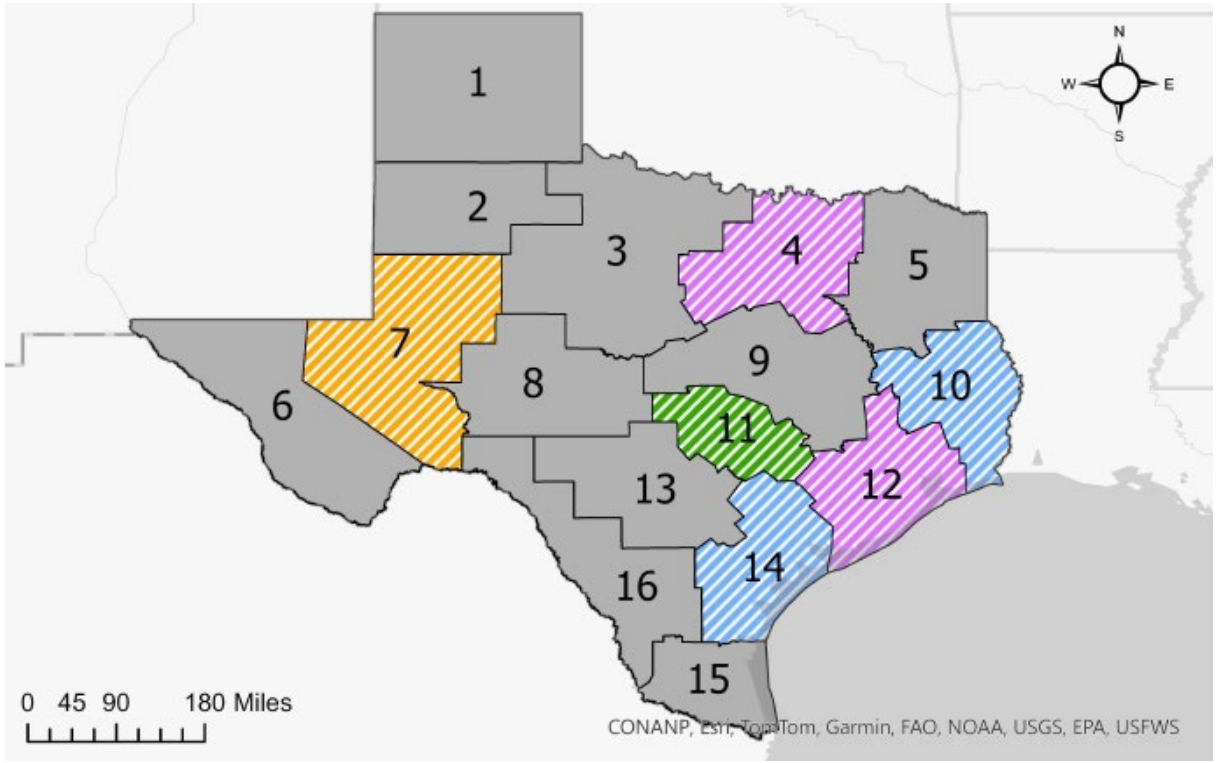
- Real time ethylene oxide (EtO) monitoring
- Limit of Detection: pptv

The TCEQ Mobile Monitoring Team

- The TCEQ Mobile Monitoring Team (MMT) operates and maintains three vans
- Supports Regional Offices with investigations
- Allows for quick response to emergency events

Regional Survey Vehicles

- In addition to MMT, five Regional Offices are equipped with Regional Survey Vehicles (RSVs)
- Allows Regions to have increased capabilities for investigations and emergency response events



MMT Headquarters

Duvas and Nephelometer Mobile Monitoring

Duvas and Picarro H_2S Mobile Monitoring

Duvas Mobile Monitoring

Mobile Monitoring Comparison Values

Mobile Monitoring Comparison Values

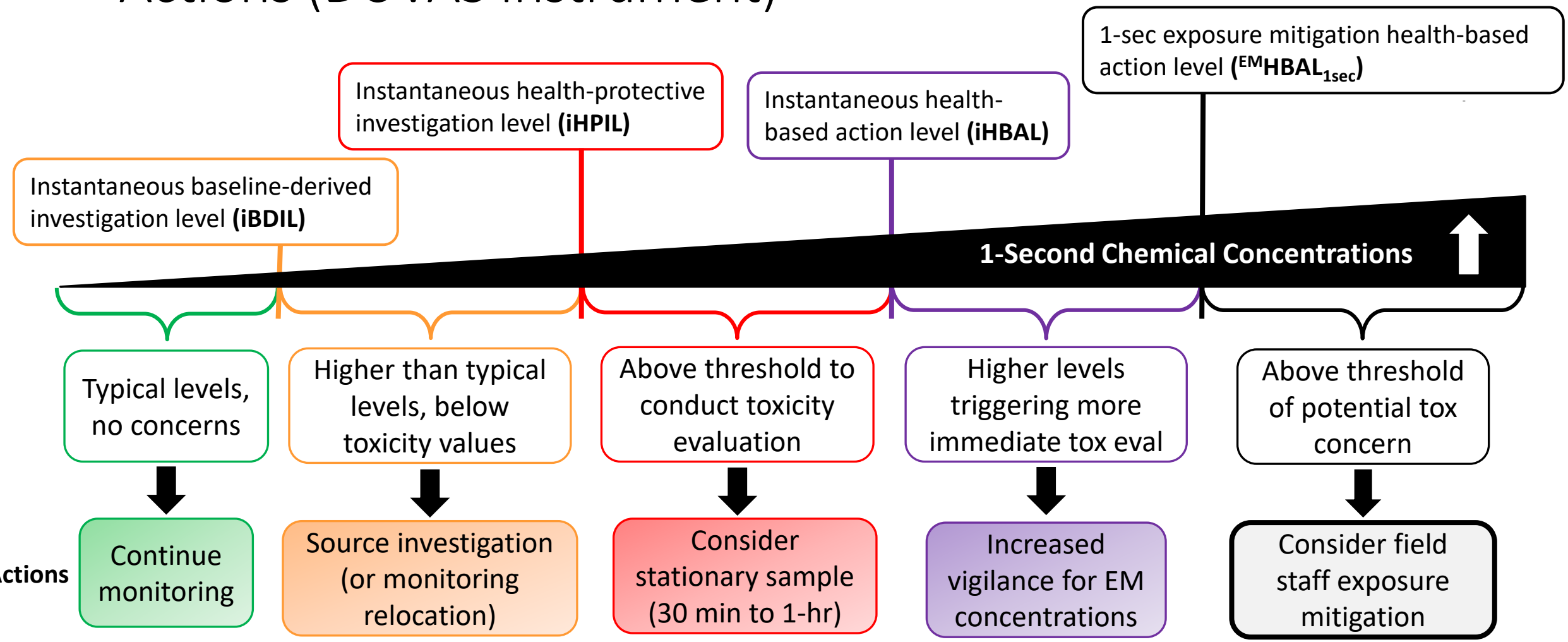
Two-fold Purpose:

- More rapidly identify abnormally high chemical releases and respond to address uncontrolled releases
- Quickly assess chemical levels that could cause adverse effects to field staff and mitigate exposure

The Challenge:

- Historically, instantaneous concentrations have not had corresponding comparison values for the protection of health effects.
- Derive scientifically sound comparison values and practical action levels appropriate for evaluating 1-30 second concentrations.

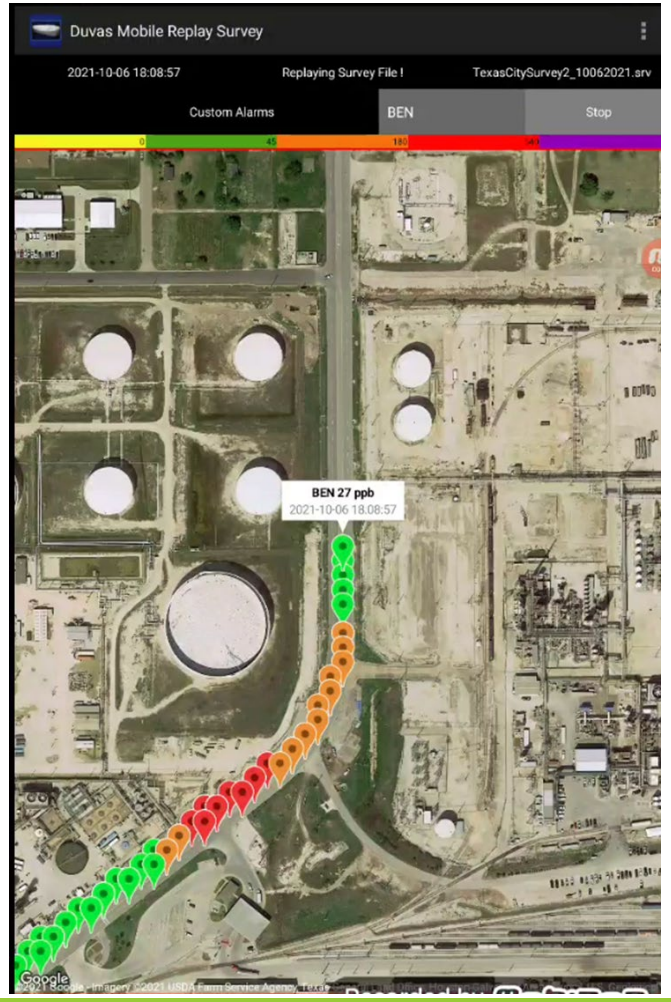
Mobile Monitoring Comparison Values & Associated Actions (DUVAS Instrument)



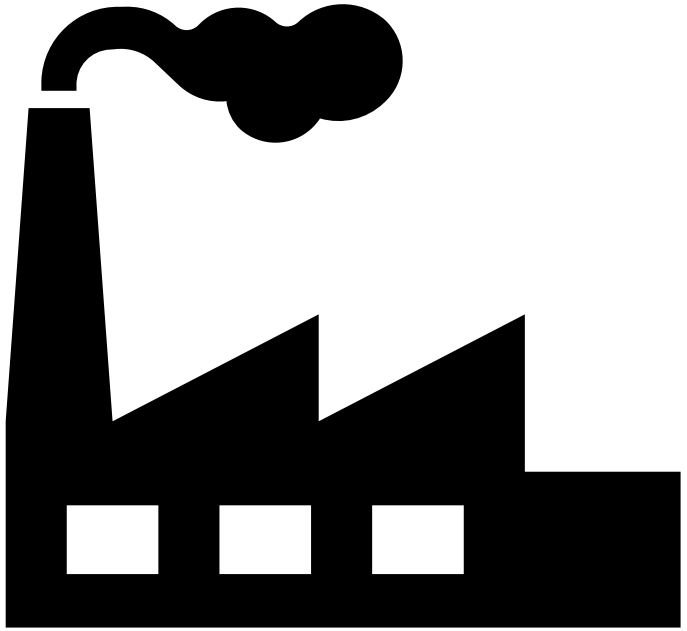
All comparison values are set at levels well below those that would cause health effects

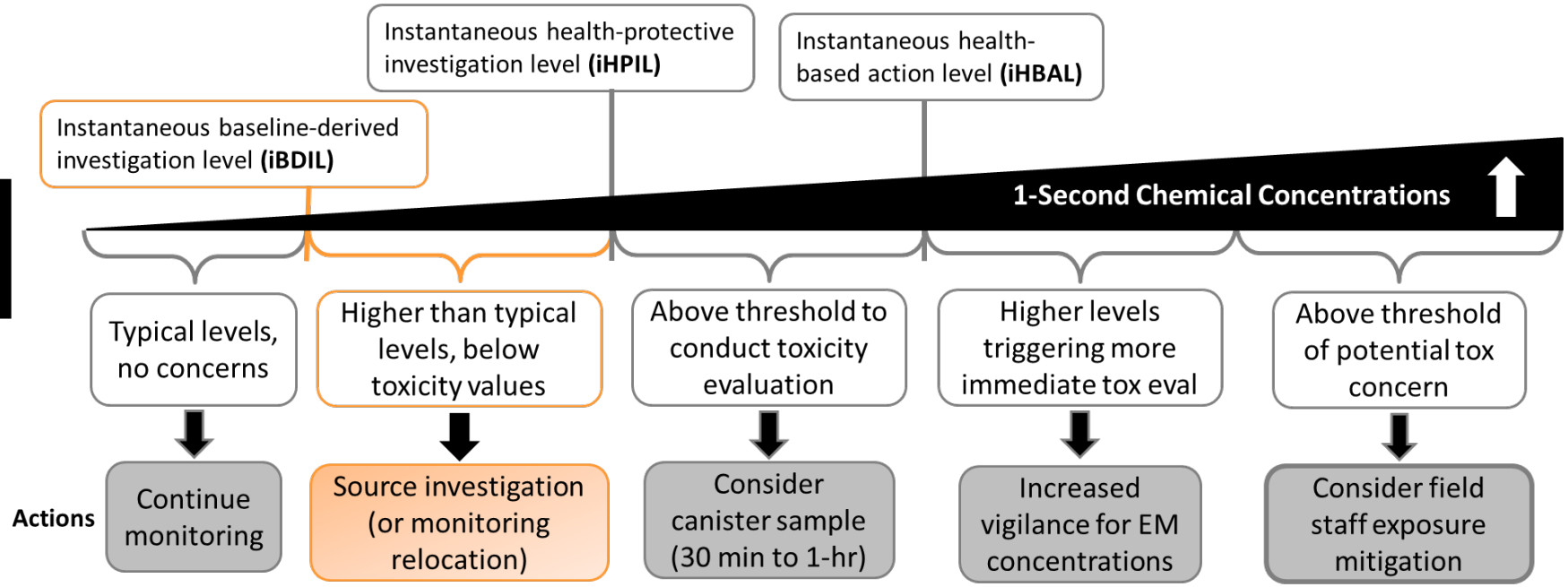
Mobile Monitoring Comparison Values

- TCEQ derived two types of comparison values:
  - Levels to identify chemical releases
  - Levels to determine toxicity
- Potential actions based on comparison value exceedances:
  - Source investigation
  - Monitoring relocation
  - Stationary monitoring to obtain longer averaging times of concentrations for toxicity evaluation
  - Exposure mitigation of field staff
- Identified levels associated with color coding of data for communication of results (green, orange, red, purple)



Levels to Identify Chemical Releases

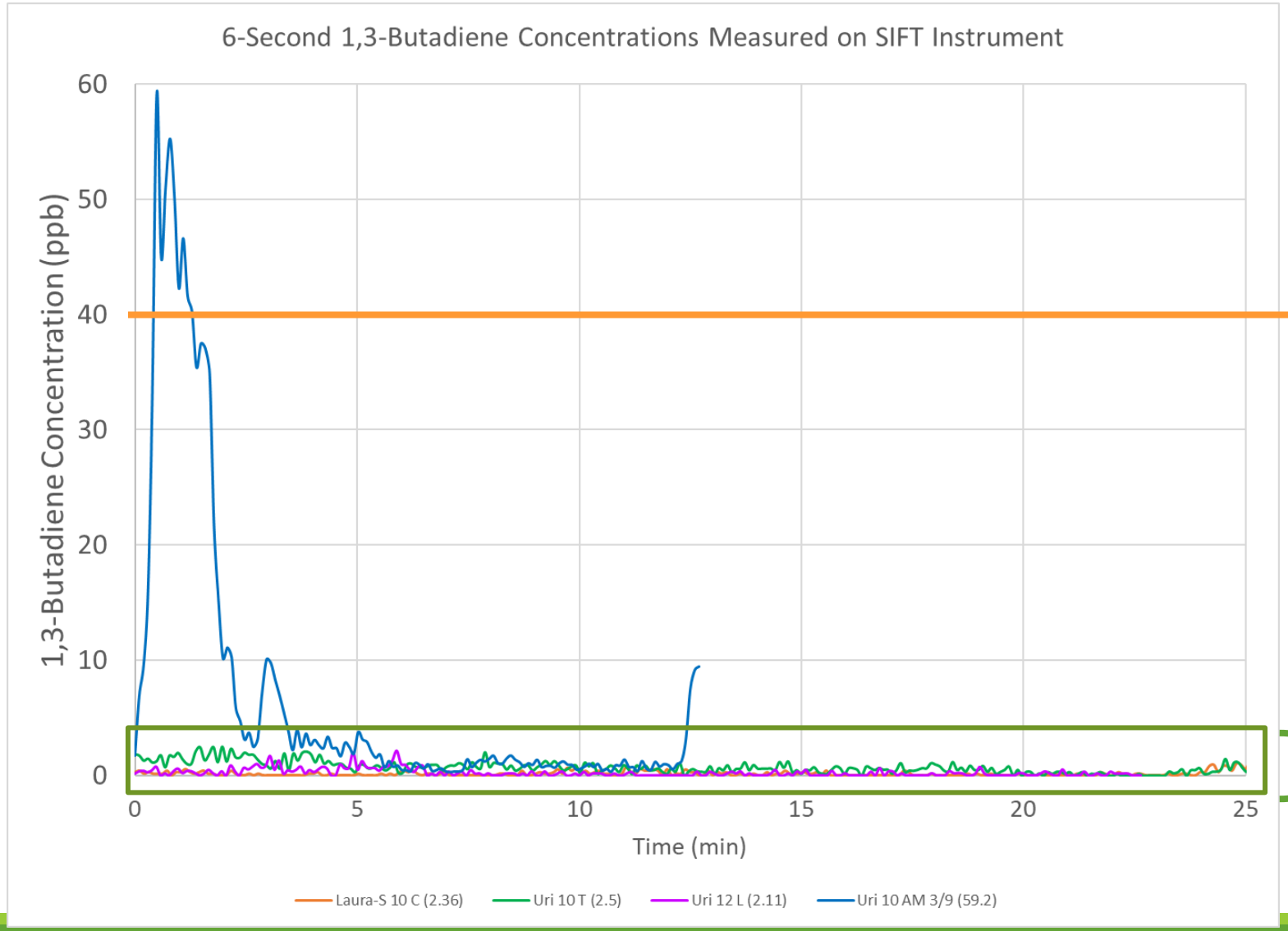




Levels to Identify Chemical Releases

- Based on levels that indicate an abnormal amount of chemical in the air that may require a source investigation
- Not based on health effect levels
  - A chemical with a low toxicity that is being measured at levels much higher than are typical indicates a release that may require action – e.g., propylene
- Derive values by first assessing the typical background or baseline level for the chemical and instrument
  - Used data from hundreds of SIFT and DUVAS mobile monitoring surveys, gathered in Beaumont, Corpus Christi, and Houston areas
- **Instantaneous baseline-derived investigation level (iBDIL)** derived from baseline chemical levels:
  - 10-fold above baseline
  - Balances need to identify abnormally high chemical concentrations, while avoiding investigating spurious concentration changes

Baseline and Investigation Levels Example



iBDIL: 10-times baseline

Chemical Baseline

Instantaneous Baseline-Derived Investigation Levels (iBDILs)

- Different types of instruments and different chemicals had different data quality
  - DUVAS is less quantitative than SIFT, generally with higher baselines
  - For consistency, a single iBDIL is used for a chemical measured by multiple instruments

- Action when exceeded: source investigation, possible monitoring relocation (if source is known and in an area without public exposure)

SIFT

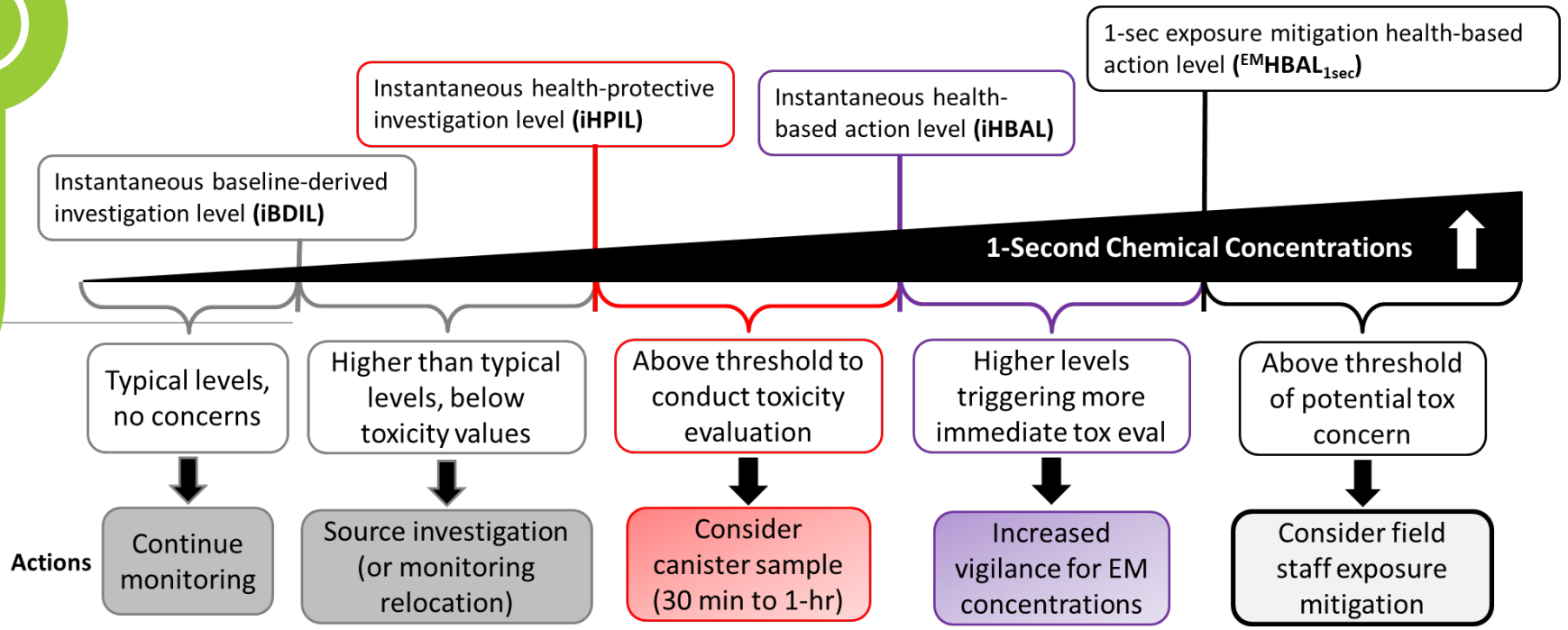
Chemical(s)	iBDIL (ppb)
Benzene	80
Toluene	70
Xylenes + Ethylbenzene	60
1,3-Butadiene	40
Styrene	60

DUVAS

Chemical(s)	iBDIL (ppb)
Benzene[#]	80
Toluene[#]	70
Ethylbenzene	350
1,3-Butadiene[#]	40
Styrene[#]	60
SO_2	80

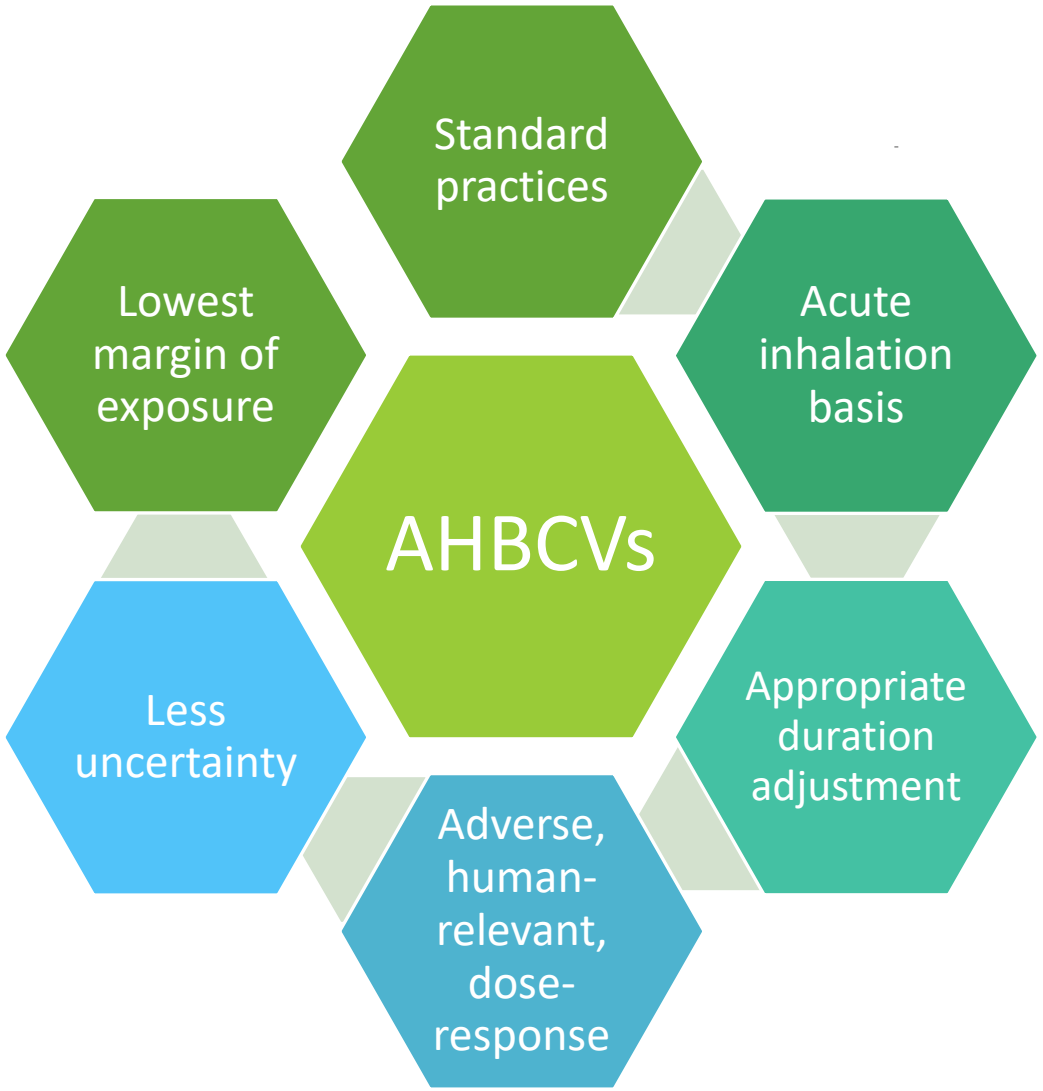
[#] DUVAS iBDILs for benzene, 1,3-butadiene, toluene and styrene are based on SIFT baselines

Levels to Determine Toxicity



Acute Health-Based Comparison Values (AHBCVs)

- Used to derive all toxicity-based mobile monitoring comparison values
- Fit-for-purpose for application to short-term exposures for investigations or emergency events
- Acute (1-hour) values developed by TCEQ or other agencies
  - e.g., TCEQ's air monitoring comparison values (AMCVs)
- Health-protective without being unduly conservative
  - Not as high as US EPA acute exposure guideline levels (AEGLs)
  - 1-hr AHBCVs are not health-effect levels



Instantaneous Toxicity-Based Comparison Values

- **Instantaneous health-protective investigation level (iHPIL)**
  - Conservatively based on 1-hour acute health-based comparison values (1x AHBCV) – e.g., TCEQ 1-hour AMCVs
  - Action when exceeded: Consider collecting a canister sample for 30 min to 1-hour
- **Instantaneous health-based action levels (iHBALs)**
  - Set at levels 3-times higher than the AHBCV (3x AHBCV)
  - Action when exceeded: Increase vigilance levels that exceed instantaneous exposure mitigation values

Above threshold to conduct toxicity evaluation

↓

Consider canister sample (30 min to 1-hr)

Chemical(s)	iHPIL (ppb)	iHBAL (ppb)
Benzene	180	540
Toluene	4,000	12,000
Ethylbenzene	20,000	60,000
1,3-Butadiene	1,700	5,100
Styrene	5,100	15,300

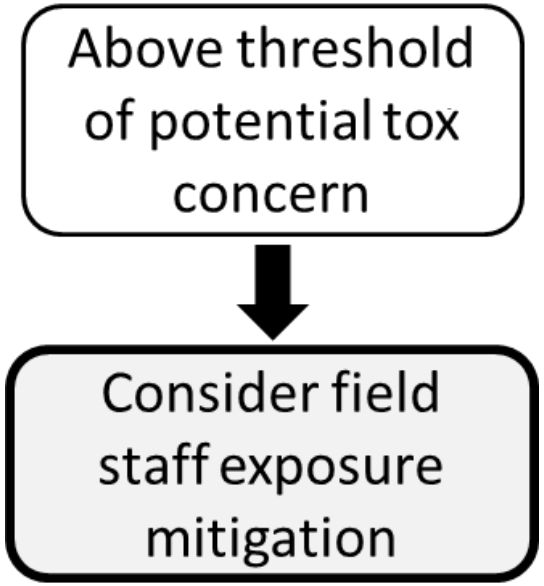
Higher levels triggering more immediate tox eval

↓

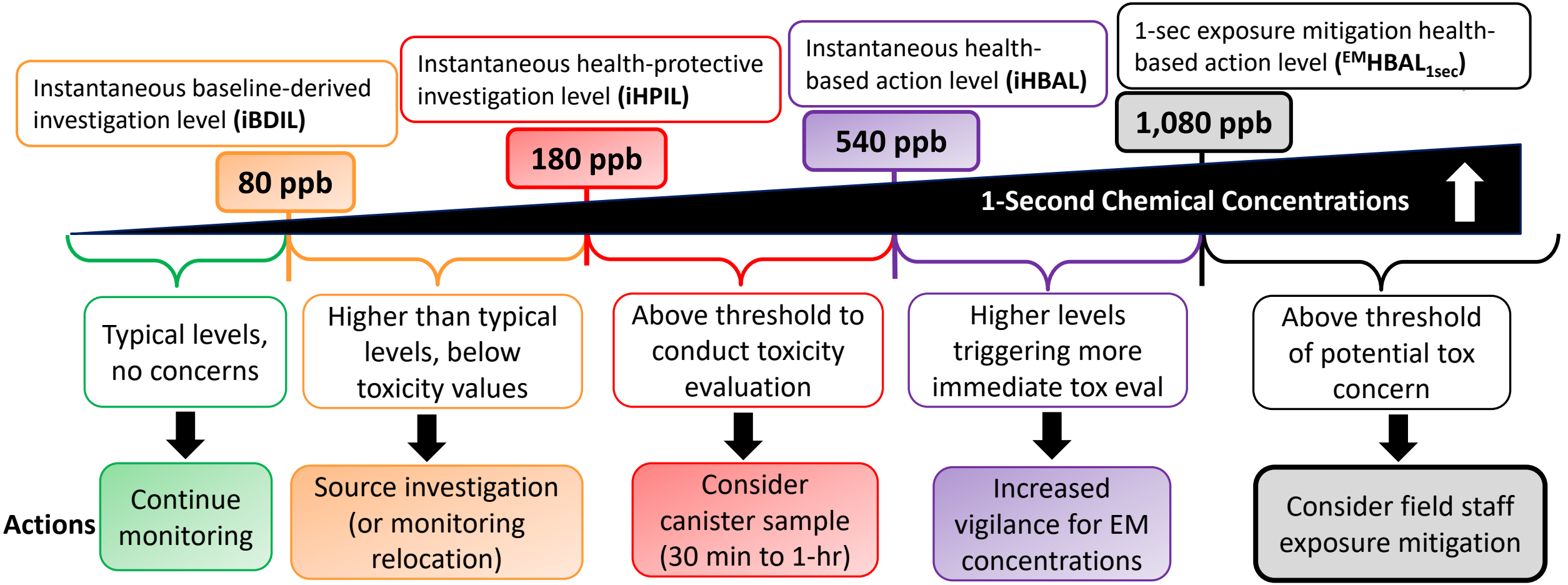
Increased vigilance for EM concentrations

Health-Based Action Levels for Exposure Mitigation (^{EM}HBALs)

- **Exposure mitigation health-based action levels (^{EM}HBALs)** represent concentrations that trigger considerations about staff exposure to the chemical.
- Because of inherent conservatism in the derivation, levels are not expected to cause acute health effects
  - Provides time to initiate exposure mitigation
  - Can be used to assist staff in the field in taking or developing exposure avoidance strategies
- Derived for different concentration averaging times: **1 second is applicable for instantaneous data (for use with instruments that cannot calculate real-time concentration averages)**; 10 minutes and 1 hour are only for use with instruments that can provide a real-time average in the field.
- Action when exceeded: Consider exposure mitigation for field staff



Example: MMCV Values & Actions for Benzene



All comparison values are set at levels well below those that would cause health effects

Benzene Fact Sheet

for field use with mobile monitoring instruments

This Field Guide provides a summary of the different mobile monitoring comparison values developed by the Toxicology, Risk Assessment, and Research Division for use

***All derived mobile monitoring comparison values are intended to be used as guidance**. Field investigators and mobile monitoring staff should use their own discretion when deciding to mitigate exposure, such as when experiencing health effects or intense odors, regardless of measured concentrations.*

What is Benzene?

- Benzene can be found everywhere in the environment
- Benzene rapidly degrades in the atmosphere
- Benzene has an aromatic, paint-thinner-like, sweet odor

At What Levels Can Benzene Cause Harm?

Breathing high levels of benzene for a short period of time can affect the central nervous system. Repeated exposure to high levels over several days or longer can cause damage to blood cells. Long-term exposure (e.g., many years) is associated with an increased risk for cancer (i.e., acute myelogenous and monocytic leukemia).

Mobile Monitoring Comparison Values

	Benzene
iBDIL (ppb) Orange	80
iHPIL (ppb) Red	180
iHBAL (ppb) Purple	540
$^{EM}HBAL_{10min}$ (ppb)	500
$^{EM}HBAL_{1hr}$ (ppb)	360
$^{EM}HBAL_{1sec}$ (ppb)	1,080

iBDIL - instantaneous baseline-derived investigation level

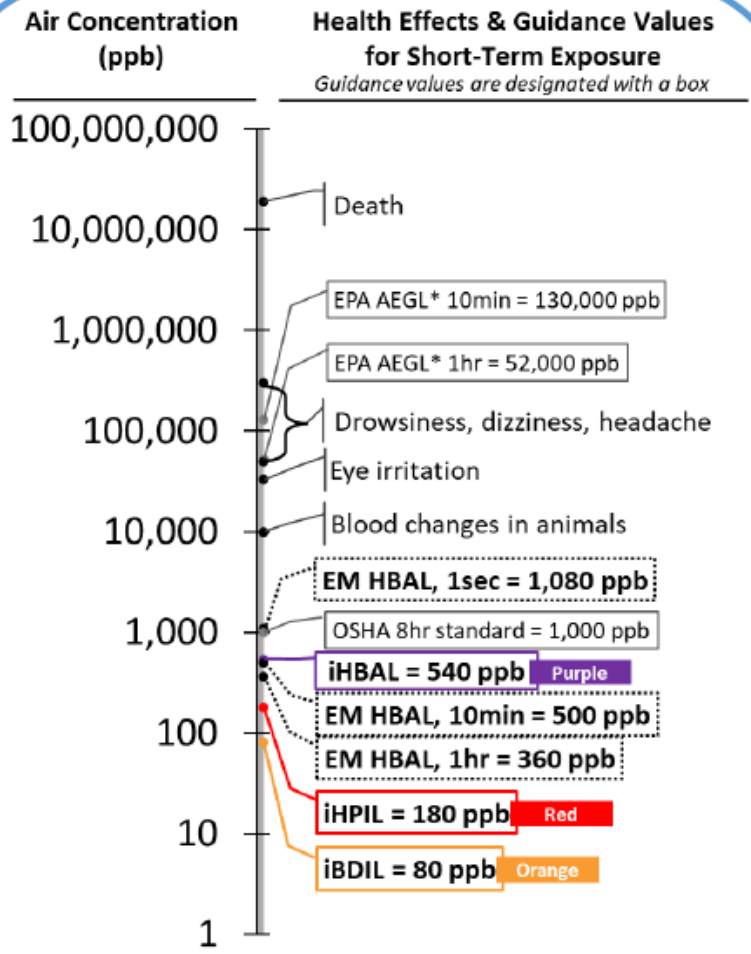
iHPIL - instantaneous health-protective investigation level

iHBAL - instantaneous health-based action level

$^{EM}HBAL_{10min}$ - 10-minute health-based action level for exposure mitigation

$^{EM}HBAL_{1hr}$ - 1-hour health-based action level for exposure mitigation

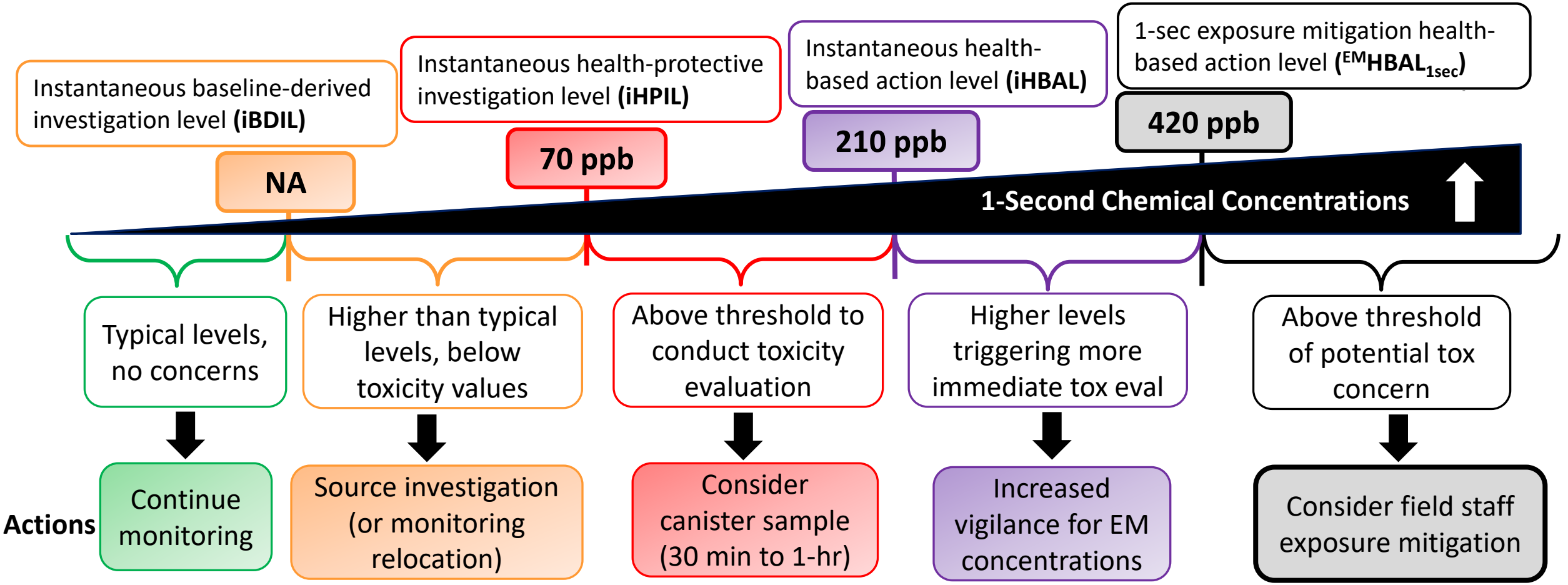
$^{EM}HBAL_{1sec}$ - 1-second health-based action level for exposure mitigation



*AEGL = Acute Exposure Guideline Level. The AEGL levels shown are AEGL-1, which is the concentration above which notable discomfort, irritation, or certain asymptomatic non-sensory effects are expected.

For more information on EPA's AEGL values, please see EPA's website.

Example: MMCV Values & Actions for Hydrogen Sulfide



All comparison values are set at levels well below those that would cause health effects

Hydrogen Sulfide (H_2S) Fact Sheet

for field use with mobile monitoring instruments

This Field Guide provides a summary of the different mobile monitoring comparison

***All derived mobile monitoring comparison values are intended to be used as guidance**. Field investigators and mobile monitoring staff should use their own discretion when deciding to mitigate exposure, such as when experiencing health effects or intense odors, regardless of measured concentrations.*

What is Hydrogen Sulfide (H_2S)?

- H_2S is a colorless gas that smells like rotten eggs
- H_2S is produced both naturally and by human processes
  - ⇒ H_2S is emitted by volcanoes, sulfur springs, swamps, and from natural gas and crude petroleum
  - ⇒ H_2S is also a by-product of operations including sewage treatment, landfills, pulp and paper mills, and manure-handling operations

At What Levels Can H_2S Cause Harm?

Exposure to high levels of H_2S can affect the respiratory and neurological systems. Odors are noticeable at low concentrations and can cause indirect health effects (headache, nausea, etc.), which should improve when exposures ceases.

Mobile Monitoring Comparison Values

	H_2S
iBDIL (ppb) Orange	—
iHPIL (ppb) Red	70
iHBAL (ppb) Purple	210
$^{EM}HBAL_{10min}$ (ppb)	210
$^{EM}HBAL_{1hr}$ (ppb)	140
$^{EM}HBAL_{1sec}$ (ppb)	420

iBDIL - instantaneous baseline-derived investigation level

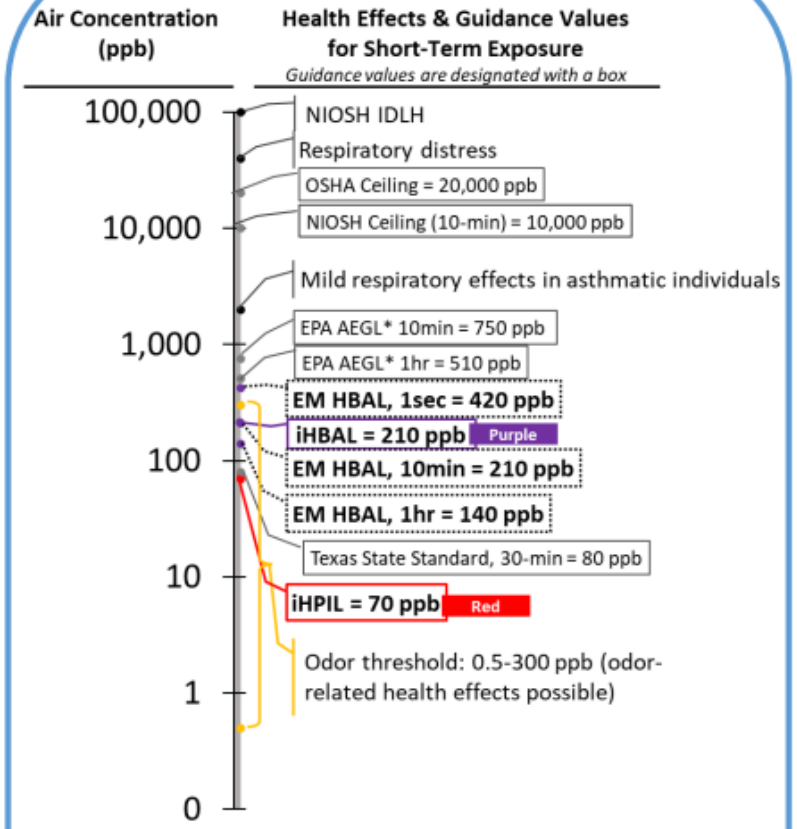
iHPIL - instantaneous health-protective investigation level

iHBAL - instantaneous health-based action level

$^{EM}HBAL_{10min}$ - 10-minute health-based action level for exposure mitigation

$^{EM}HBAL_{1hr}$ - 1-hour health-based action level for exposure mitigation

$^{EM}HBAL_{1sec}$ - 1-second health-based action level for exposure mitigation



*AEGL = Acute Exposure Guideline Level. Levels shown are AEGL-1, the concentration above which notable discomfort, irritation, or certain asymptomatic non-sensory effects are expected.

IDLH—immediately dangerous to life or health

For more information on EPA's AEGL values, please see EPA's website.

Hydrogen Sulfide (H_2S) Mobile Monitoring Surveys (El Paso Lower Valley Area)

The Purpose of the Mobile Monitoring Surveys

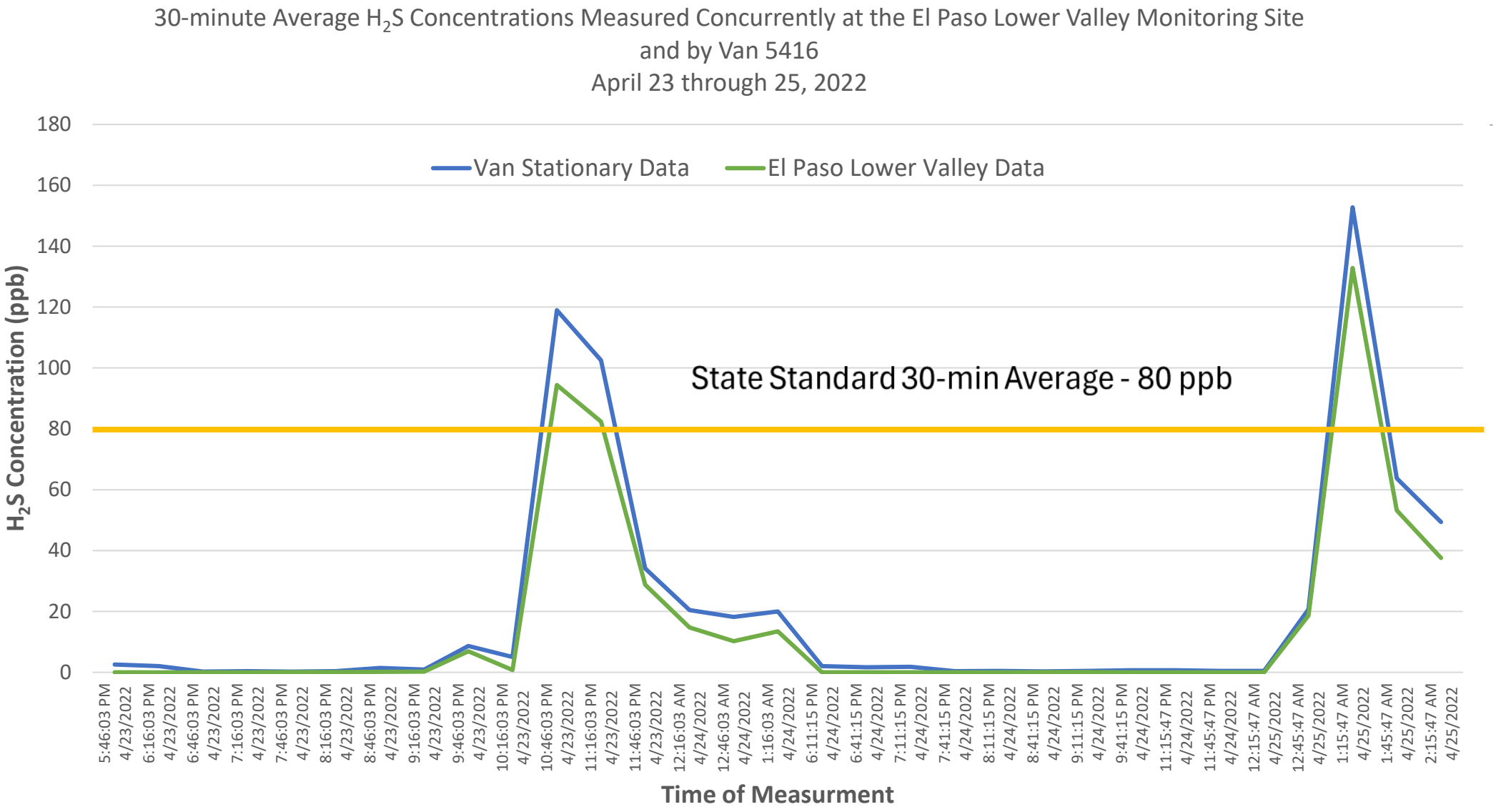
- On April 23 through 25, 2022, the Texas Commission on Environmental Quality (TCEQ) Mobile Monitoring Team (MMT) conducted an ambient air monitoring project in the Air Pollutant Watch List (APWL) area 0601 in El Paso, Texas.

- The Region was investigating potential hydrogen sulfide (H_2S) emission sources in the area. Elevated H_2S concentrations have consistently been measured at the El Paso Lower Valley stationary monitoring site (Constant Ambient Monitoring Station, CAMS) for many years.

- A potential source has been previously identified across the border in Mexico. However, this monitoring project was conducted to attempt to determine if other unidentified sources may be present.

El Paso Lower Valley Area

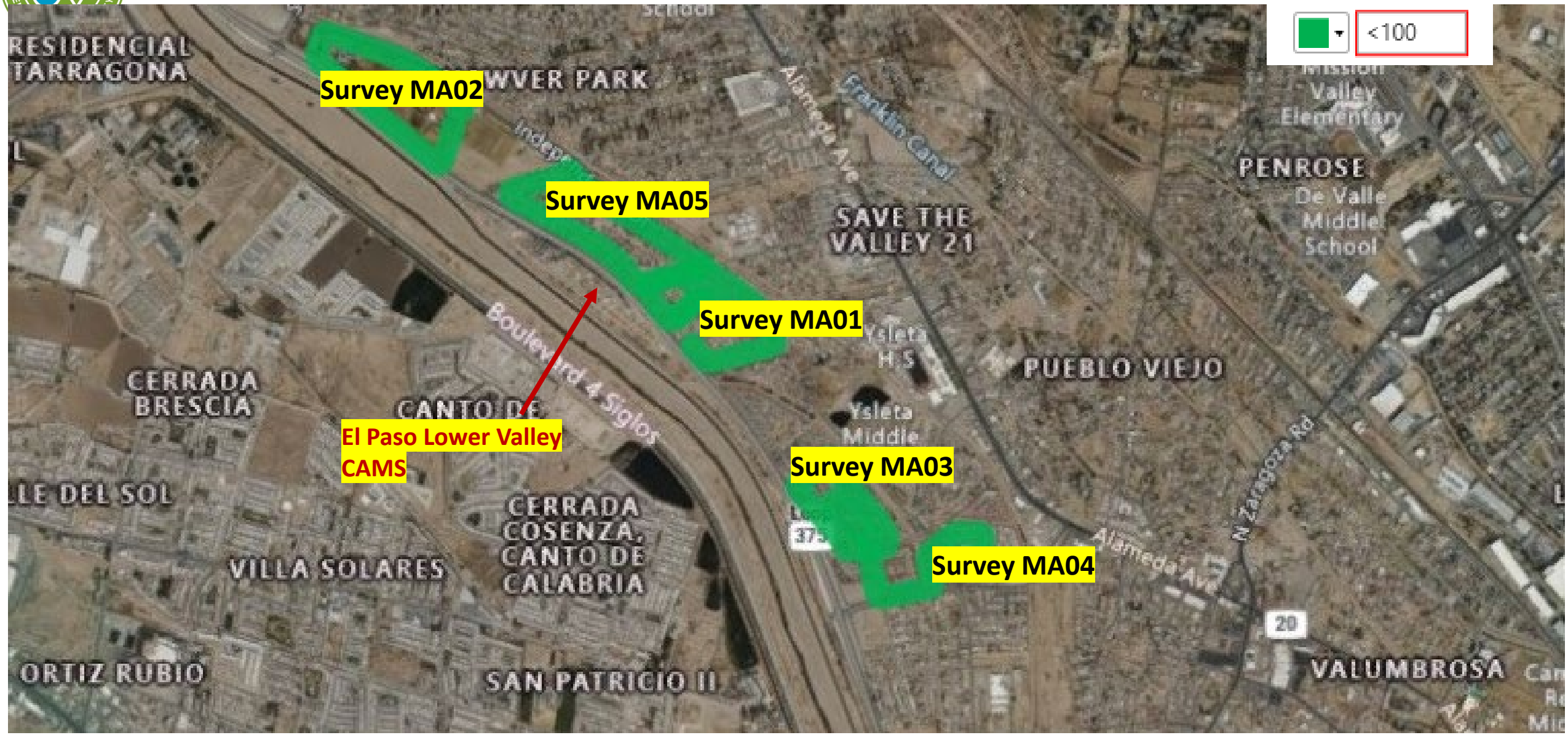
Concurrent H_2S Measurements from CAMS and Mobile Van



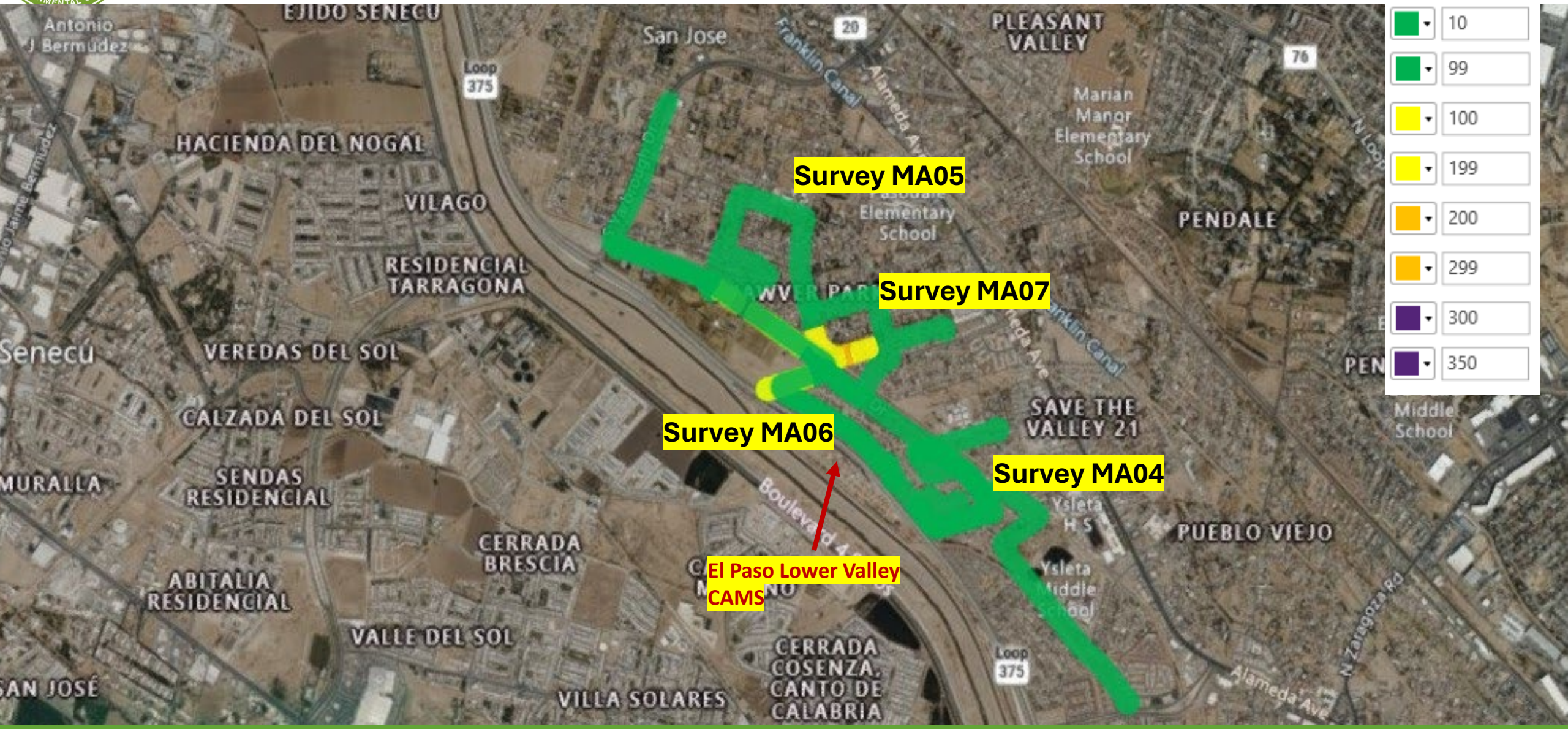
Mobile Van 9427 Surveys

Date	Time	Mobile survey	Stationary survey
4/23/2022	5:56 PM		
4/24/2022	1:20 AM	5	2
4/24/2022	6:36 PM		
4/25/2022	2:32 AM	6	--

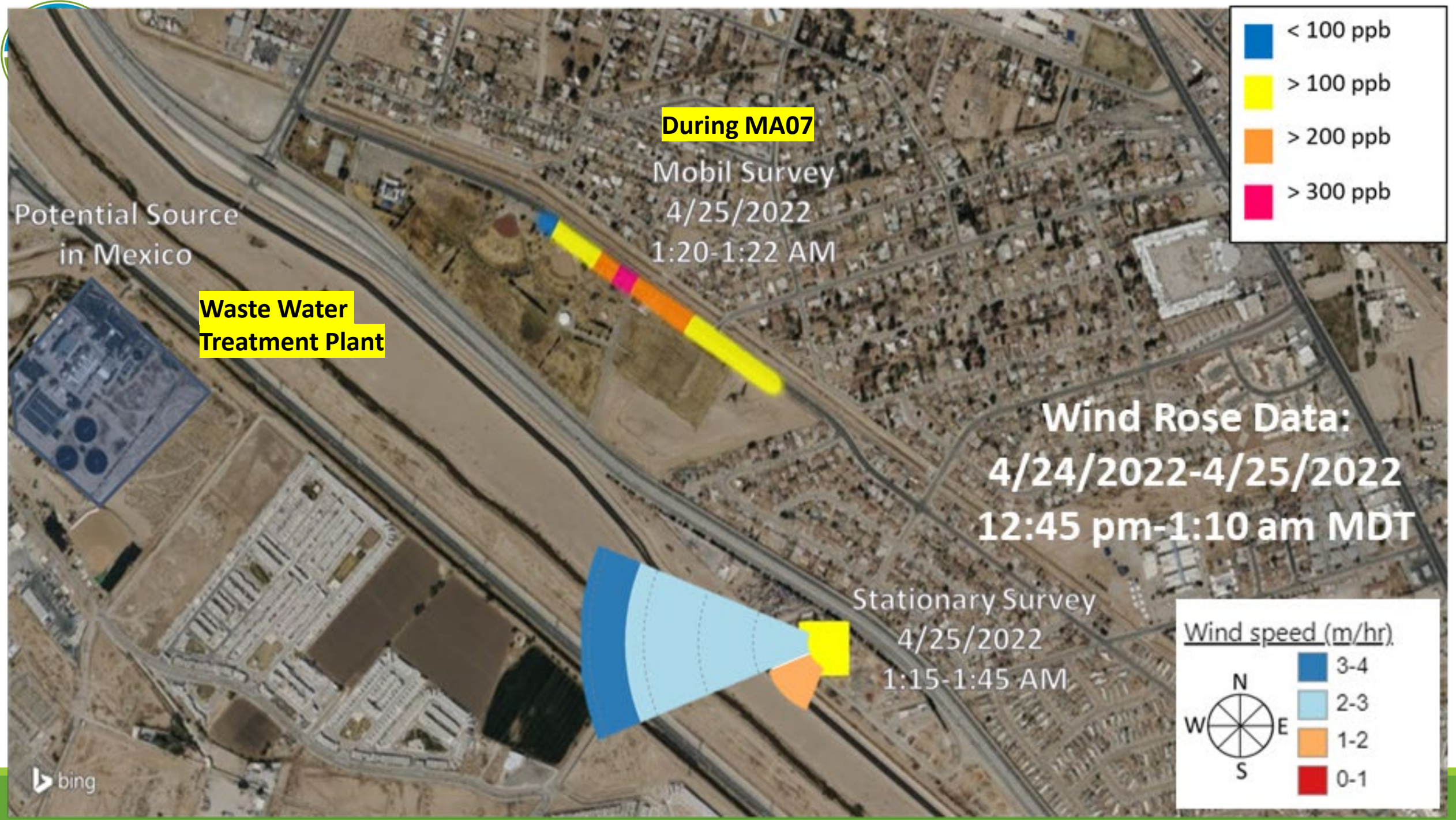
Map of 5 mobile surveys from 5:56 am 4/23/2022 to 1:20 am 4/24/2022



Map of 6 mobile surveys from 6:36 am 4/24/2022 through 2:32 am 4/25/2022



Map of mobile survey MA07 from 1:17 – 1:39 am 4/25/2022


During MA07
Mobil Survey
4/25/2022
1:20-1:22 AM
Potential Source
in Mexico
Waste Water
Treatment Plant
< 100 ppb
> 100 ppb
> 200 ppb
> 300 ppb
Wind Rose Data:
4/24/2022-4/25/2022
12:45 pm-1:10 am MDT
Stationary Survey
4/25/2022
1:15-1:45 AM
Wind speed (m/hr)
N
W
E
S
3-4
2-3
1-2
0-1
bing

MMCV of H_2S

Mobile Monitoring Comparison Values

	H_2S
iBDIL (ppb)	—
iHPIL (ppb)	70
iHBAL (ppb)	210
$^{EM}HBAL_{10min}$ (ppb)	210
$^{EM}HBAL_{1hr}$ (ppb)	140
$^{EM}HBAL_{1sec}$ (ppb)	420

Orange

Red

Purple

iBDIL - instantaneous baseline-derived investigation level

iHPIL - instantaneous health-protective investigation level

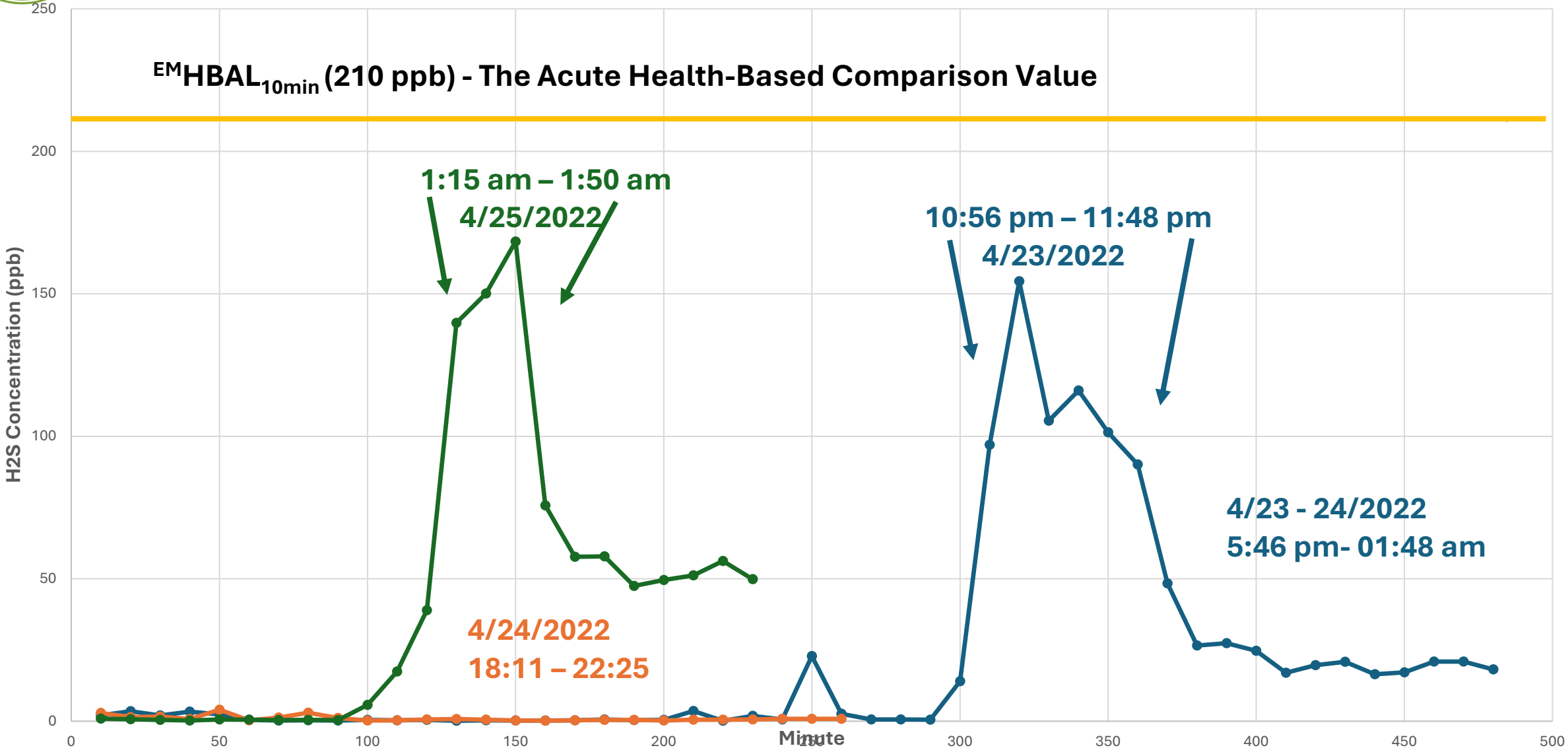
iHBAL - instantaneous health-based action level

$^{EM}HBAL_{10min}$ - 10-minute health-based action level for exposure mitigation

$^{EM}HBAL_{1hr}$ - 1-hour health-based action level for exposure mitigation

$^{EM}HBAL_{1sec}$ - 1-second health-based action level for exposure mitigation

H_2S Stationary 10-min Discrete Average Concentration

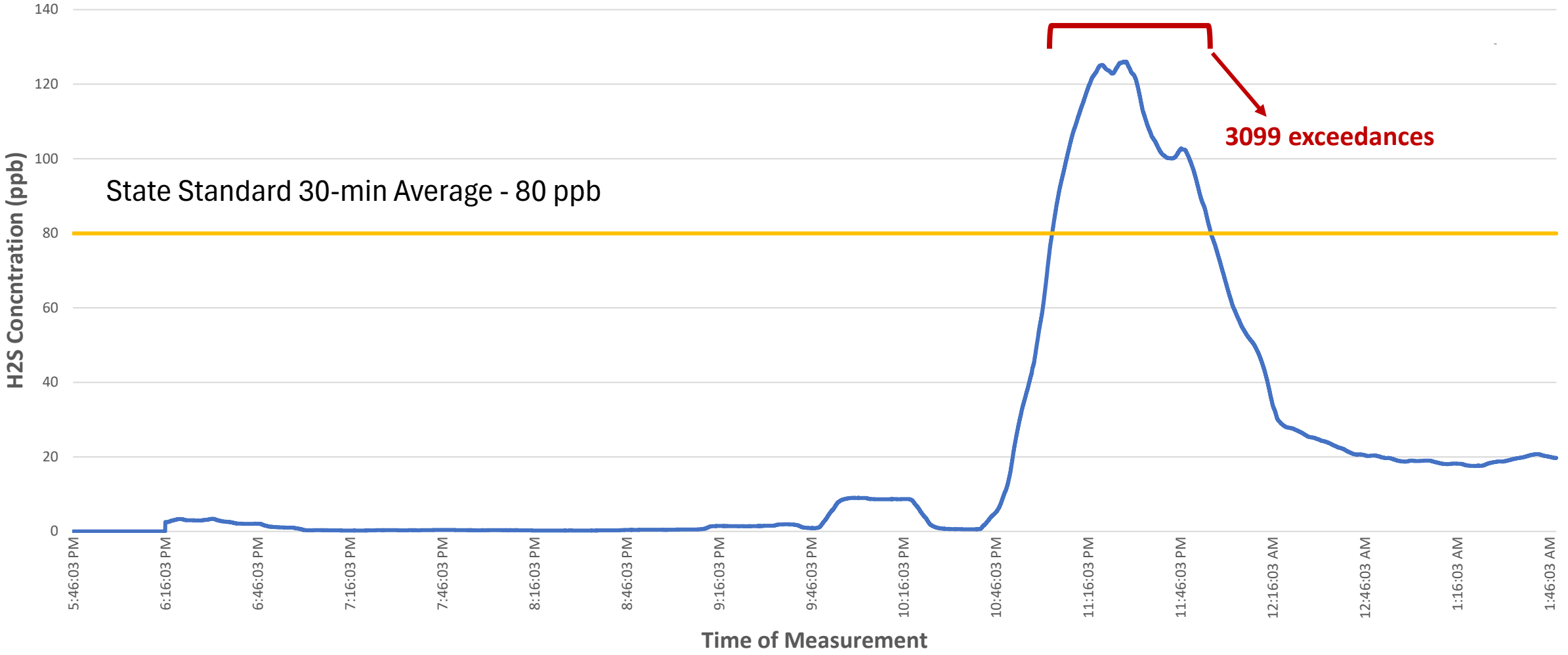


Discrete vs Rolling Average Concentration

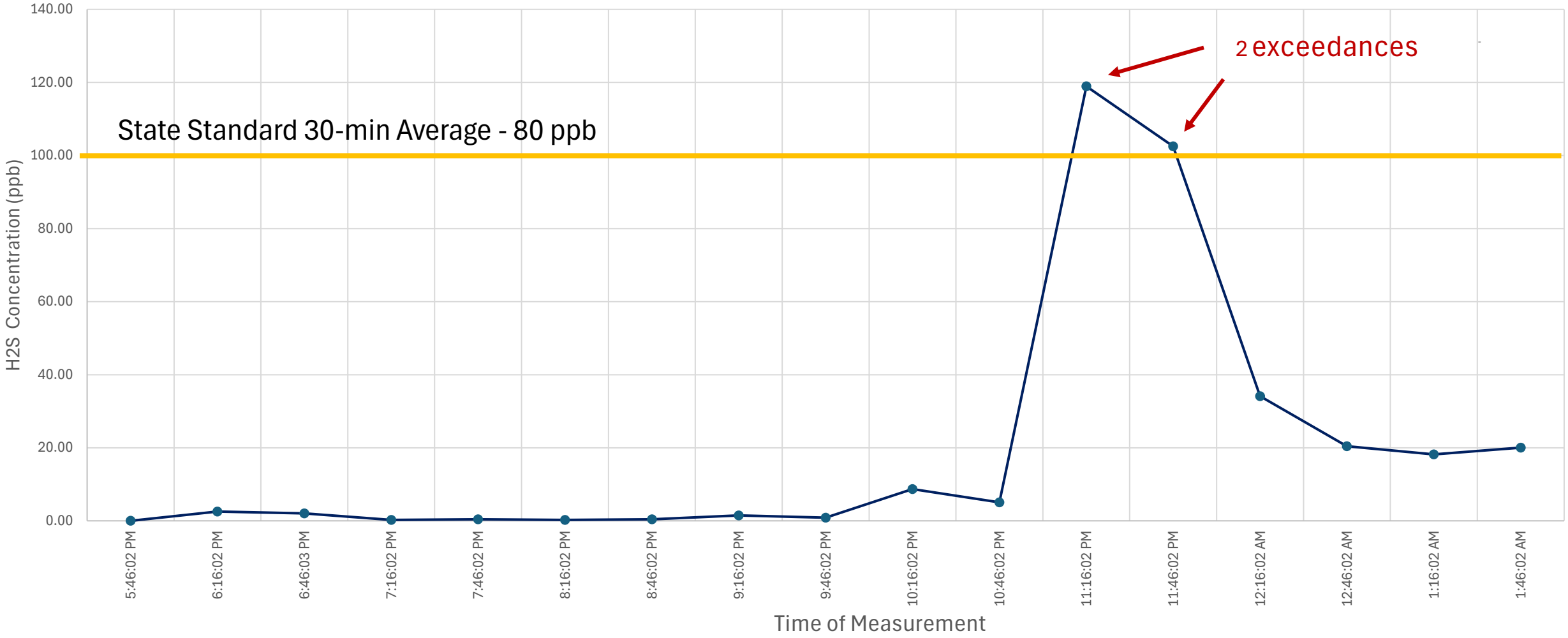
- When evaluating the health effects from the exposure to H_2S, 30-minute discrete average concentrations were used, instead of 30-minute rolling average concentrations.

- For the detection of H_2S at a rate of one measured data point per second, a 30-minute rolling average will include any data point (after the first 30 minutes) in calculating up to 1,800 averages; in reality, that specific exposure at the time only happened once not *1,800 times. Therefore, the discrete average concentrations were used to evaluate the health effect*.

Graph of the H_2S 30-Minute Rolling Average Concentration



Graph of H_2S 30-Minute Discrete Average Concentration



Summary

Date	4/23-24/2022	4/24/2022	4/24-25/2022
Monitoring Time Period	5:46 pm - 1:48 am	6:11 pm - 10:25 pm	11:15 pm - 3:04 pm
Stationary survey	ST01	ST01	ST02
Max inst. [H_2S]	237 ppb	14 ppb	215 ppb
Max 10' avg. [H_2S]	154 ppb	4 ppb	168 ppb
Max 30' avg. [H_2S]	119 ppb	2 ppb	153 ppb
Exceedance	2	--	1

For exposure mitigation evaluation:
No Exceedance for $^{EM}HBAL_{1hr}$ (140 ppb), $^{EM}HBAL_{10min}$ (210 ppb), or $^{EM}HBAL_{1sec}$ (420ppb)

Conclusion

- Three H_2S 30-minute averages measured at the stationary sampling site, the El Paso Lower Valley monitoring site, exceeded the H_2S state regulatory standard numerical value (80 ppbv) two consecutive 30-minute periods from 4/24/2022 and one from 4/25/2022
- Although adverse health effects would not be expected, the concentrations measured could result in the perception of odors if exposure were to occur (odor threshold: 0.5-300 ppb).
- Concurrent mobile survey monitoring showed the highest instantaneous readings just north of JP Shawver Park at the same time-frame as the highest 30-minute average at the stationary site.
- Based on these limited data, it appears the monitor is positioned to detect elevated H_2S concentrations that are entering the neighborhood.

Acknowledgements

- EPA Region 6 has been involved in either data gathering, developing protocols, and/or field testing the MMCVs and Field/Decision Guides

- TCEQ's Mobile Monitoring team for gathering data, reviewing protocols, and/or field testing MMCVs and Field/Decision Guides
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  - Michael Honeycutt, PhD
  - Jong-Song Lee, PhD
  - Janet Hamilton, PhD
  - Anthony Tran, MS
  - Mingyuan Wei, PhD
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Questions?