

Exposures and Health Risks Across Multiple Communities Near Oil and Gas Operations in Colorado

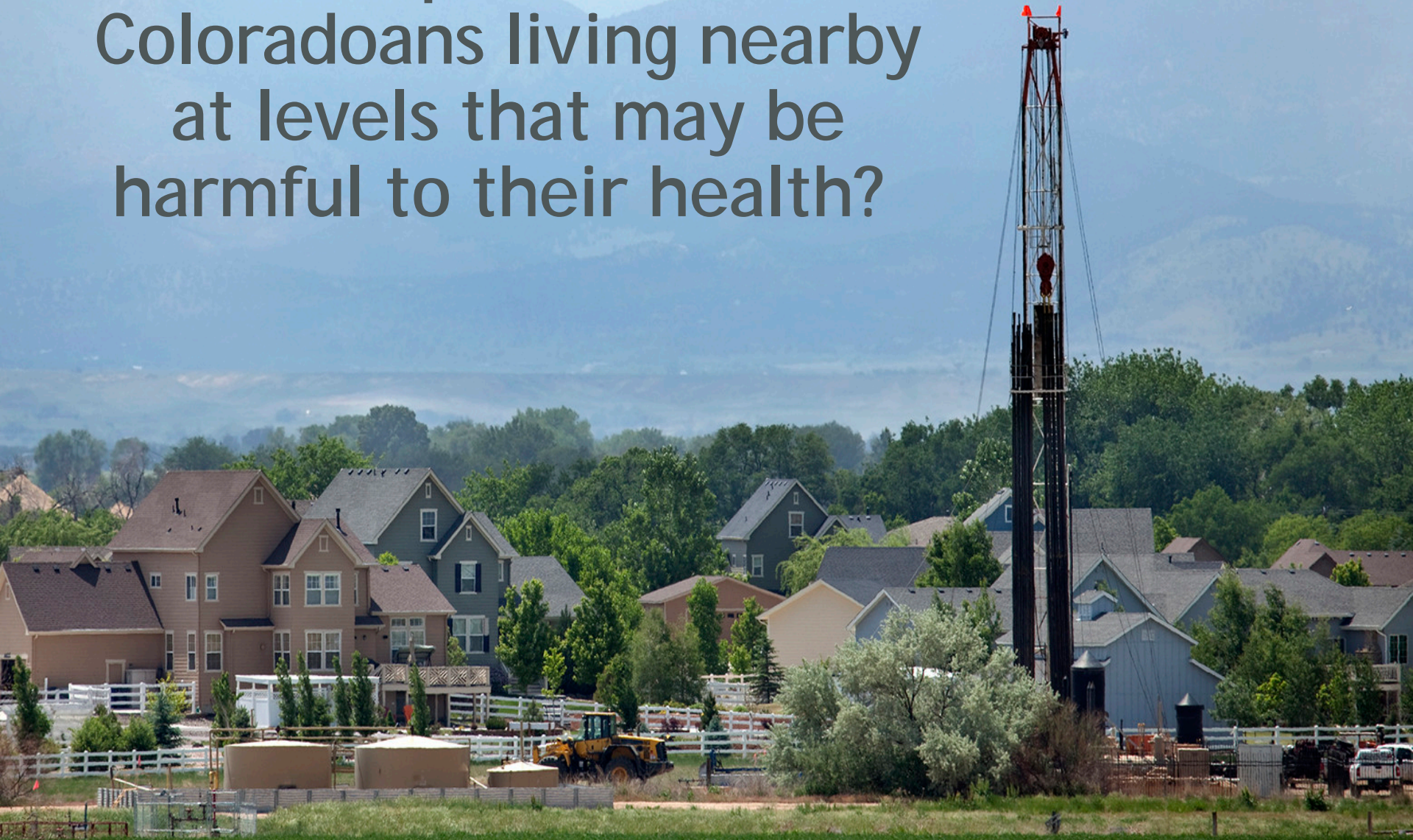
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State Toxicologist

September 14, 2018
HEI Fall Workshop



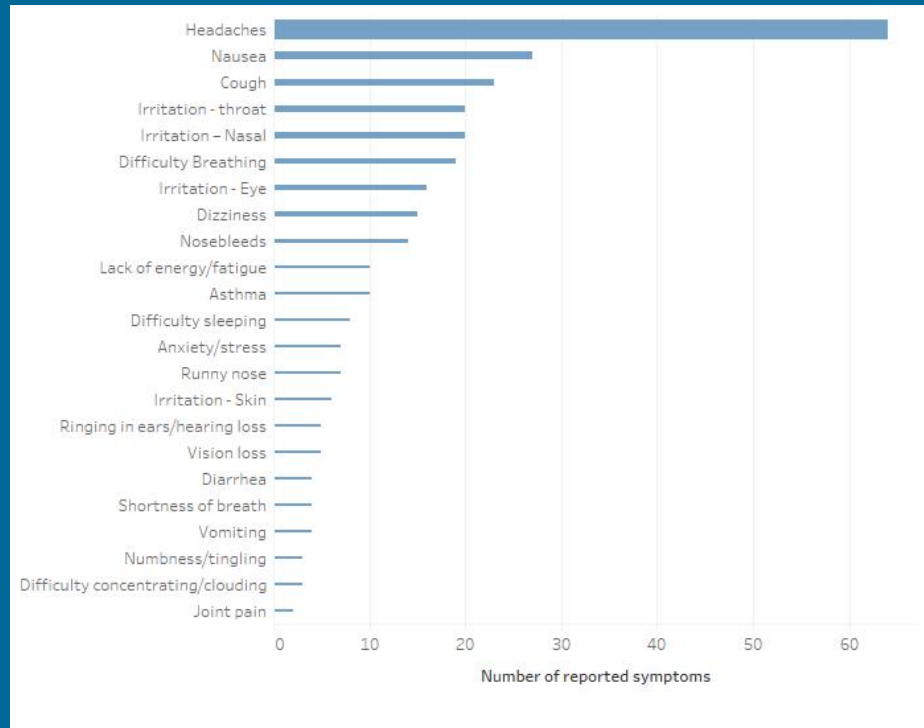
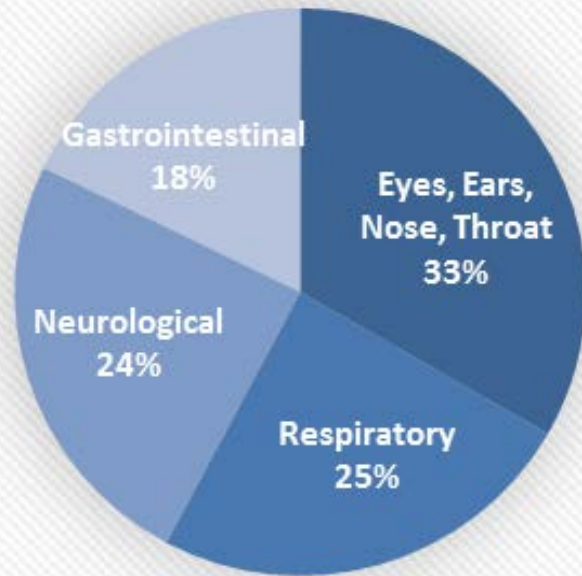
COLORADO
Department of Public
Health & Environment

Do VOCs from UOGD result
in exposures to
Coloradoans living nearby
at levels that may be
harmful to their health?



Health Symptoms Reported to OGHIR

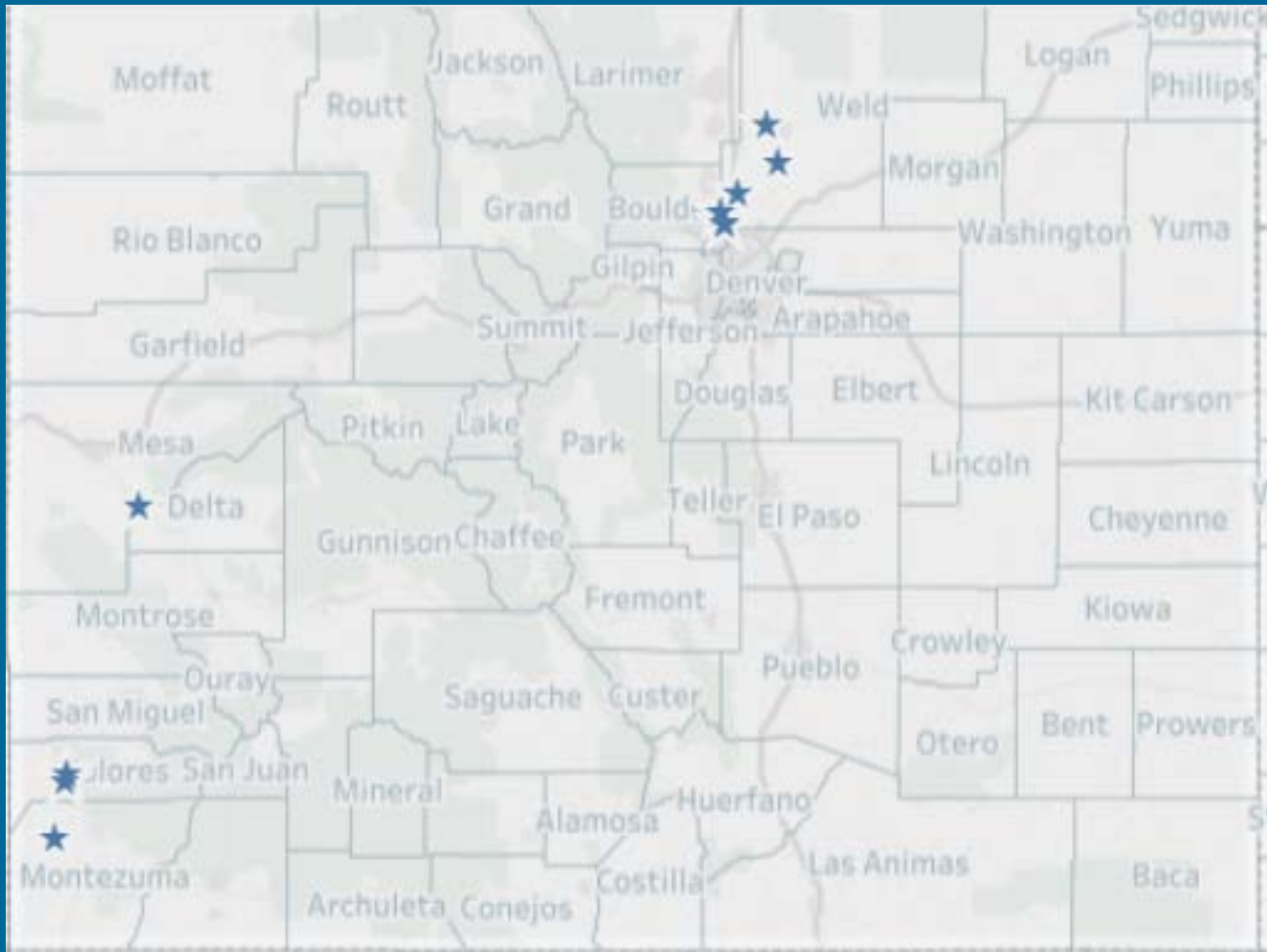
Percentage of Reported Symptoms by Health Effect Category



- 300+ health complaints
- 80% of symptoms coincided with odors during drilling
- Most complaints are localized in communities where new UOGD is occurring.

OGHIR Questions

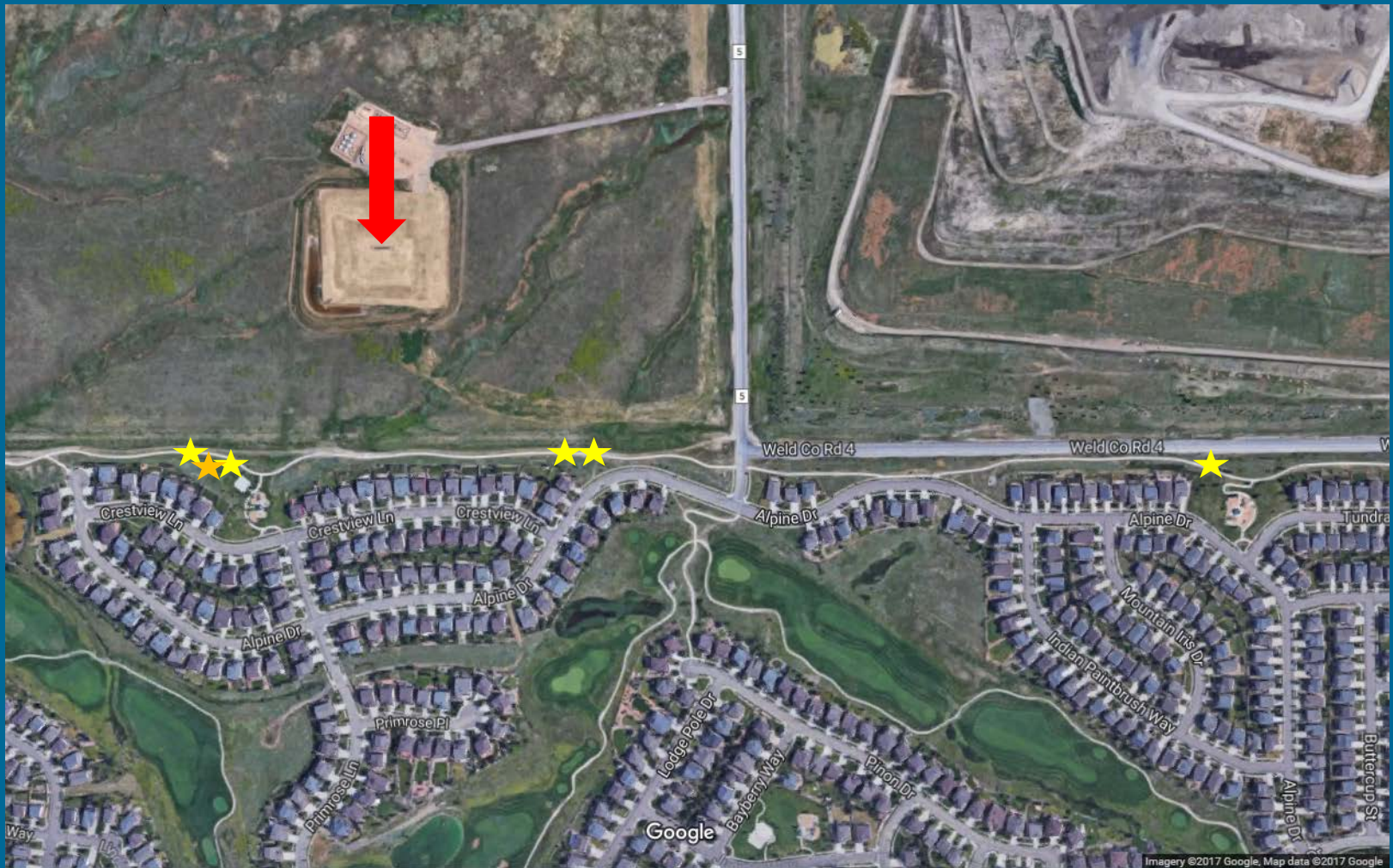
1. What UOGD related VOCs are present in communities near UOGD operations?
2. What VOCs are driving risk and/or reported health symptoms?
3. What exposure durations are driving risk and/or reported health symptoms?



- 4 exposure investigations with mobile lab
- Multiple single samples
- ~1200 hours of continuous air sampling

Take Home

- Limited set of high priority VOCs
- Flowback > Drilling > Hydraulic Fracturing
- Acute health risks from intermittent, infrequent peak air concentrations



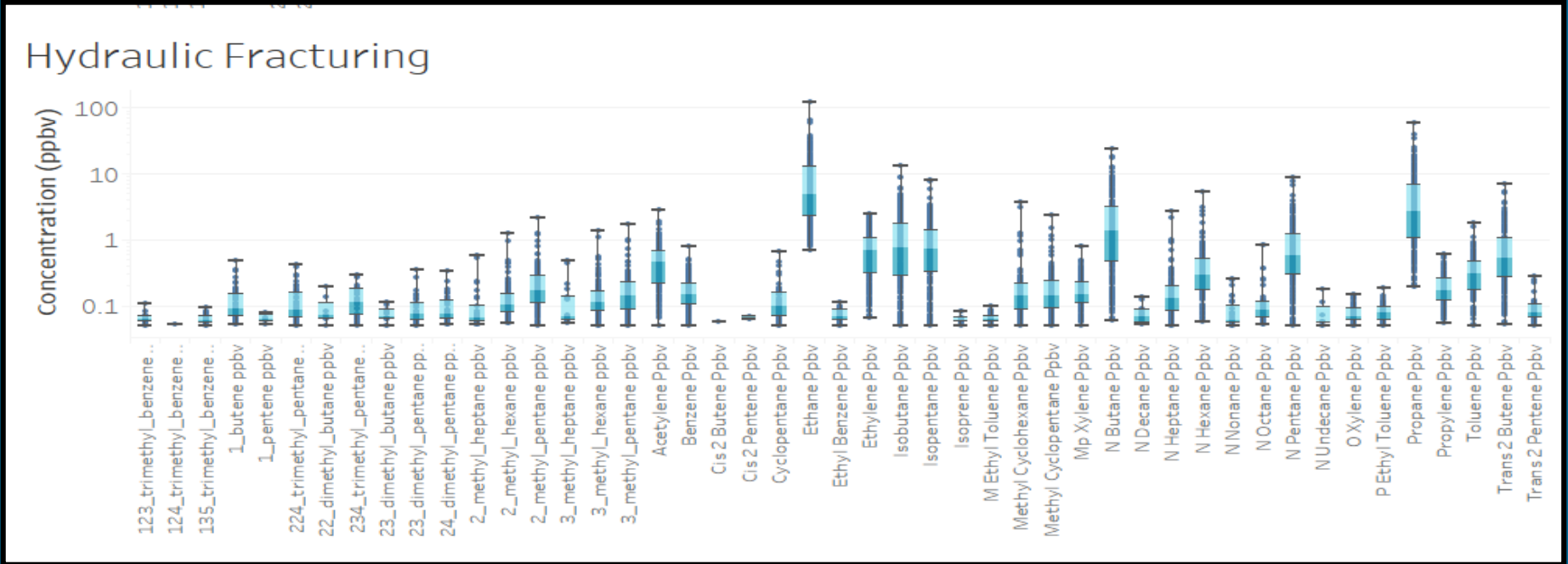
- Multiple grab samples during odor events
- Mobile lab 1,000 feet downwind of wellpad

Colorado Air Monitoring Mobile Lab (CAMML)



- 64 UOGD related VOCs
- Meteorology
- Drilling, Hydraulic Fracturing and Flowback
- 55 days
- 900 hours

Screening Level Risk Assessment



MAX



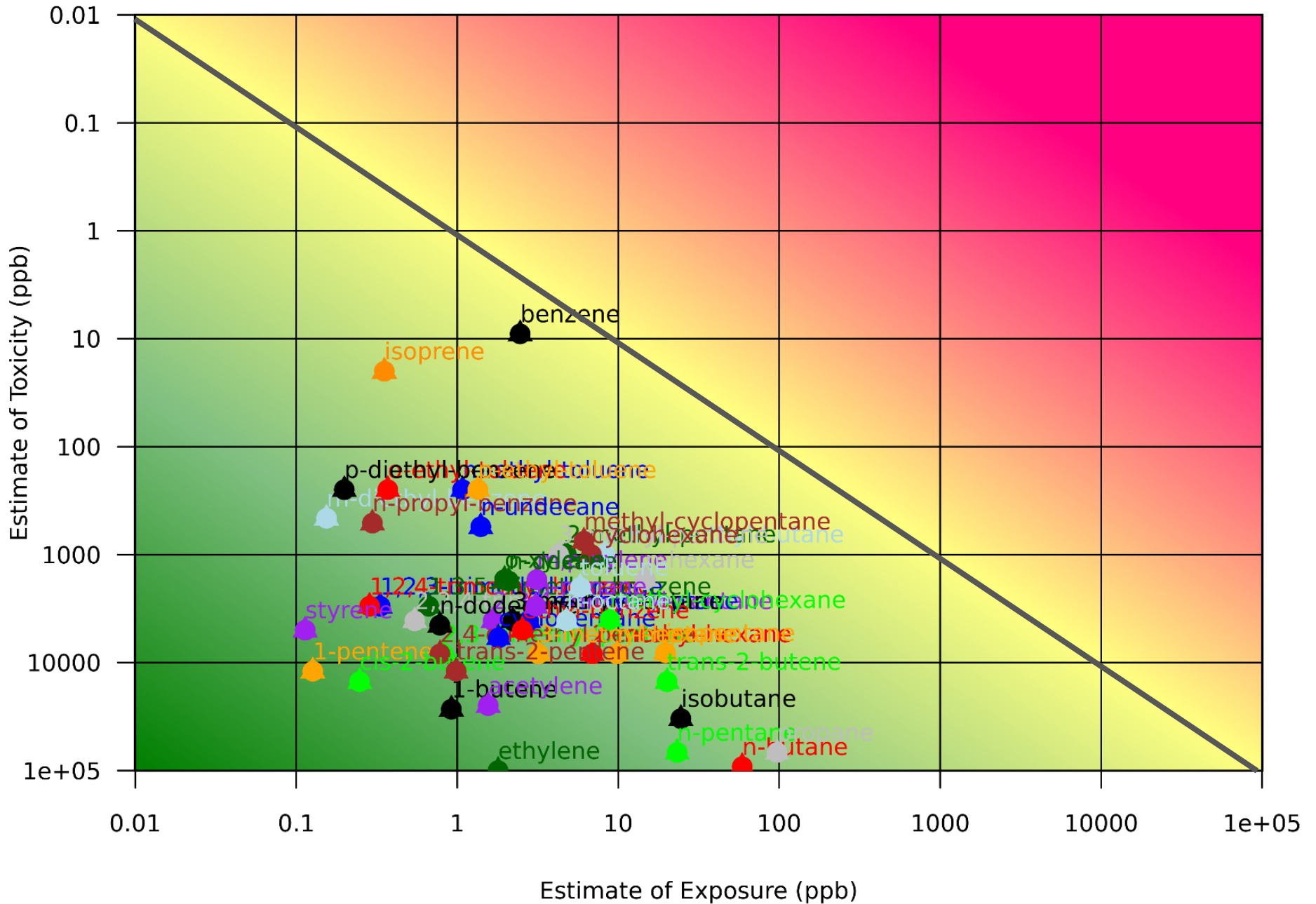
ACUTE (Short-term)

AVERAGE

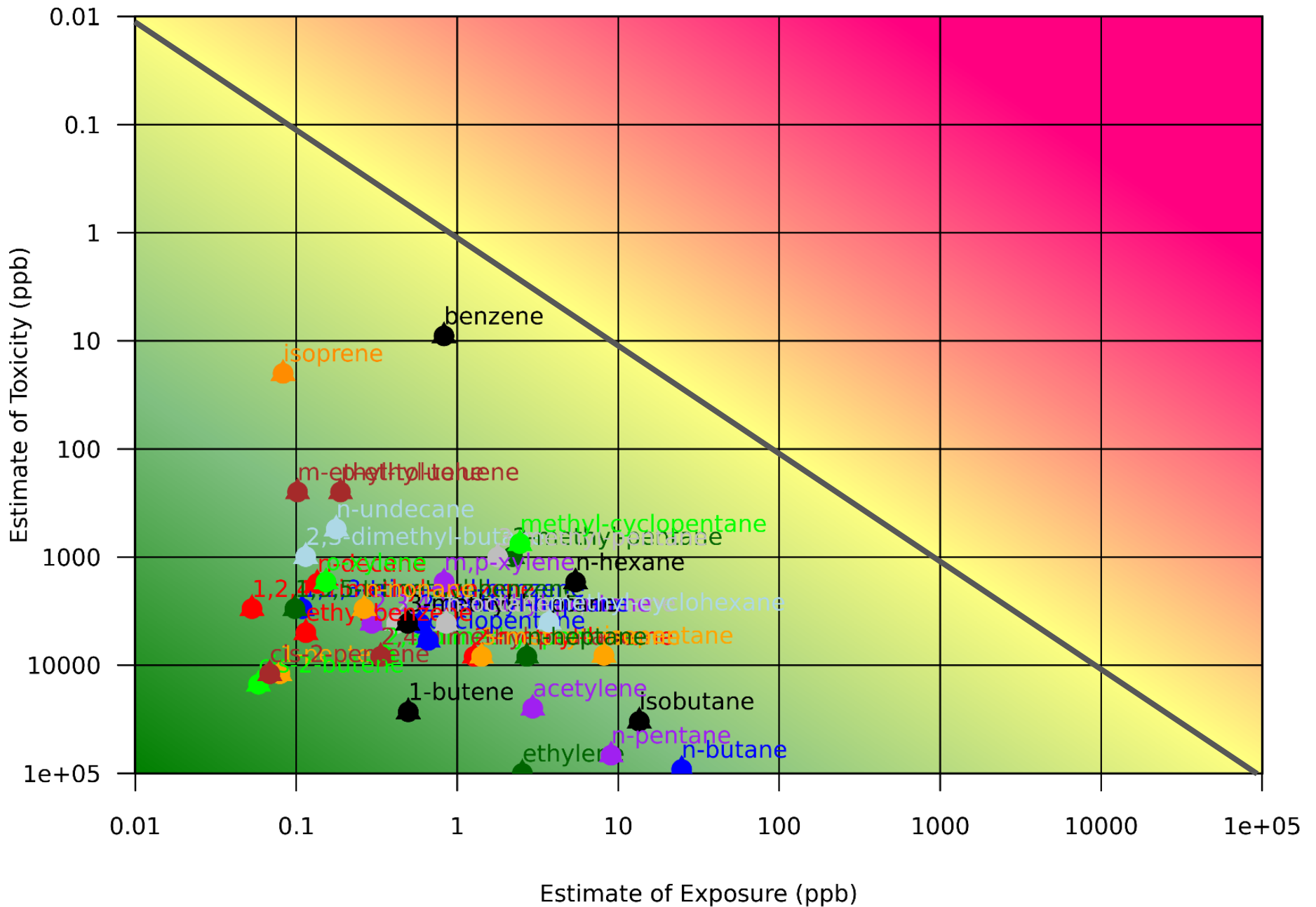


CHRONIC (long-term)

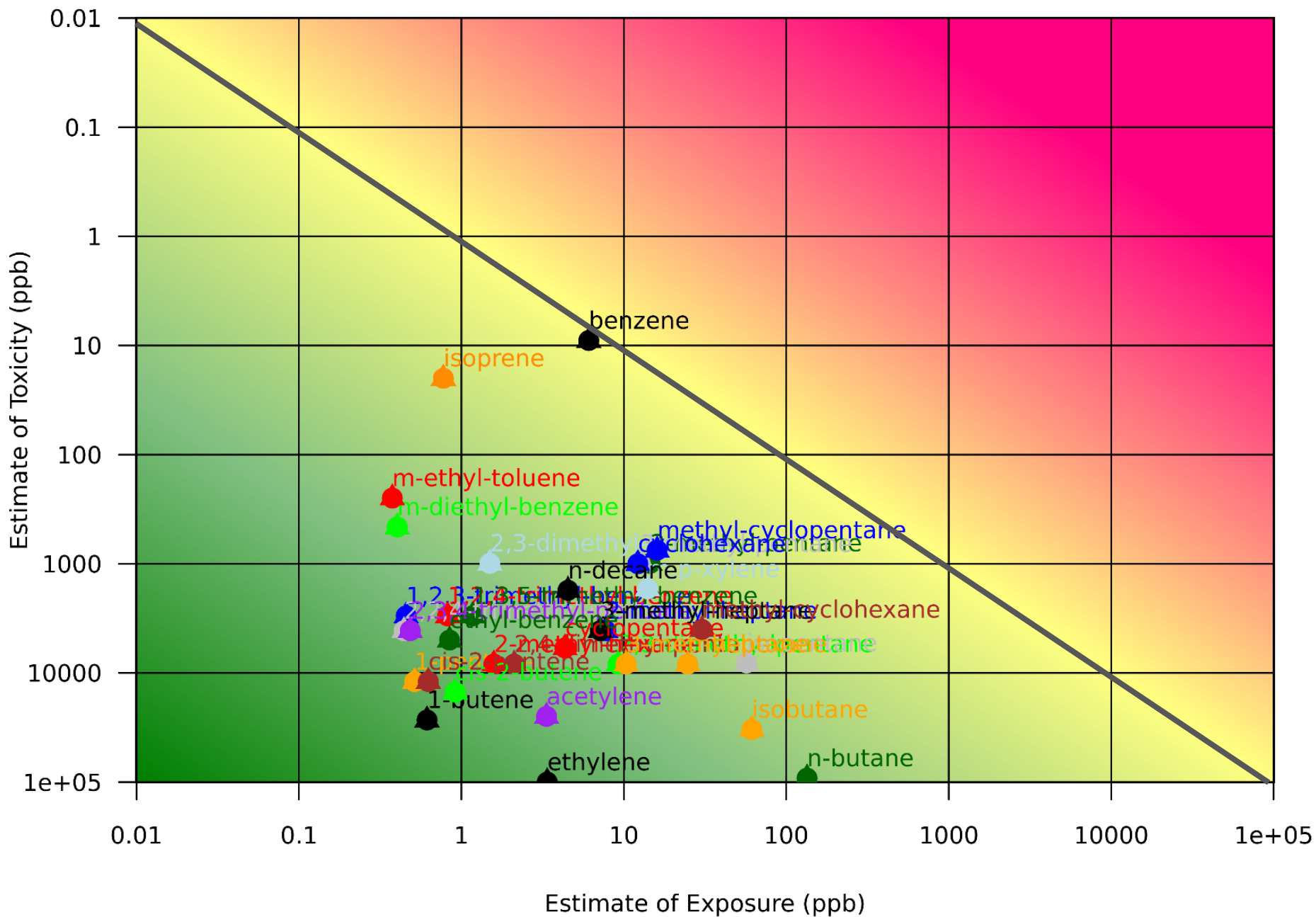
Acute Drilling



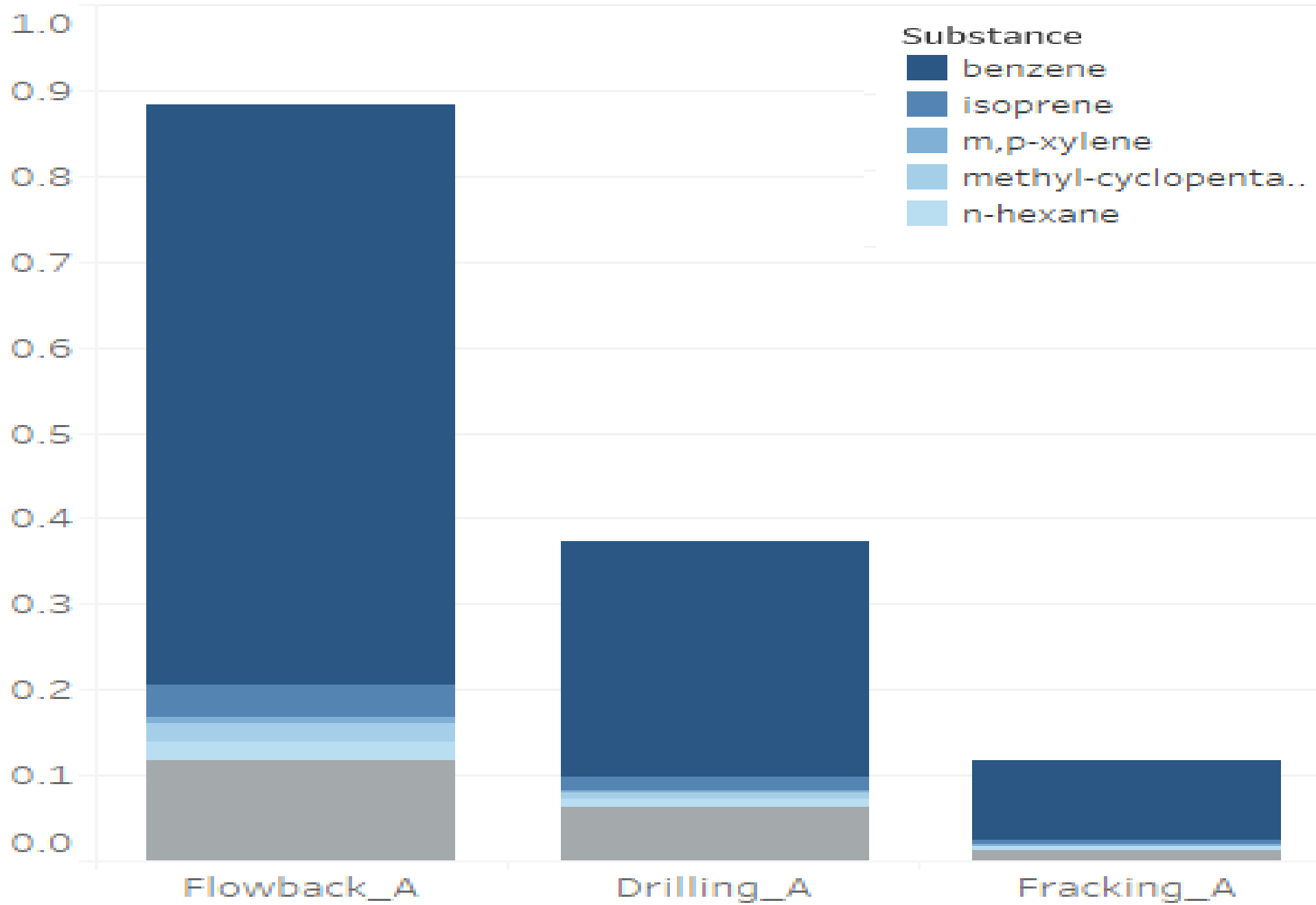
Acute Hydraulic Fracturing



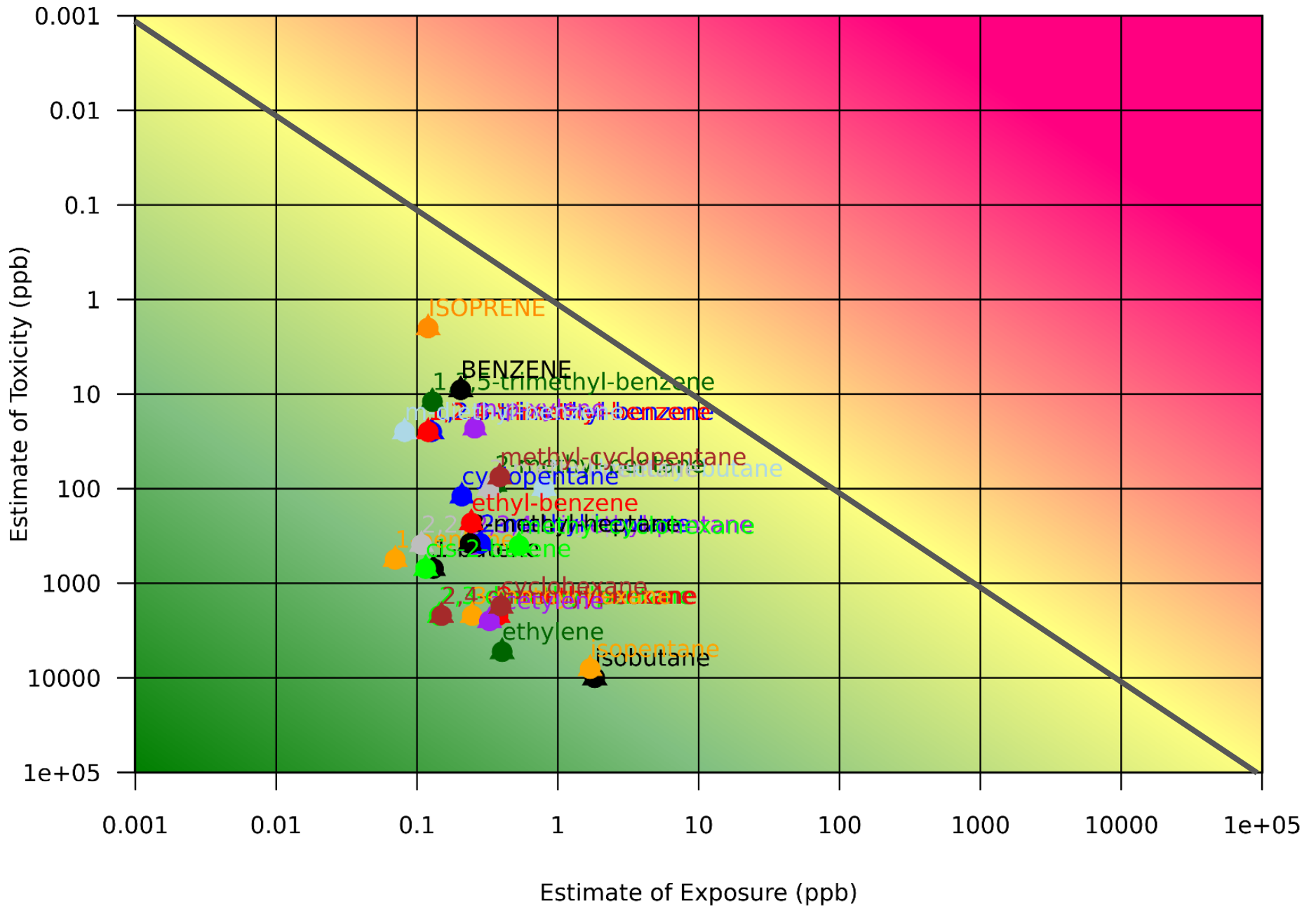
Acute Flowback



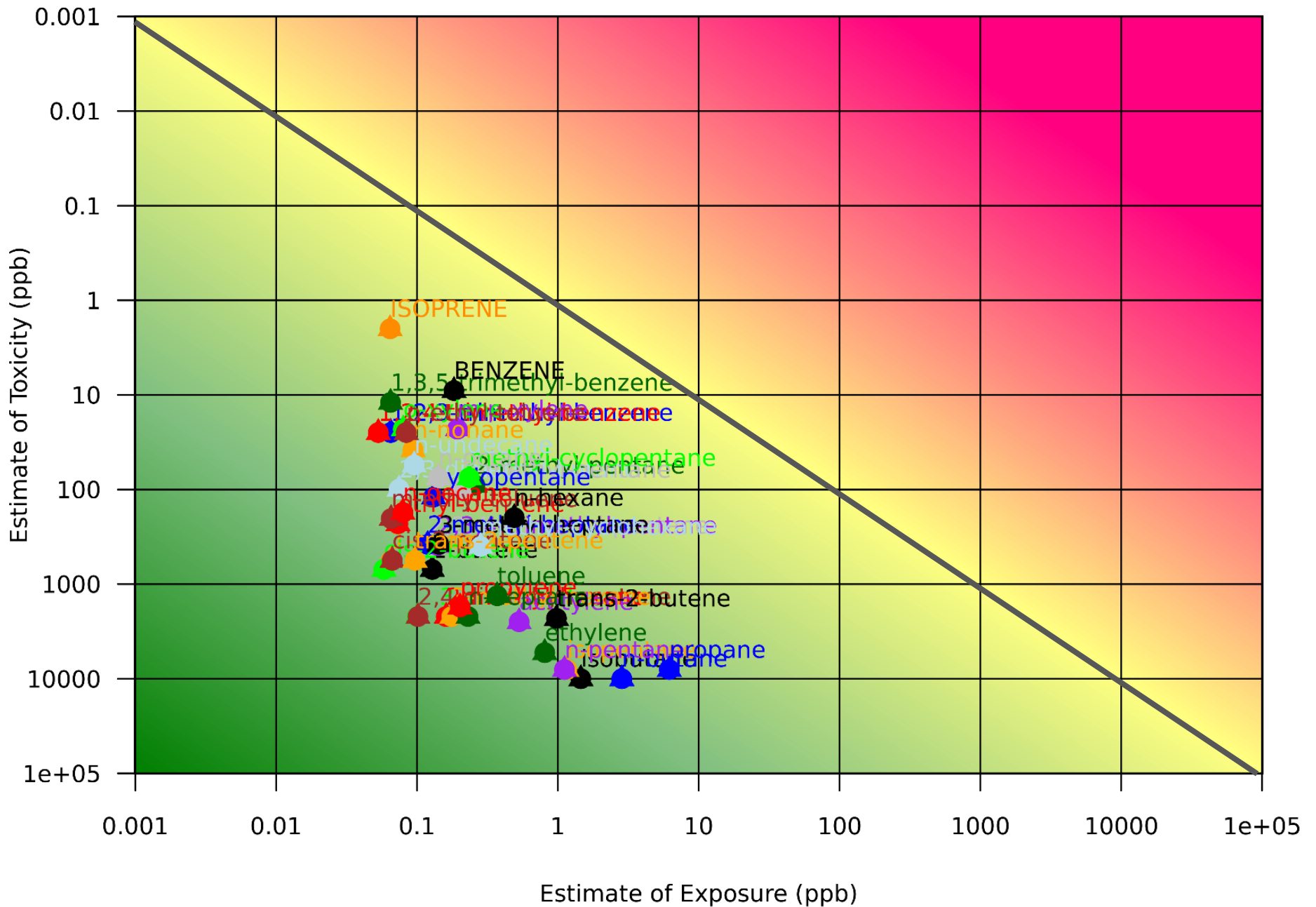
Acute Hazard Index by Operation Type



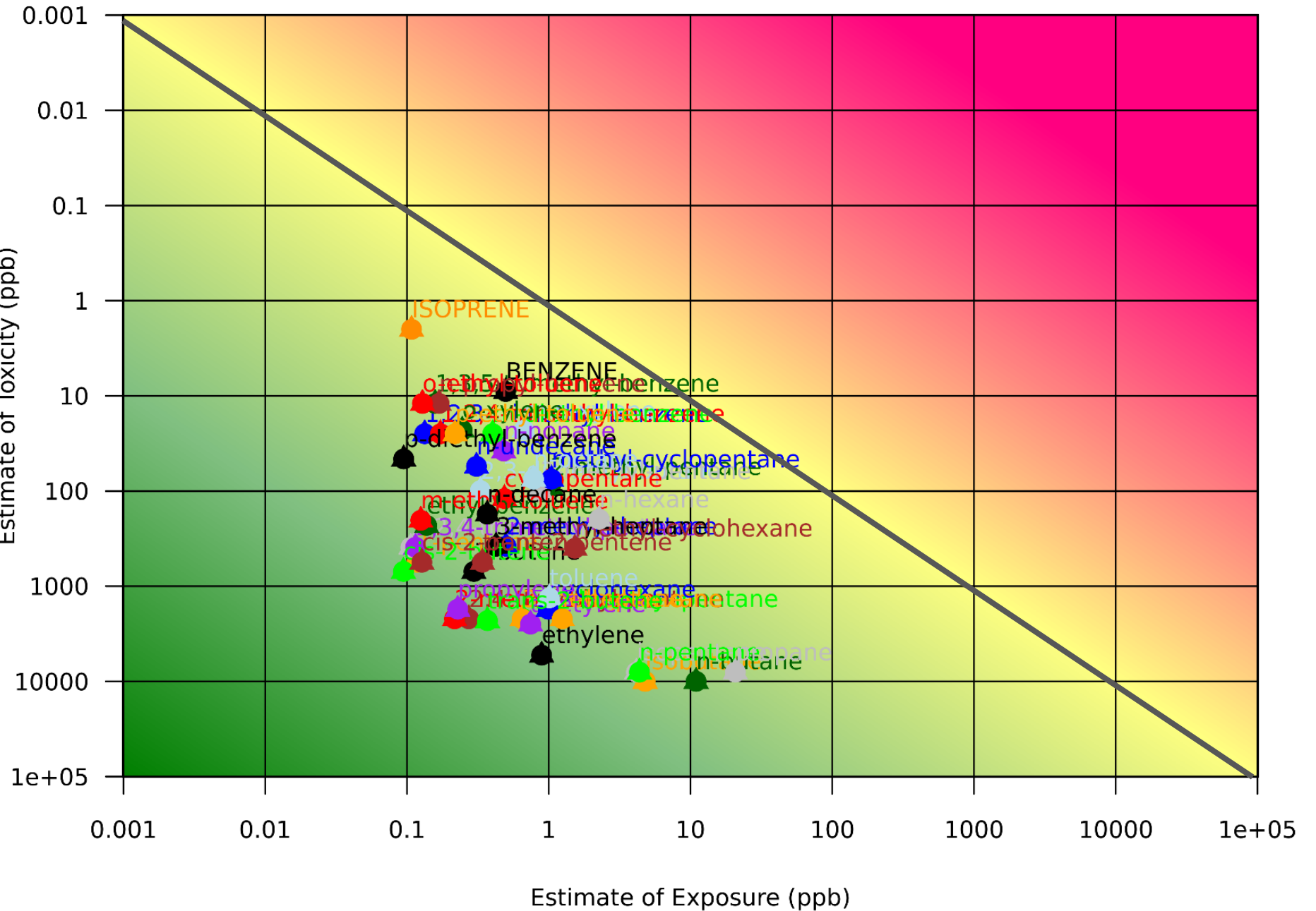
Chronic Hydraulic Fracturing



Chronic Hydraulic Fracturing

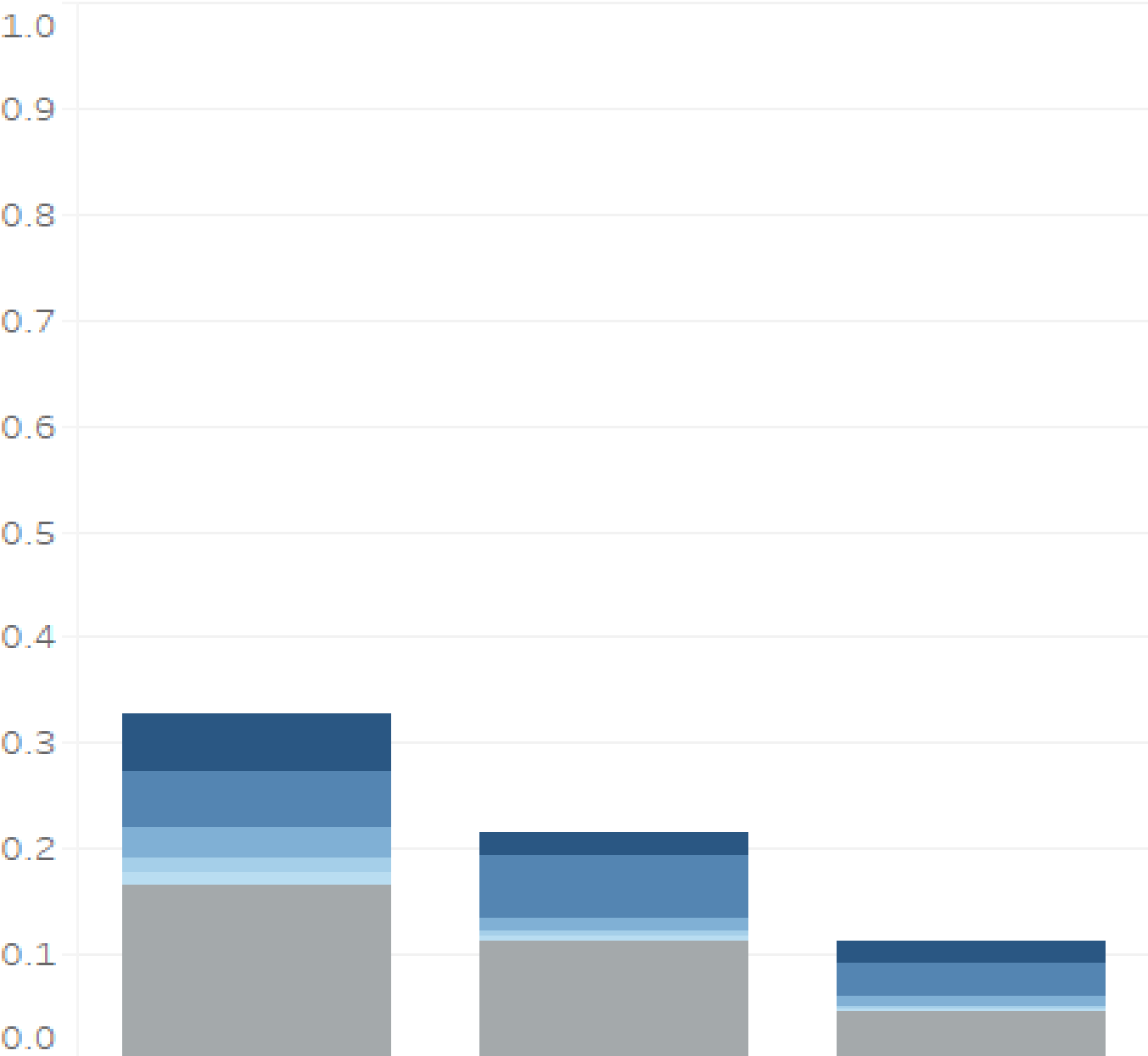


Chronic Flowback

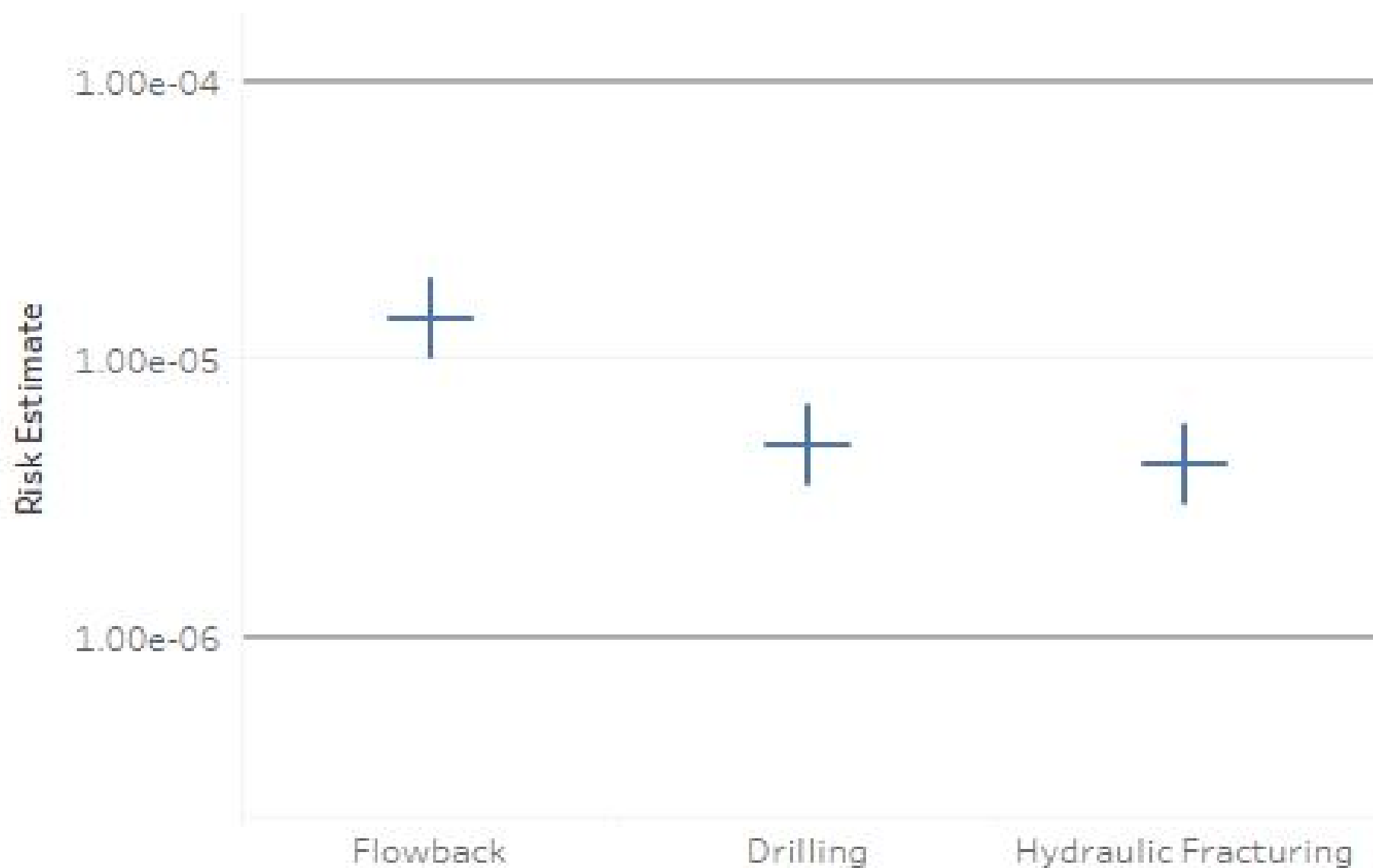


Chronic Hazard Index by Operation Type

- Substance
- benzene
 - isoprene
 - m,p-xylene
 - methyl-cyclopenta...
 - n-hexane



Benzene Cancer Risk Estimates



Summary of Exposure Investigations

- All 64 VOCs are consistently below health guideline values
- Flowback > Drilling > Hydraulic Fracturing
- Benzene is a high priority VOC
- Intermittent peak exposures that could lead to acute health risks

?



Source



Emissions



Concentration



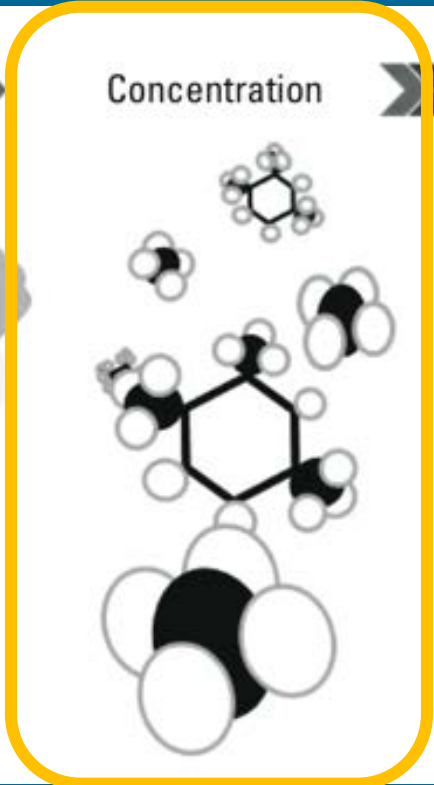
Exposure

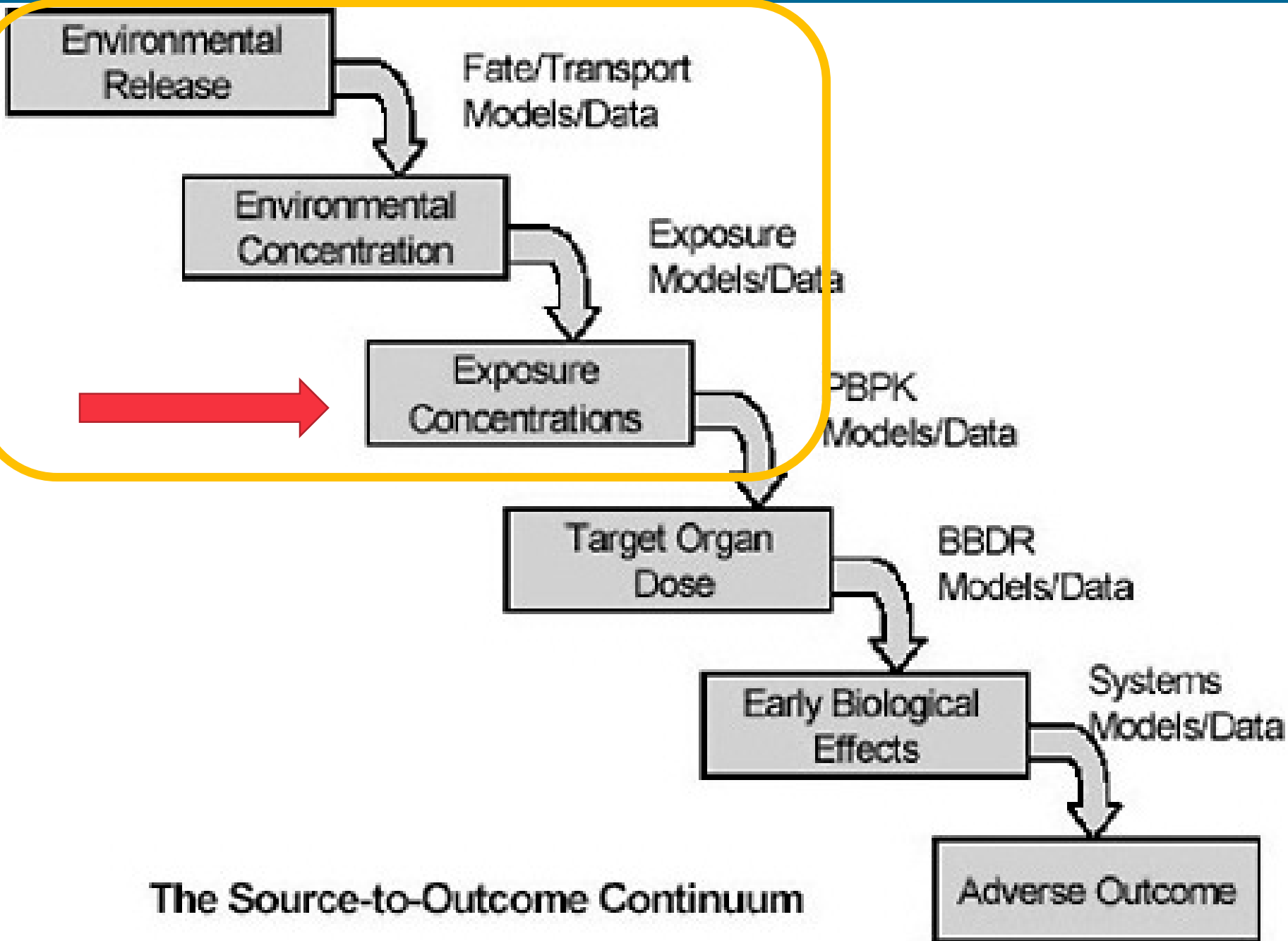


Dose



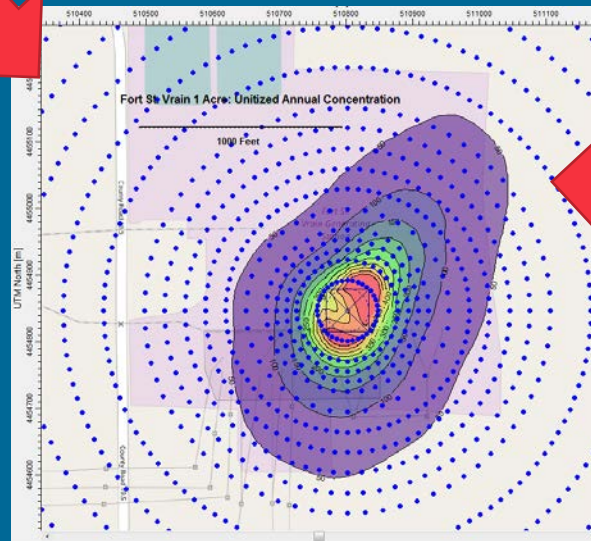
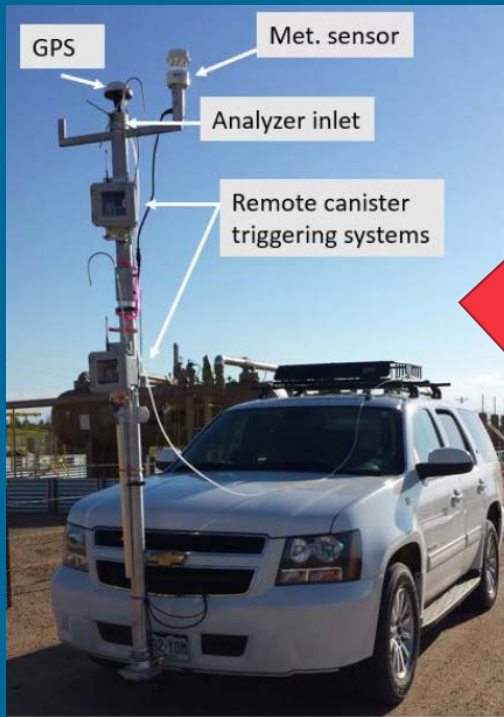
Health effects





The Source-to-Outcome Continuum

Probabilistic Health Risk Assessment



HEI Charge Questions

What exposure pathways and phases of UOGD should be the focus?

- Air
- Completion activities

What potential UOGD exposures are not well understood with existing data and merit original research?

- Acute, intermittent peak exposures
- Measurements in time-frames relevant to conducting risk assessments
- Limited set of VOCs (Benzene)
- Wellpad size
- Distance

What is the value of the research for decision-makers?

