# LOOKING THROUGH A PUBLIC HEALTH LENS TO INTERPRET AIR MEASUREMENT DATA AND MAKE SENSE OF GUIDANCE VALUES

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# Recent Headlines - What does it all mean?

## CDPHE funded 2019 modeling study

NEWS > ENVIRONMENT

### Colorado to tighten oversight of oil and gas sites near homes in wake of study finding possible short-term health effects

Industry official: "There are no long-term health impacts related to oil and gas development"

### Long-Awaited Colorado Health Study Finds Significant Risks From Fracking

CHASE WOODRUFF | OCTOBER 17, 2019 | 2:03PM

"This study confirms prior research, as well as our studies out in the field, that there is not an enhanced level of cancer, but that there is a quite infrequent risk of short-term effects, like the dizziness, headaches and nosebleeds. They're quire infrequent, but they're the ones that we take seriously enough that we're going to investigate further," said John Putnam, CDPHE Director of Environmental Programs.

9 News.com Oct. 17, 2019

## CDPHE mobile laboratory study

NEWS > ENVIRONMENT

### Elevated level of benzene detected at Greeley school near oil and gas operation

State health officials say they're trying to pinpoint source of pollution measured at Bella Romero K-8 Academy

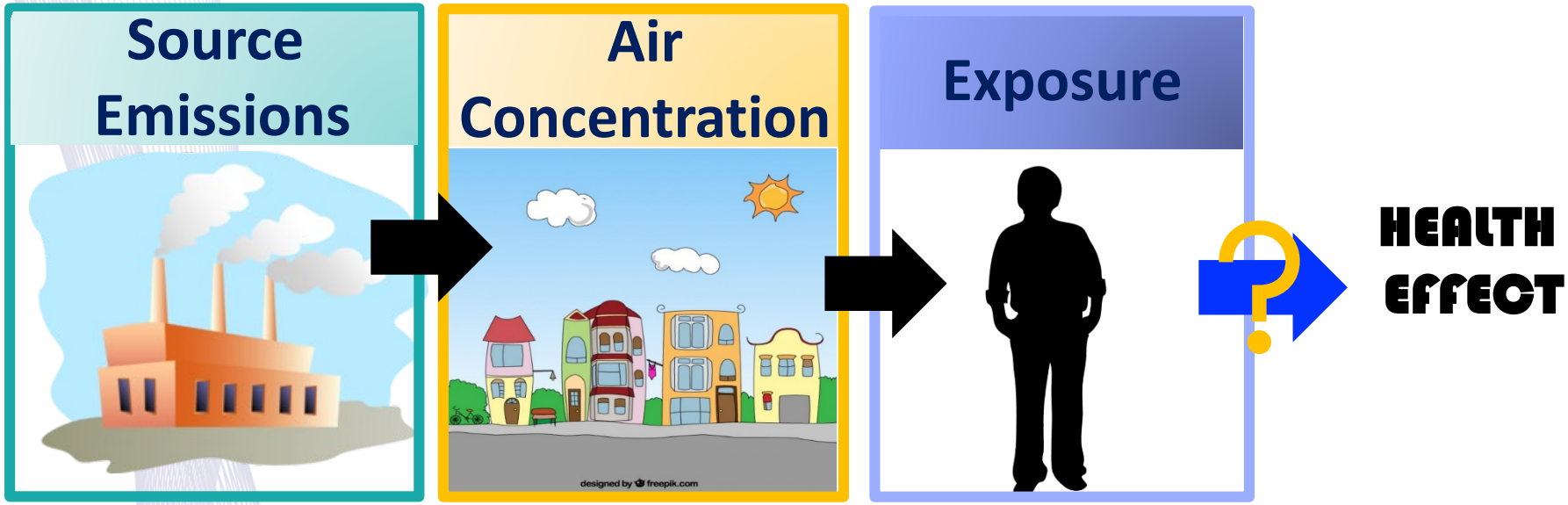
# KEY TAKE HOMES

- ✓ Air studies should be designed as fit for purpose
  - ❖ Before collecting data, know your "why" and what you will do with it

- ✓ Health guideline values are NOT clear lines between safe and unsafe

- ✓ Air models and measurement studies intended to be used for public health risk management decisions, not to prove causality
  - Do NOT correlate any symptoms with the types of risks estimated by this model

# Source to Health Outcome Paradigm

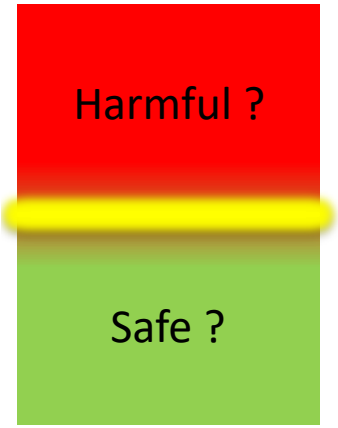


# Special Considerations for Public Health Exposure Limits

# Safe or Not Safe?...That is the question

$$\text{RISK} = \frac{\text{ENVIRONMENTAL EXPOSURE}}{\text{HEALTH GUIDELINE VALUE}}$$

- Compare an estimate of exposure to federally or state health protective guideline levels




*pertains to non-cancer risk

# HEALTH GUIDELINE VALUES

## What is it?

- ✓ Chemical specific number related to the toxicity of the chemical
- ✓ An estimate of the amount of a chemical a person can breathe each day without a detectable risk to health
- ✓ Highly conservative to ensure protection

## What are they used for?

- ✓ Screening tool for health risk assessments
  - *to identify chemical exposures that pose potential concern*
  - *to inform risk management decisions*

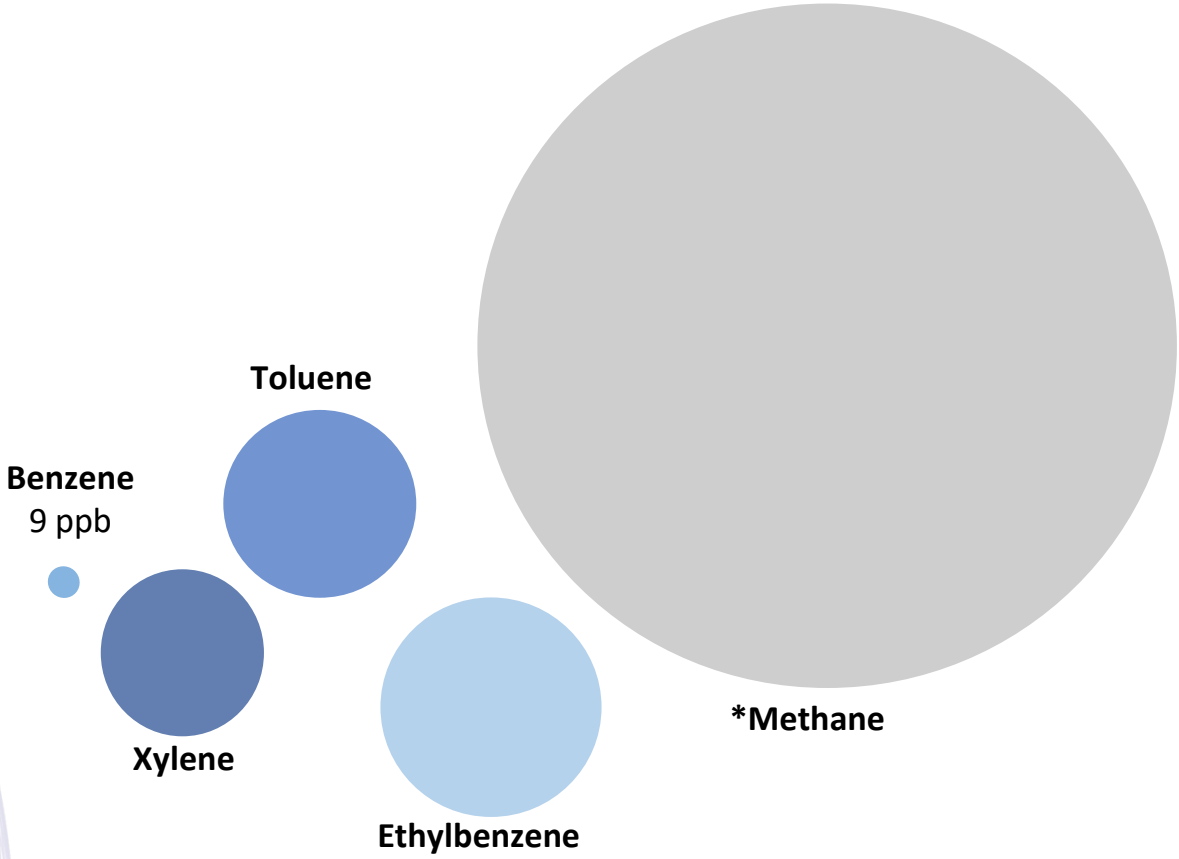
## What does an exceedance mean?

- ✓ "If someone is exposed to an amount above the minimum risk levels, it *does not mean that health problems will happen*…it means that they may want to look more closely at a site." *Agency for Toxic Substances and Disease* Registry

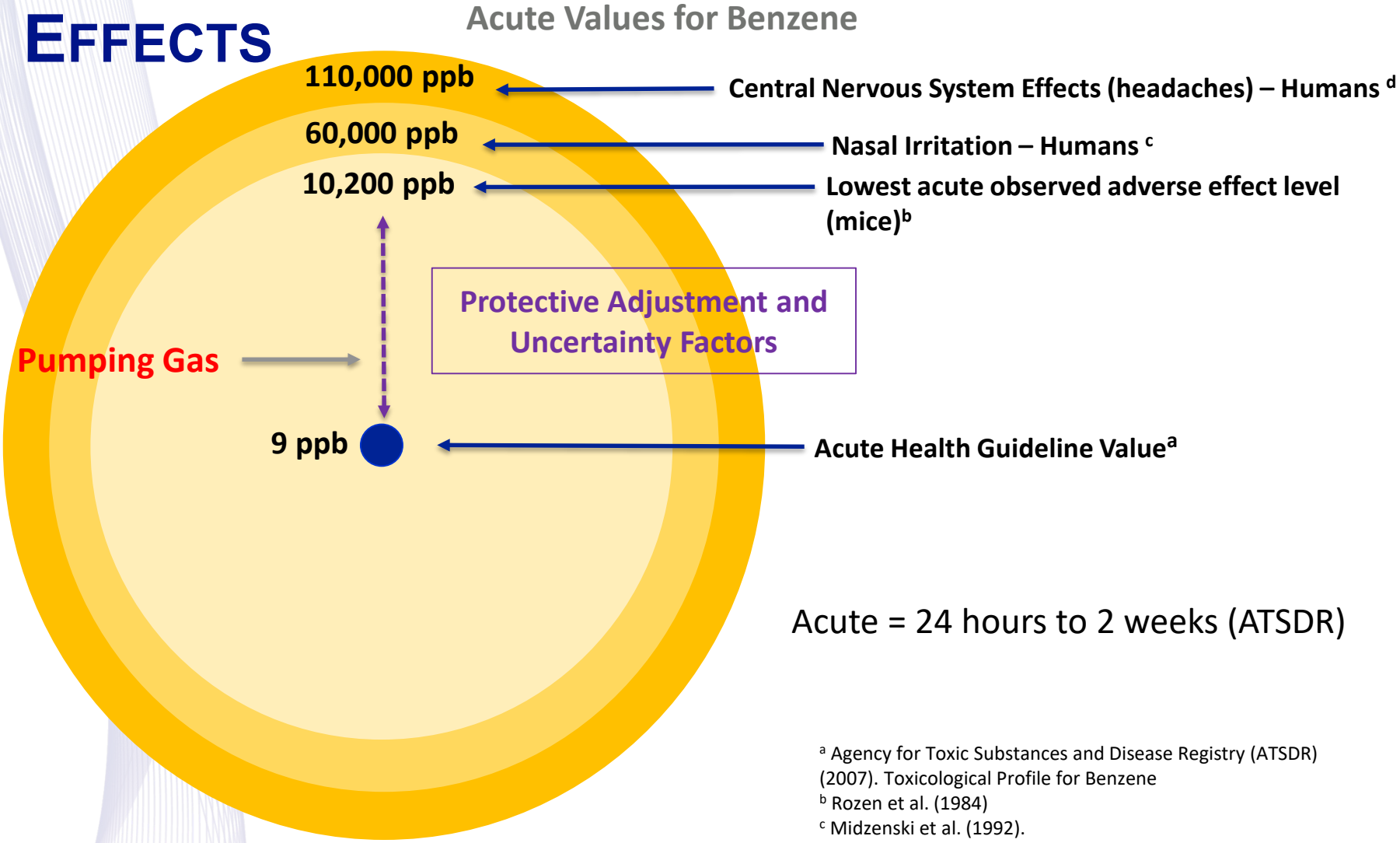
# NOT ALL CHEMICALS ARE CREATED EQUAL

"*All* substances are poisons;
there is none which is not a poison. The right
*dose* differentiates a poison from a remedy."

# NOT ALL CHEMICALS ARE CREATED EQUAL



# Health Guideline Values ≠ Health Effects




Acute = 24 hours to 2 weeks (ATSDR)

[a] Agency for Toxic Substances and Disease Registry (ATSDR) (2007). Toxicological Profile for Benzene
[b] Rozen et al. (1984)
[c] Midzenski et al. (1992).
[d] Wells and Nelder (1991).

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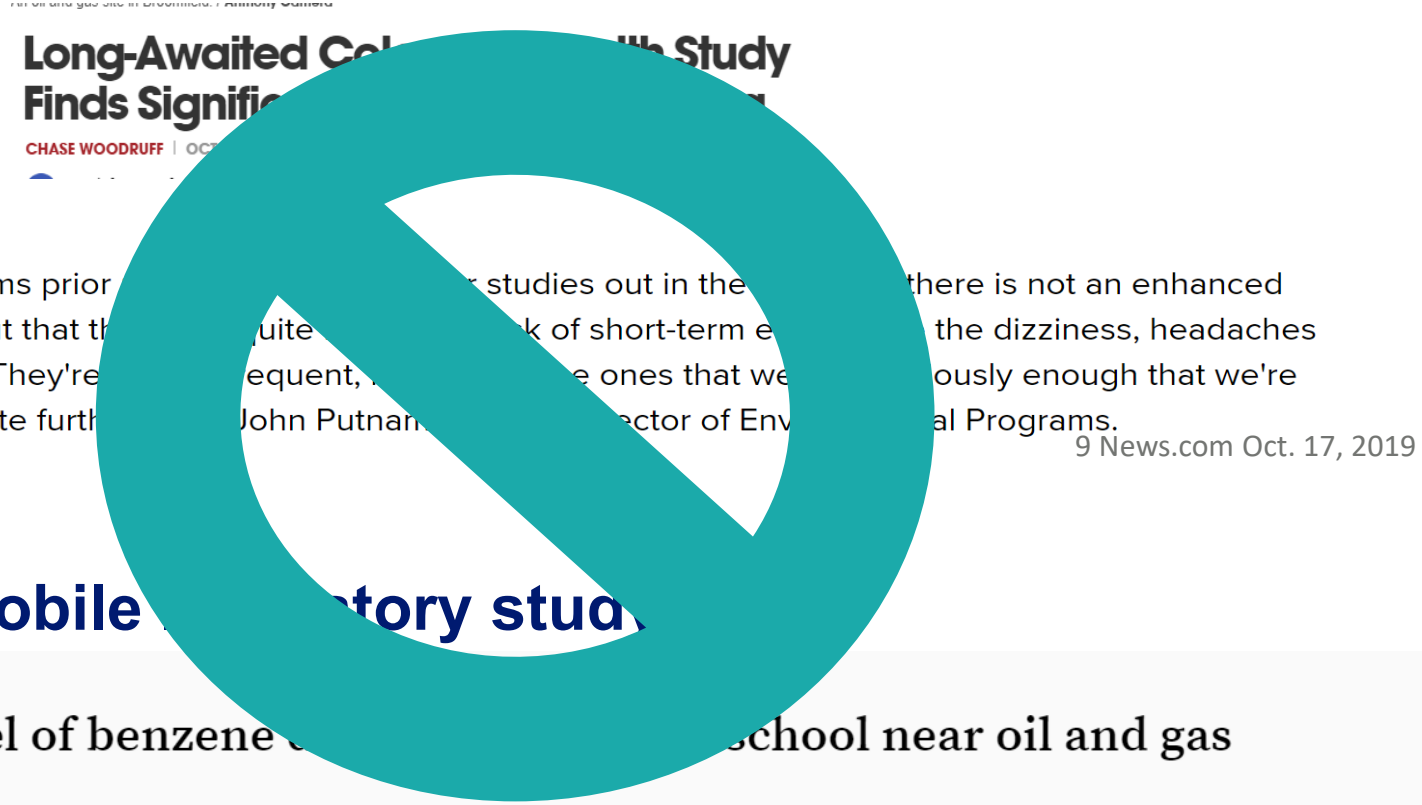


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## CDPHE mobile
tory stud

NEWS › ENVIRONMENT

**Elevated level of benzene
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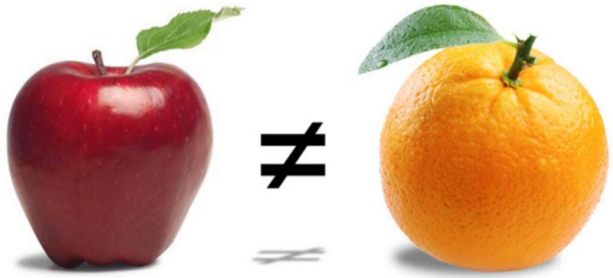
# Selection of Health Guideline Values

- chemical  specific
  - No health guideline values or “action levels” for methane or total VOCs
- vary by agency
- Many agencies have different guidelines relevant to
  - the intent of the assessment
  - exposure route
  - Duration (short term vs long term exposures)
- 200-fold difference of benzene acute values across different agencies

# Air Studies

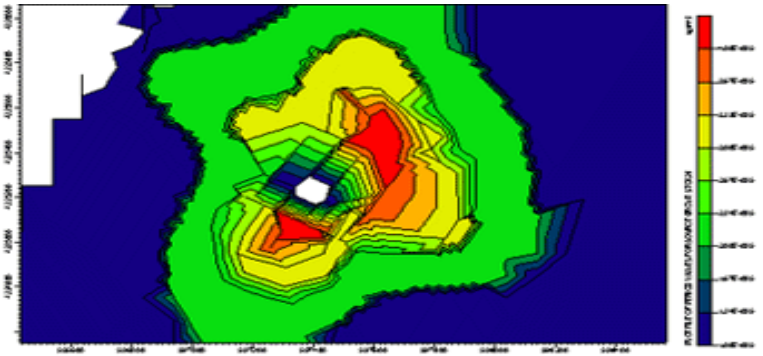
- Why?
  - Permitting?
  - Compliance?
  - Public health exposure and risk?
  - Source attribution?
  - Climate change?
- What?
  - What is the chemical(s) of concern?
  - What are the complaints?
  - Methane? Total VOCs, benzene?
  - Maximum values?  Average values?



- Where?
  - Based on why
  - Fenceline vs. Community
- How long?
  - What is representative of the time frame of interest?
  - How will you compare to guidelines?

# How Are Air Exposures Assessed?

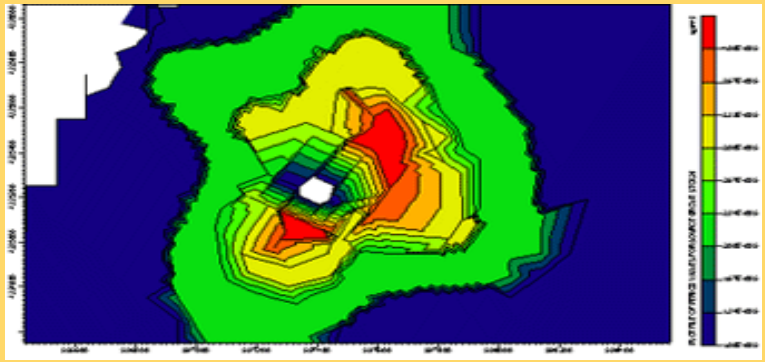
## Predictive Model



## Empirical Air Data

# How Are Air Exposures Estimated?

## Predictive Model



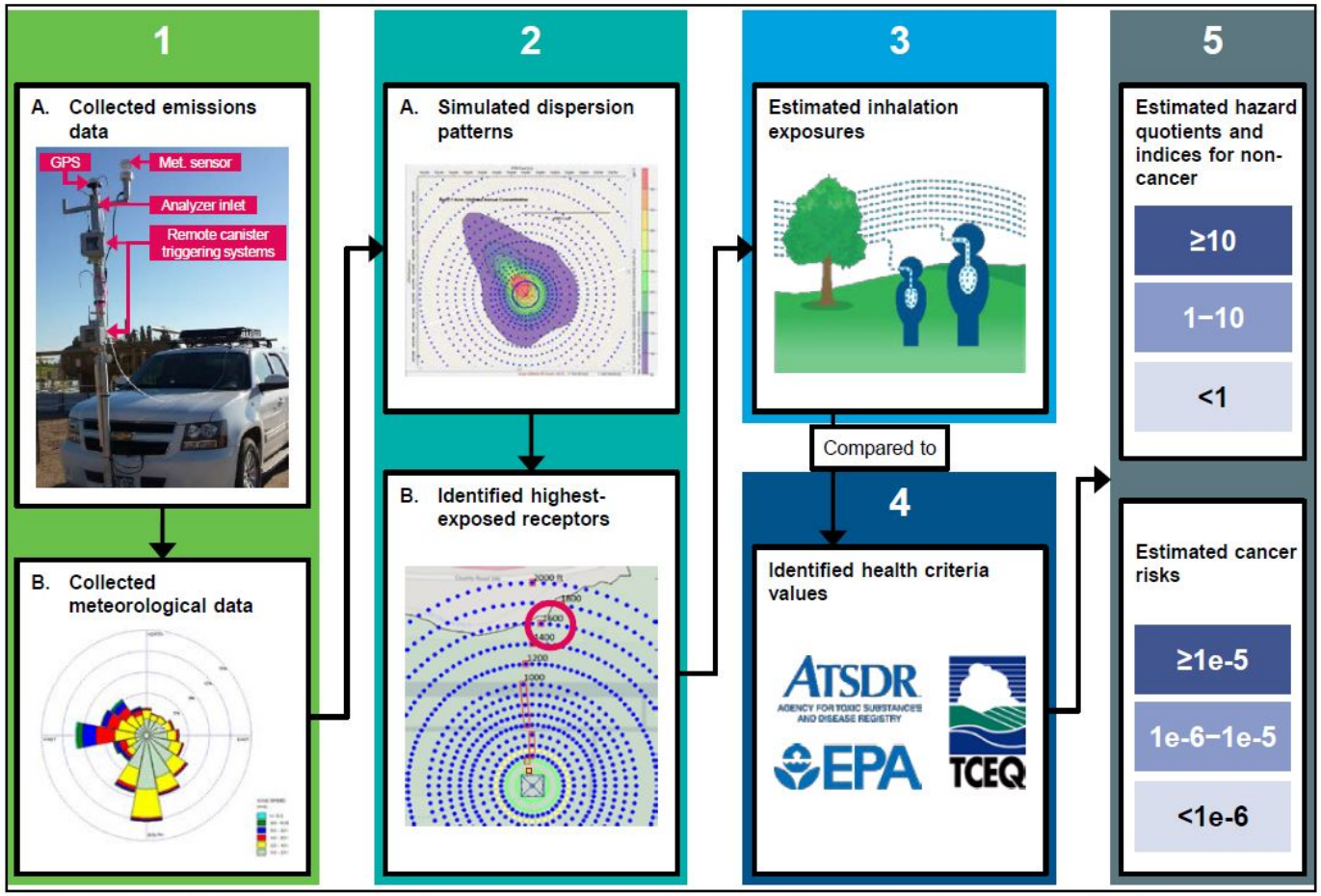
## Empirical Air Data

# CDPHE FUNDED 2019 MODELING STUDY

Designed to predict health risks under varying hypothetical conditions

- Regions
- Well pad sizes
- Meteorological conditions
- Population activities

# CDPHE Modeling Study Design




Notes: The methods for each step of the figure are more fully described as noted: 1A = Section 2.3; 1B = Section 2.5; 2A = Section 2; 2B = Sections 2.7.3 and 2.8; 3 = Section 3; 4 = Section 4; 5 = Section 5. Figure depicting collection of emissions data is from Figure 2.3 of (CSU, 2016a).

**Figure 1-1. Illustration of the Steps in the Risk Assessment**

from *Final Report: Human Health Risk Assessment for Oil & Gas Operations in Colorado* (Carr et al, 2019)

# WHAT DID THE MODELING SHOW

- ✓ Long-term health effects
  - volatile organic compounds (VOCs) are unlikely to occur to people living within 2000 feet from a wellpad

- ✓ Short term health effects
  - worst-case scenario for the highest exposed person
    - ❖ there were no impacts for most of the VOCs
    - ❖ benzene exceeded health guideline values during flowback
      - ➢ Infrequent
      - ➢ Up to 2000 feet

# What Do the Results Mean

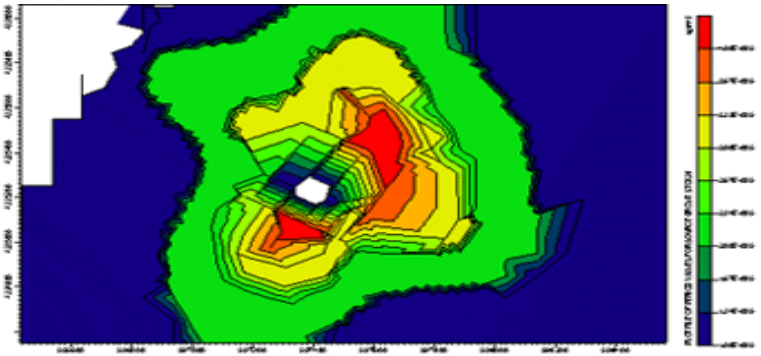
- ✓ The highly variable emissions over very short periods of time need to be studied more closely using site specific monitoring to measure actual, rather than modeled, chemical exposures

- ✓ "Our identification of these estimated exceedances of acute health guidelines is highly conservative…" Carr et al (2019)

- ✓ "Additional measurements could help to refine the risk estimates in these assessments and/or allow for assessments that are more site-specific." Carr et al (2019)
  - Relevance to current best management practices
  - Generic nature of the emissions and model assumptions

# How Are Air Exposures Estimated?

## Predictive Model



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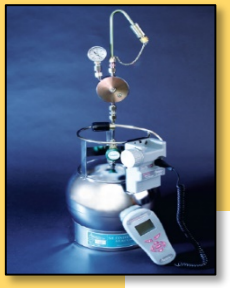
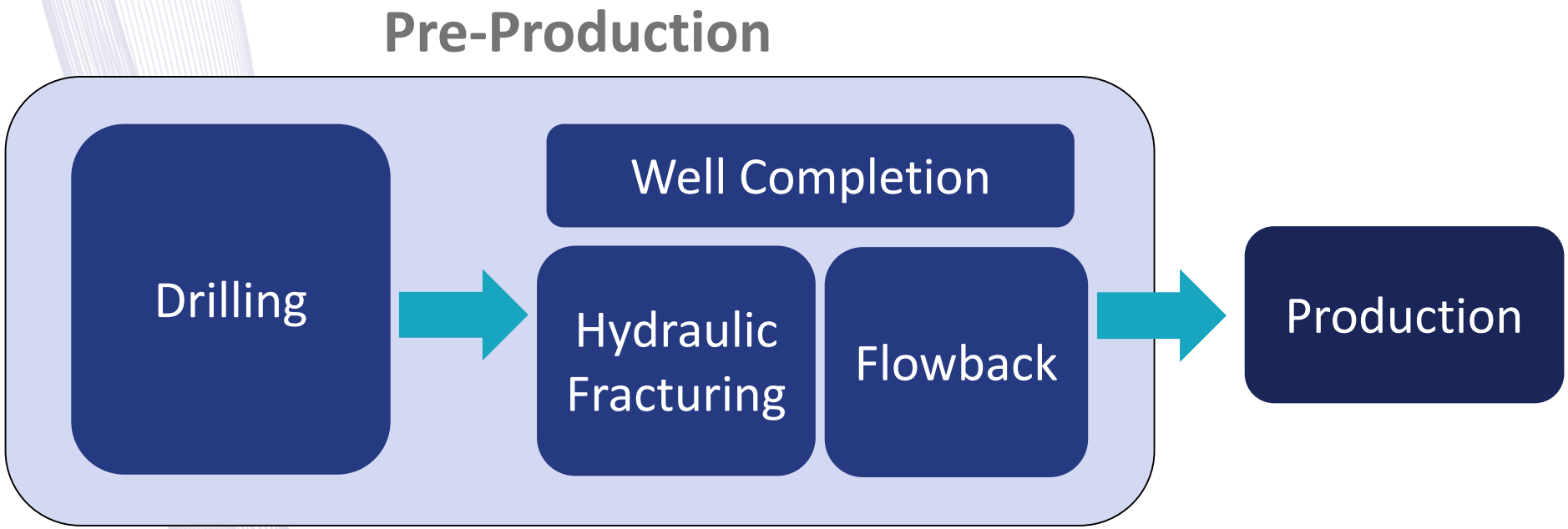


# Public Health Exposure Assessment: Air Monitoring and Sampling

Real-time air monitoring can be used in decision making and to determine if *immediate action* is required.


Time-integrated air sampling provides average concentrations that can be compared to HGVs

# Air Studies To Assess Public Health Risks



# Study Design

| What we did | What it tells us | How it was done | What we measured |
|---|---|---|---|
| Continuous, real-time monitoring | Immediate health impacts | People "roaming" on pad and off pad<br>• Community locations downwind of pad<br>• Visual and odor observations<br>• 12-24 hours/day | • Total Volatile Organic Compounds (VOCs)<br>• Benzene<br>• Hydrogen sulfide<br>• Particulate matter |
| Analytical Sampling | Are levels of individual VOCs exceeding health guideline values | • 24 hour collection of air<br>• Multiple locations<br>  • Perimeter of Wellpad<br>  • Communities | Over 50 different VOCs |

# Preliminary Air Study Results

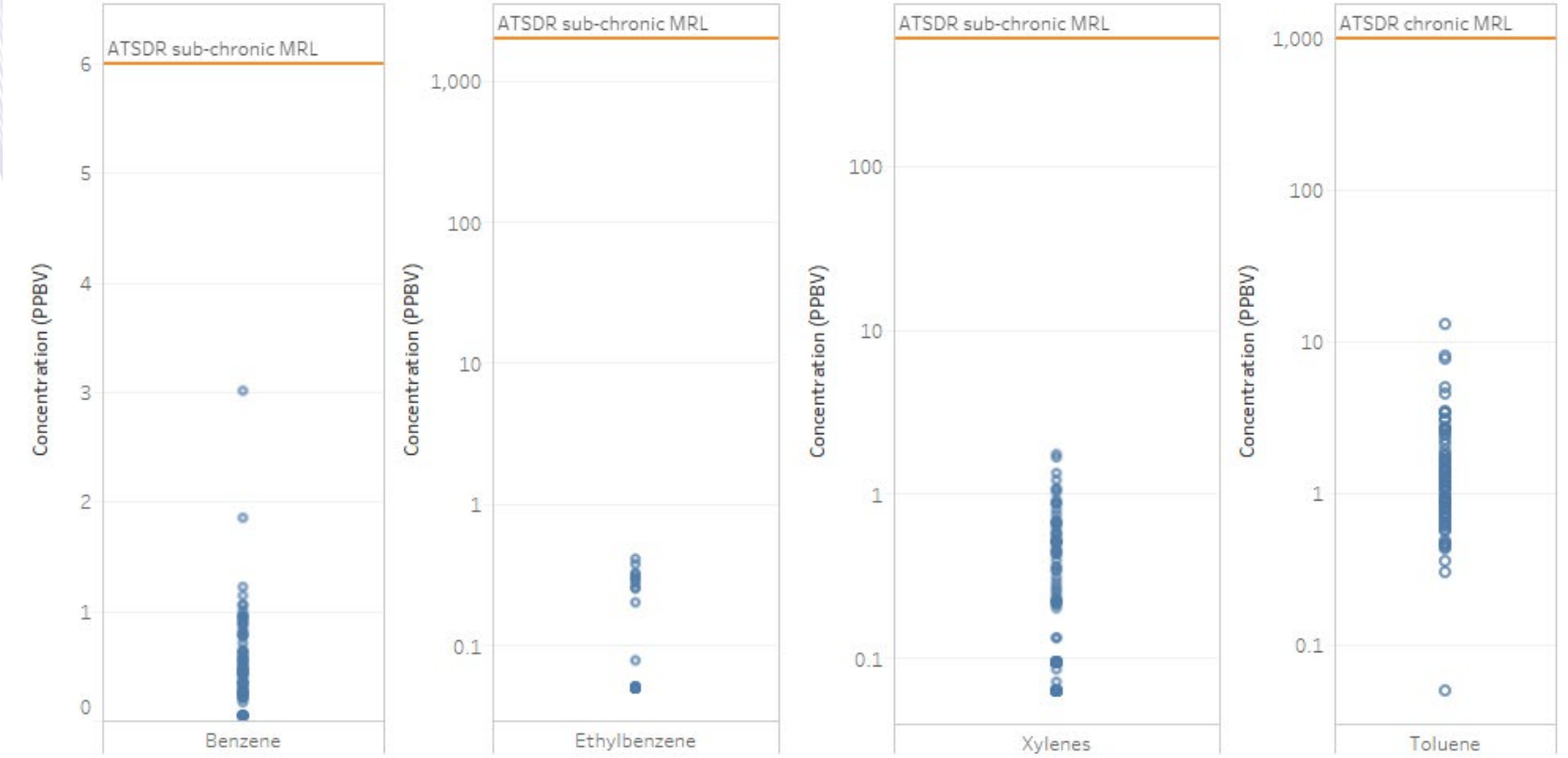
- ✓ 11 wellpads
- ✓ Range of BMPs
- ✓ > 100 days of sampling
- ✓ Different seasons
- ✓ 24,000 real-time measurements
- ✓ 650 analytical samples

# Study Example: Real-Time Measurement Results

- 24,000 real-time community measurements
- >97% of tVOCs were non-detects (<1ppb)
- 0 benzene detections


* preliminary data- do not cite

# MAXIMUM AIR CONCENTRATIONS COMPARED TO CONSERVATIVE HEALTH GUIDELINE VALUES




*preliminary data- do not cite

- 650 analytical samples
- All OG related analytes below short and long term health guideline values

# Preliminary Air Study Conclusions

**Current BMPs are adequately controlling pre-production and production VOC emissions to levels that are not expected to cause adverse health effects to nearby communities**

# KEY TAKE HOMES

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