

Operators Annual Planning Meeting for Air, Water and Socioeconomics –Pinedale Anticline

BLM Building Pine St. Pinedale 09 August 2012

UW Air Quality Research in the Pinedale Anticline 2012

DEPARTMENT OF ATMOSPHERIC SCIENCE
FIELD, SOLTIS, MONTAGUE

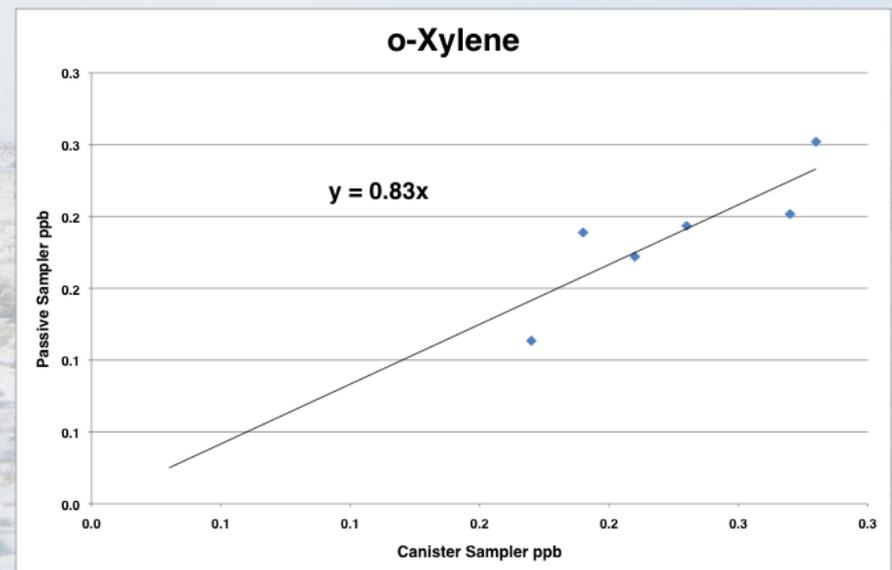
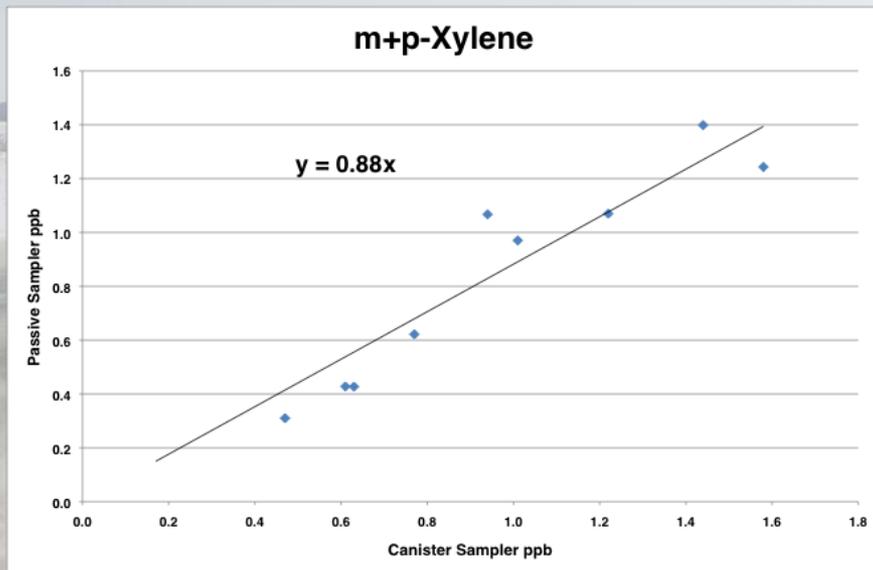
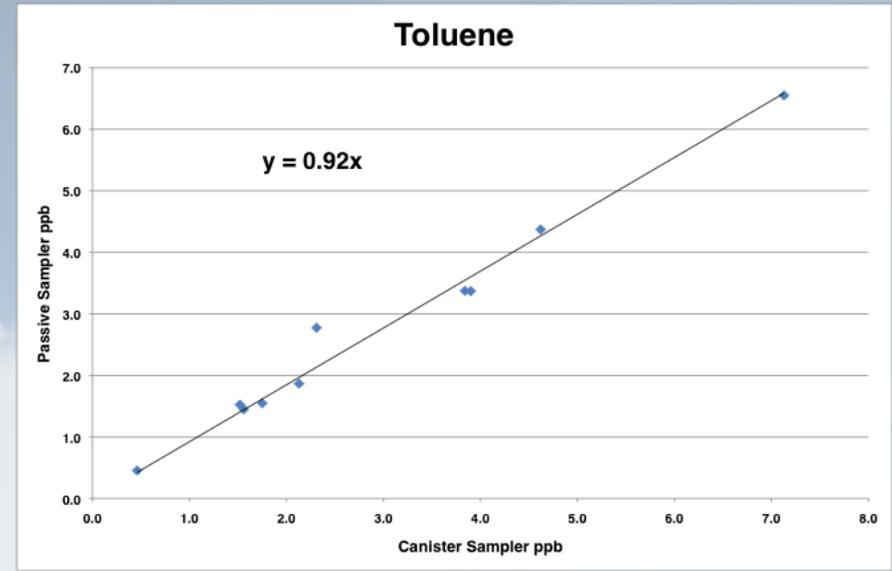
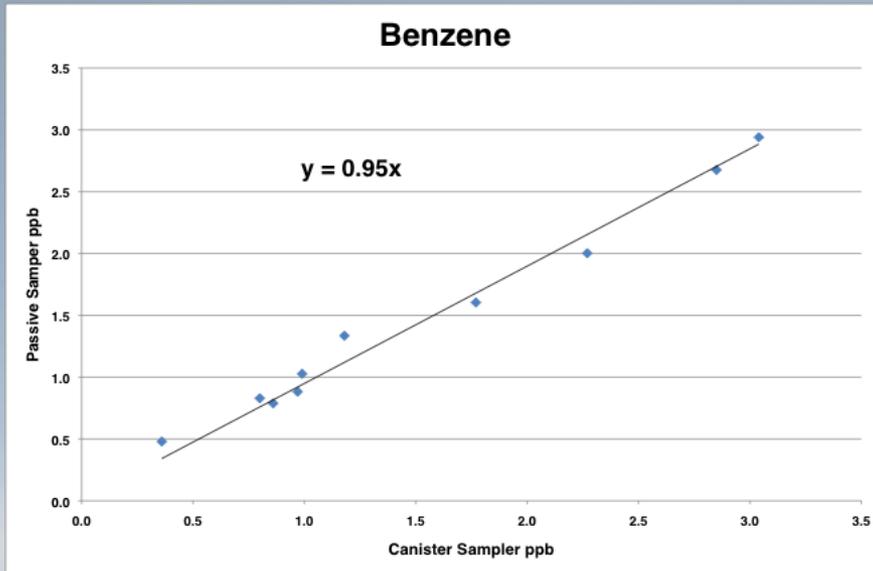


PINEDALE ANTICLINE SPATIAL AIR QUALITY ASSESSMENT

PASQUA 2012

PAPO and UW SER funded project

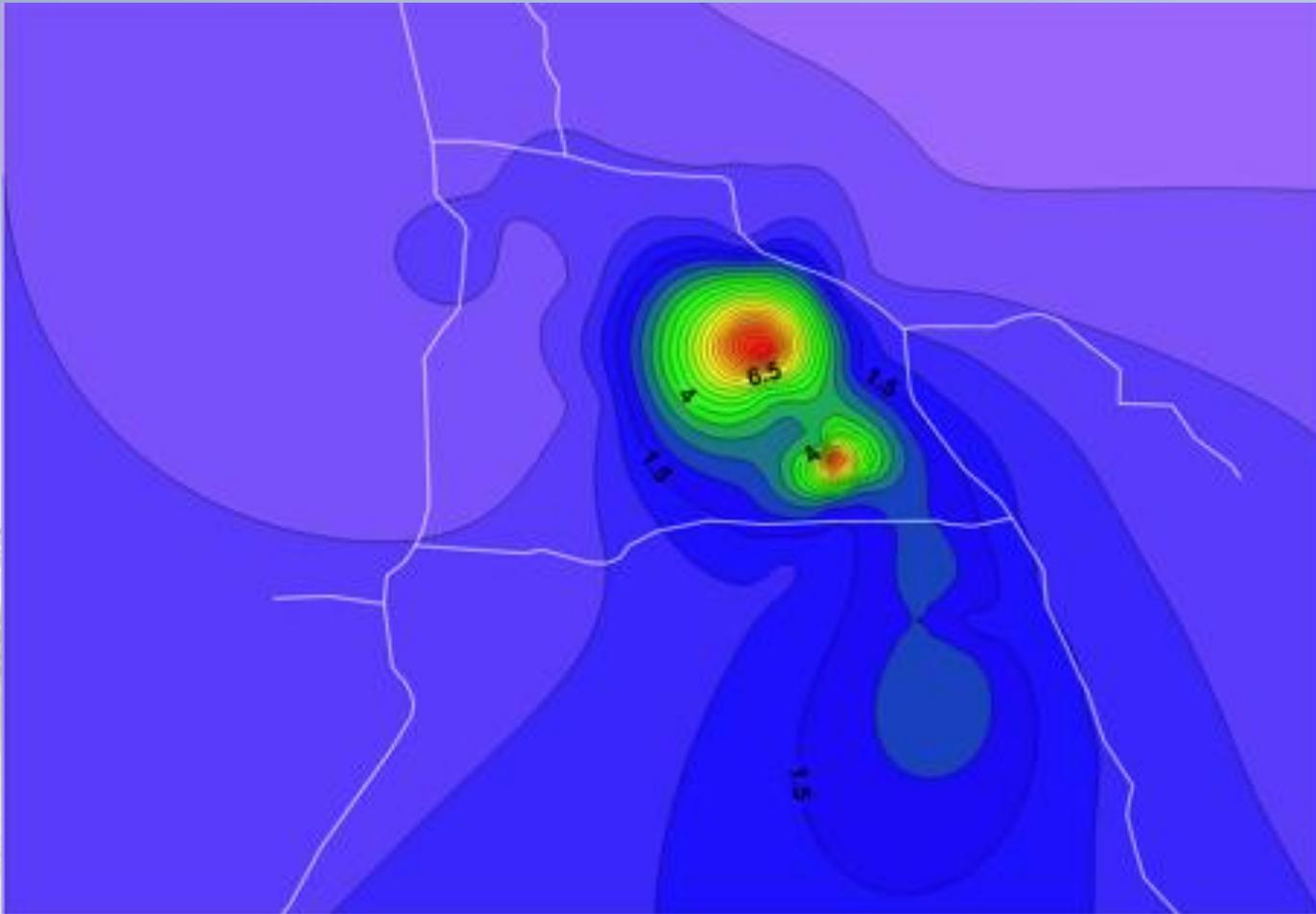
Collocation of Canister and Passive Samplers



Passive Sampler Surveys 2011/2012

Toluene ppb

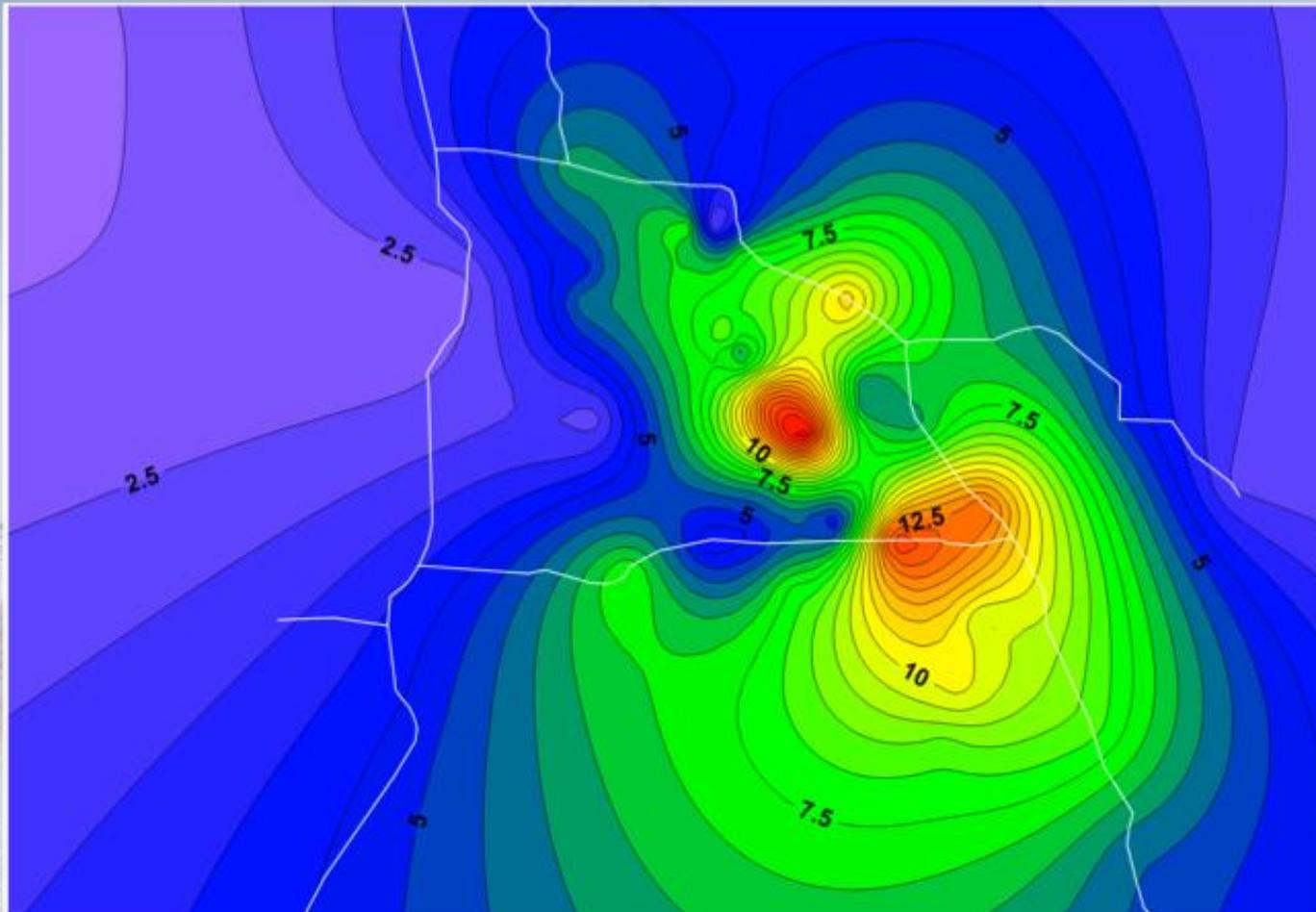
February 2012



Passive Sampler Surveys 2011/2012

NO_x ppb

February 2012



PASQUA CONCLUSION I

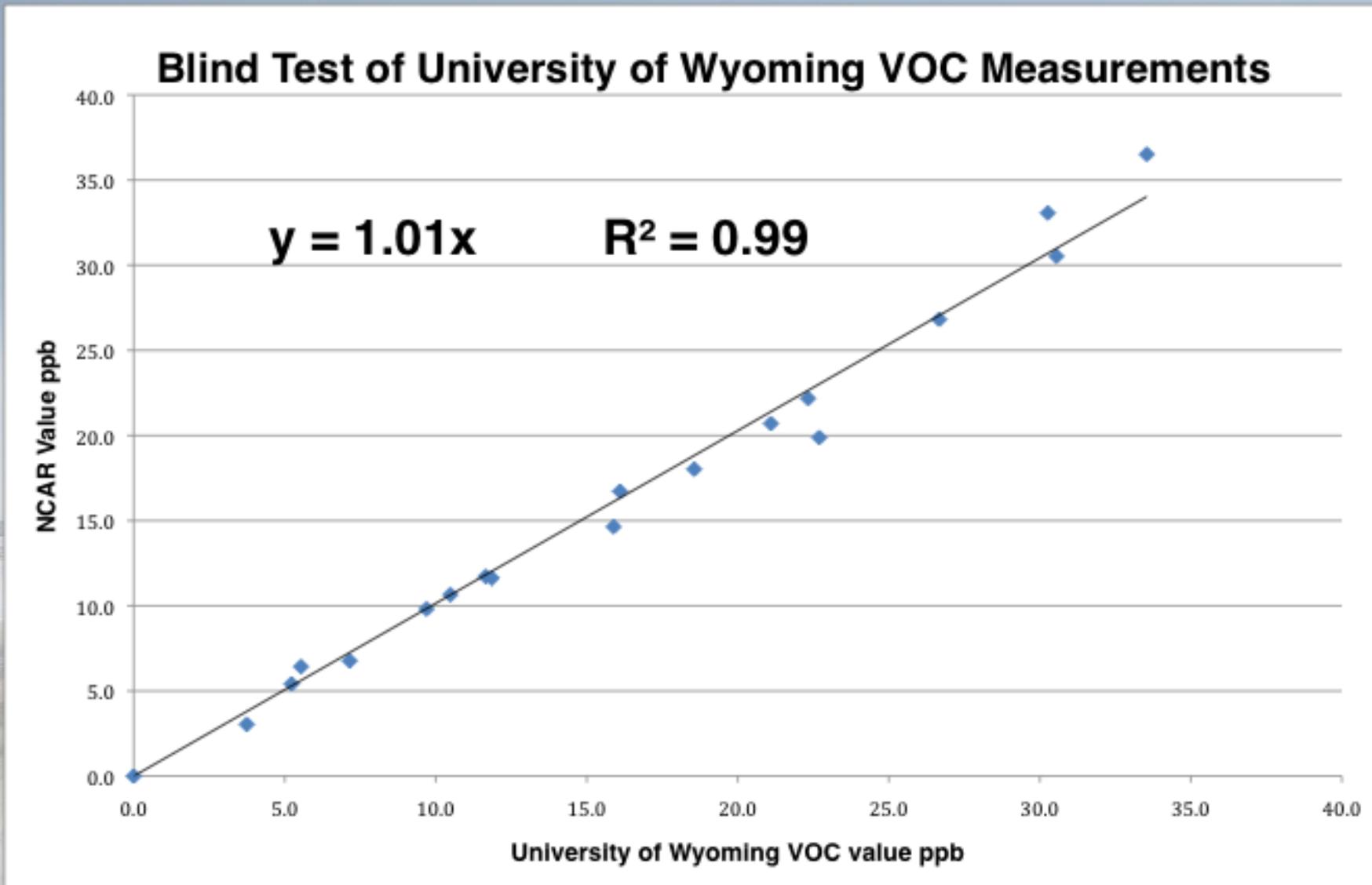
**High quality BTEX passive
sampling surveys show two
hotspot areas**

Twelve Canister Sampler Surveys 2012



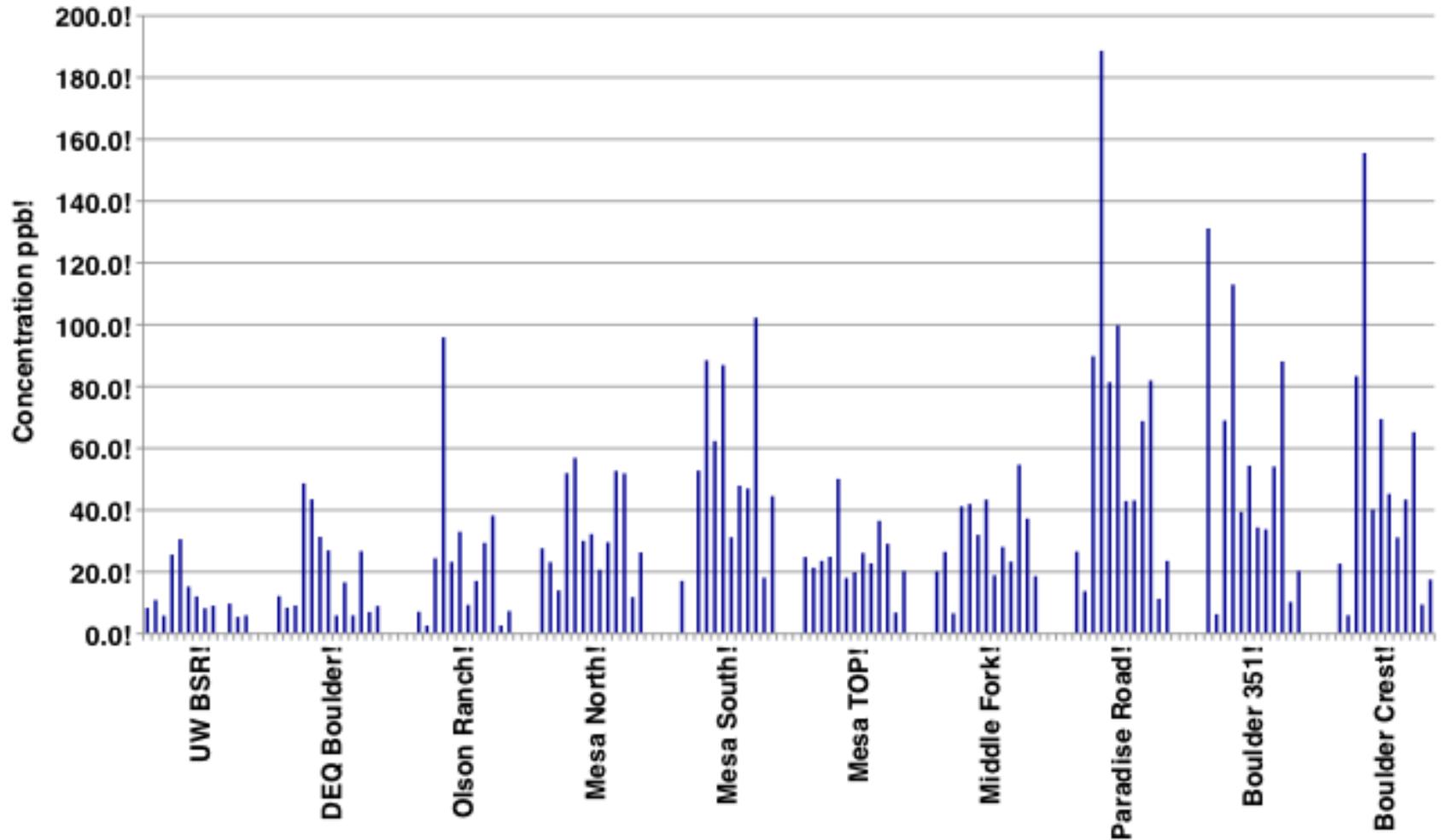
January to March 2012 encompassing “ozone season”

2012 National Center for Atmospheric Research Audit of 31 VOC

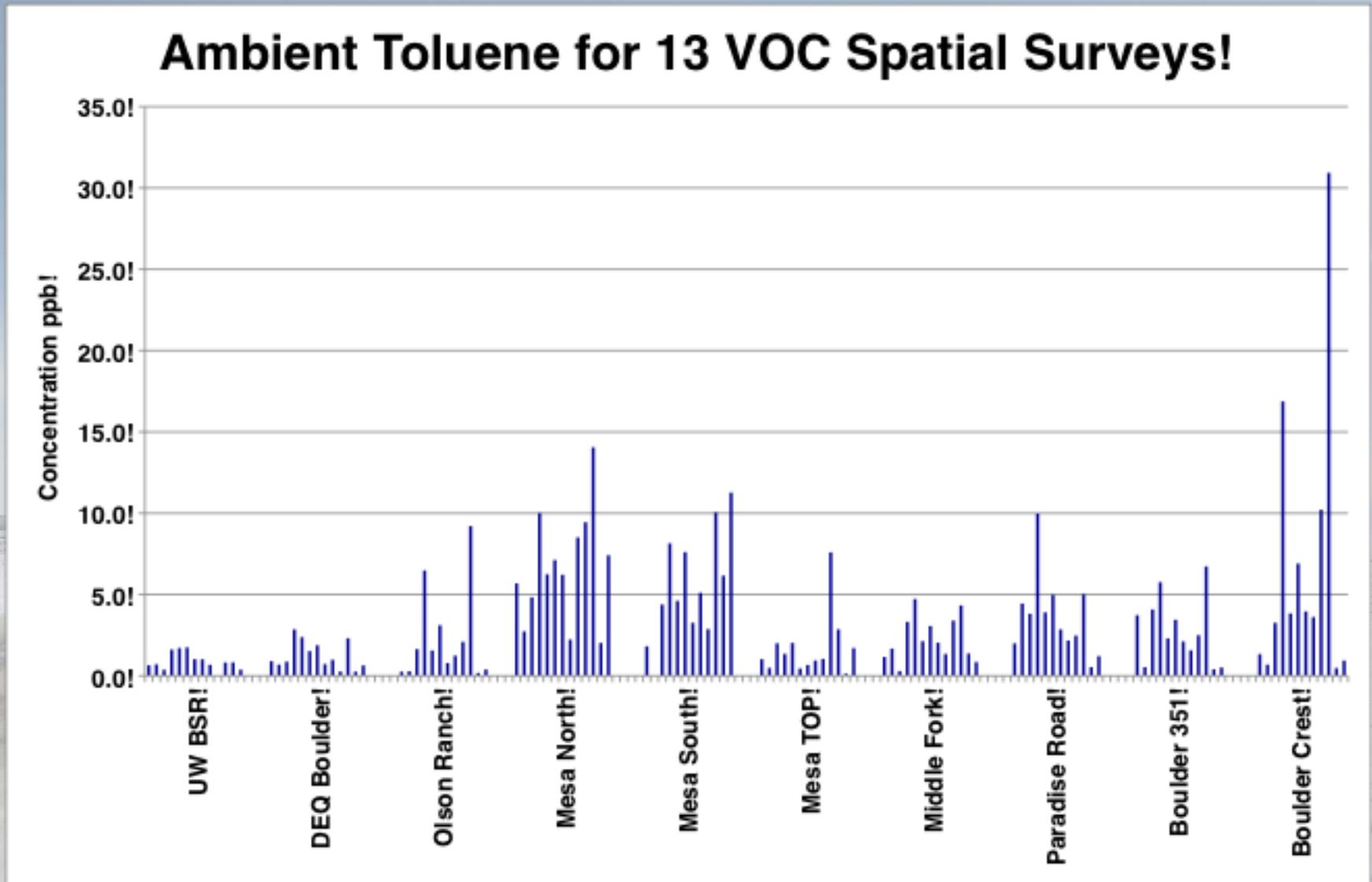


PASQUA 2nd yr. VOC Surveys

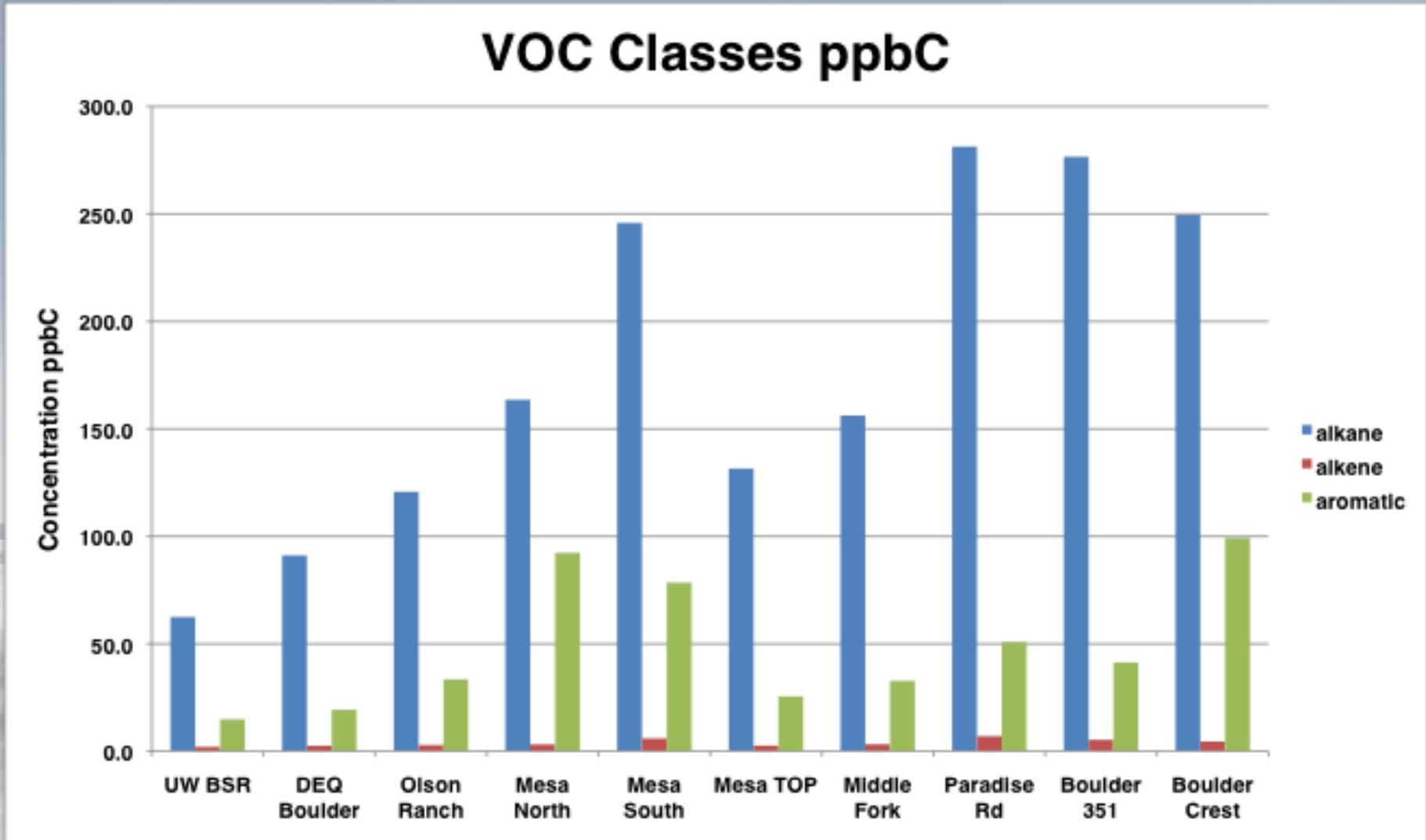
Ambient Ethane for 13 VOC Spatial Surveys!



PASQUA 2nd yr. VOC Surveys



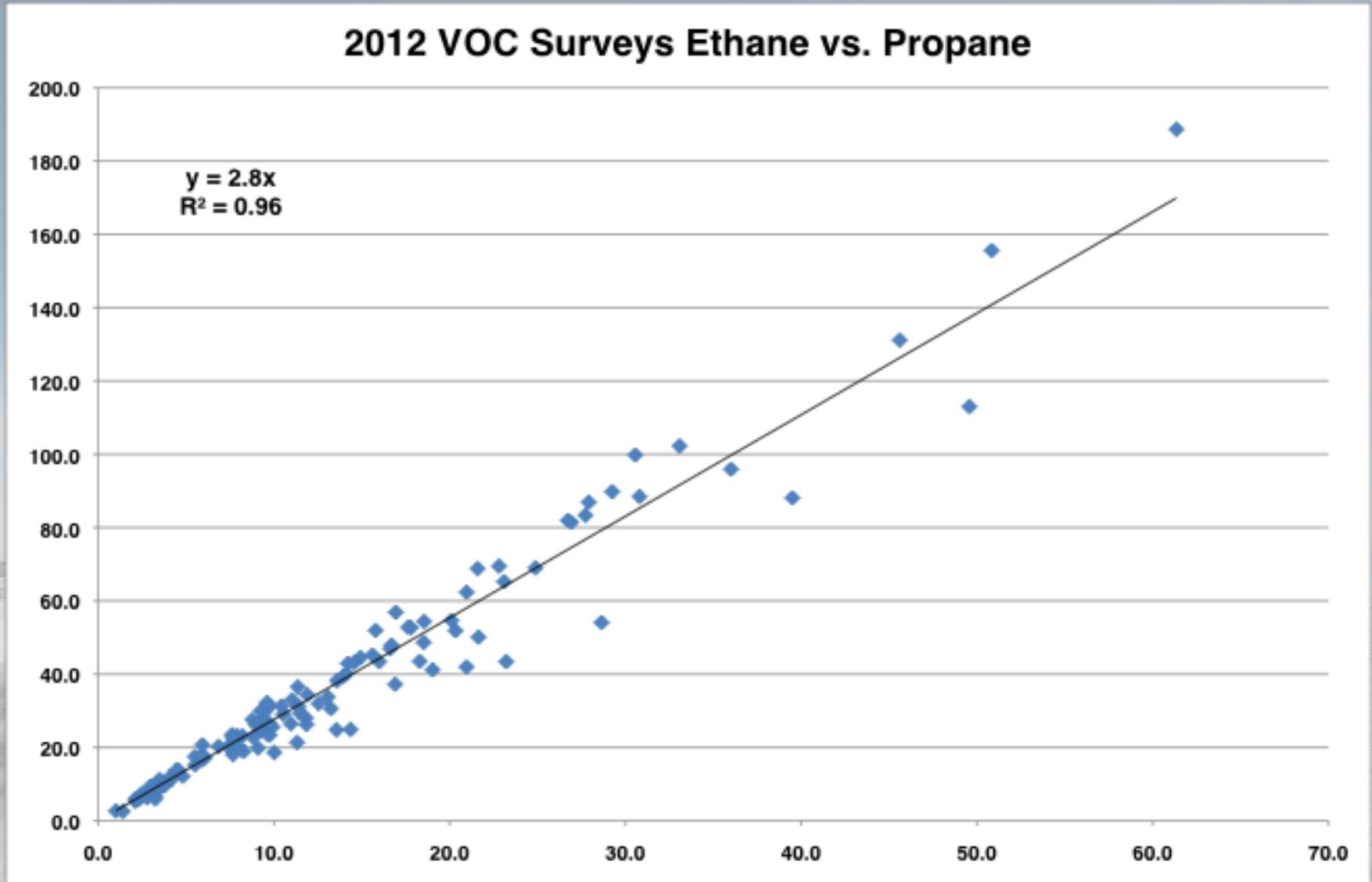
VOC Survey Distribution



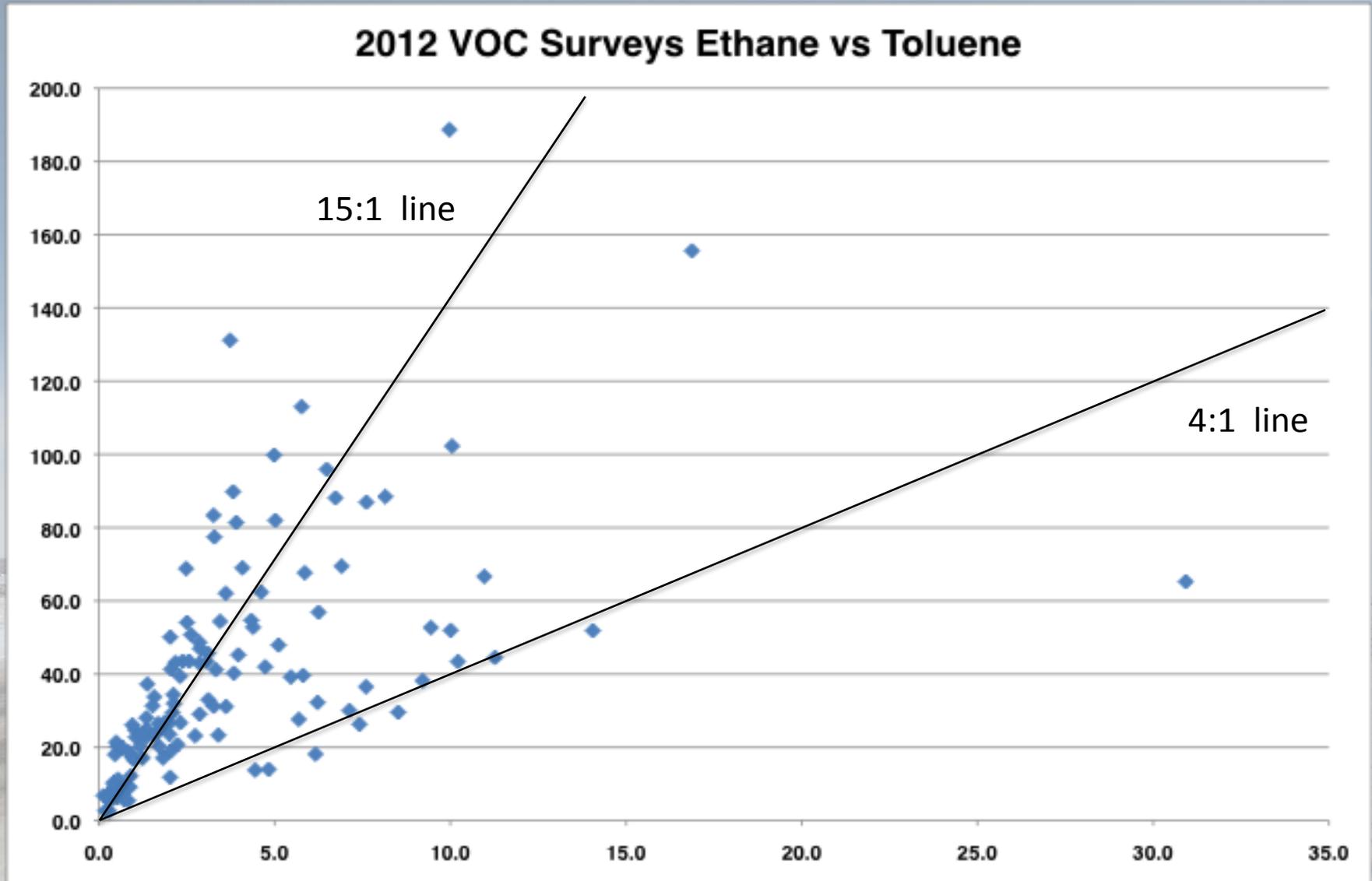
PASQUA CONCLUSION II

**High quality canister surveys
have better defined VOC
associated with PAPA for ozone
modeling**

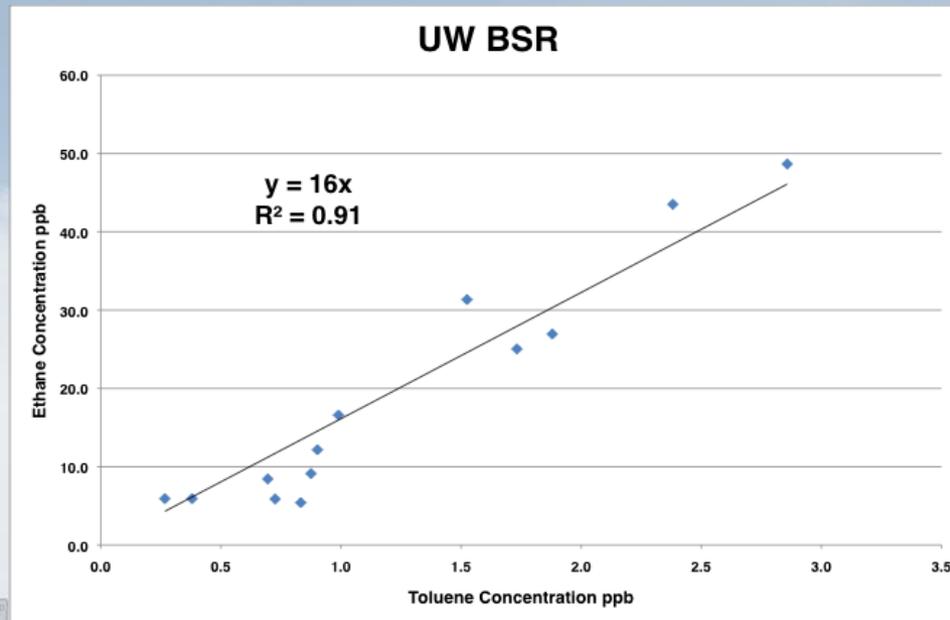
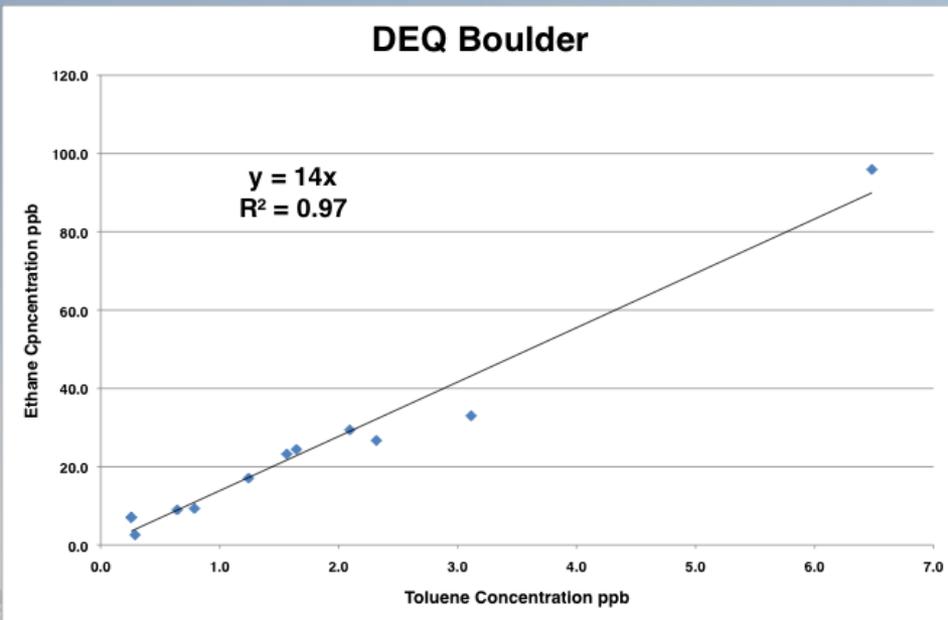
All 10 sites Ethane vs. Propane



All 10 sites Ethane vs. Toluene

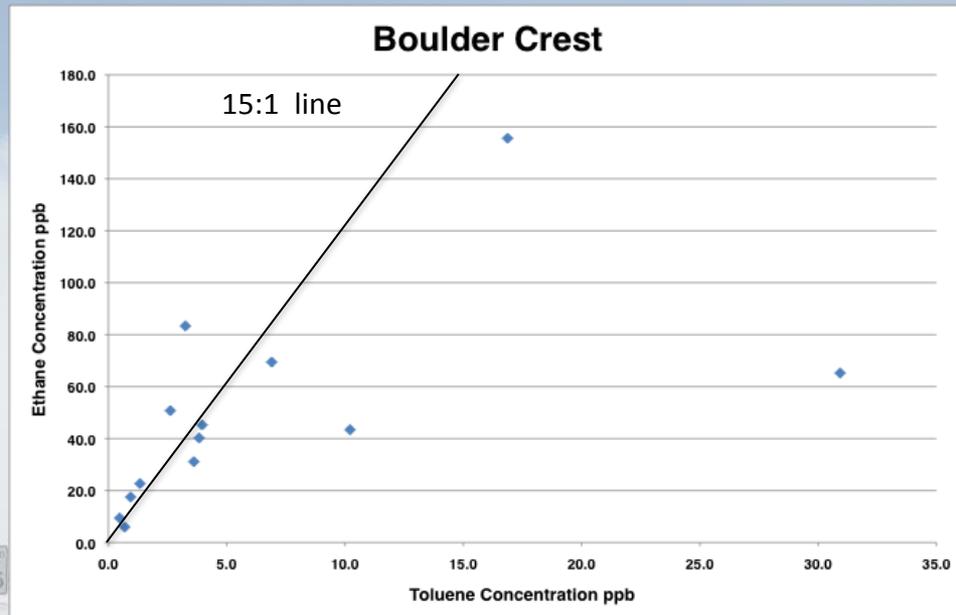
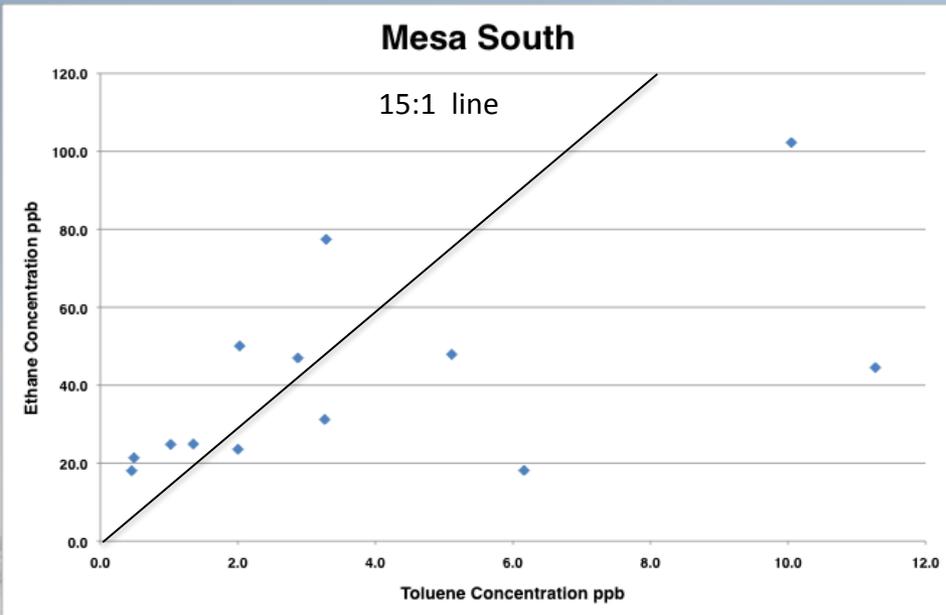


Two Sites With Well Mixed Air Ethane vs. Toluene



DEQ Boulder and Boulder South Road show good agreement of ethane and toluene (15:1) r^2 above 0.9

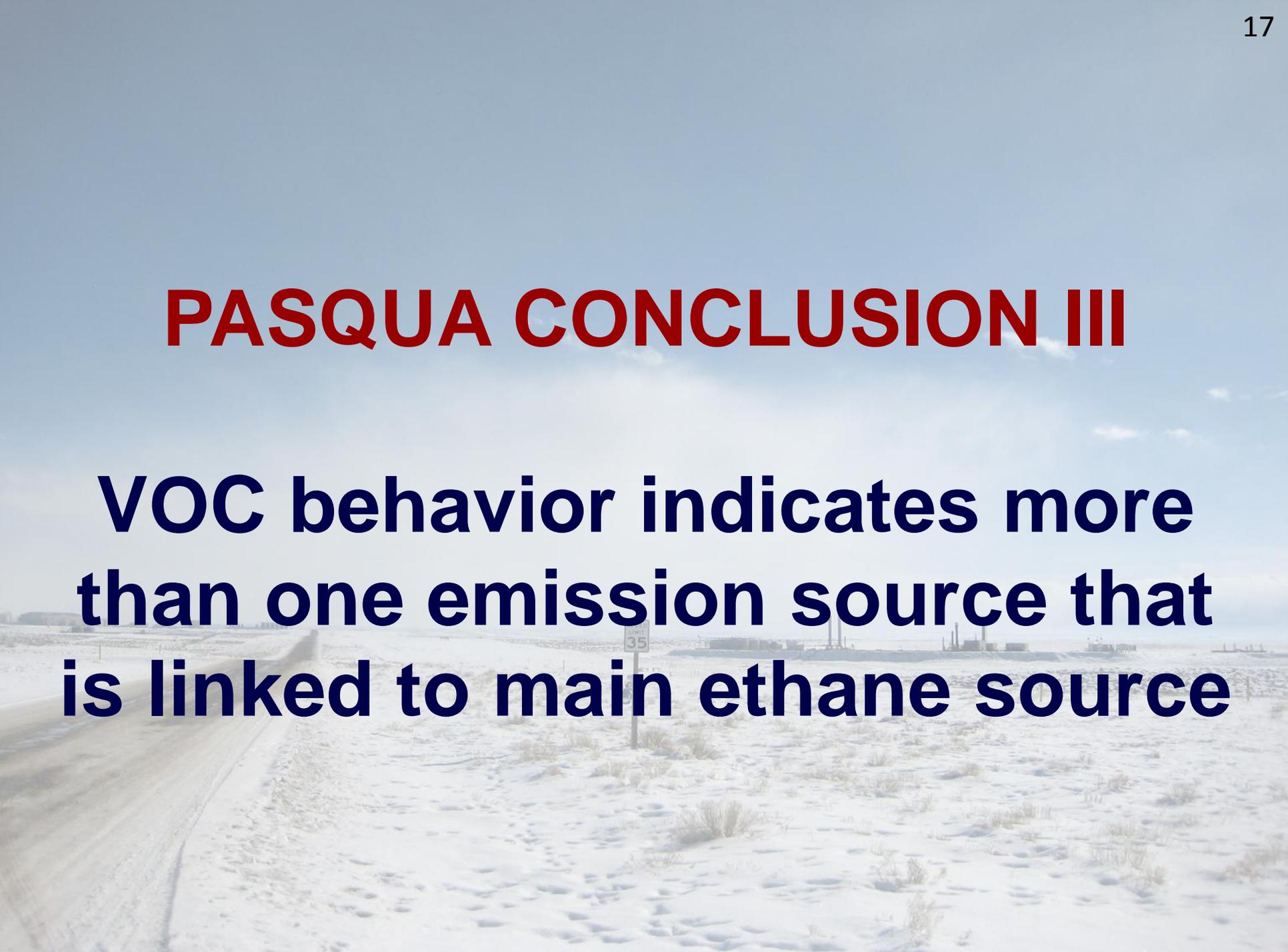
Two Sites Closer to Emissions Ethane vs. Toluene



Mesa South and Boulder Crest show poor agreement of ethane and toluene r^2 below 0.3

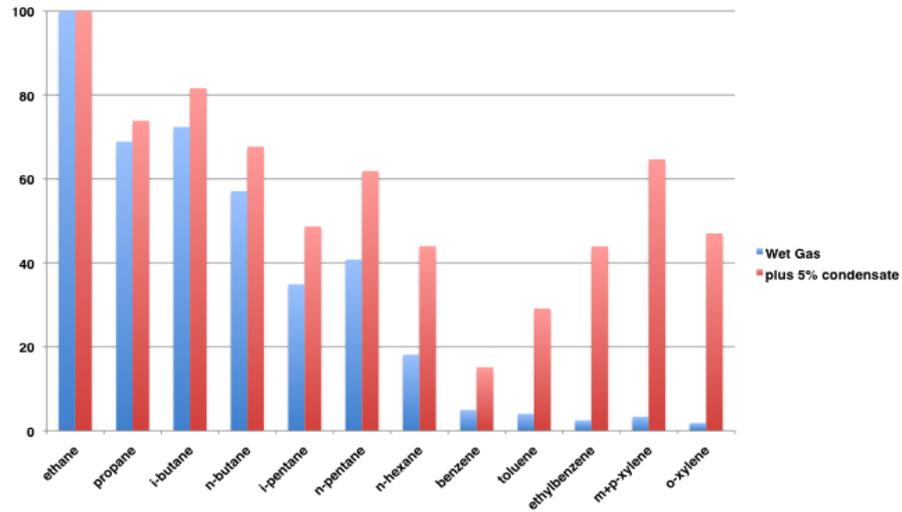
PASQUA CONCLUSION III

VOC behavior indicates more than one emission source that is linked to main ethane source

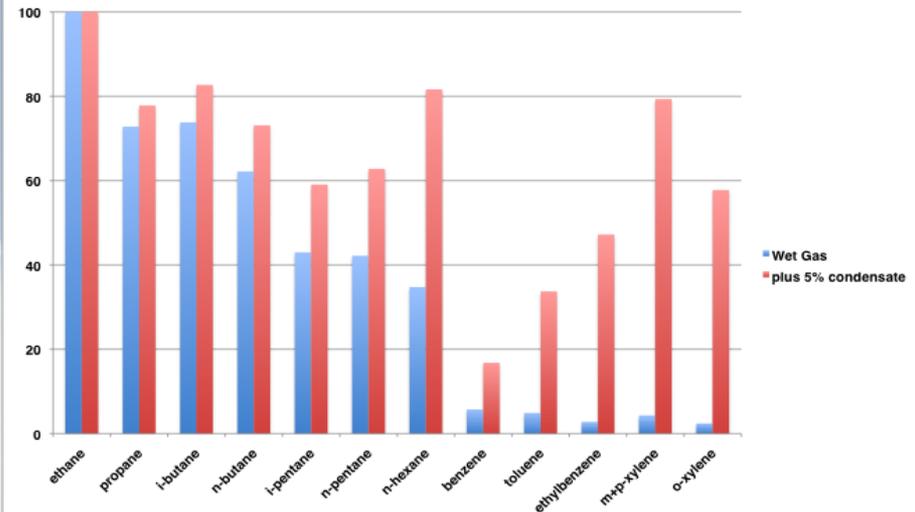
A photograph of a snowy landscape. In the foreground, a dirt road curves to the left. The ground is covered in snow with some sparse, dry grass. In the middle ground, there is a speed limit sign that says '35'. In the background, there are several industrial buildings or structures, possibly a refinery or chemical plant, under a clear blue sky with some light clouds.

If all Ethane is all fugitive and +5%¹⁸ of propane is condensate then...

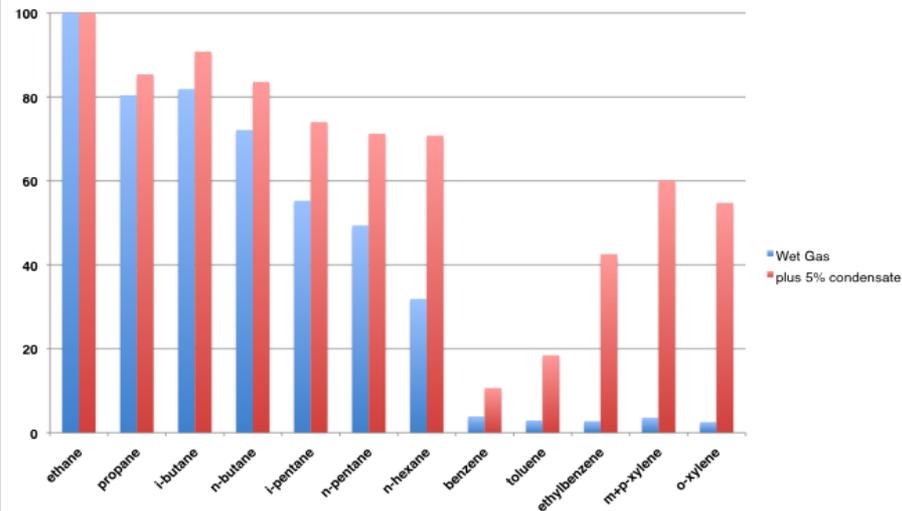
UW Boulder South Road



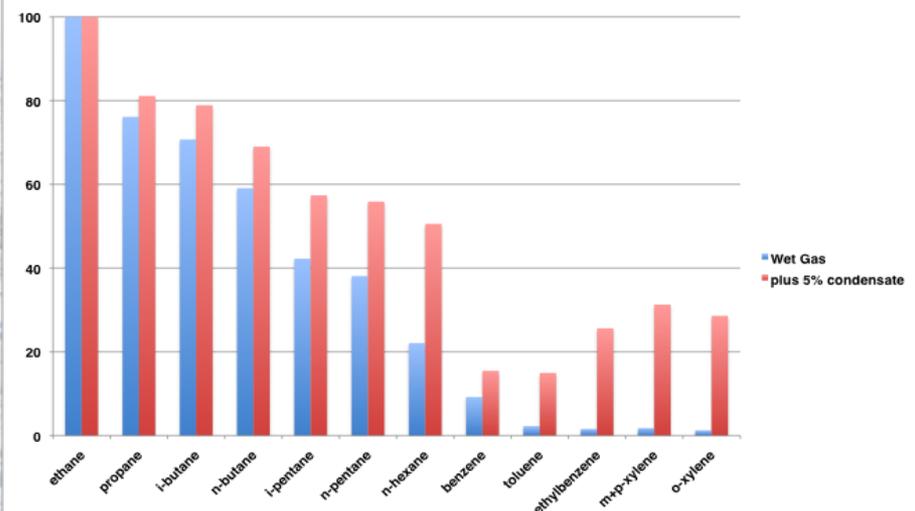
DEQ Boulder



Mesa South



Boulder Crest Road



NEXT STEPS COMMENT I

For mitigation to be effective we need to know the true balance between contributing sources

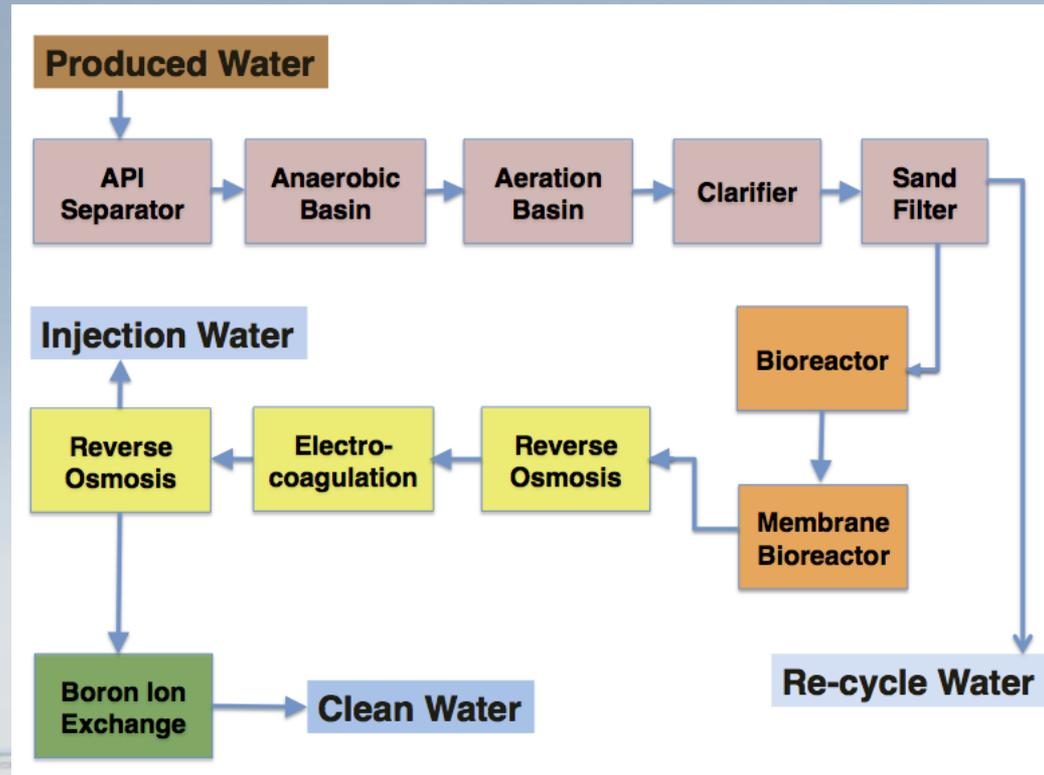
UW Initiative I Water Treatment



Pinedale Anticline Disposal facility

- Since 2006 over 20 million barrels processed
- Capacity of 60,000 barrels/day for processing and 20,000 barrels/day for discharge
- Typical Feed 28,000 to 80,000 $\mu\text{g/L}$ of BTEX

Water Treatment Schematic



Abridged from
Anticline Disposal
website

if BTEX in = BTEX out and since

1 bbl = 120L & 5 million bbl/yr processed with BTEX at 50,000 $\mu\text{g/L}$ then

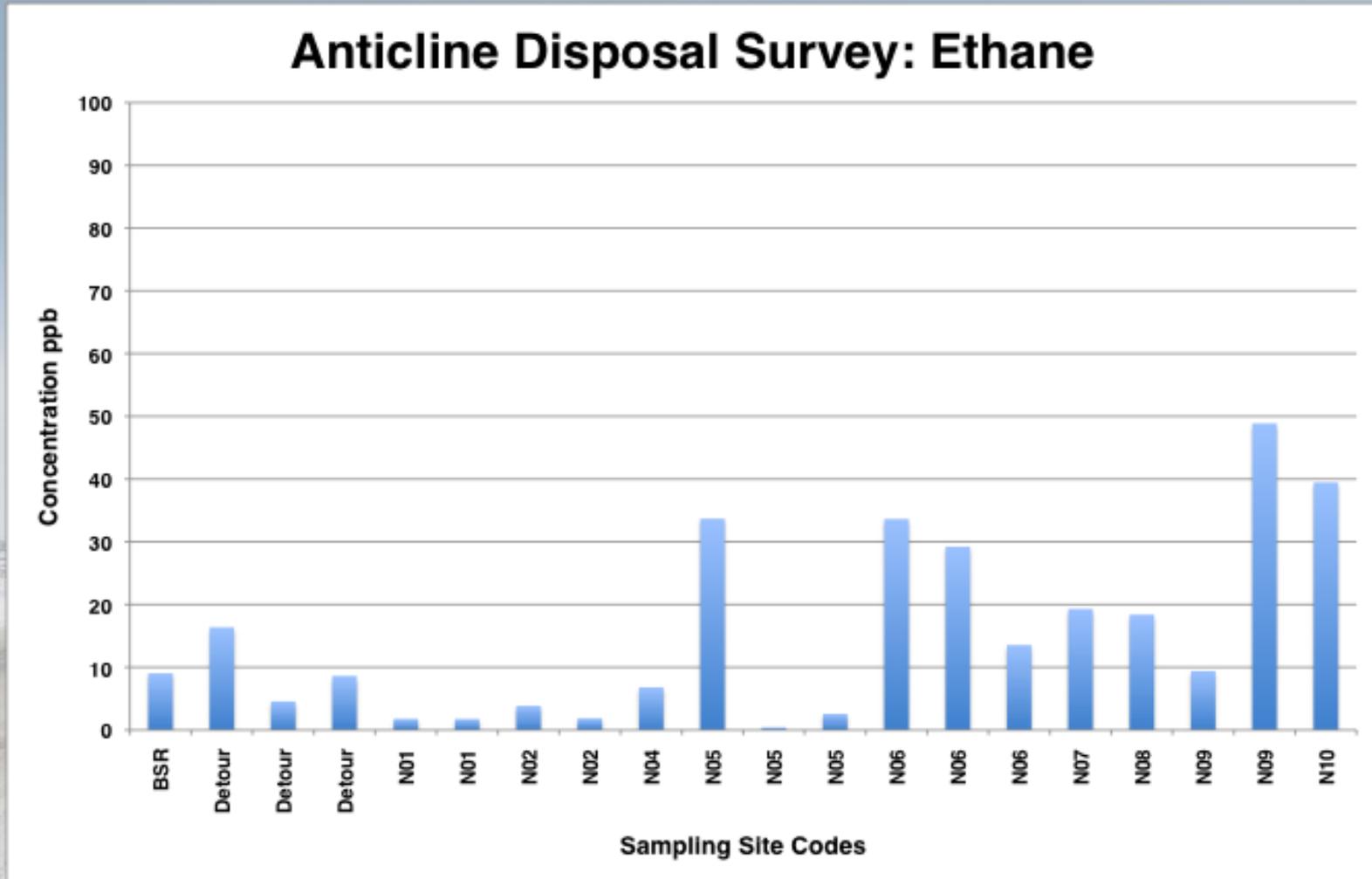
BTEX emission is 30,000 kg/yr or 30 tonnes/yr

Anticline Disposal Facility Survey

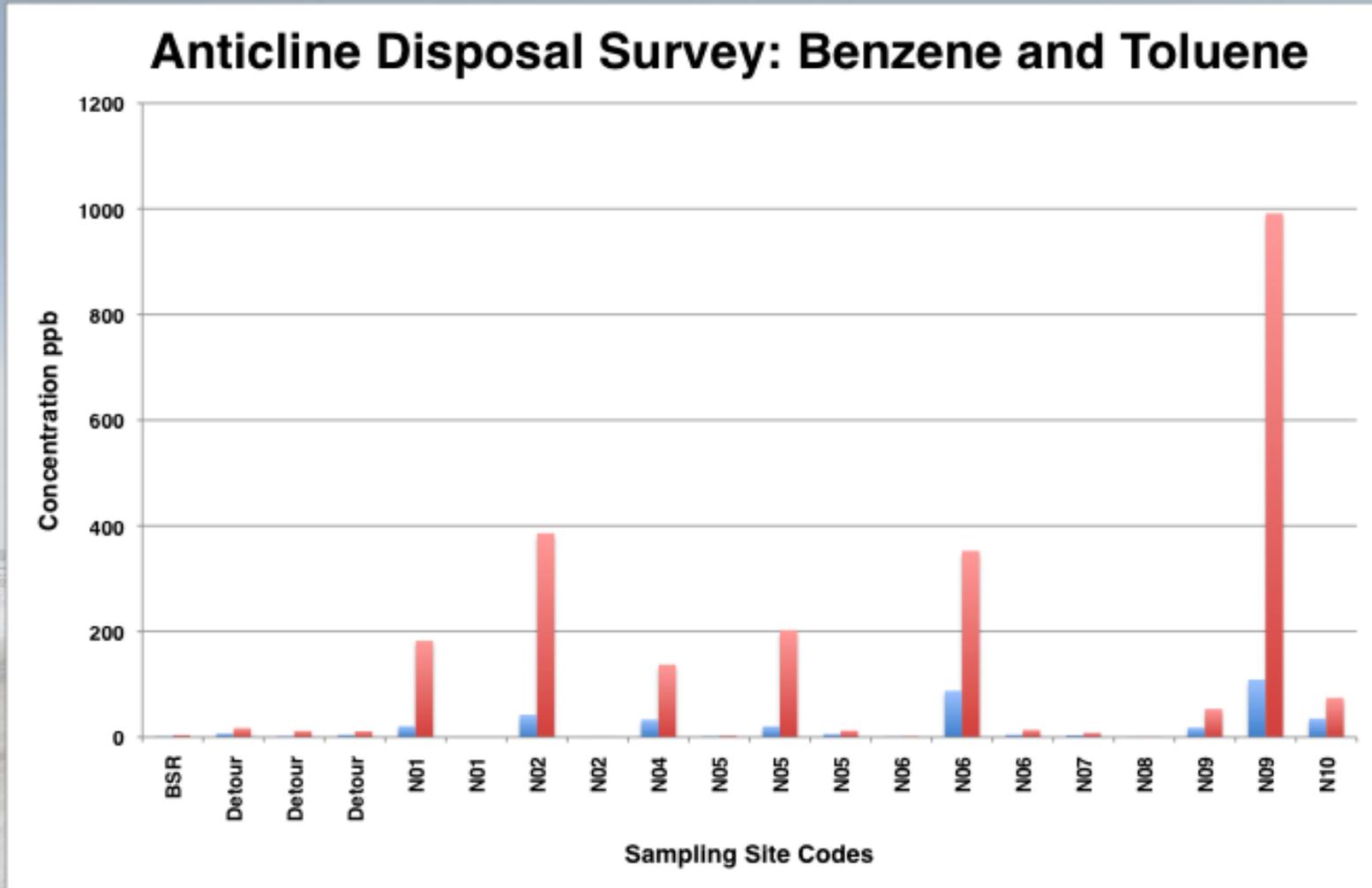




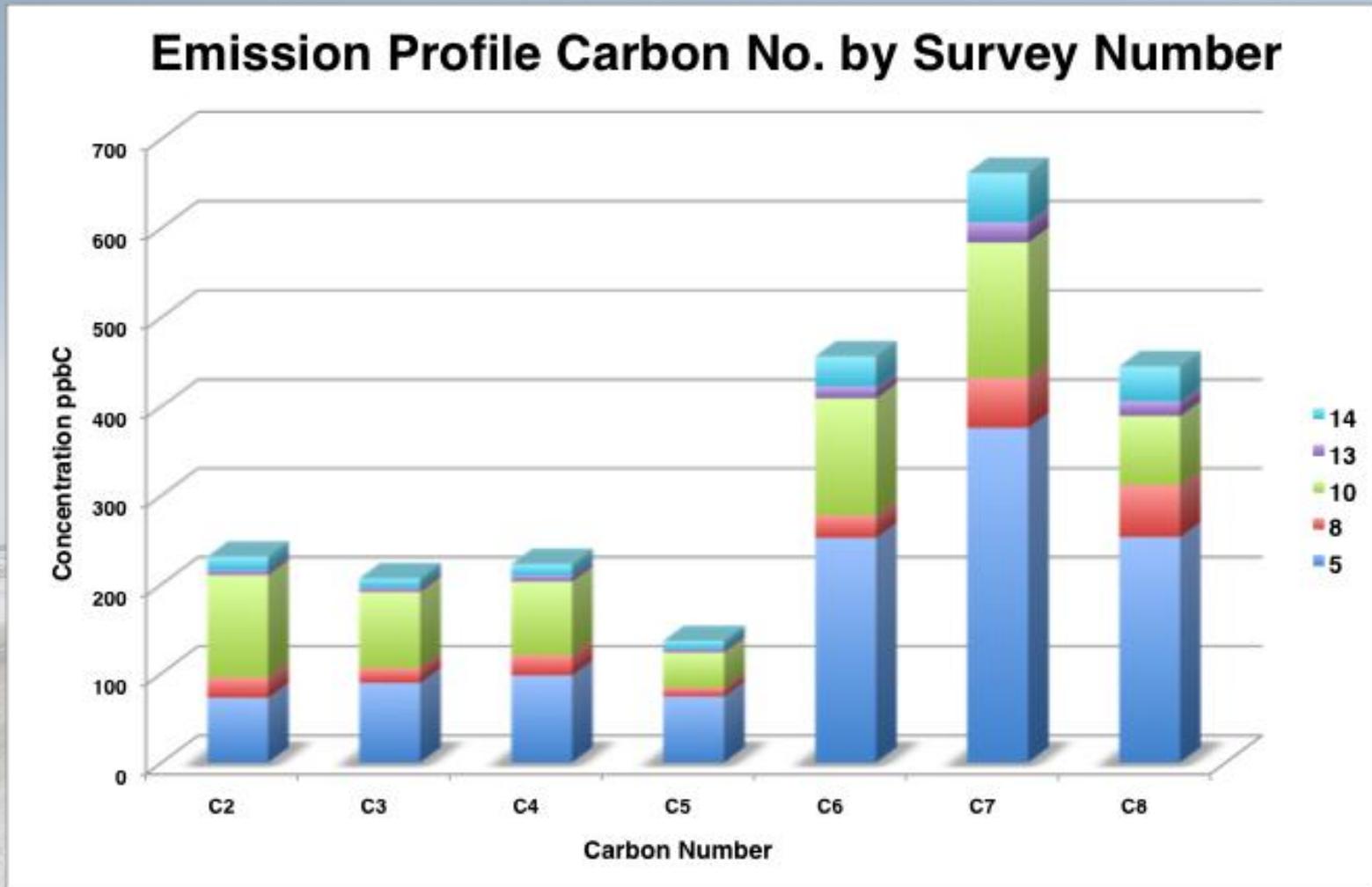
Water Treatment Emissions I



Water Treatment Emissions II



Treatment Emission Profile



Back of Envelope Emission “Guestimation”

If Boundary = Facility level
(~4,000 $\mu\text{g}/\text{m}^3$)

with a homogenous mixing volume of
400,000 m^3 and a refresh rate of 4 per hour

then BTEX emission is ~150 Kg/day
(55 tonnes/yr)

Comparable but higher than BTEX “In vs.
Out” estimate (30 tonnes/yr)

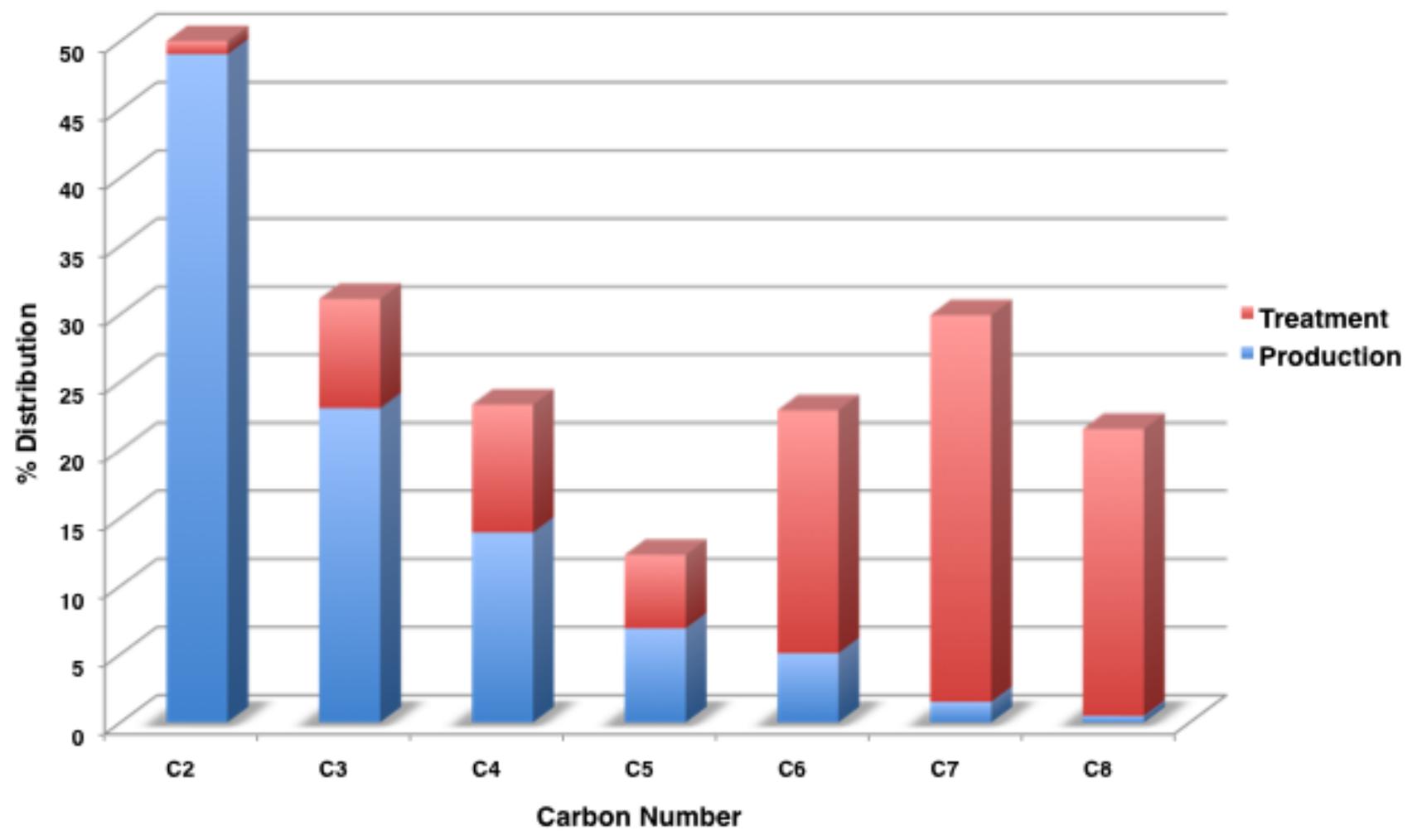
NEXT STEPS COMMENT II

Water Treatment emissions of highly reactive VOC need further assessment

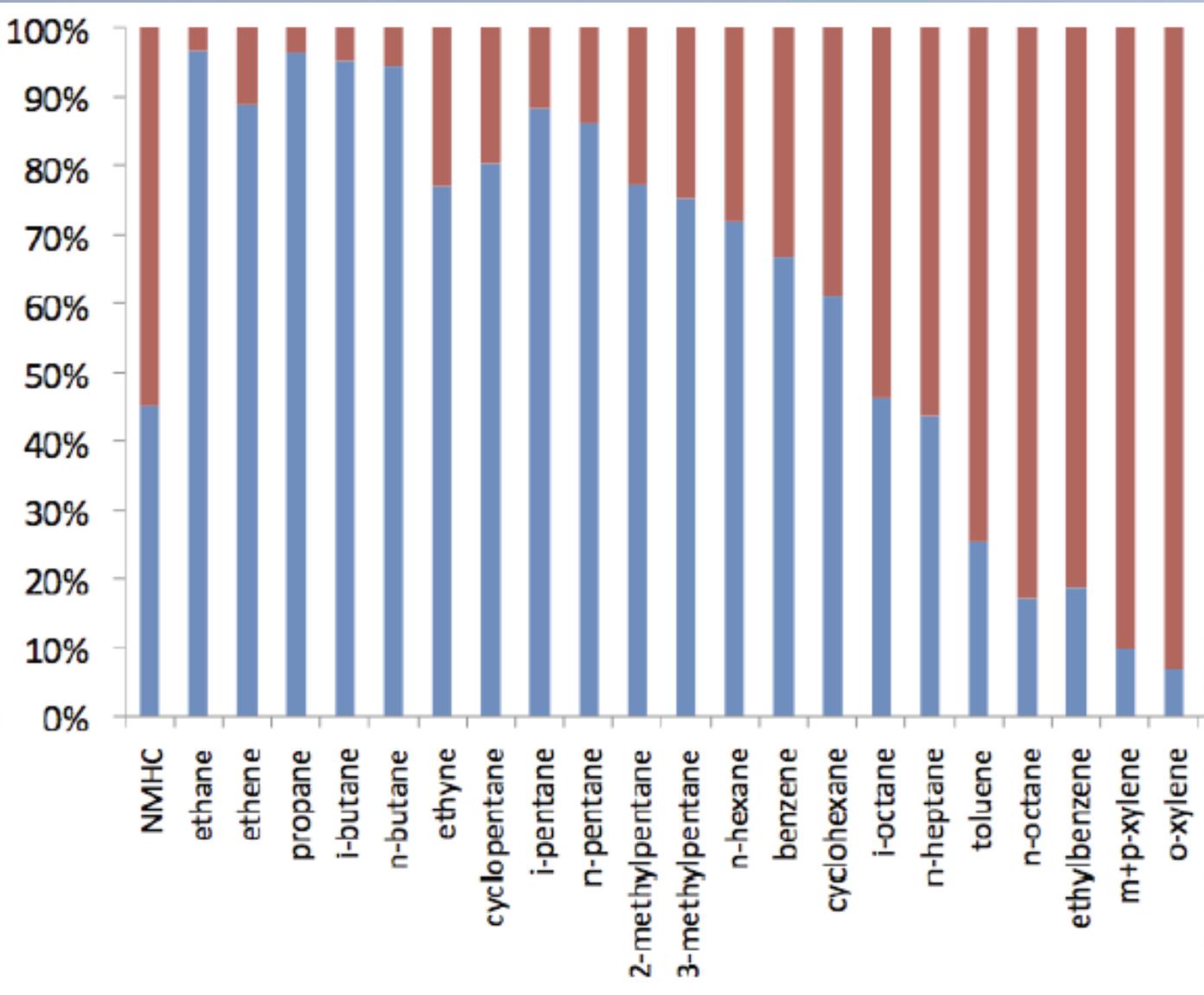
A photograph of a snowy landscape. A road curves from the bottom left towards the center. A speed limit sign with the number 35 is visible on the right side of the road. In the background, there are some industrial structures and a fence line. The sky is overcast and grey.

Wet Gas vs. Water Treatment

Comparative Carbon No. Distribution %



PMF Analysis 2011 UW BSR



PASQUA CONCLUSIONS IV

**Clear influence of two different
emission source types at
UW BSR**

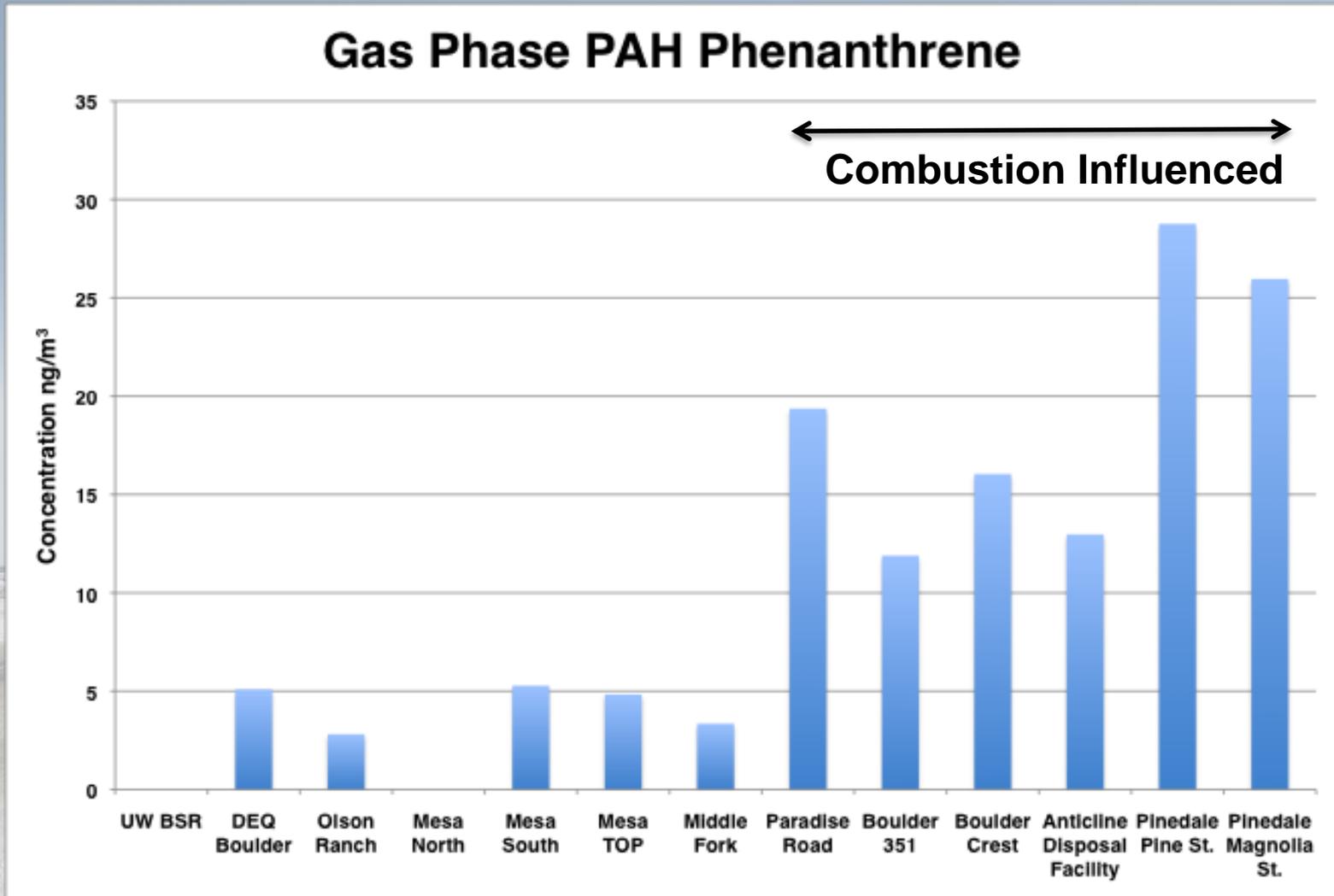
UW Initiative II Prototype Tests

EU European Reference Laboratory Passive Samplers

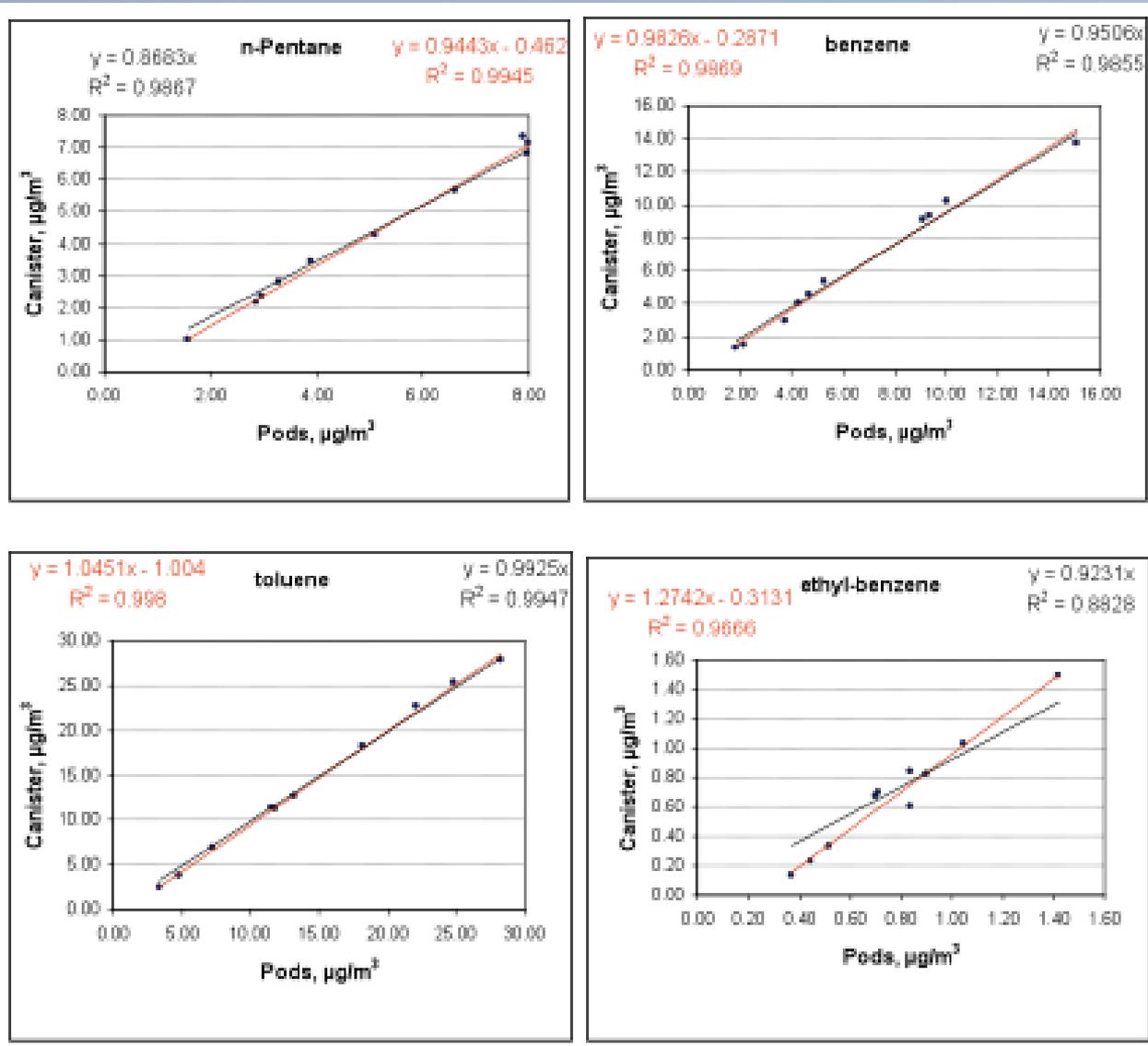
- VOC C4 to C9 Passive Samplers (v1)
- PAH 3 to 4 ring Volatile Phase Compounds (v2)



PAH as Potential Traffic Marker

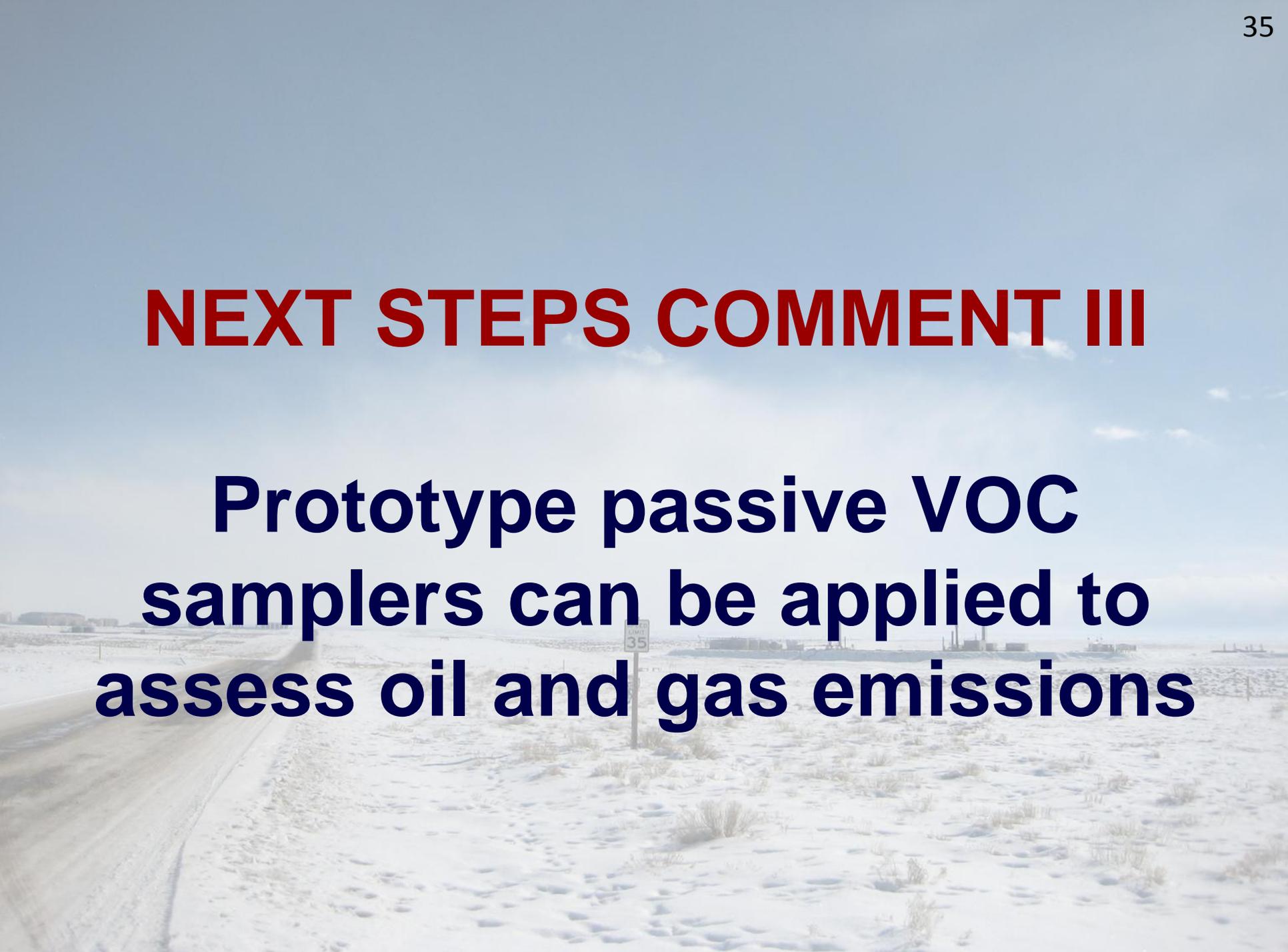


EU VOC Sampler vs. UW Canister



NEXT STEPS COMMENT III

Prototype passive VOC samplers can be applied to assess oil and gas emissions

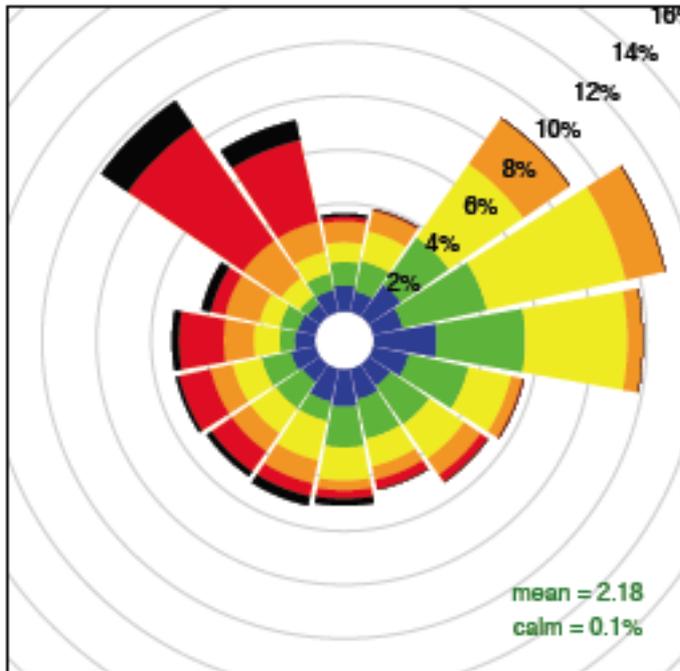


WDEQ Funded UW O3w Project



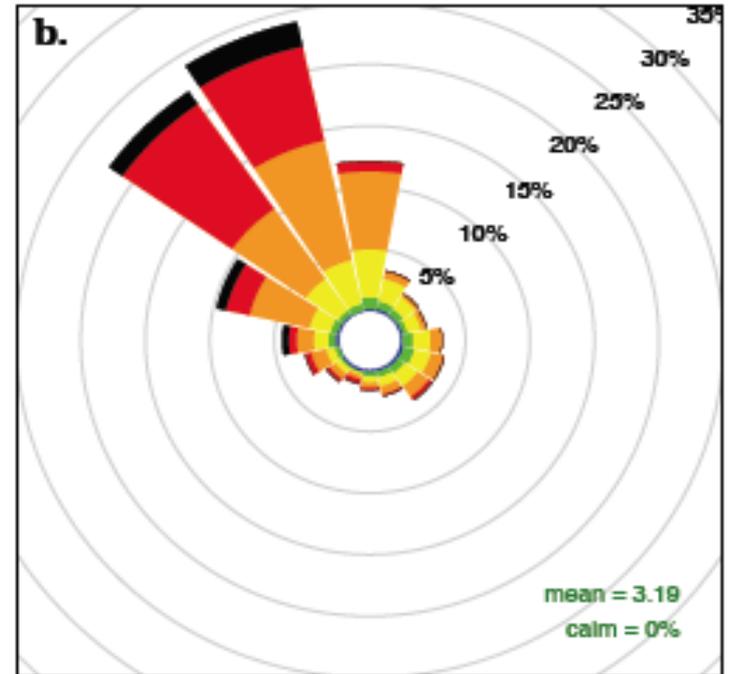
O3w Project Status

Riverside



0-0.5 0.5-1 1-2 2-4 4-8 8-11.8
wind spd.
(m s⁻¹)

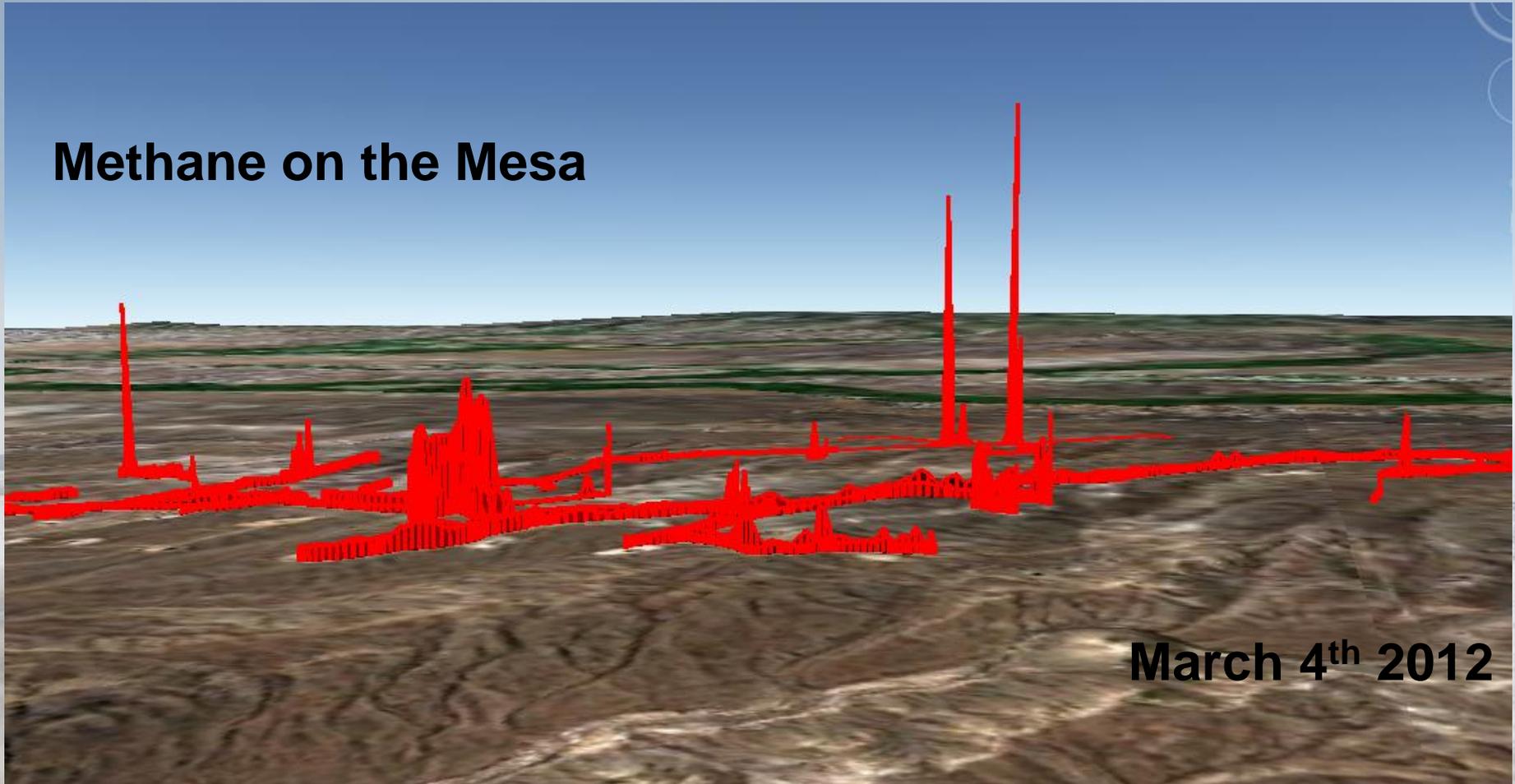
Mesa



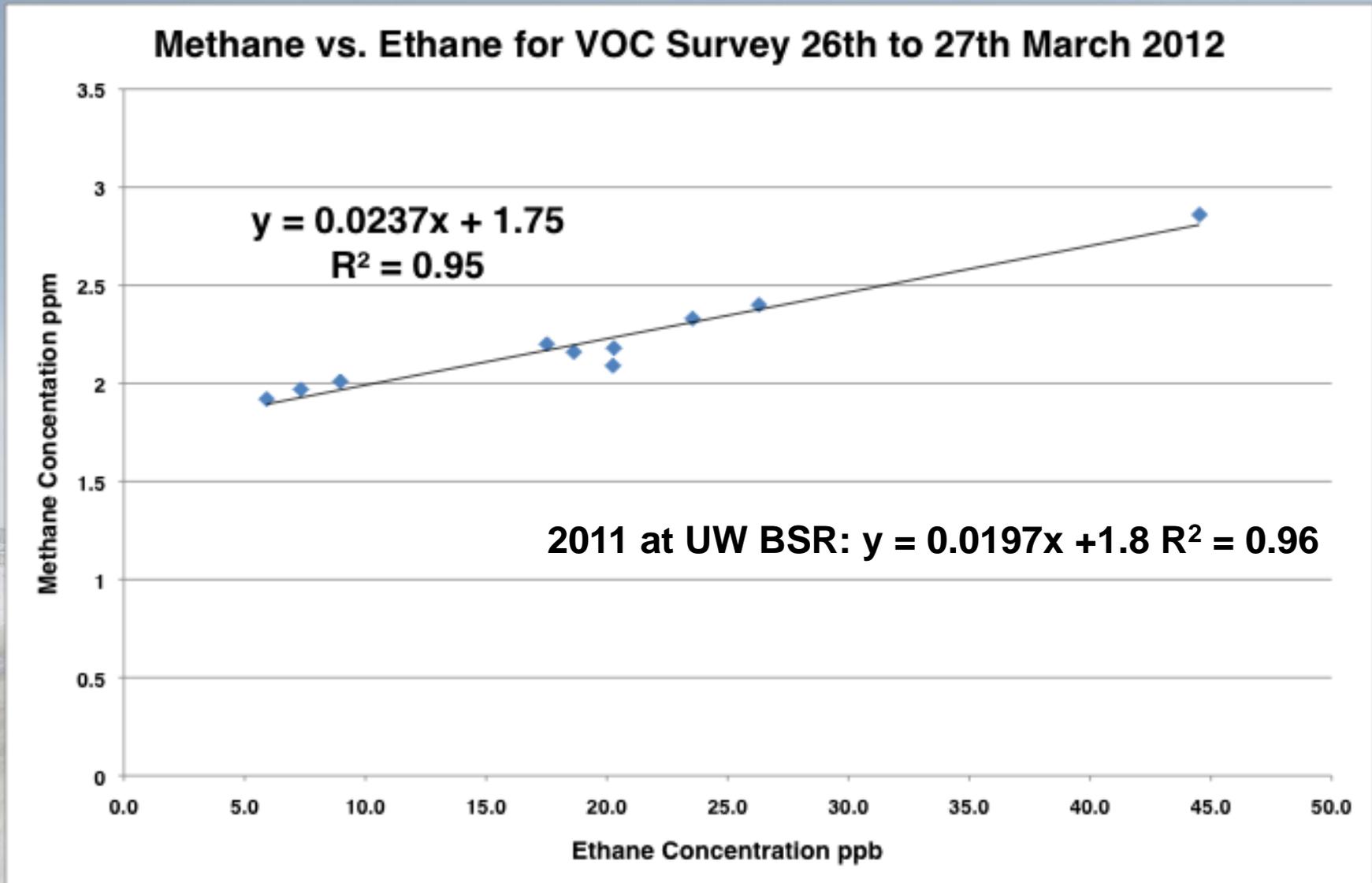
0.08-0.055-1 1-2 2-4 4-8-12.41
wind spd.
(m s⁻¹)

UW Initiative III Mobile Methane Monitoring

Methane on the Mesa



Methane in an Ambient Air



NEXT STEPS COMMENT IV

**Methane can be used a marker
of natural gas emission
sources, UW has tools for this
task**

UNIVERSITY OF WYOMING POTENTIAL PROJECT Winter 2012/2013



Winter 2012/2013

Intensive mobile campaign:

Source Apportionment:

- Gas production
- Well drilling and completion
- Water treatment
- Traffic

Surveying:

- Emission Measurement Inventory
- Production equipment surveying



Winter 2012/2013

UW Contribution:

- New Mobile Monitoring Vehicle (\$750K value)
- Including PTR-MS-TOF and Picarro CH₄
- EU samplers at no cost
- Researcher time and knowledge

Funding Request:

- ~\$100K per year for a two year definitive study
 - For travel and part-time researcher support

NEXT STEPS COMMENT V

- UW has heavily invested in equipment (~\$1 million)
- UW is requesting the minimum funding level (~\$100K)

Thank You & Questions?



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on line at <http://www-das.uwyo.edu/ozone/index.html>

