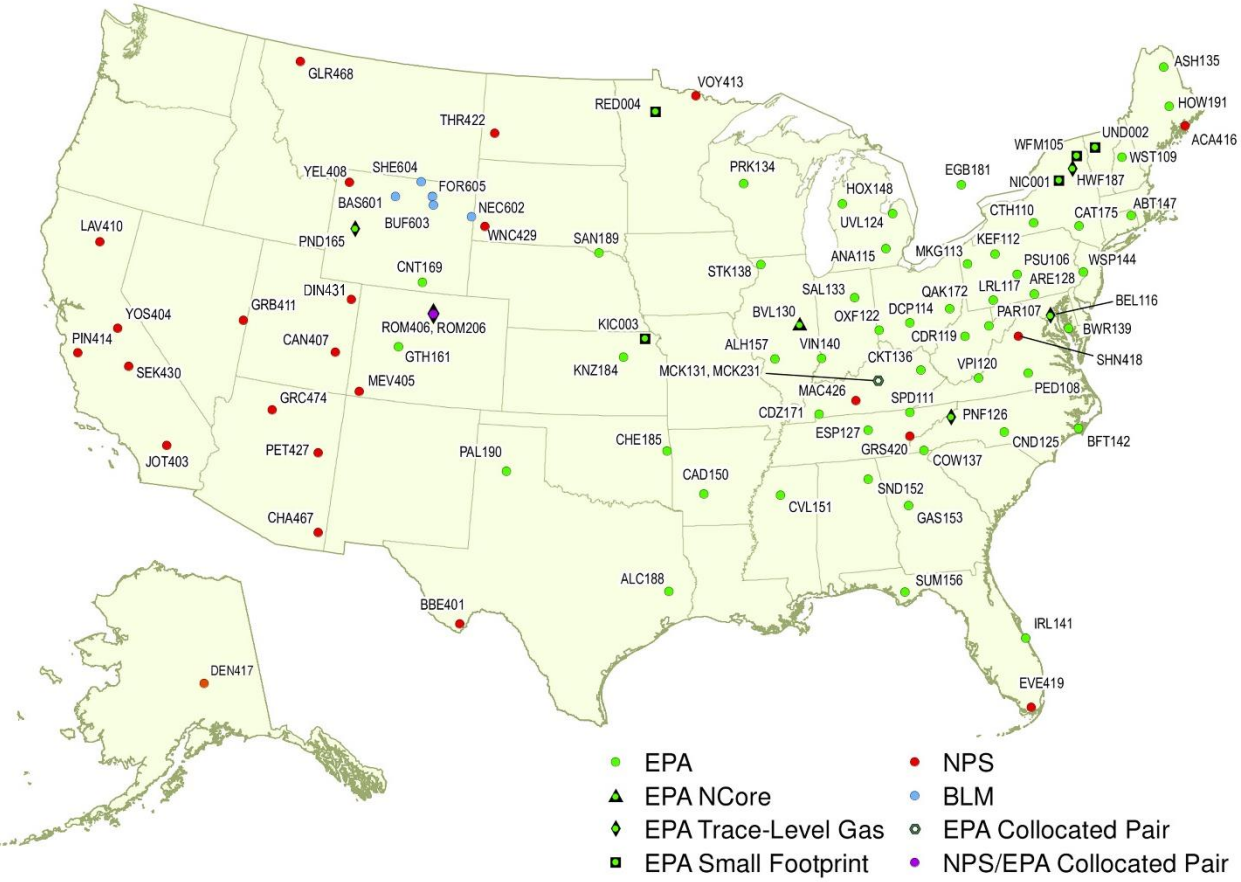
Speciated Reactive Nitrogen Measurements using Chemiluminescence

Kevin Mishoe[1], Christopher Rogers[1], Melissa Puchalski[2], Gregory Beachley[2], Ralph Baumgardner[3]

[1]AMEC Environment & Infrastructure, Inc
[2]US EPA Office of Air & Radiation
[3]US EPA Office of Research and Development

Site Map



- 92 Total Monitoring Sites at 90 Locations
  - 62 Sponsored by EPA
  - 25 Sponsored by NPS
  - 5 Sponsored by Wyoming BLM
- 80 Ozone and Filter pack
- 12 Filter pack only

CASTNET Partners

Program Partners

Federal

- Allegheny National Forest
- Medicine Bow-Routt National Forest
- Monongahela National Forest
- Hubbard Brook Exp. Forest
- USDA Natural Res. Conservation Service (NRCS)
- Agricultural Research Center (USDA)
- USDOI-Bureau of Land Management
- Environment Canada – CAPMoN
- USDA-FS Timber & Watershed Lab
- USDA-FS Forestry Sciences Laboratory
- Holly Springs National Forest
- Apalachicola National Forest
- White Mountain National Forest
- USDA-FS Rocky Mountain Research Station
- Nantahala National Forest
- Gunnison National Forest
- USDA-FS Toecane District
- US Fish & Wildlife Service
- United States Army Engineering District/Louisville
- USDA South. Res. Station Coweeta Hydrological Lab
- National Park Service

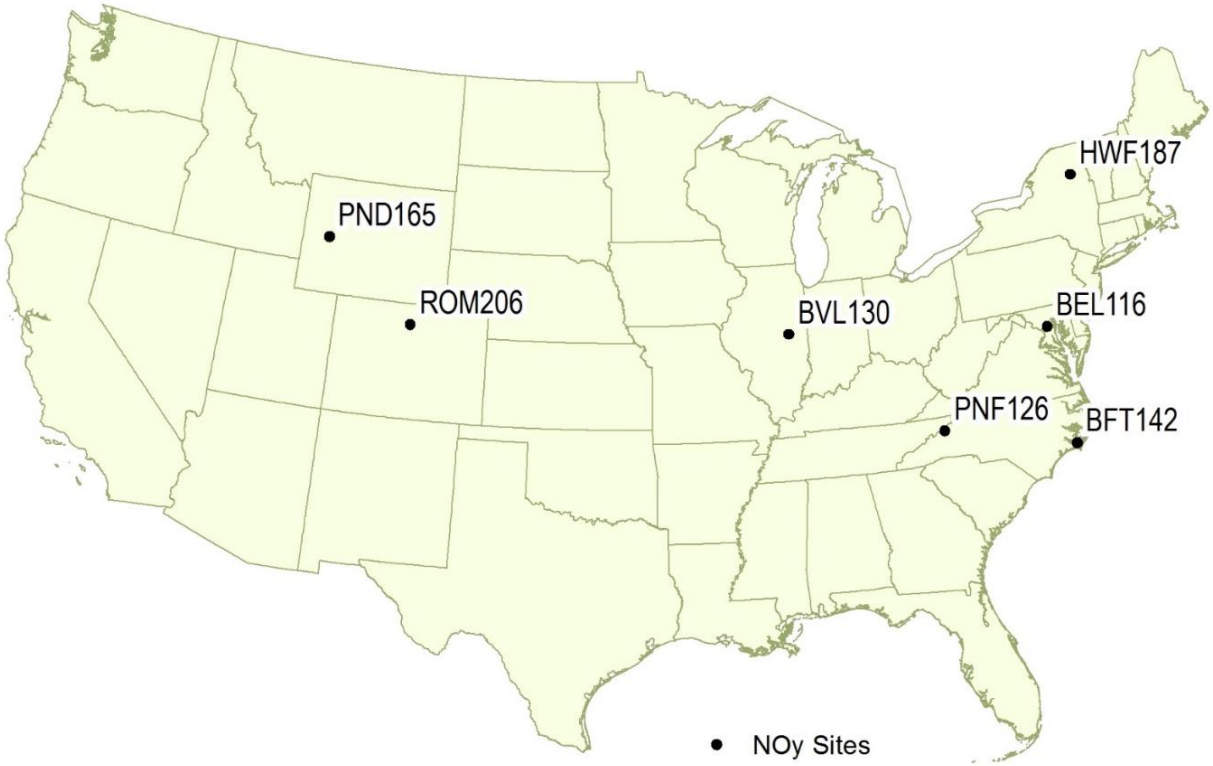
State/Local/Tribal

- Rocky Mountain Biological Laboratory
- Alabama-Coushatta Tribe of Texas
- Vermont Dept. of Environmental Conservation
- Cherokee Nation
- Laurel Hill SP (PA Dept. of Cons. & NR)
- Maurice K. Goddard SP (PA Dept. of Cons. & NR)
- New York Department of Environmental Conservation
- Deer Creek SP (OH Dept of Nat. Resources)
- Cumberland St. Forest VA Department of Forestry
- NYS Energy Research & Development Authority
- Santee Sioux Tribe of Nebraska
- St. Johns River Water Management District
- Washington Crossing SP (NJ DEP)
- Edgar Evans SP (TN Dept. Of Envir. Conservation)
- Cedar Creek SP (WV Division of Nat. Resources)

University

- Texas A&M Agrilife Research & Extension Center
- Penn State Fruit Research & Extension Center
- University of Maine Plant, Soil & Environ. Science
- Auburn Univ. Alabama Agricultural Experiment St.
- Purdue Univ. Dept of Agronomy
- University of MD Dept. of Atmos. & Oceanic Sci.
- Univ. of GA, College of Agriculture & Envir. Scien
- Miami Univ. Inst. for the Envir. & Sustainability
- Cornell University, Ecology & Evolutionary Biology
- SUNY ESF Adirondack Ecology Center
- University of IL, Illinois State Water Survey
- KSU Division of Biology/Konza Prairie LTER
- UNC Institute of Marine Sciences
- Penn State Univ. Dept. of Meteorology
- Ouachita Baptist Univ. School of Natural Sciences
- VA Tech Dept. of Plant Path., Phys. & Weed Sci.
- University of Michigan School of Natural Resources
- Proctor Maple Research Center (UVM)

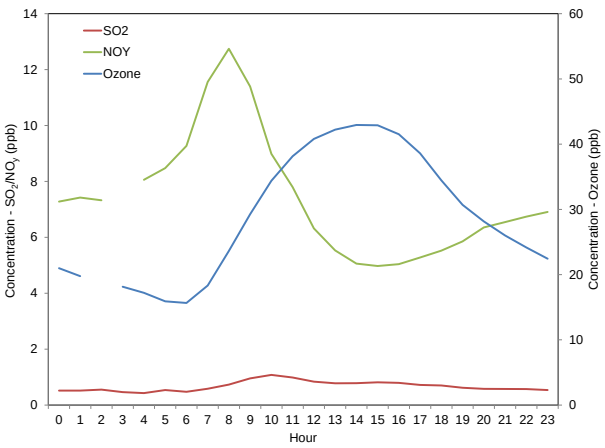
NO_y Site Map (EPA)



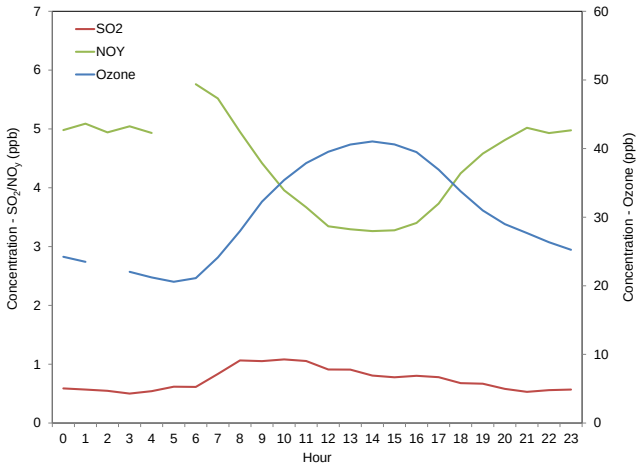
- 10 Years at BEL116
- Additional 5 Sites added in 2012 and 2013
- BFT142 NOx/NOy Study Site

NO_y Diurnal Cycle – 2013

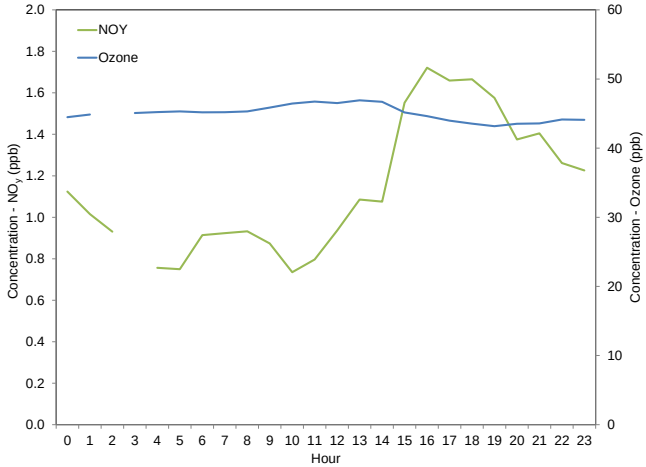
BEL116, MD



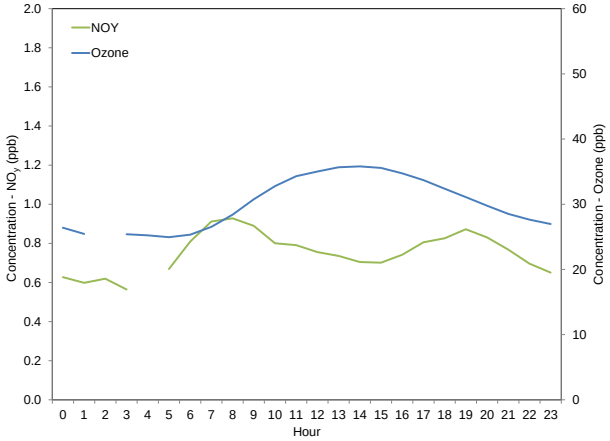
BVL130, IL



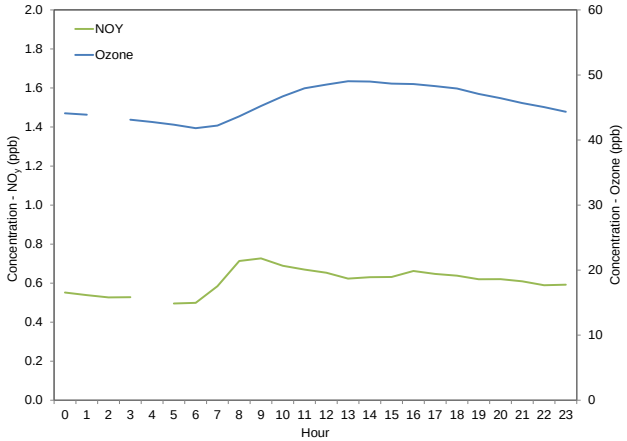
ROM206, CO



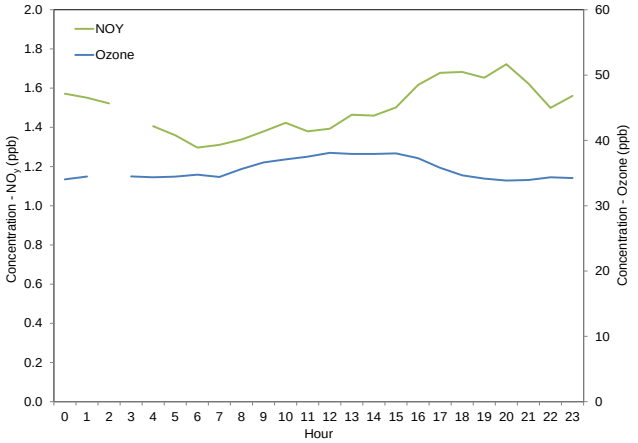
HWF187, NY



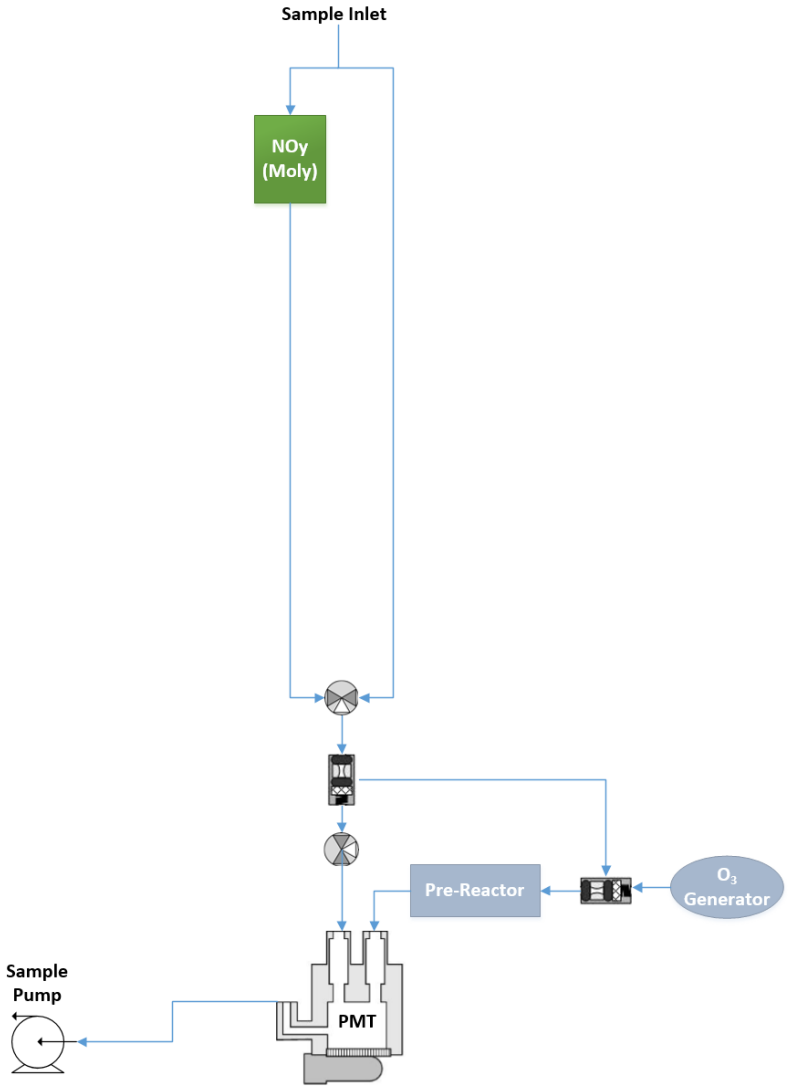
PND165, WY



PNF126, NC



Normal NO_y Analyzer Configuration

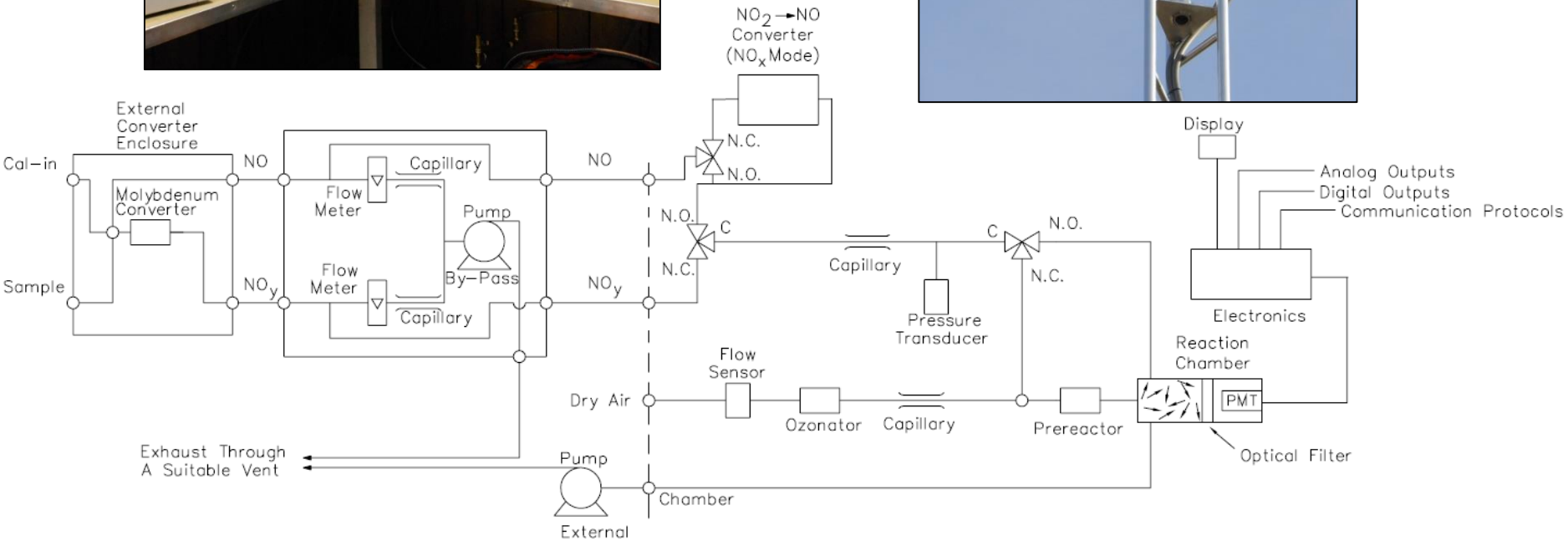


- TN_x
  - Reduced Reactive Nitrogen
    - NH_3
    - pNH_4
  - NO_y
    - NO_z
      - HNO_3
      - HNO_2
      - PAN
      - pNO_3
      - Organic N
      - …
    - NO_x
      - NO_2
      - NO

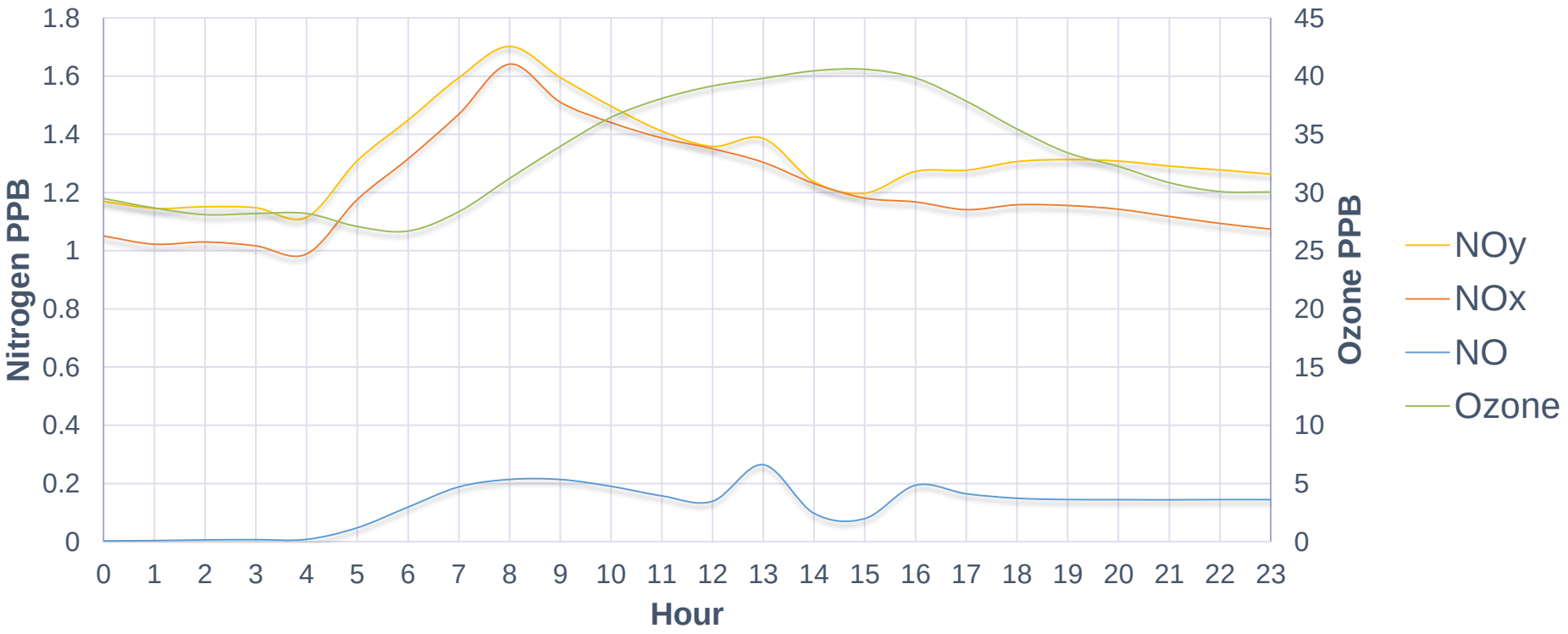
Beaufort, NC Nitrogen Study

- Early 2012 – Early 2013
- Thermo 42i-Y
- Two converters
- NO_y and NO_x
- NO_2 (by difference)
- http://epa.gov/castnet/javaweb/docs/Beaufort_NOy_NH3_Report.pdf

BFT142 NO_x/NO_y

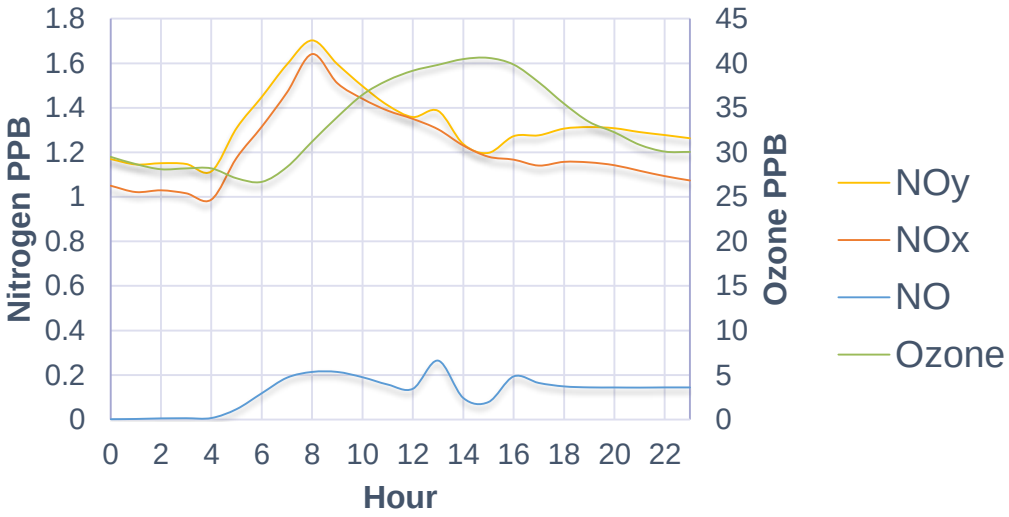


Beaufort, NC Nitrogen Study



Conclusions from BFT142

- NO_x and NO_y were much closer than expected in rural location



- Inlet Losses
- HNO_3 Gradient

What Else Can Be Done?

- Large Nationwide NO_y network (NCore, CASTNET, others)
- NO_z may be underestimated
- “Value-Added” Options to Improve N Characterization

Equipment

- NO_y Analyzer (API T200U) - $20K
- Calibration System - $20K

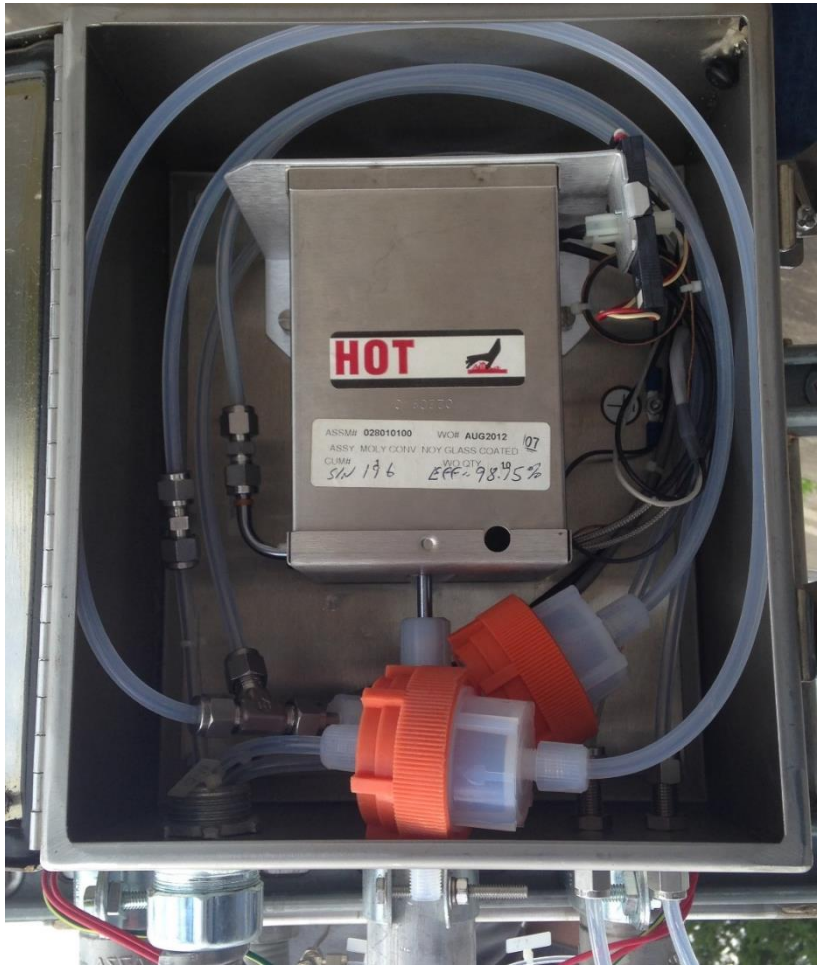
- NO_y Converter - $1.5K
- NO_x Converter - $1K
- Photolytic NO_2 Converter - $5K
- TN_x Converter - $4K
- NH_3 Calibrator - $6K

Converters – NO_y

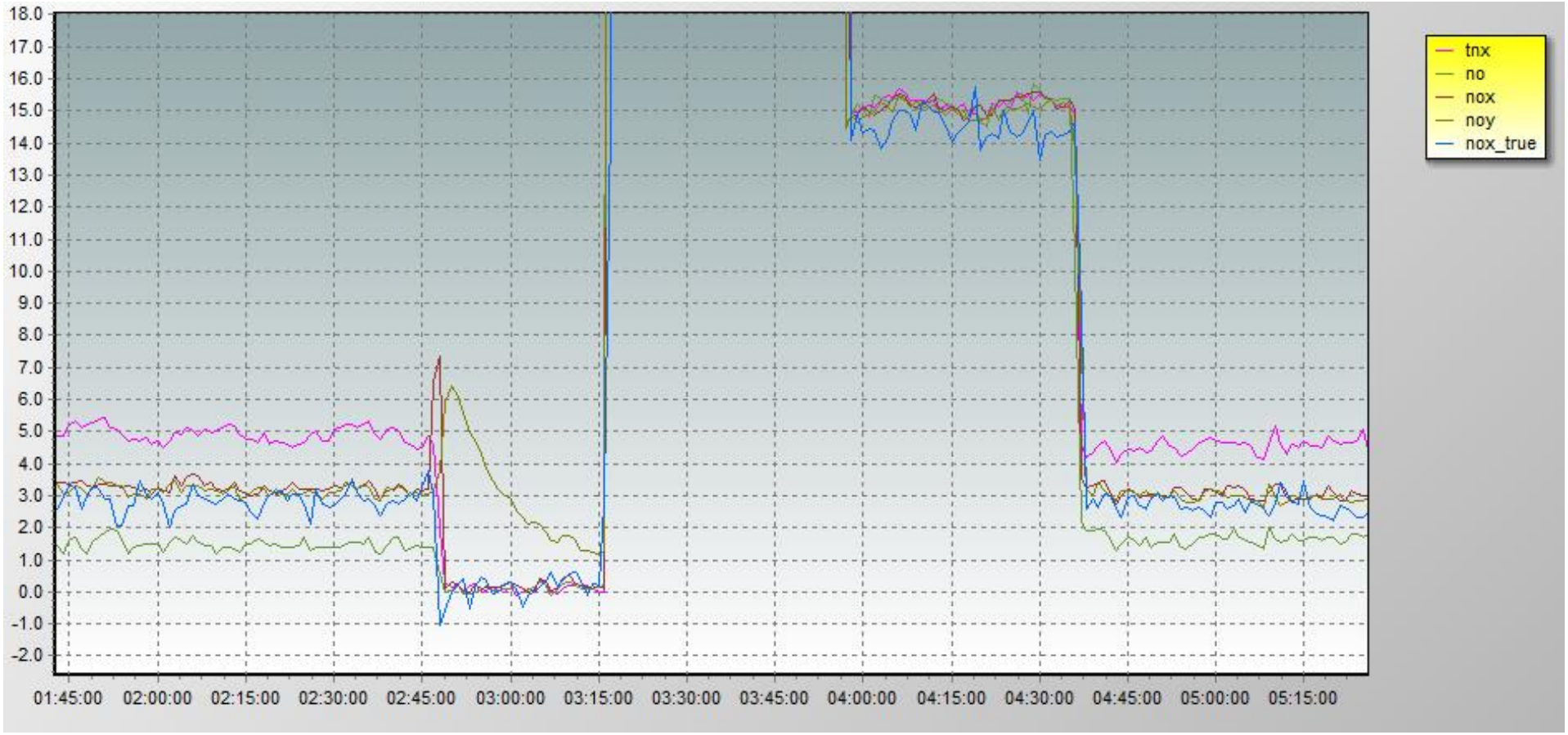
- 315 Celsius
- Molybdenum Catalyst

Concerns

- Outgassing
- NH_3 Conversion



Converters – NO_y

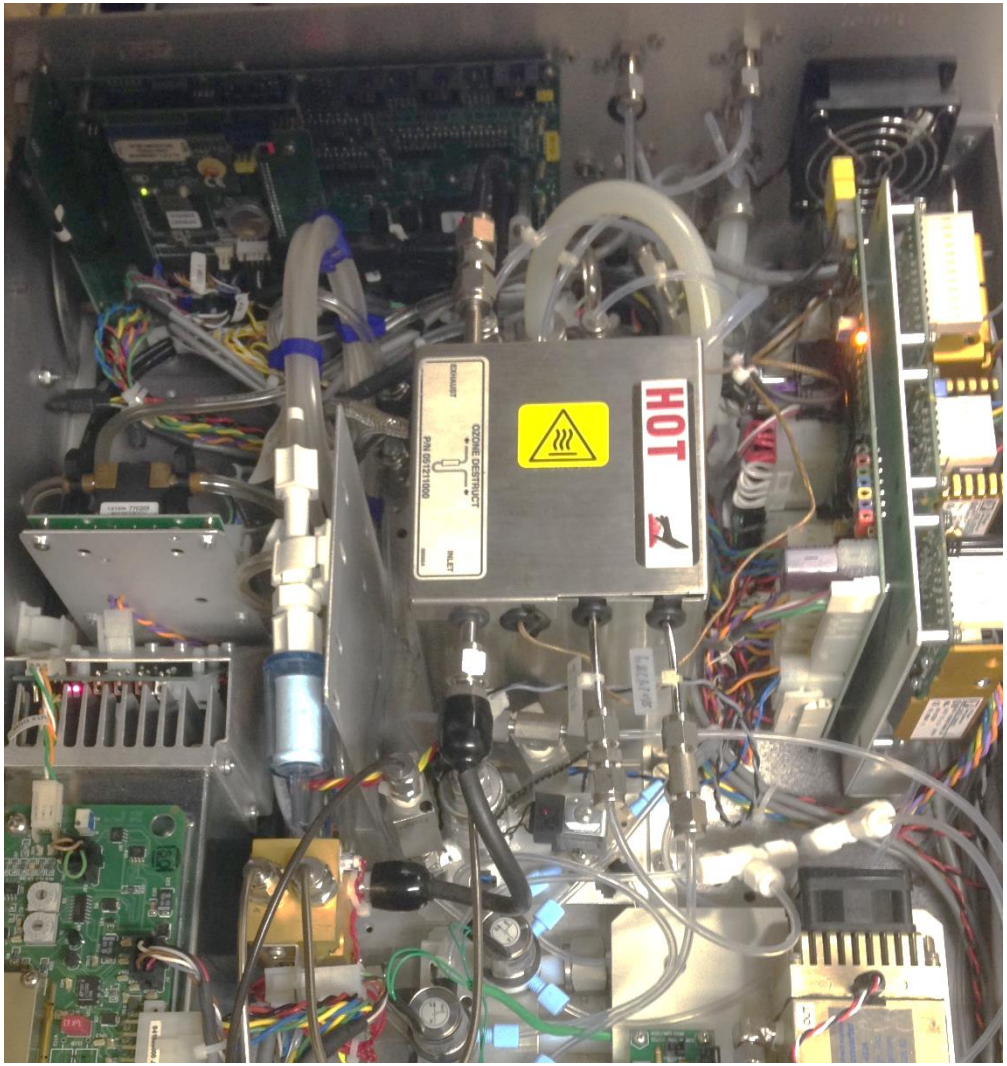


Converters – NO_x

- 315 Celsius
- Molybdenum Catalyst

Concerns

- Outgassing
- NH_3 Conversion
- NO_z Conversion (Overestimate NO_2)

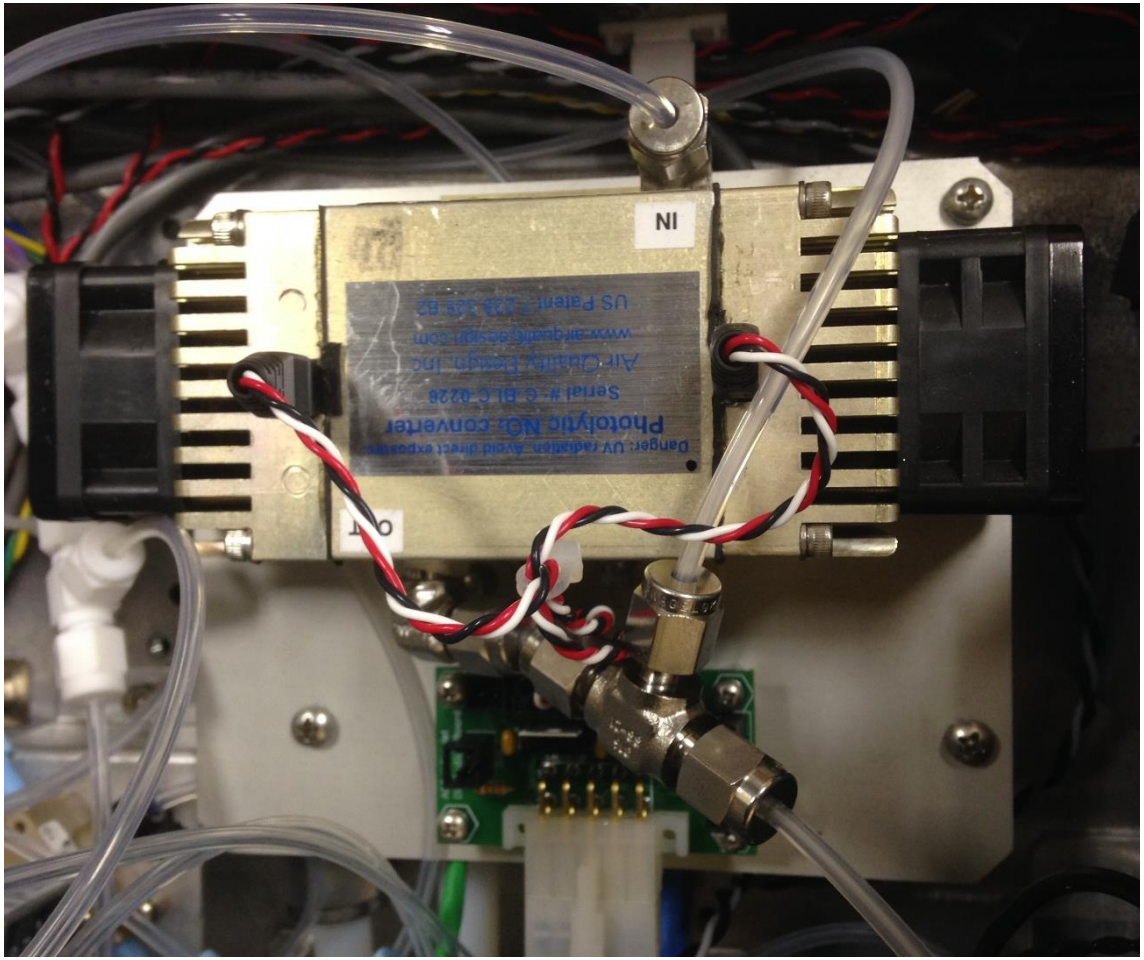


Converters – “True” NO_2

- Selective for NO_2
- Blue LED (352-420 nm)

Concerns

- Low Efficiency (~50%)
- Current Cost

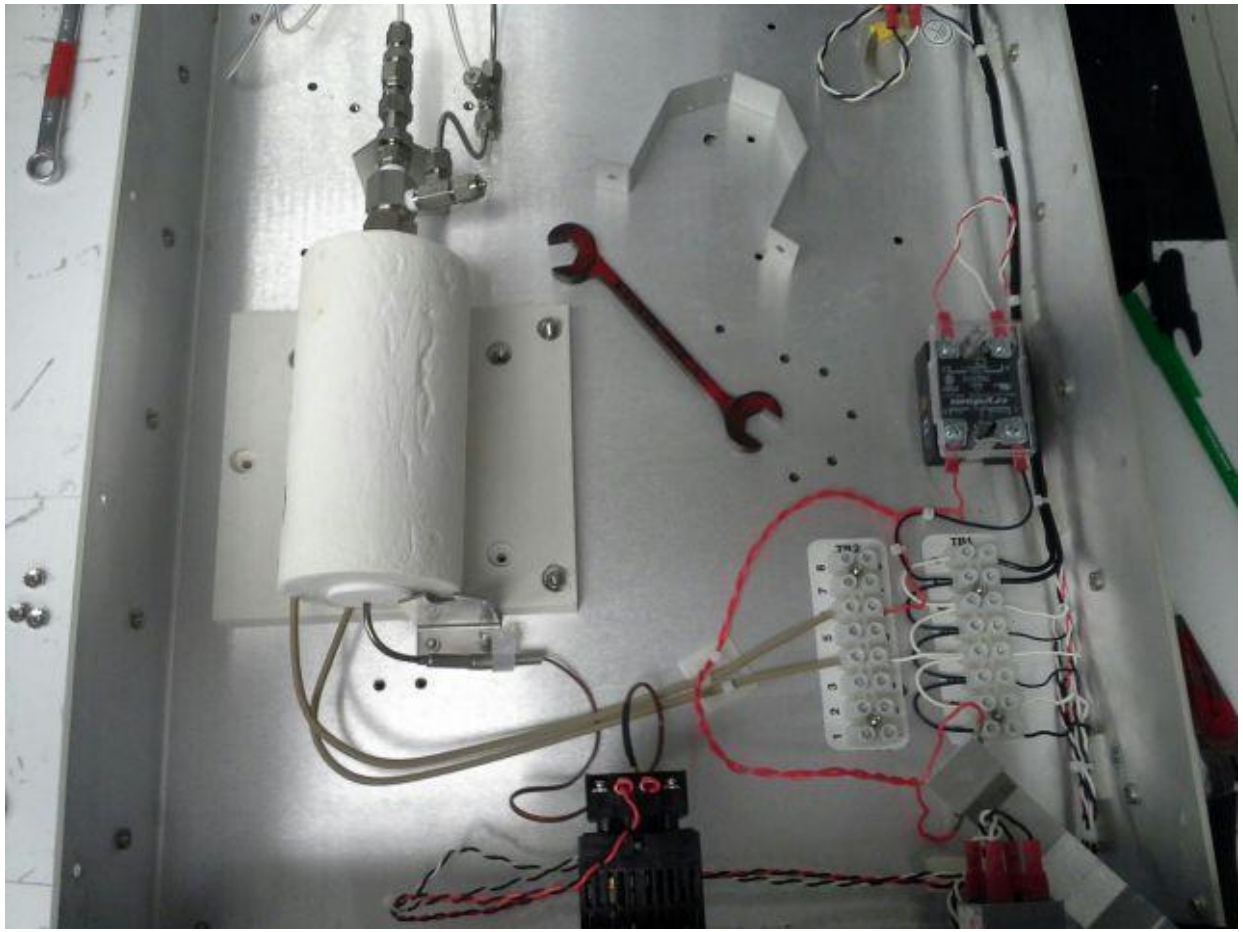


Converters – TN_x

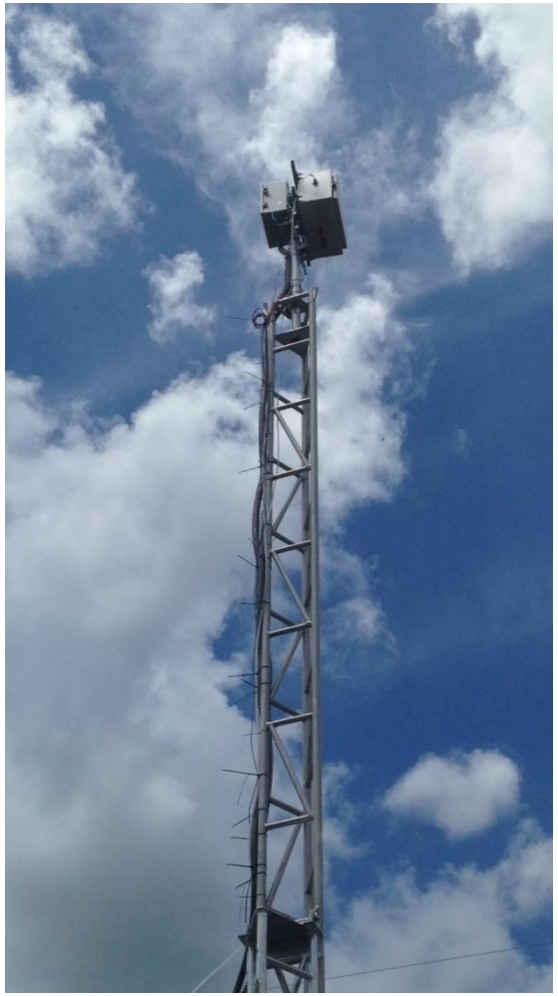
- 825 Celsius
- Stainless Steel / Platinum Catalyst

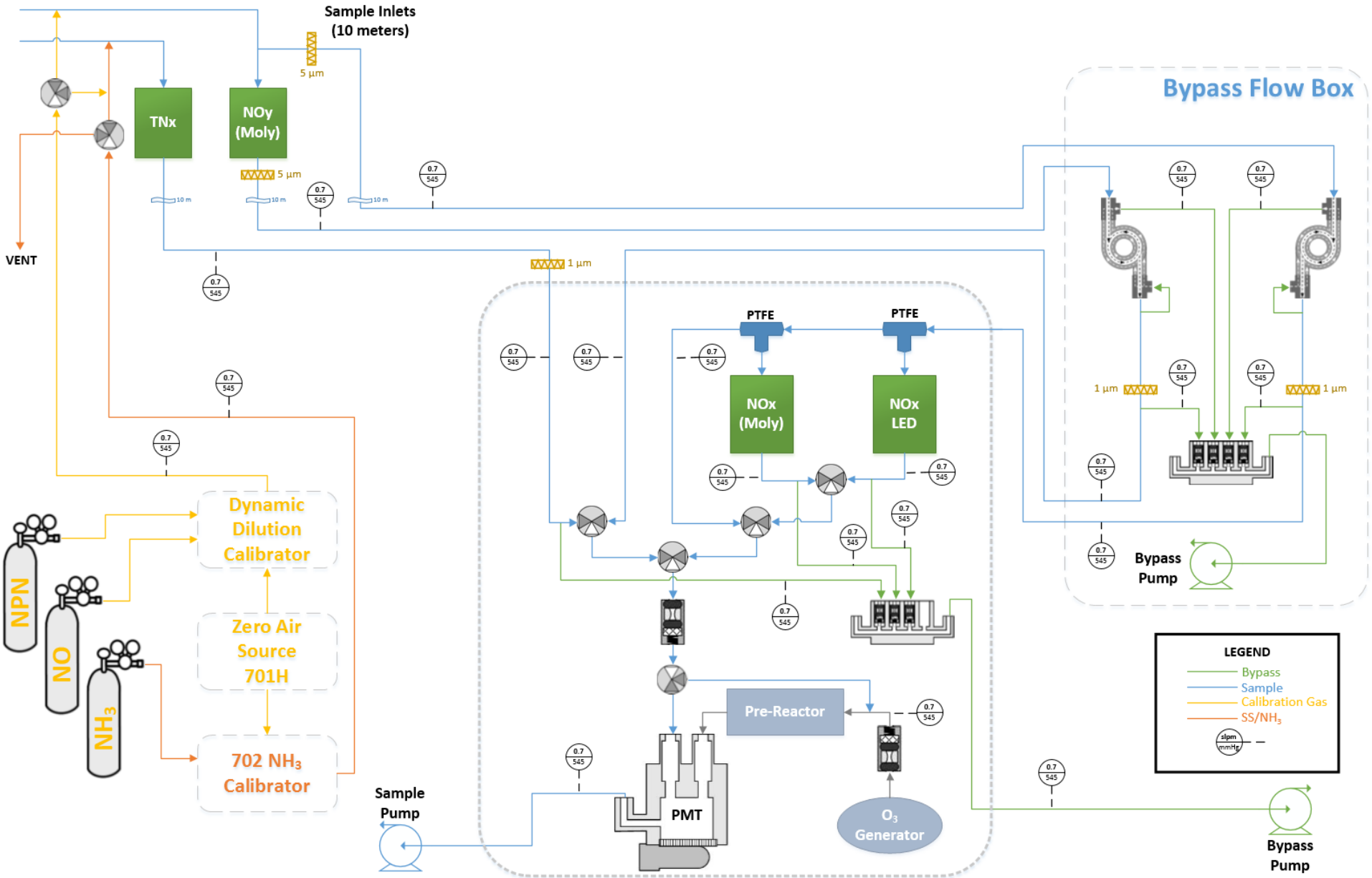
Concerns

- Lots of Heat!
- NH_3 Response Time

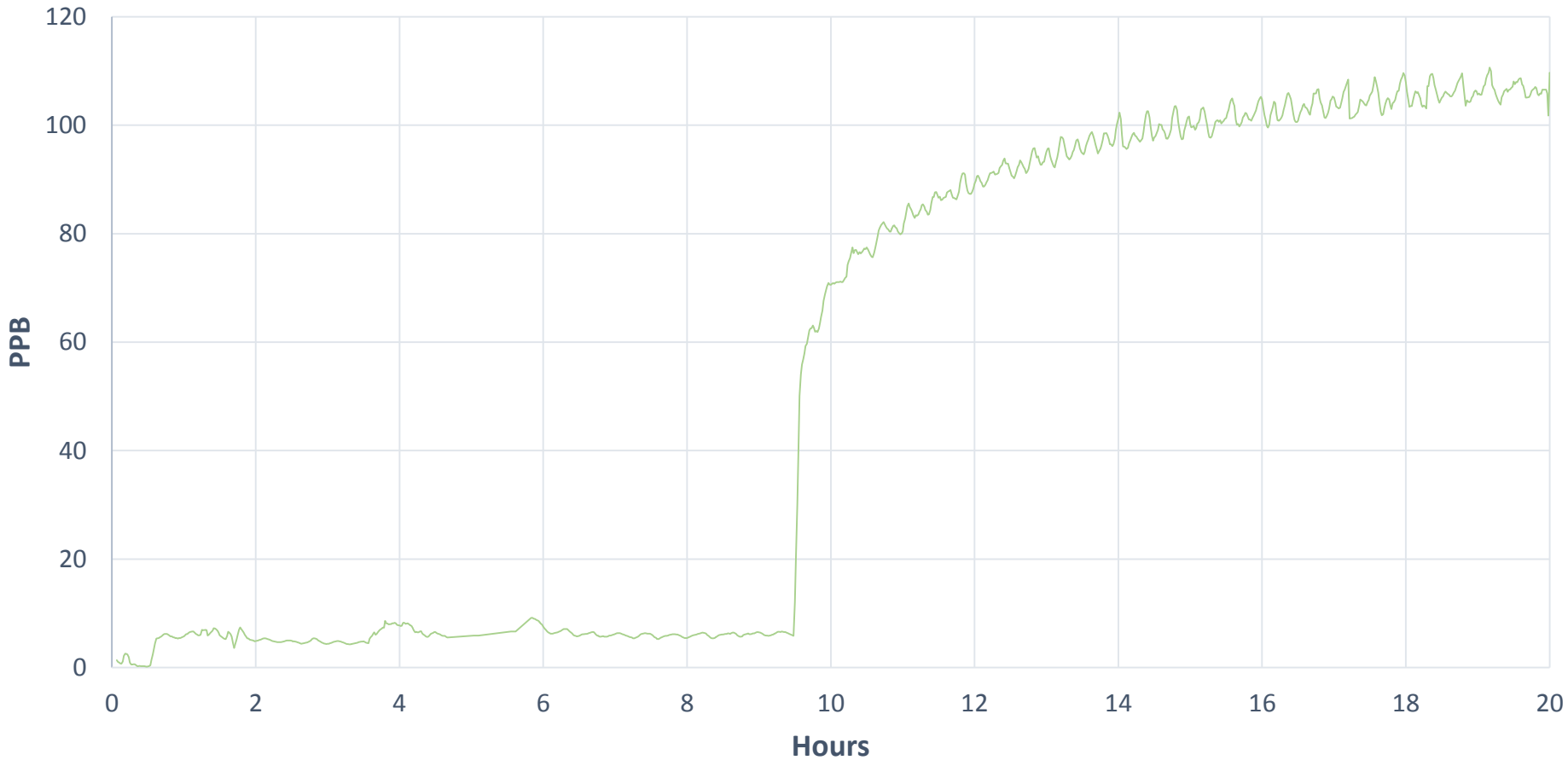


Converters – TN_x

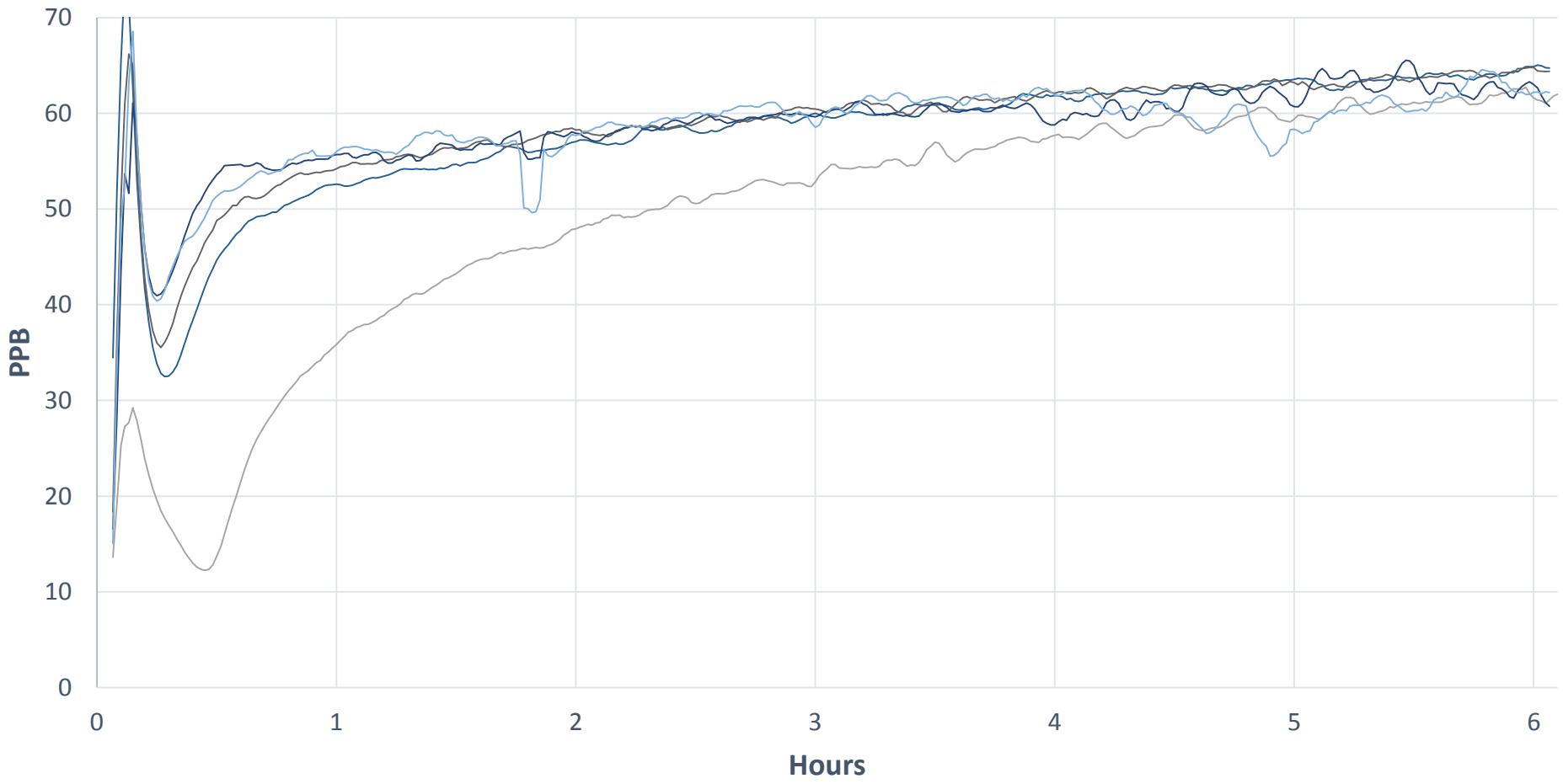



Sample Inlets
(10 meters)
5 µm
TNx
NOy
(Moly)
5 µm
10 m
10 m
10 m
VENT
1 µm
Bypass Flow Box
PTFE
PTFE
NOx
(Moly)
NOx
LED
1 µm
1 µm
Dynamic
Dilution
Calibrator
Zero Air
Source
701H
702 NH3
Calibrator
NPN
NO
NH3
Pre-Reactor
PMT
O3
Generator
Sample
Pump
Bypass
Pump
Bypass
Pump
LEGEND
Bypass
Sample
Calibration Gas
SS/NH3
slpm
mmHg

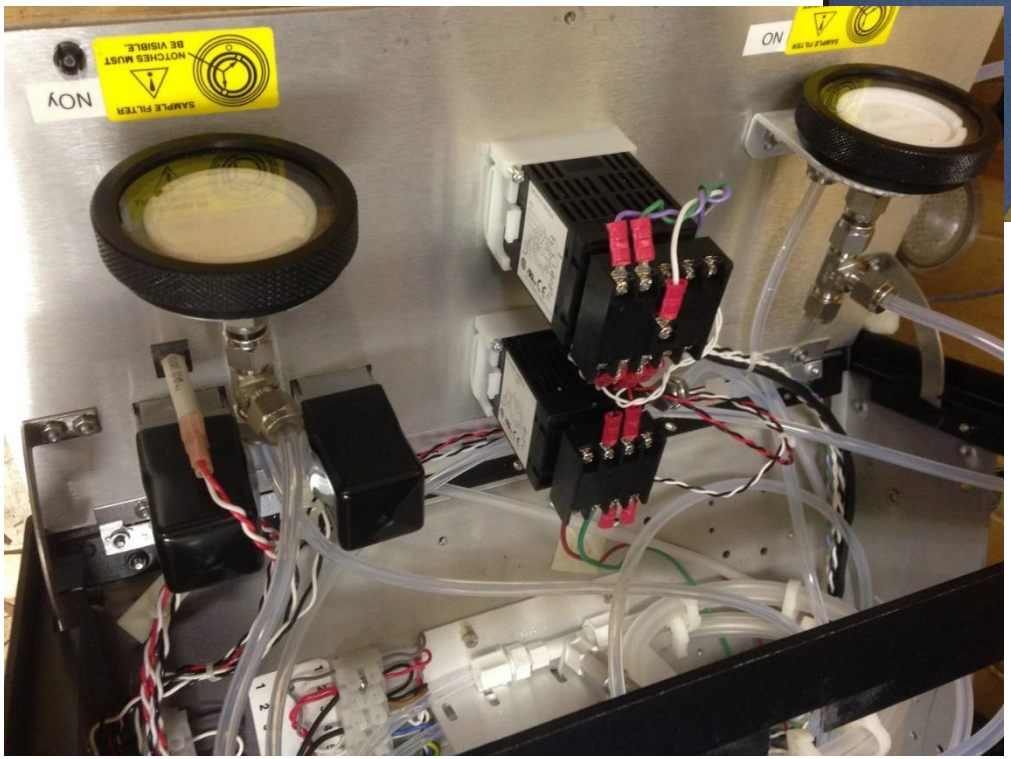
NH_3 Response Time – New 50' SS 1/8" Tubing



NH_3 Response Time



Modifications



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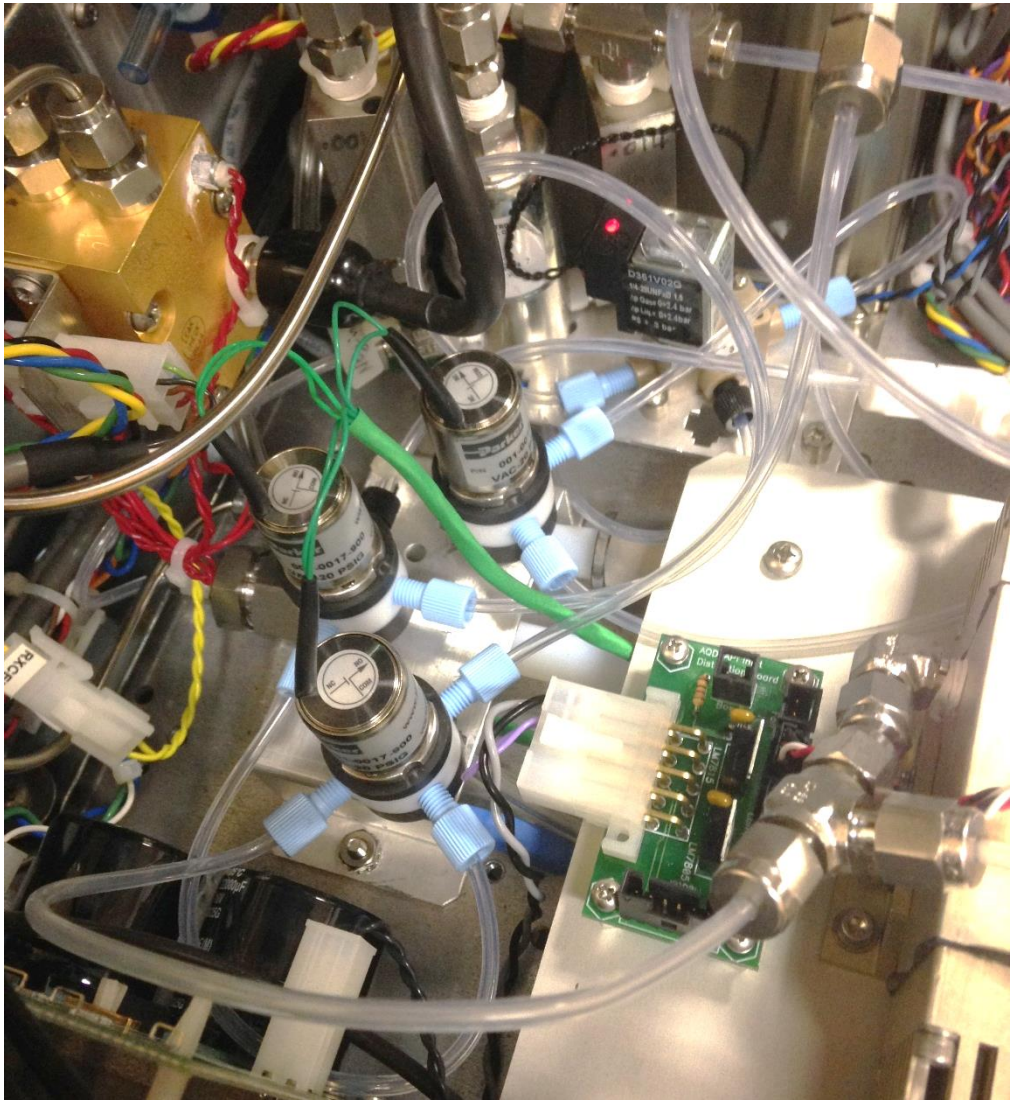

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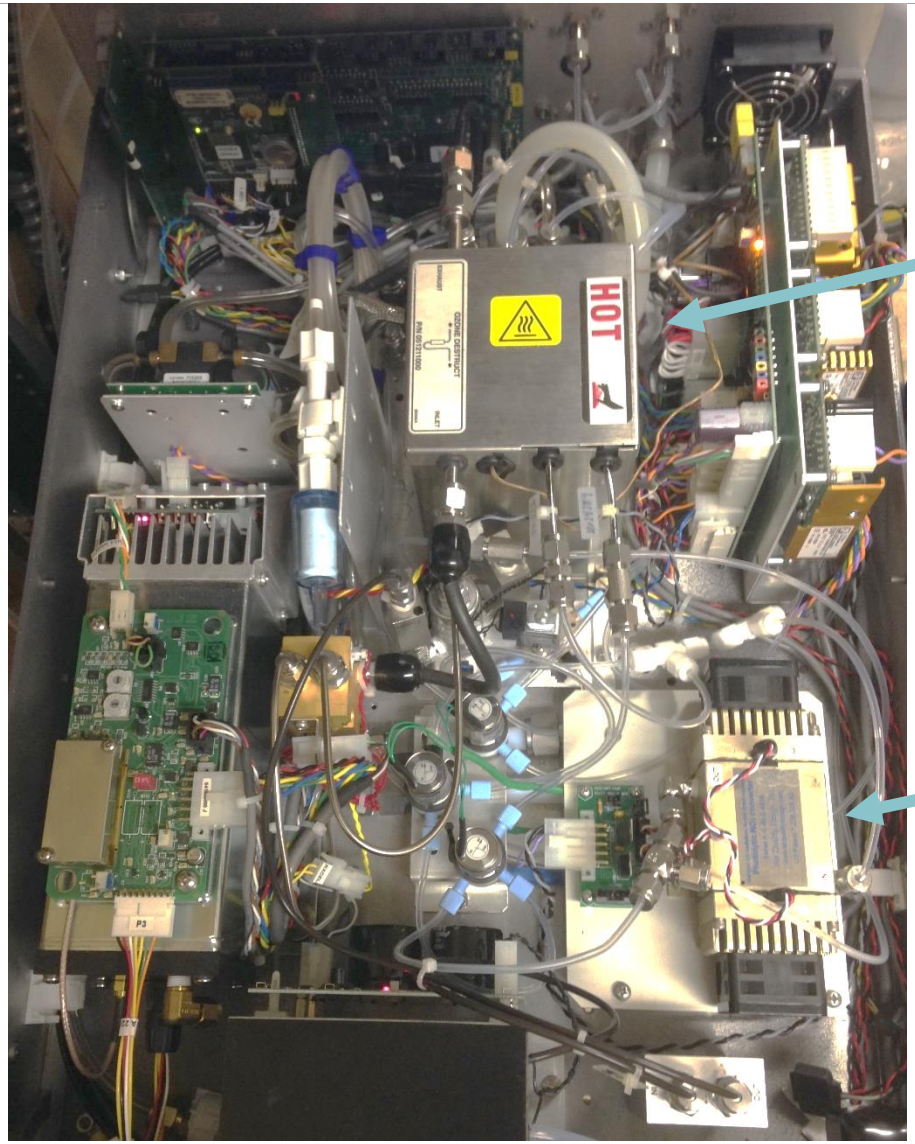
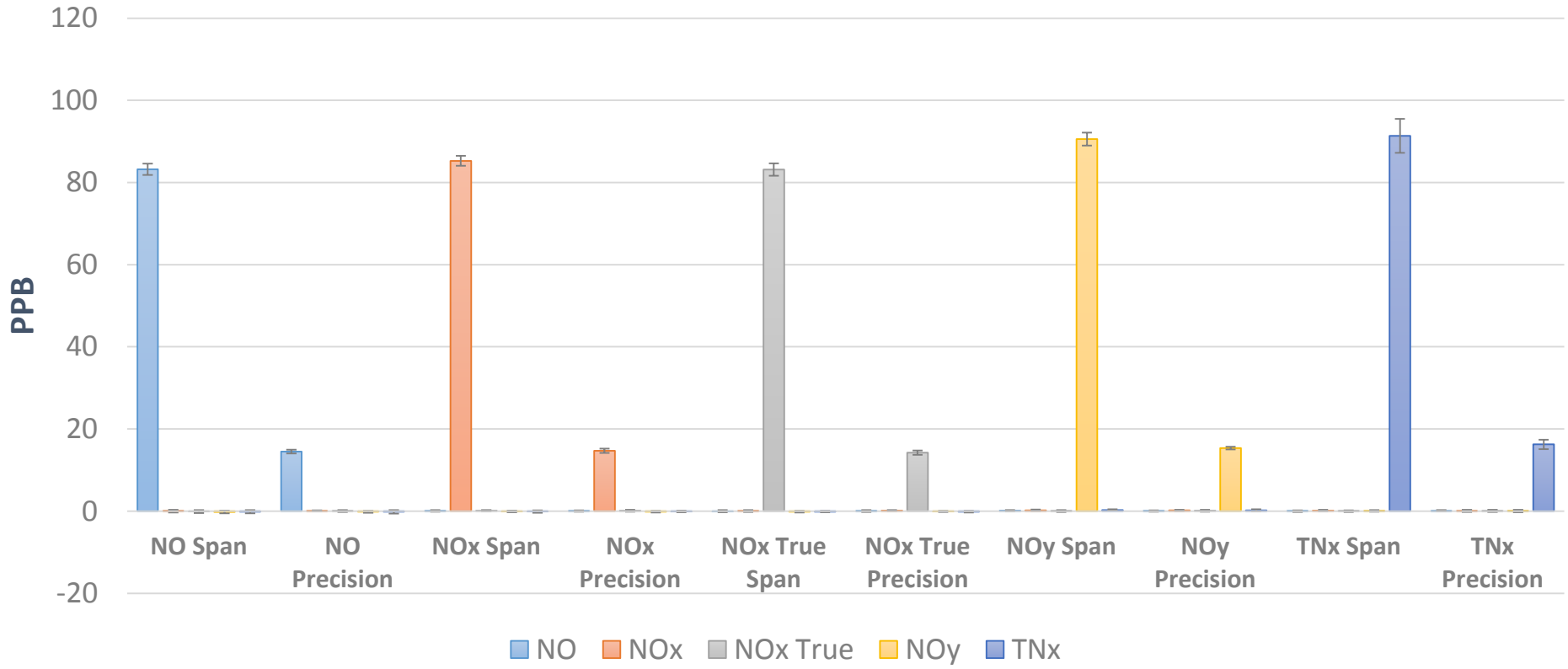


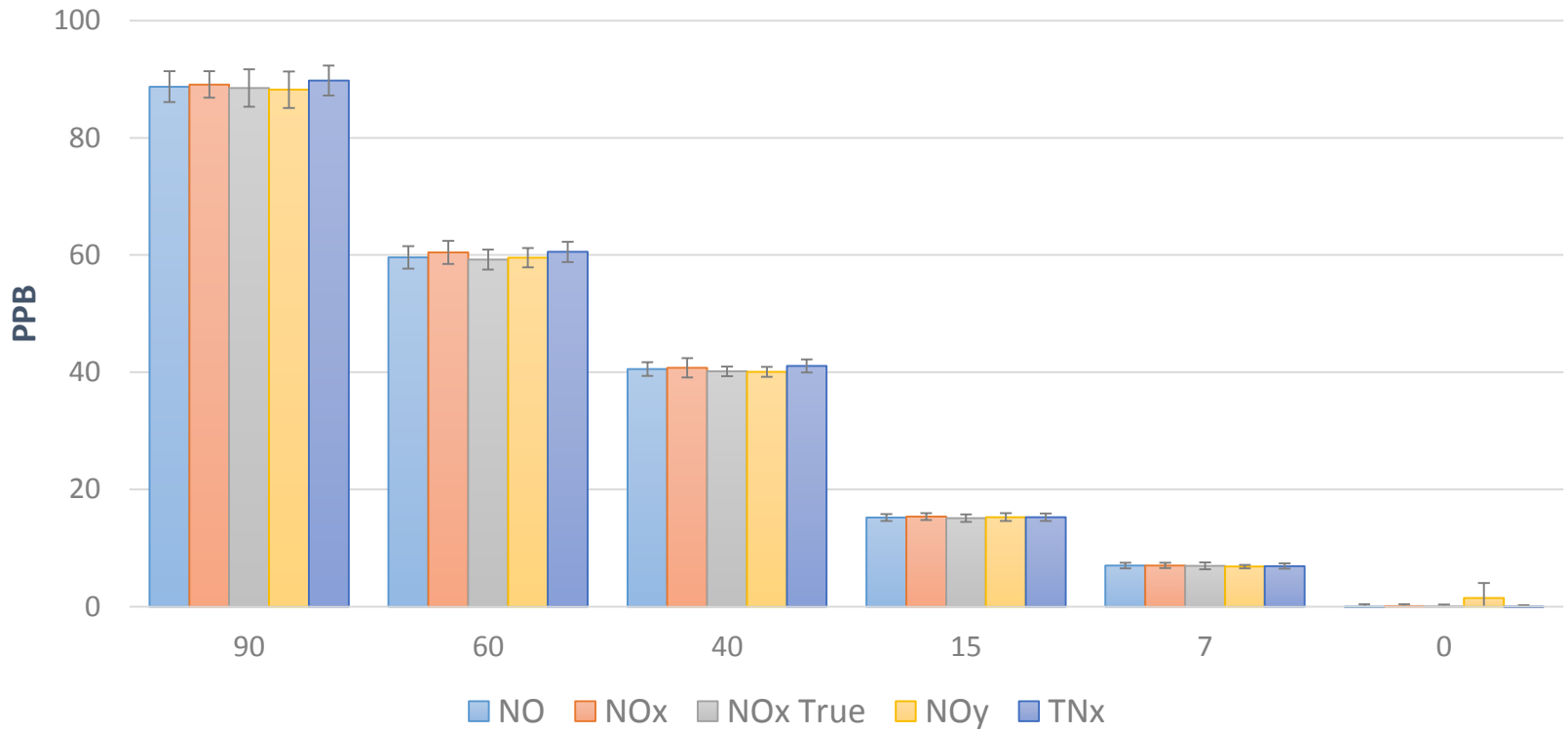
NO_x (Moly)

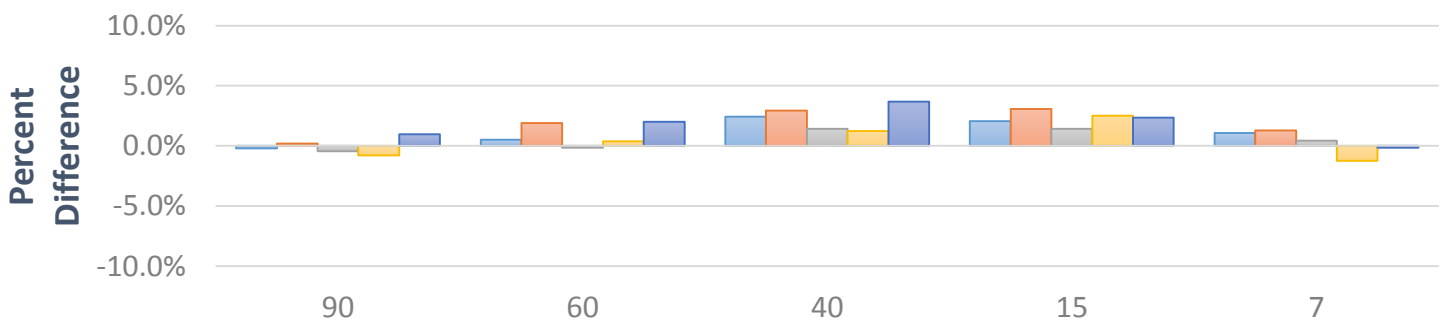
NO_x Photolytic

Channel Isolation

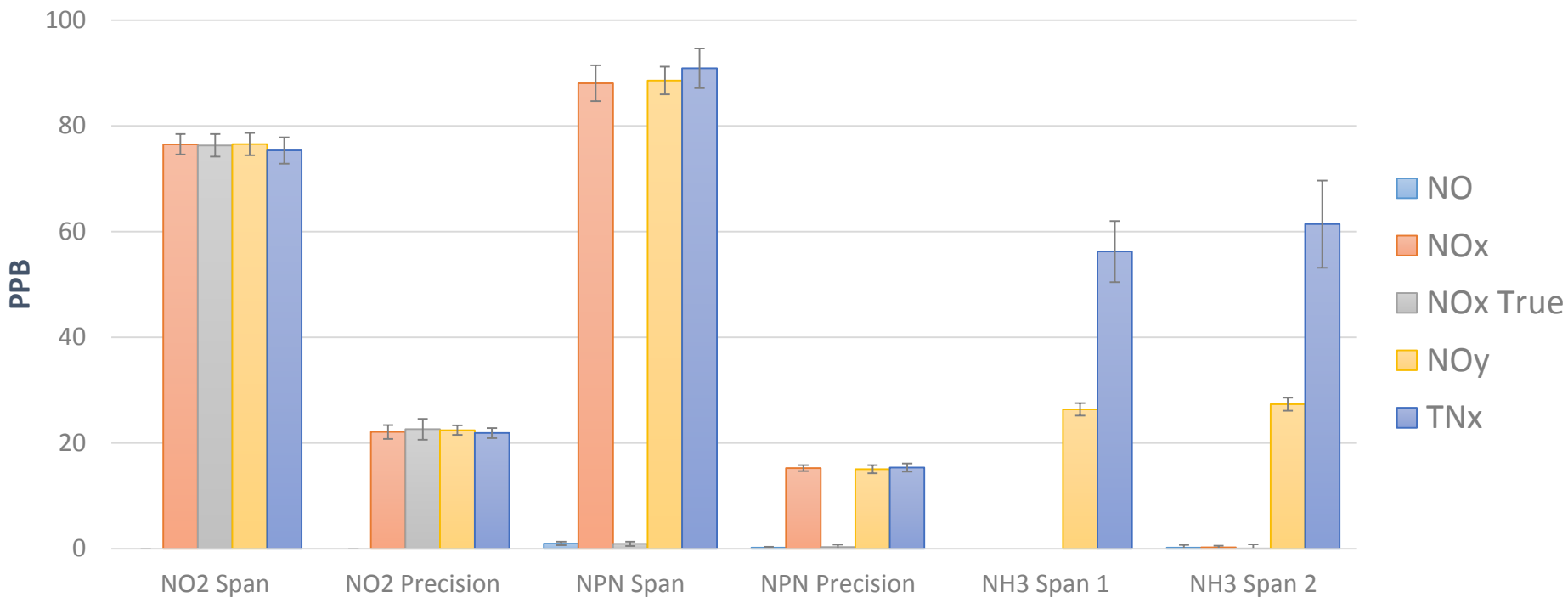


Audit Results Using NO Gas

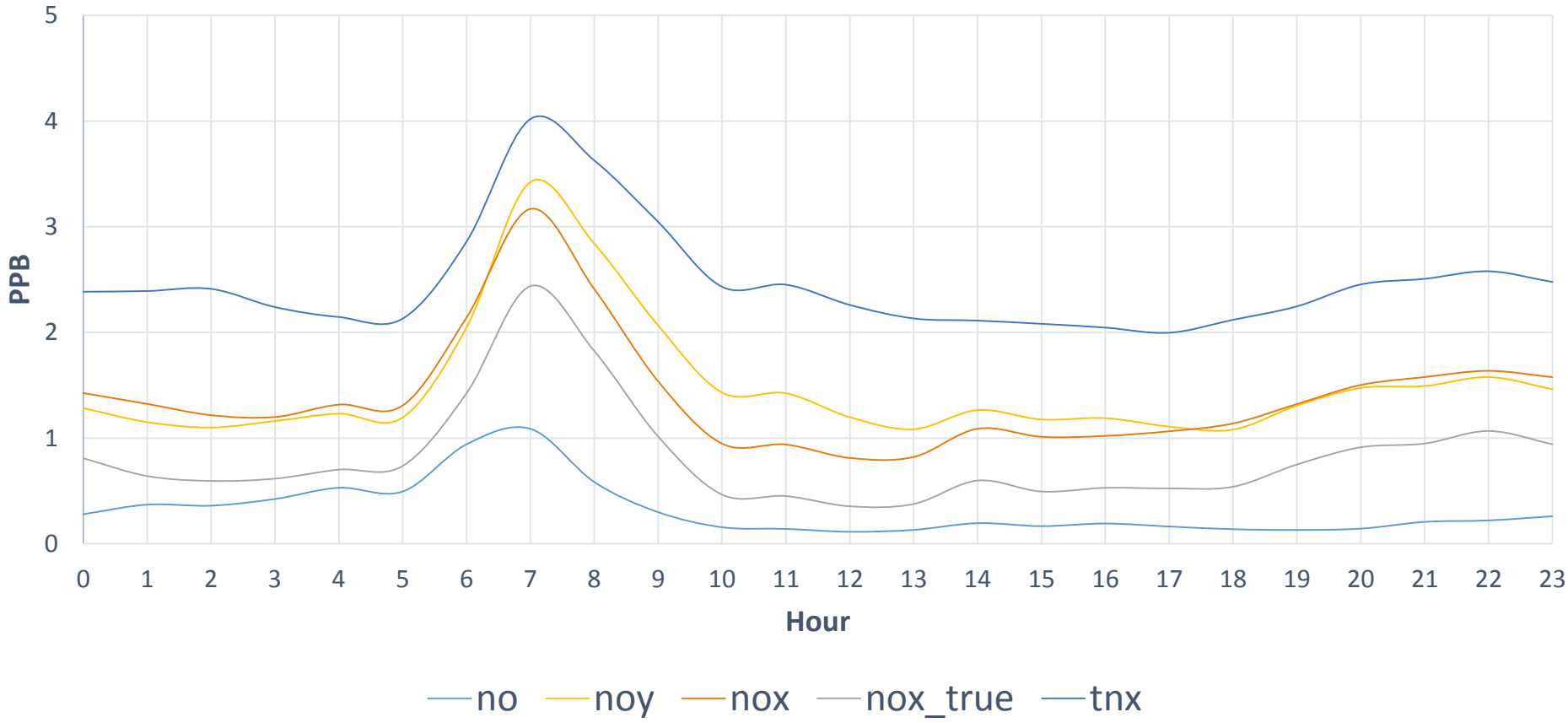




Conversion Efficiency



Diurnal Profile



Next Steps

- Installation at Beltsville, MD CASTNET site
  - Comparisons:
    - AMoN NH_3 (Bi-Weekly)
    - MARGA NH_3, pNH_4, HNO_3, pNO_3 (Hourly)
    - CASTNET Filter Pack pNH_4, HNO_3, pNO_3 (Weekly)

- Add HNO_3 Channel
  - NO_y Converter with Denuder/Filter
  - HNO_3 by Difference

- Comments?

  kevin.mishoe@amec.com