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Drill Rigs, Ambient Air Quality, and Air Impact Management

Bradley Thomas
Randy Kanady
IOGCC
Columbus, Ohio
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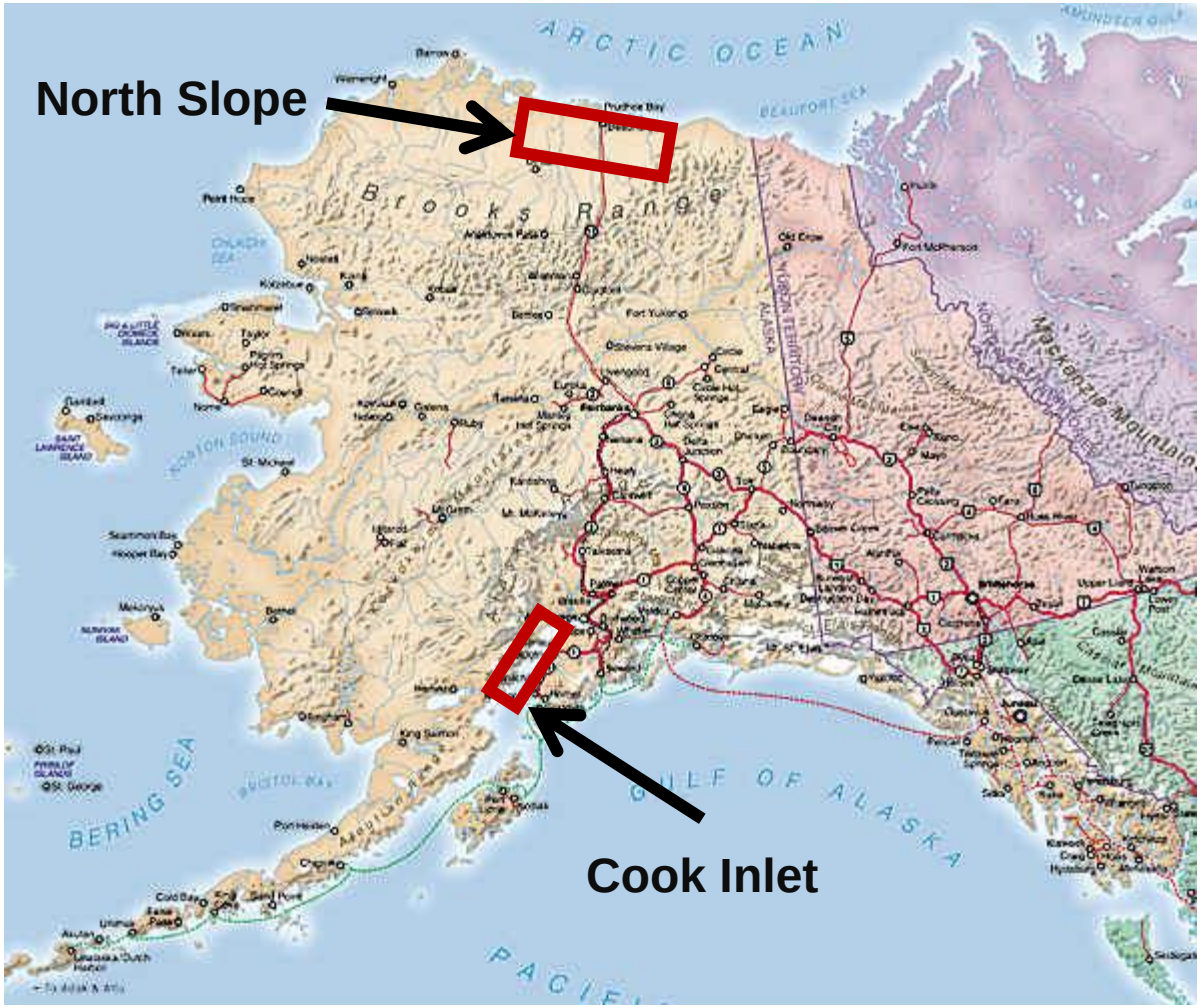
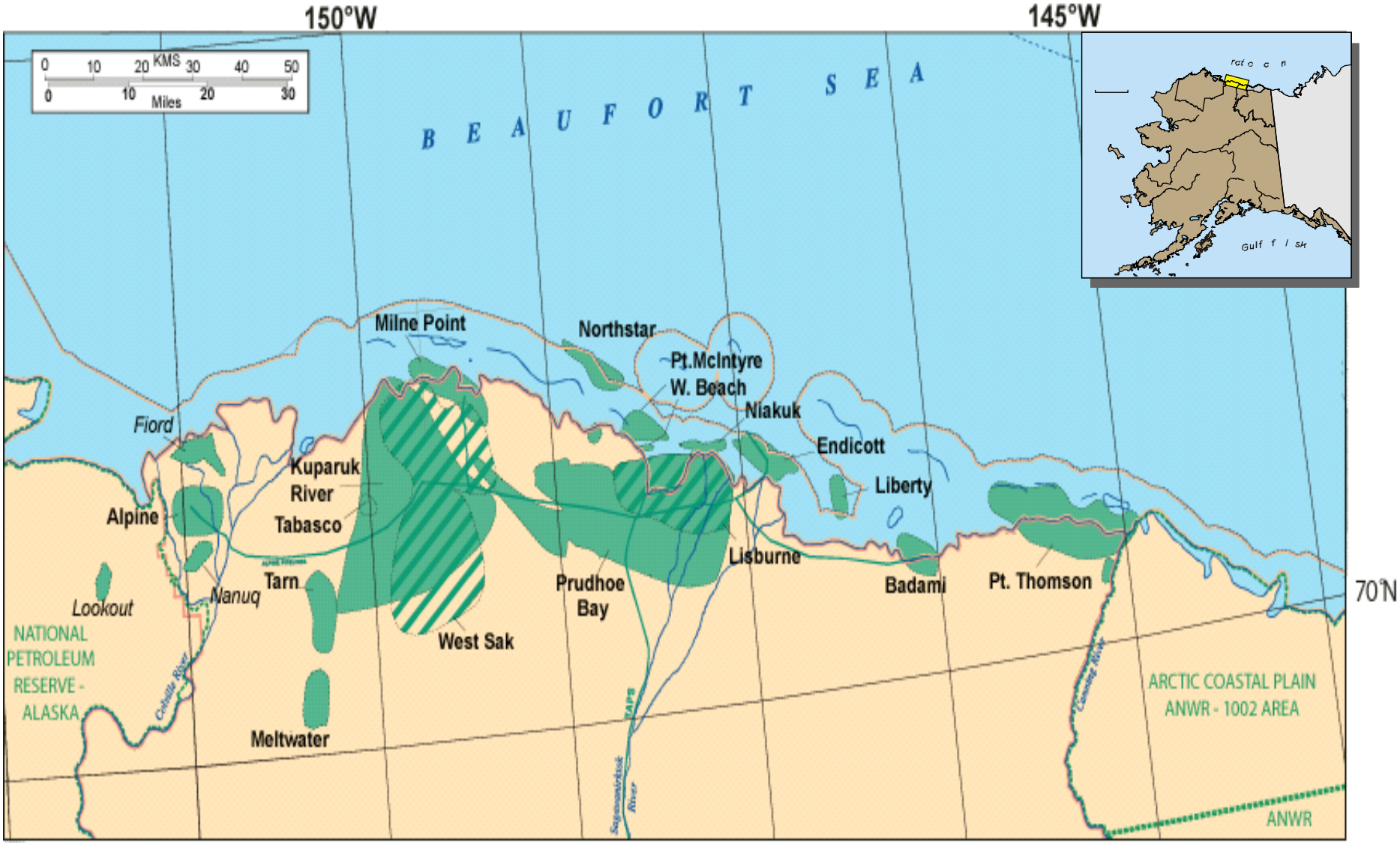
Presentation Summary

- Oil & Gas Drilling in Alaska
- Oil & Gas Drilling and the National Ambient Air Quality Standards (NAAQS)
- Ambient Air Monitoring Results
- Ongoing Ambient Air Monitoring Studies
- Managing Drill Rigs' Ambient Air Impacts

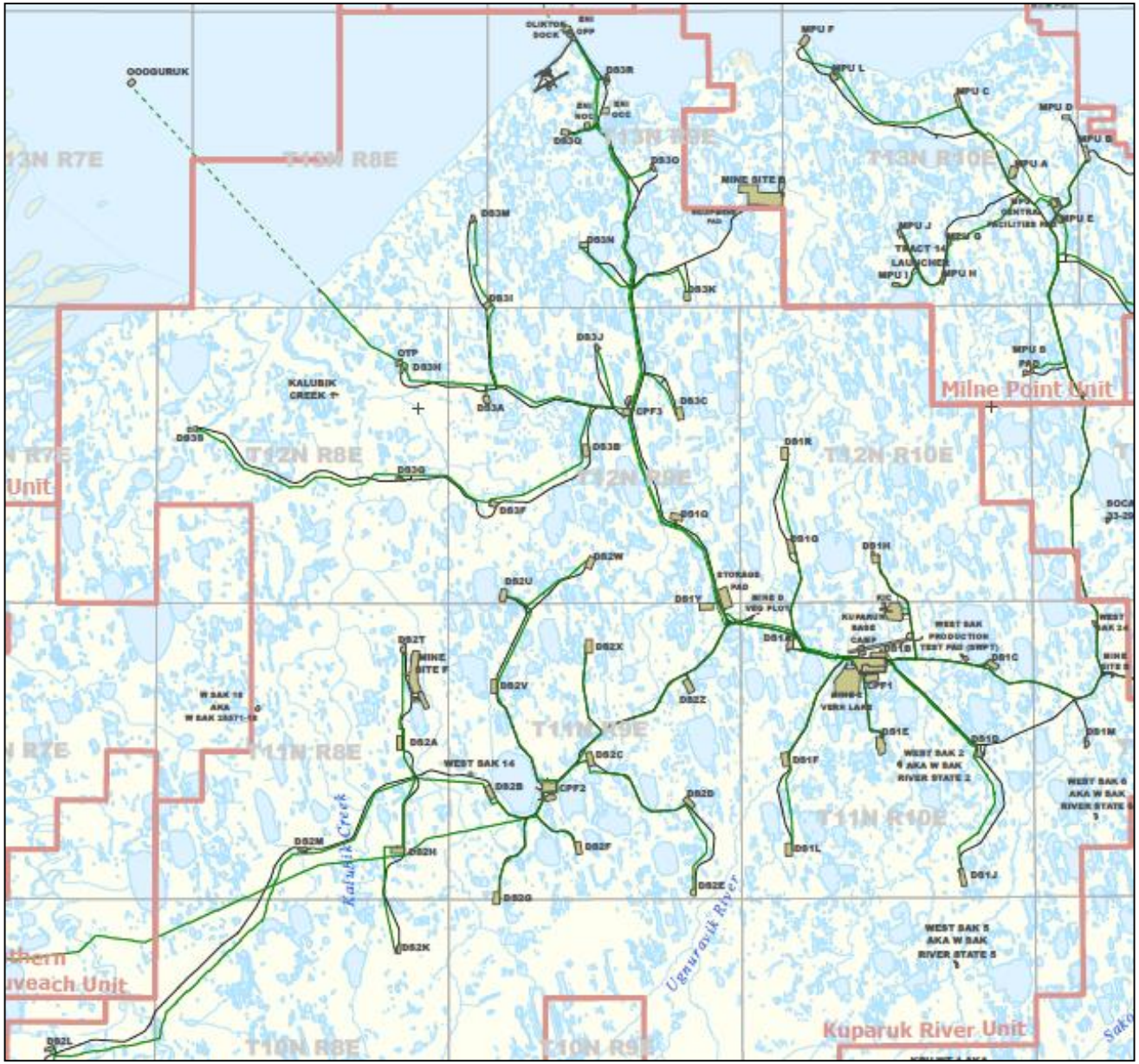
Alaska Oil and Gas Operating Areas



North Slope Alaska Units & Reservoirs



Kuparuk River Unit



-3 processing plants

-All 3 are major facilities in terms of air emissions (PSD)

-Average of 15 well sites feed into each

-Power generation on site

-Separated gas is re-injected or used on site as fuel

-Separated water pumped back into production reservoirs

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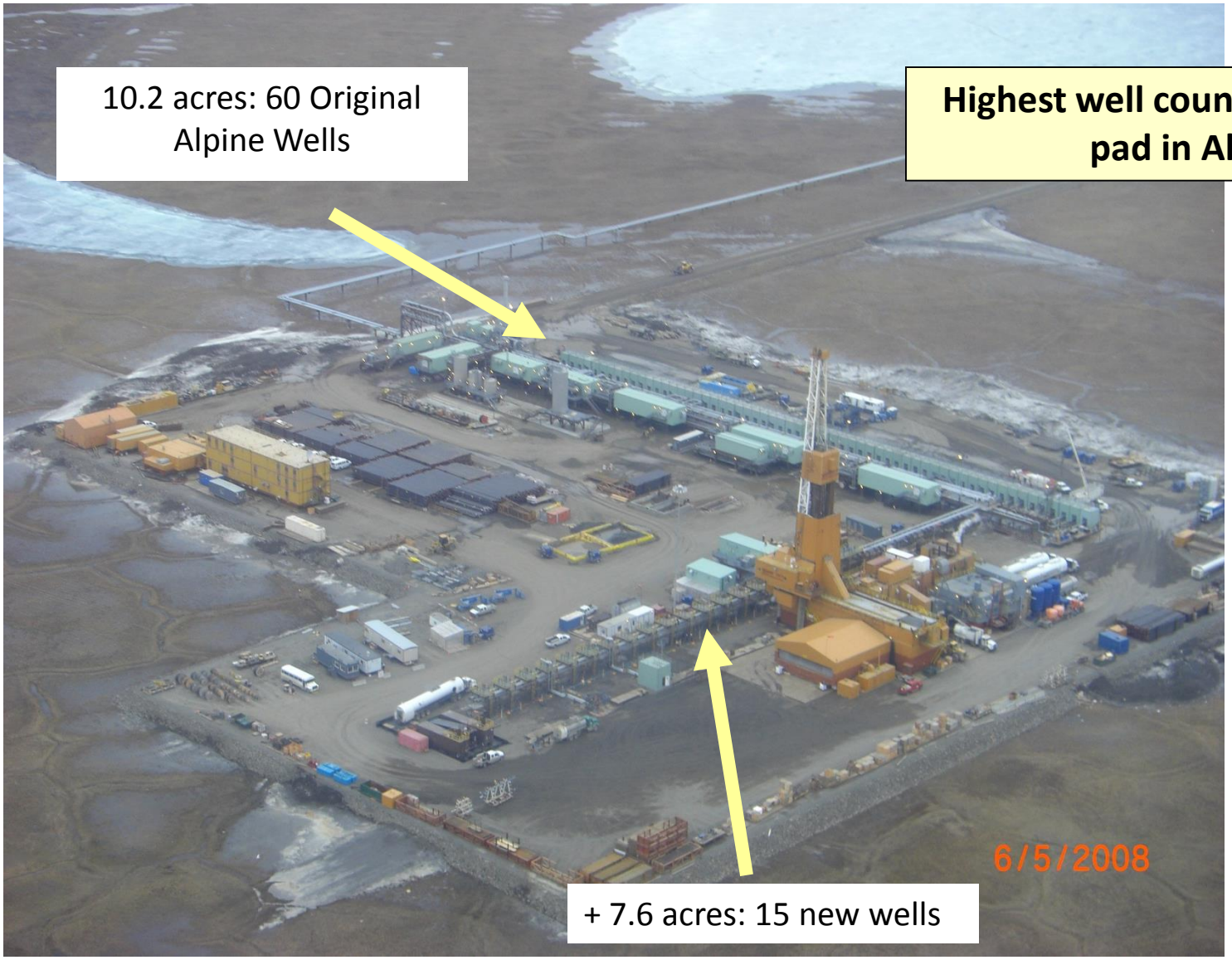
Alpine's CD2 Pad: 75 Wells on 18 acres



Highest well count of any gravel pad in Alaska.

Oil & Gas Drilling in Alaska

North Slope Summary

- 10-50 wells/pad
- ~100 pads on the North Slope
- Pads in wetlands so size strictly controlled

Rig Activity

- ~5-15 drilling rigs active at a given time on the North Slope
- In infill drilling, pad occupied for 30-100 days per year
- In development drilling, pad can be occupied for 2+ years

Typical North Slope Rig - Doyon 19

- Million pound derrick
- Cantilever – min. 10’ centers
- 500 ton hookload
- 44,000 ft-lb torque
- 2-1600 hp mud pumps
- 5 – 1474 hp Cat. 3512 engines
- Fuel use: ~ 2000 gpd on grid power
- Fuel use: ~ 4000 gpd on gensets
- 5000 psi standpipe pressure
- Mobile, self propelled
- Cuttings process and injection module

In design and operation, our research indicates NS rigs are similar to L48 rigs; they are distinguished only by the amount of heater/boiler capacity required

A New Issue

- In Alaska, drill rigs and their associated air emissions, have been evaluated for impacts on ambient air quality for at least a decade
- These evaluations have occurred within the context of NEPA analyses and the state's air permitting program
- We have had to re-evaluate how we've been doing this due to the new 1-hour NO_2 NAAQS

Oil & Gas Drilling and the NAAQS

- Historically, 40 CFR 51, Appendix W modeling has been employed to assess whether drill rigs meet the National Ambient Air Quality Standards (NAAQS)

- This approach requires all equipment to be stationary (24-7-365) and that all equipment operate at allowable or capacity rates

- Challenges using this approach
  - No drilling equipment is stationary
  - No simultaneous operations
  - No simultaneous capacity operations
  - Lots of transient equipment with exhaust points very close to the ground
  - Equipment restrictions often unworkable

- This modeling approach and the new 1-hour NO2 NAAQS have proven to be unworkable for drill rigs

The Central Question:

Do Drill Rigs' Emissions Cause Exceedance of the NAAQS?

Answer

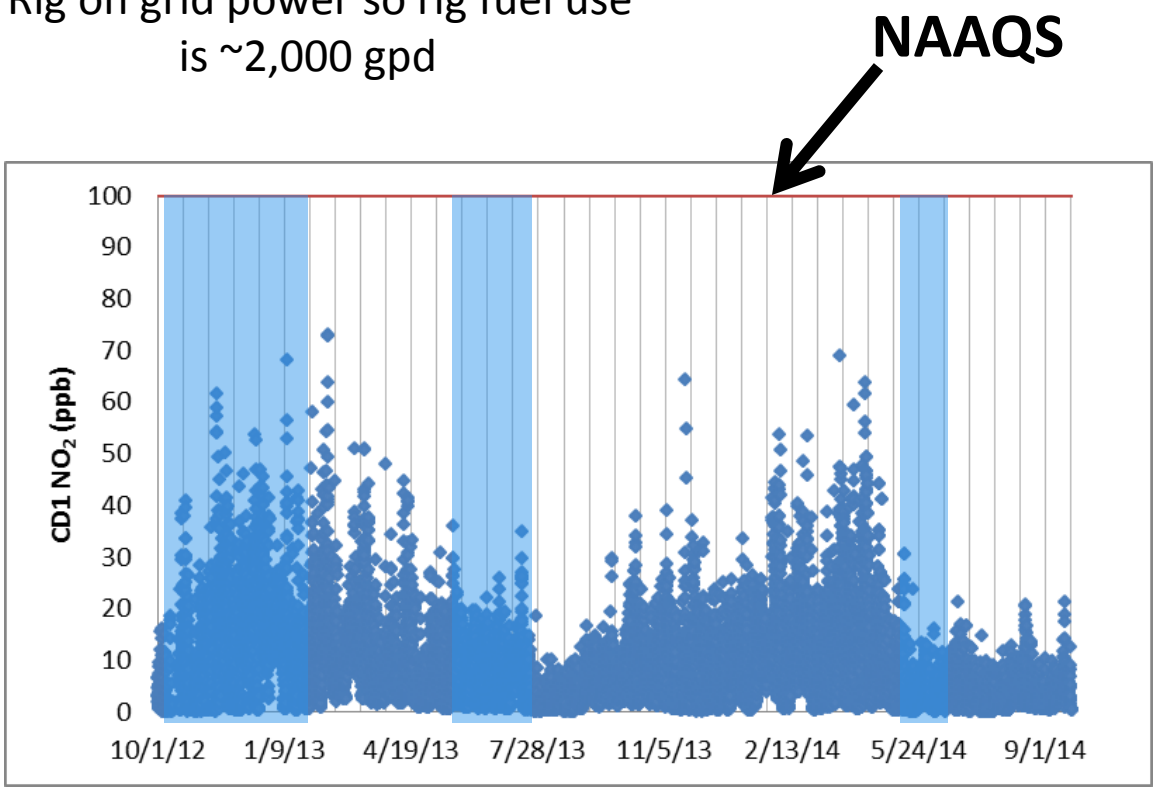
Based on all of the ambient air quality data collected around drill rigs in Alaska since 1992, the answer is NO.

Ambient Air Monitoring Results

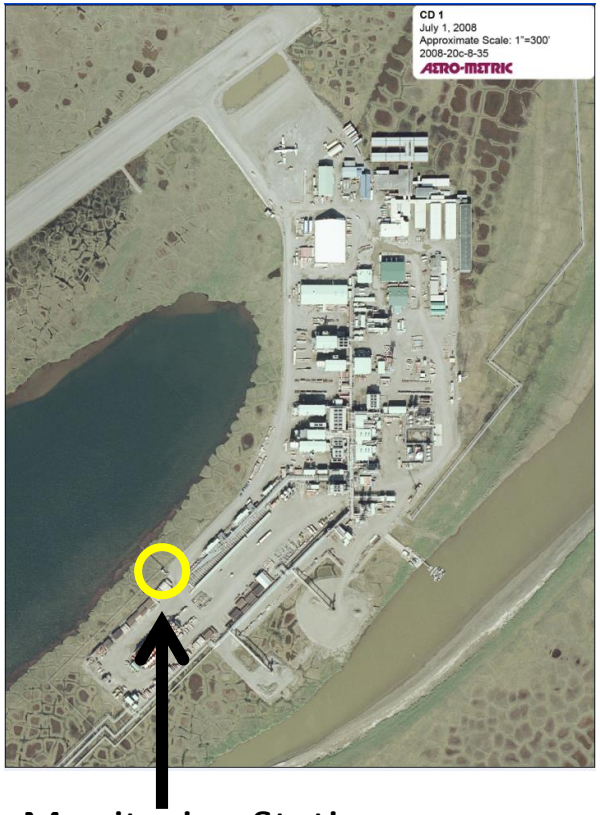
- 20+ years of ambient air quality monitoring data collected at several North Slope drilling locations has shown no violation of any of the NAAQS
- We believe the full range of drilling activities have been covered by these monitoring data sets
- Examples of our data follow

Alpine CD1 Monitoring*

*Rig on grid power so rig fuel use is ~2,000 gpd

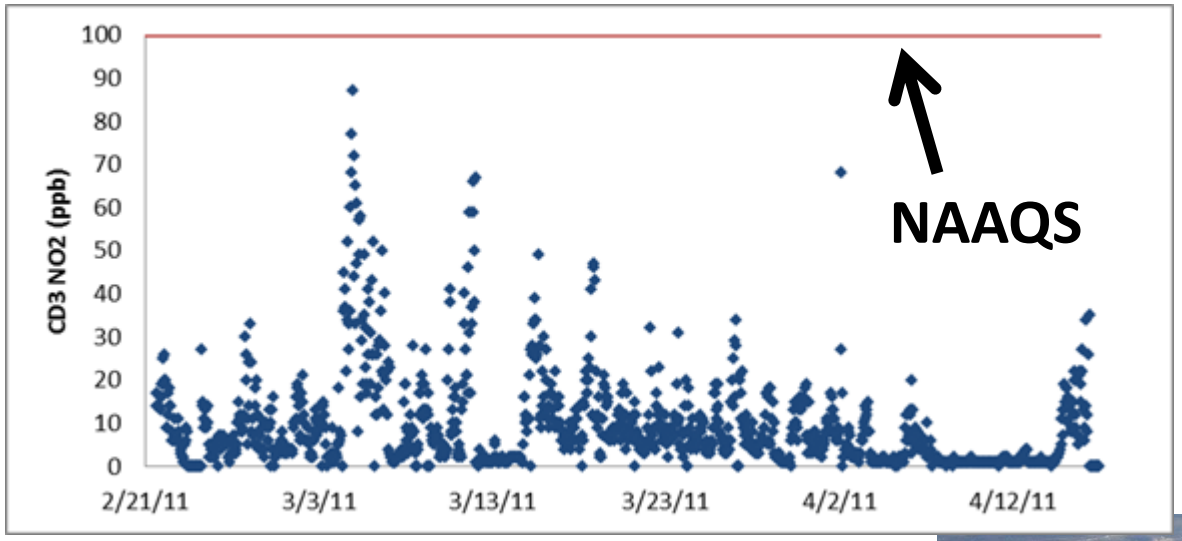


*Drill rig present in shaded green regions



Well-line is collocated with a PSD major crude oil processing facility

Alpine CD3 Monitoring*



*Rig(s) present entire time and on grid power though total fuel use was >5,000 gpd

Monitoring Station

Maximum 1-hour NO_2 reading: 87 ppb

Dual rig drilling program with simultaneous well-fracturing operation

Prudhoe Bay A-Pad Monitoring*

*no grid power available

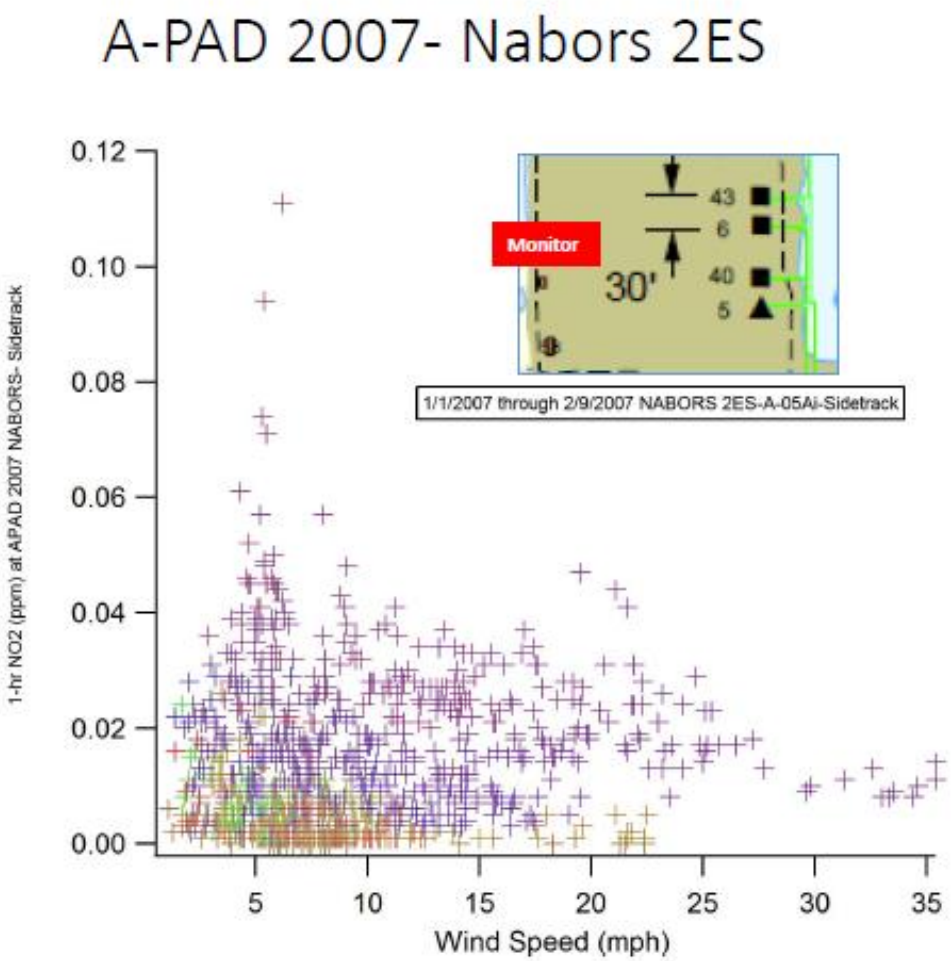
Year Range	3-year average of 1-hour NO_2 (ppb) NAAQS Standard 100 ppb
1992-94	56
1993-95	61
1994-96	50
1995-97	48
1996-98	38
1997-99	33
1998-00	36
1999-01	36
2000-02	37
2001-03	40
2002-04	41
2003-05	41
2004-06	48
2005-07	51
2006-08	54
2007-09	35
2008-10	32
2009-11	31
2010-12	36
2011-13	37

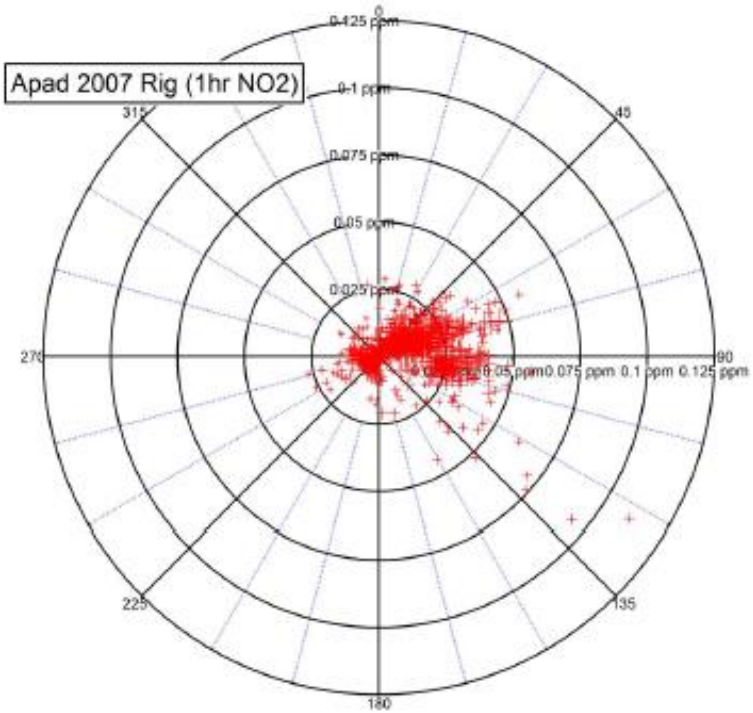
>20 years of data at a single drill site

Sample ADEC Analysis of A-Pad Data

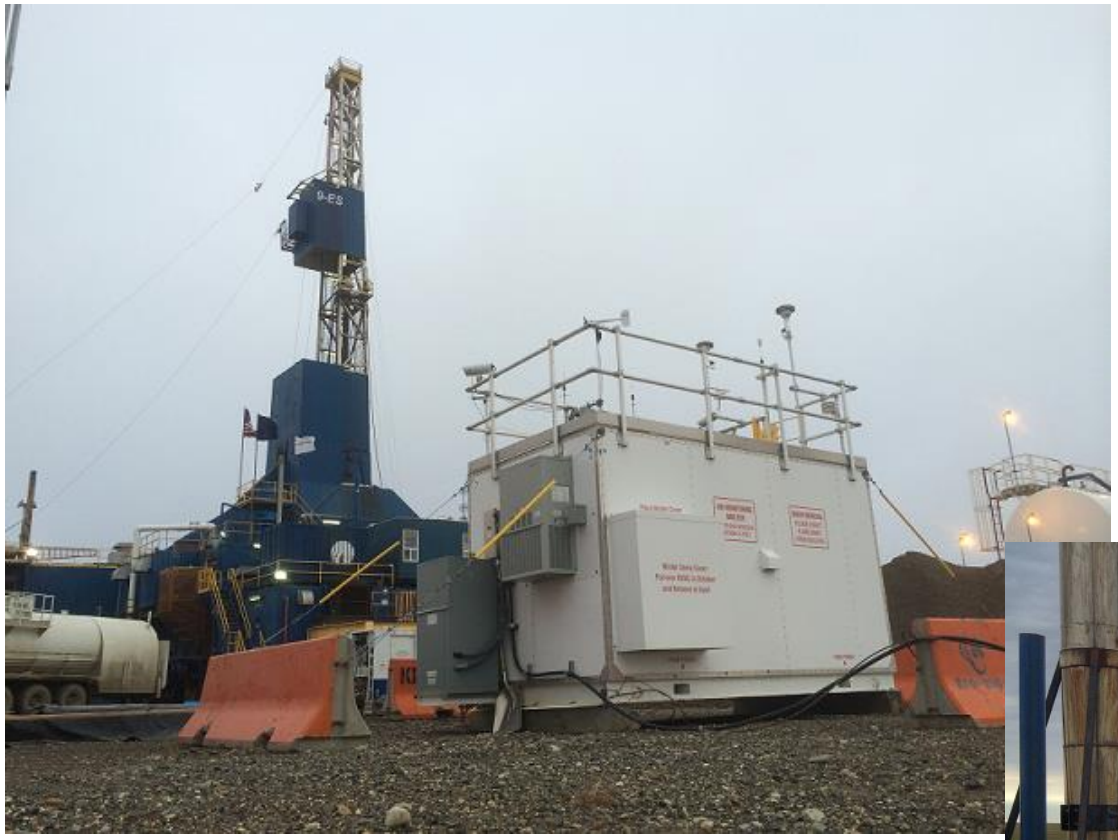
Rig about 100 feet due east from monitoring station.

Rig impacts are very localized.

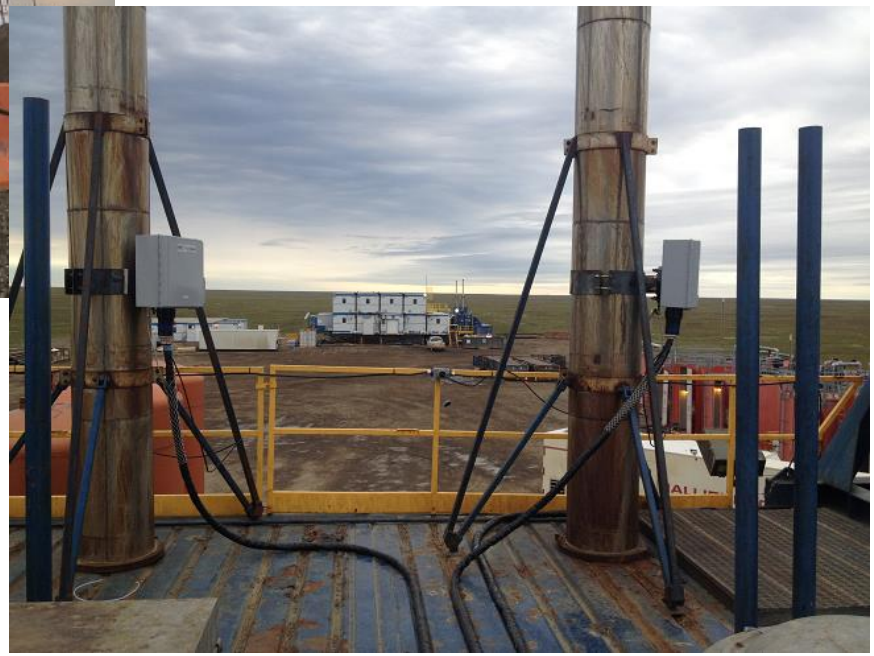




Kuparuk DS-2N Monitoring Study

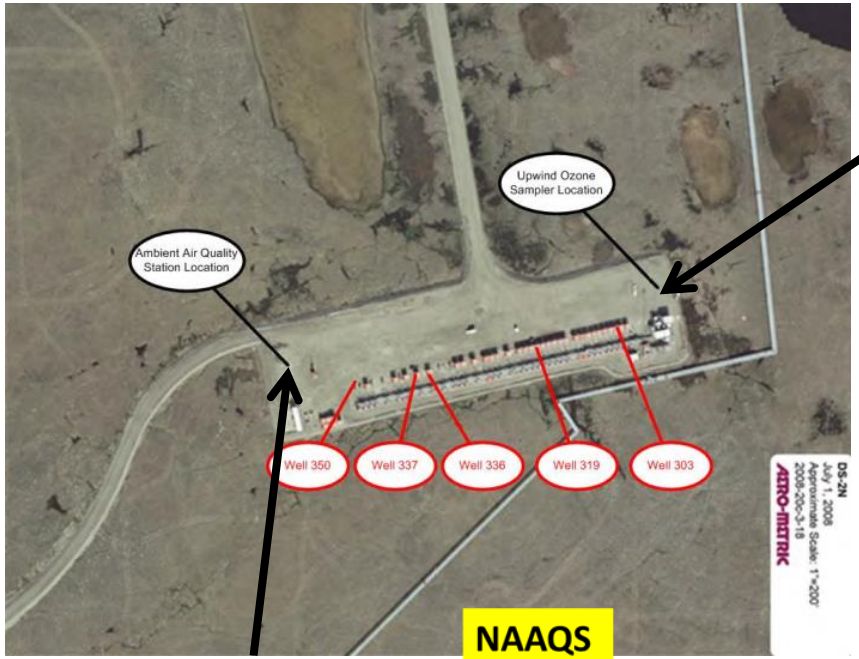


- Full ambient air monitoring station
- Upwind/downwind O3 monitors
- CEMS on heater, boilers, engines
- Hourly fuel metering
- 5 well slots will be worked
- Mix of on-grid/off-grid drilling



Rigorous 5 month study in collaboration with ADEC and BLM

Kuparuk DS-2N Monitoring Study*

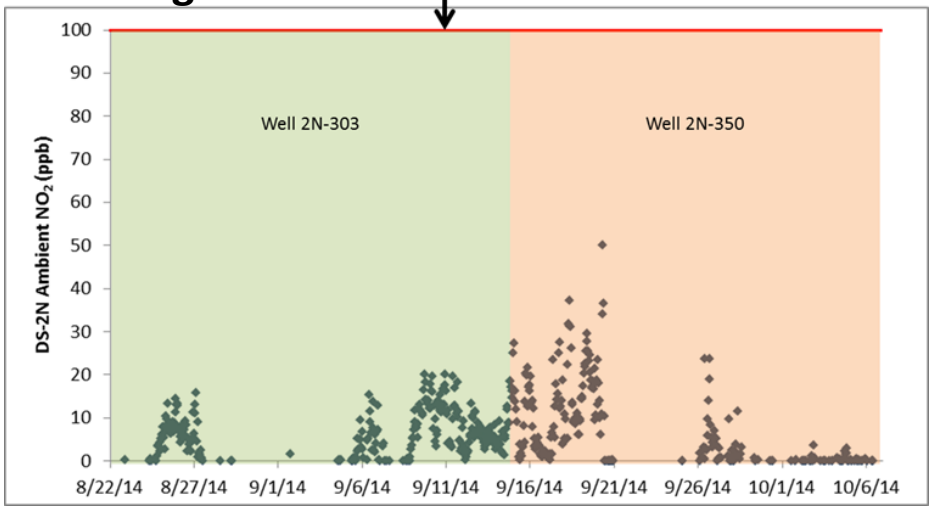


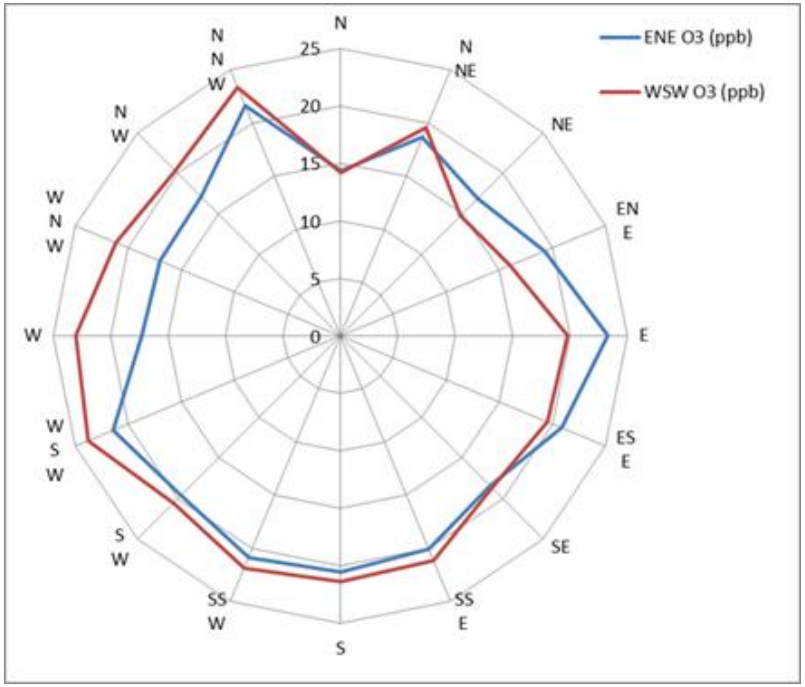
*Rig present entire time

Ozone Analyzer

Monitoring Station

NAAQS





Rigorous 5 month study in collaboration with ADEC and BLM

Air Impact Management

- 20+ years of ambient air quality data collected around drill rigs provides reasonable assurance NAAQS are protected
- Nearly all of our studies undertaken with EPA Tier 0 engines; engine tiers are increasing so emission rates are falling
- Alaska studies were conducted within high intensity Arctic environment operations (worst case?)
- Refined modeling analyses have shown drill rigs do meet the ambient air quality standards

Air Impact Management

- **The Alaska O&G industry is proposing to ADEC:**
  - A narrowing of how drill rigs are included in the stationary source permitting program
  - A stream-lined approach (e.g., Permit by Rule) to handling 95%+ of the drilling activities in the state
  - The establishment of a committee consisting of state and industry representatives to periodically review ambient air data and to ensure pragmatic regulatory approaches to drill rig and rig activities
- **We are also proposing that modeling for NEPA analyses, registration programs, or other needs should:**
  - Be refined to account for site-specific fuel demands
  - Include use of statistical methods (e.g., Monte Carlo) since the challenging standards are themselves statistical
  - Exclude the smaller and more transient equipment that might be on the pad periodically while the rig(s) operate

QUESTIONS?