US EPA ARCHIVE DOCUMENT

Significant Concentration Gradient Analysis: A Case Study

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Region 4 Modelers Workshop

Atlanta, Ga.

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Project Overview

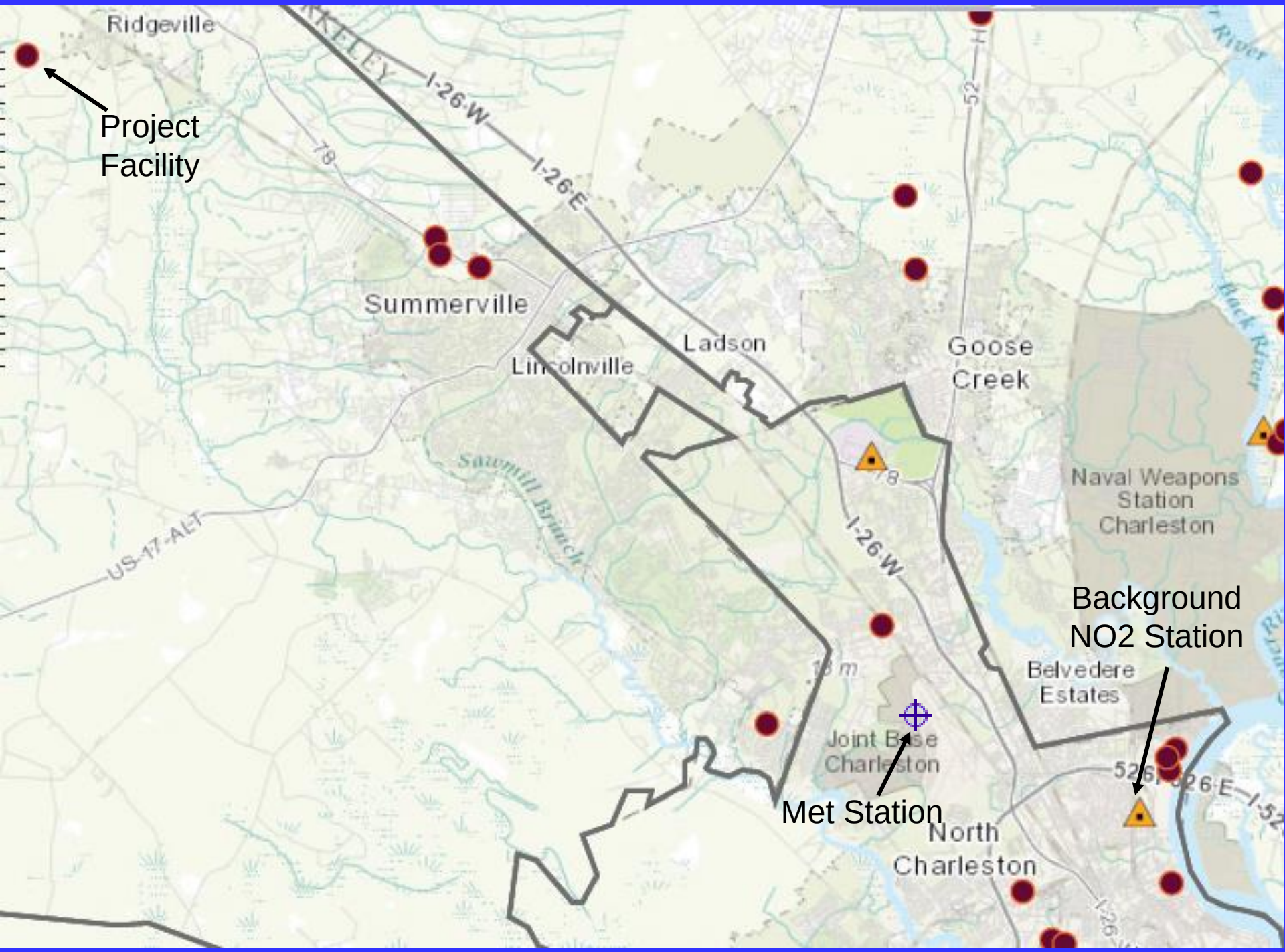
- Project Major for:
  - PM_{10} = 93 tpy
  - $PM_{2.5}$ = 93 tpy
  - NO_x = 325 tpy
  - CO = 4757 tpy
  - VOCs = 116 tpy
- Facility to install controls on existing source to net out of SO_2
- 5 EGUs, 3 cement facilities, 1 paper mill, and 1 steel mill within 50 km of project
- Rural location in coastal plain of SC
- 70 ft elev

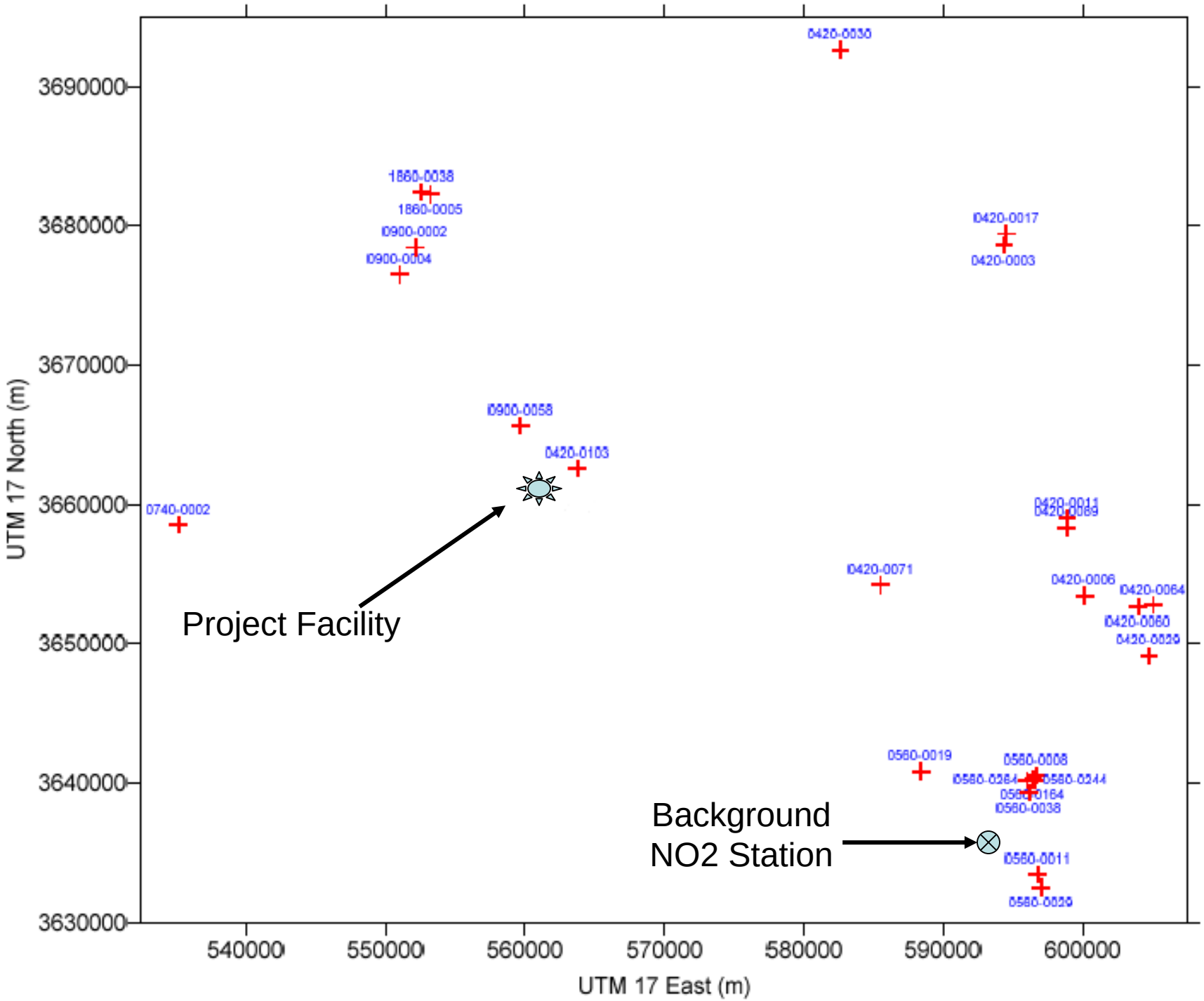
Project Overview (cont)

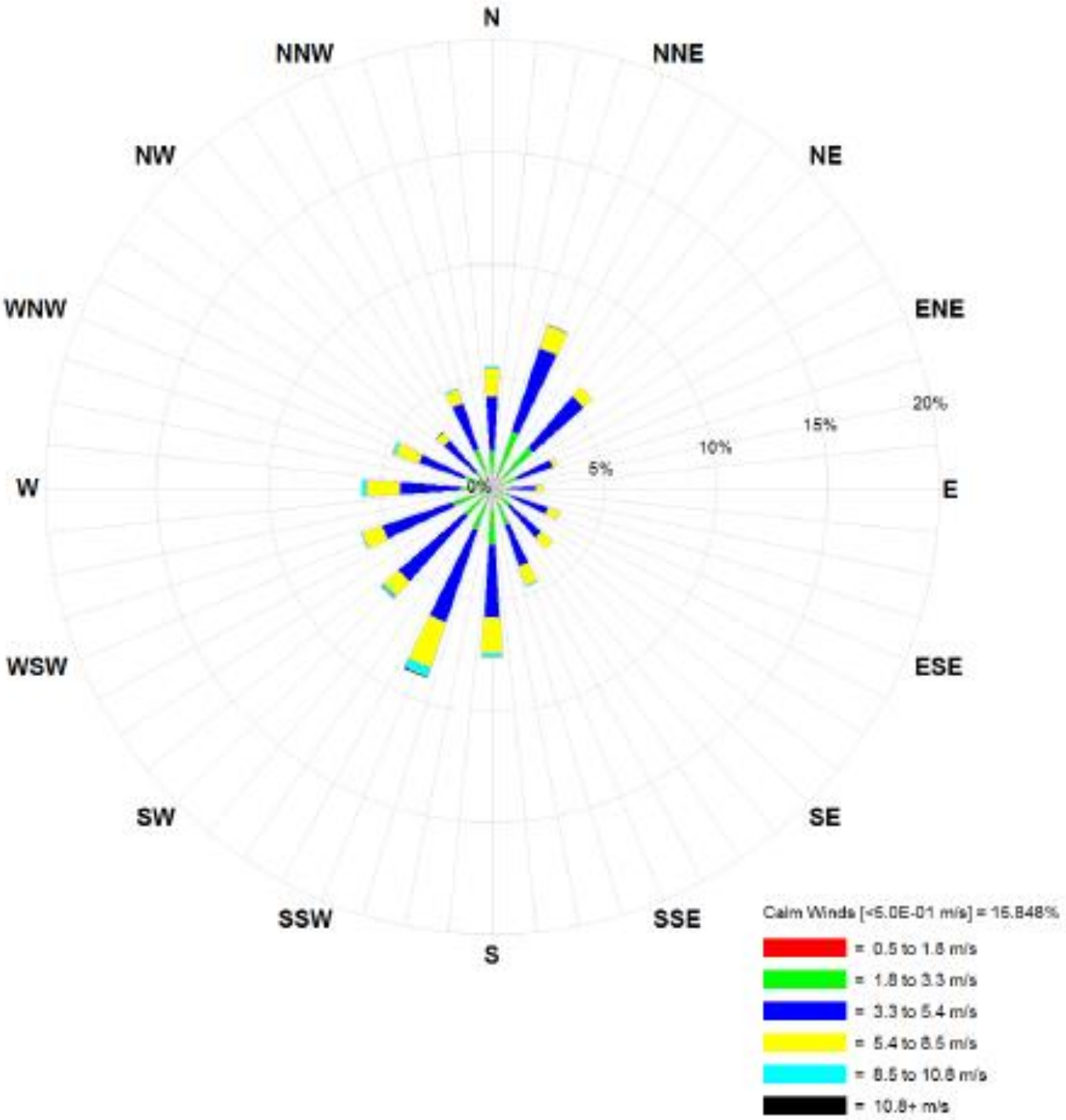
- Significant impact modeling results > SILs for PM_{10}, $PM_{2.5}$, NO_2, and CO
- Conservative screening (20D) used to determine background inventory for PM_{10}, $PM_{2.5}$, and CO
- Significant concentration gradient procedure used to determine NO_2 inventory

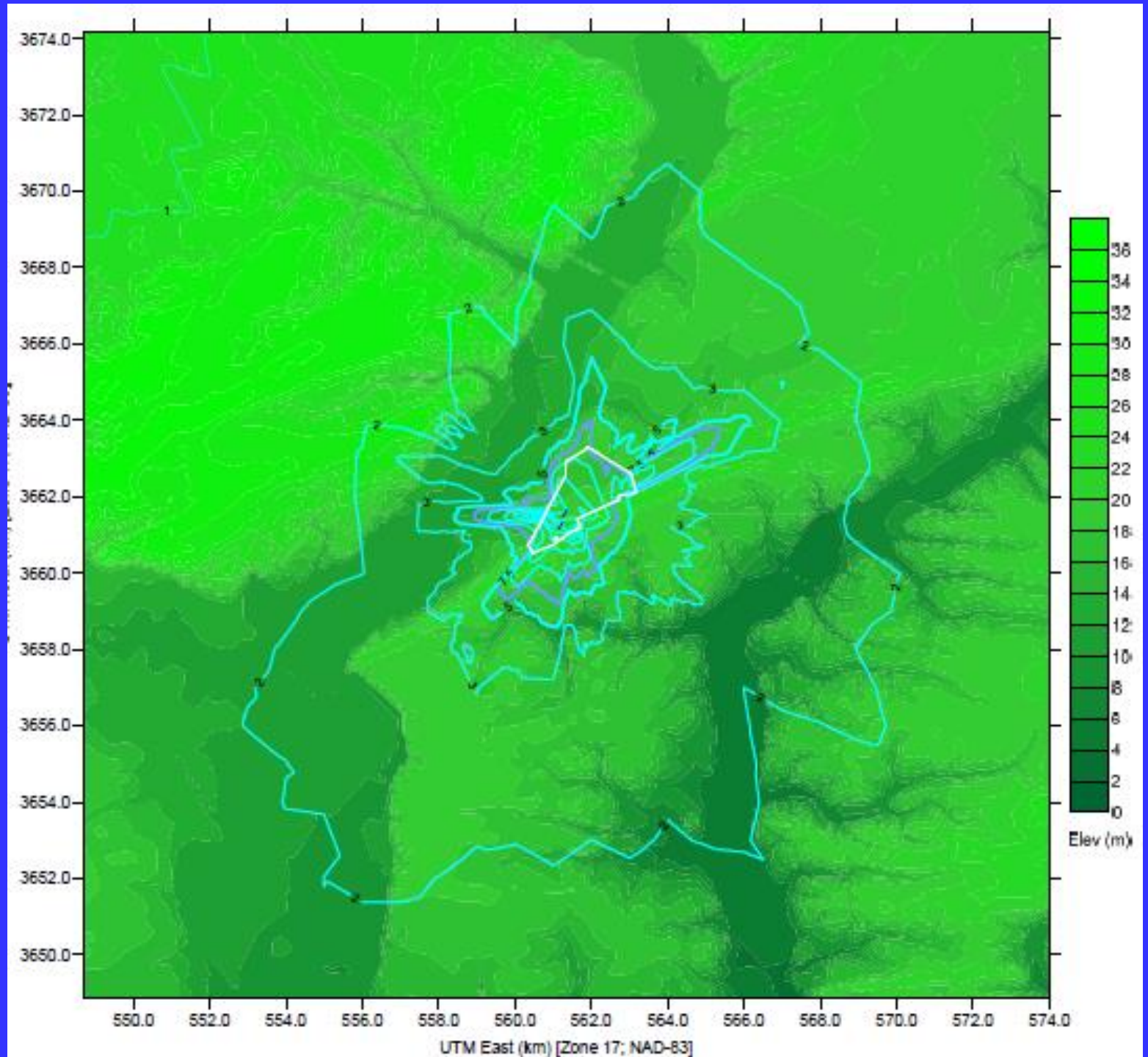
Background Concentration Determination

- App. W: "…two components of background should be determined:.. nearby sources and… other sources."
  - Nearby sources: those expected to cause a "significant concentration gradient in the vicinity of the source… under consideration…"
  - Other sources: portion of background attributable to natural, minor, and distant major sources (i.e., monitored background)


Project Facility
Ridgeville
I-26-W
I-26-E
Summerville
Lincolnville
Ladson
Goose Creek
Naval Weapons Station Charleston
Sawmill Branch
US-17-ALT
Background NO2 Station
Belvedere Estates
Joint Base Charleston
Met Station
North Charleston


0420-0030
1860-0038
1860-0005
0900-0002
0900-0004
0420-0017
0420-0003
0900-0058
0420-0103
0740-0002
0420-0011
0420-0069
0420-0071
0420-0006
0420-0064
0420-0060
0420-0020
0560-0019
0560-0008
0560-0244
0560-0164
0560-0038
0560-0011
0560-0020
Project Facility
Background
NO2 Station
3690000
3680000
3670000
3660000
3650000
3640000
3630000
UTM 17 North (m)
540000
550000
560000
570000
580000
590000
600000
UTM 17 East (m)

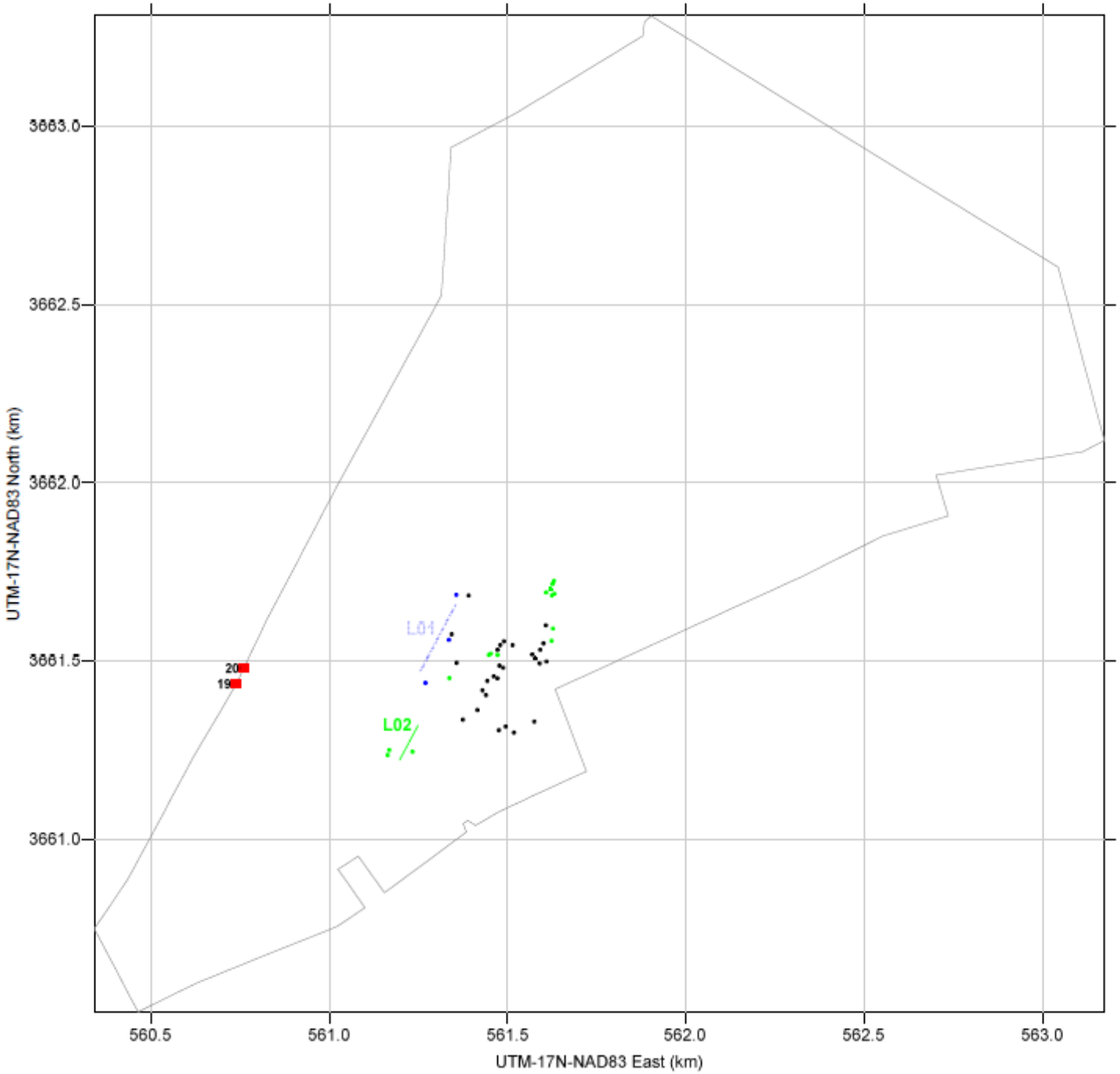

N
NNE
NE
ENE
E
ESE
SE
SSE
S
SSW
SW
WSW
W
WNW
NW
NNW
0%
5%
10%
15%
20%
Calm Winds [<5.0E-01 m/s] = 15.848%
= 0.5 to 1.8 m/s
= 1.8 to 3.3 m/s
= 3.3 to 5.4 m/s
= 5.4 to 8.5 m/s
= 8.5 to 10.8 m/s
= 10.8+ m/s


3674.0
3672.0
3670.0
3668.0
3666.0
3664.0
3662.0
3660.0
3658.0
3656.0
3654.0
3652.0
3650.0
550.0
552.0
554.0
556.0
558.0
560.0
562.0
564.0
566.0
568.0
570.0
572.0
574.0
UTM East (km) [Zone 17; NAD-83]
36
34
32
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
Elev (m)

1-Hr Controlling Meteorology

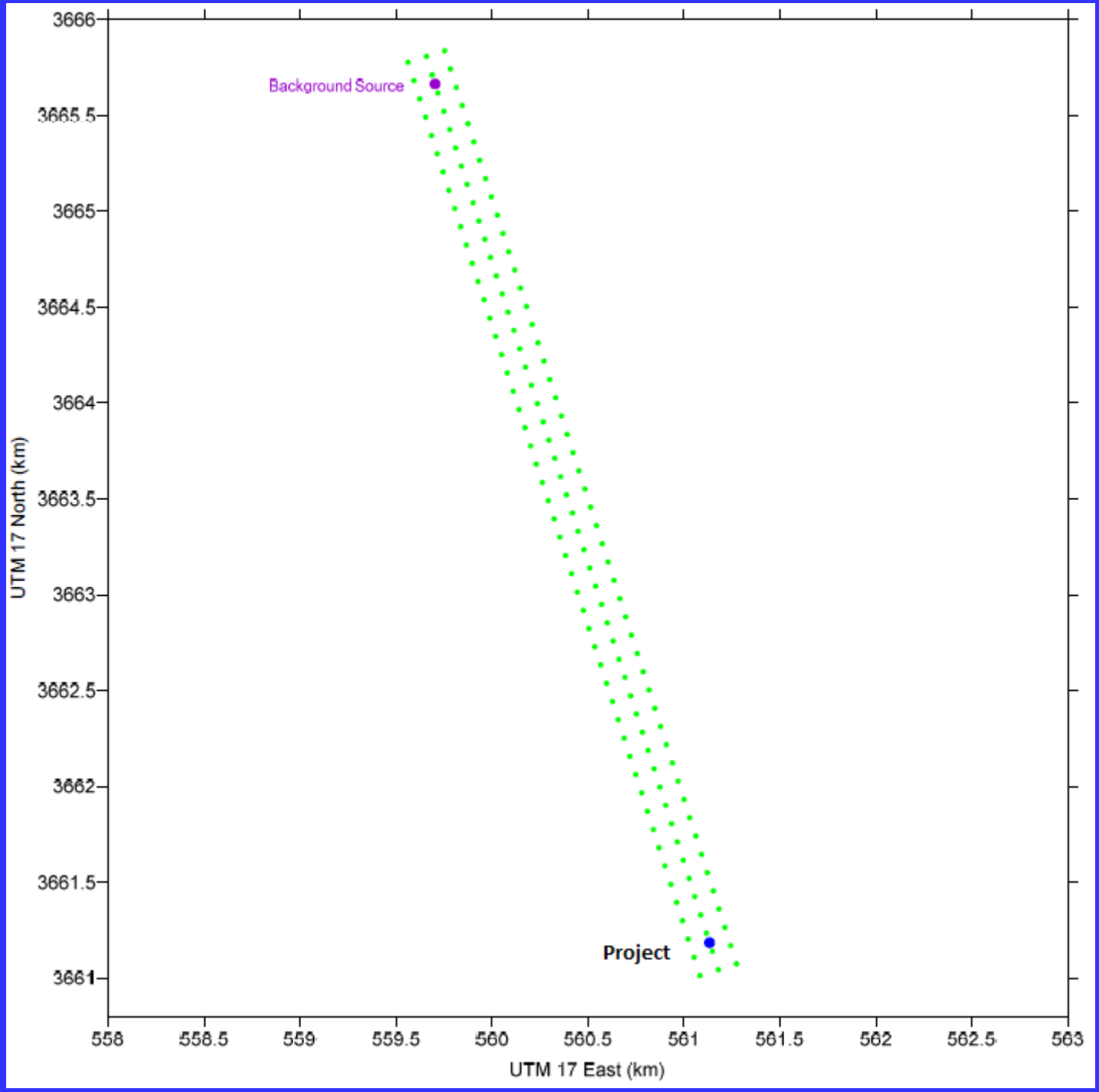
Year	Hour (ending)	Wind Speed m/s	Wind Direction degrees
2006	19	5.96	88
2007	22	2.86	89
2008	20	3.36	93
2009	22	4.36	88
2010	3	2.36	87

NAAQS NO2-1HR Controlling Receptors

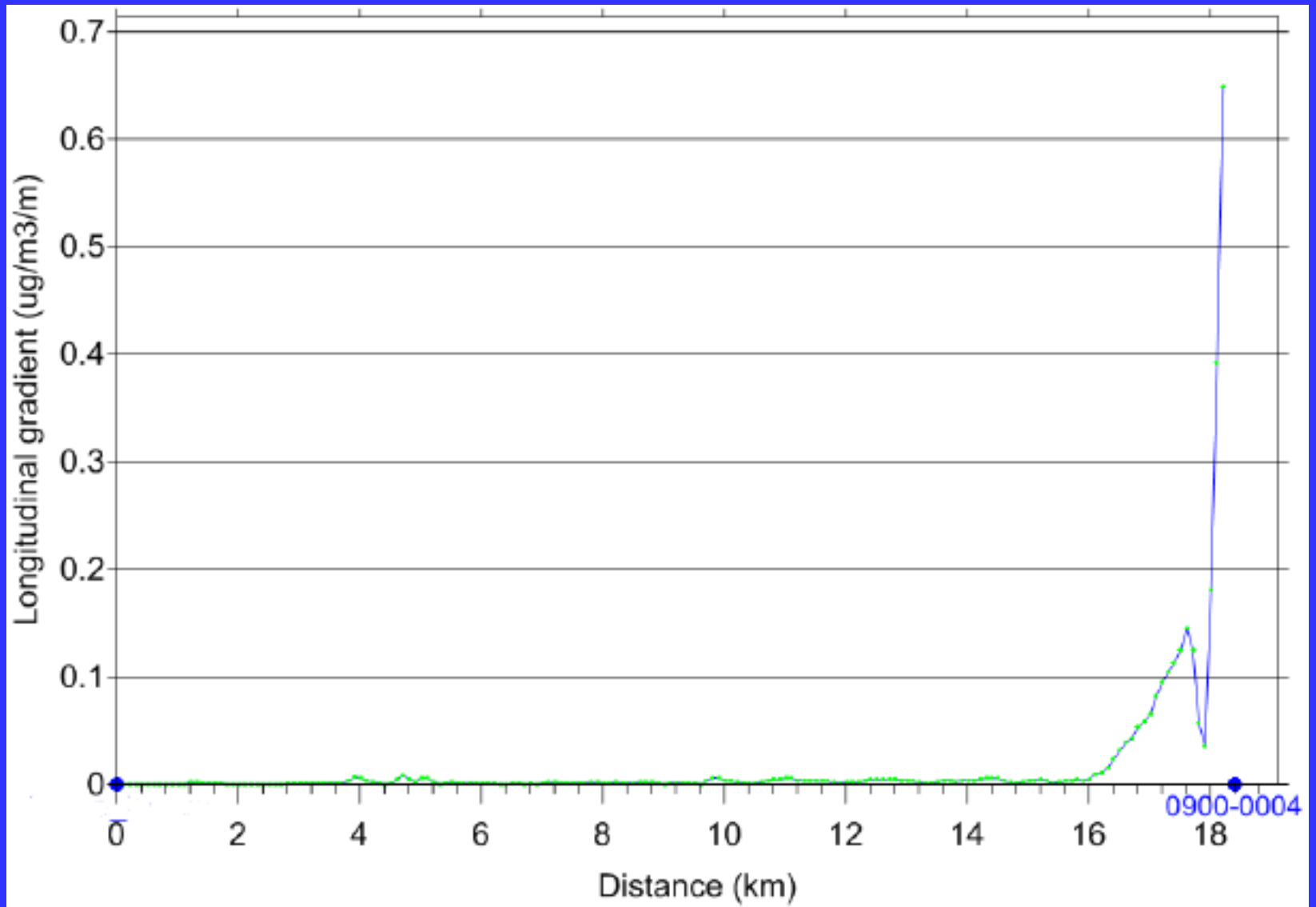


NO_2 1-Hr Background Inventory Procedure

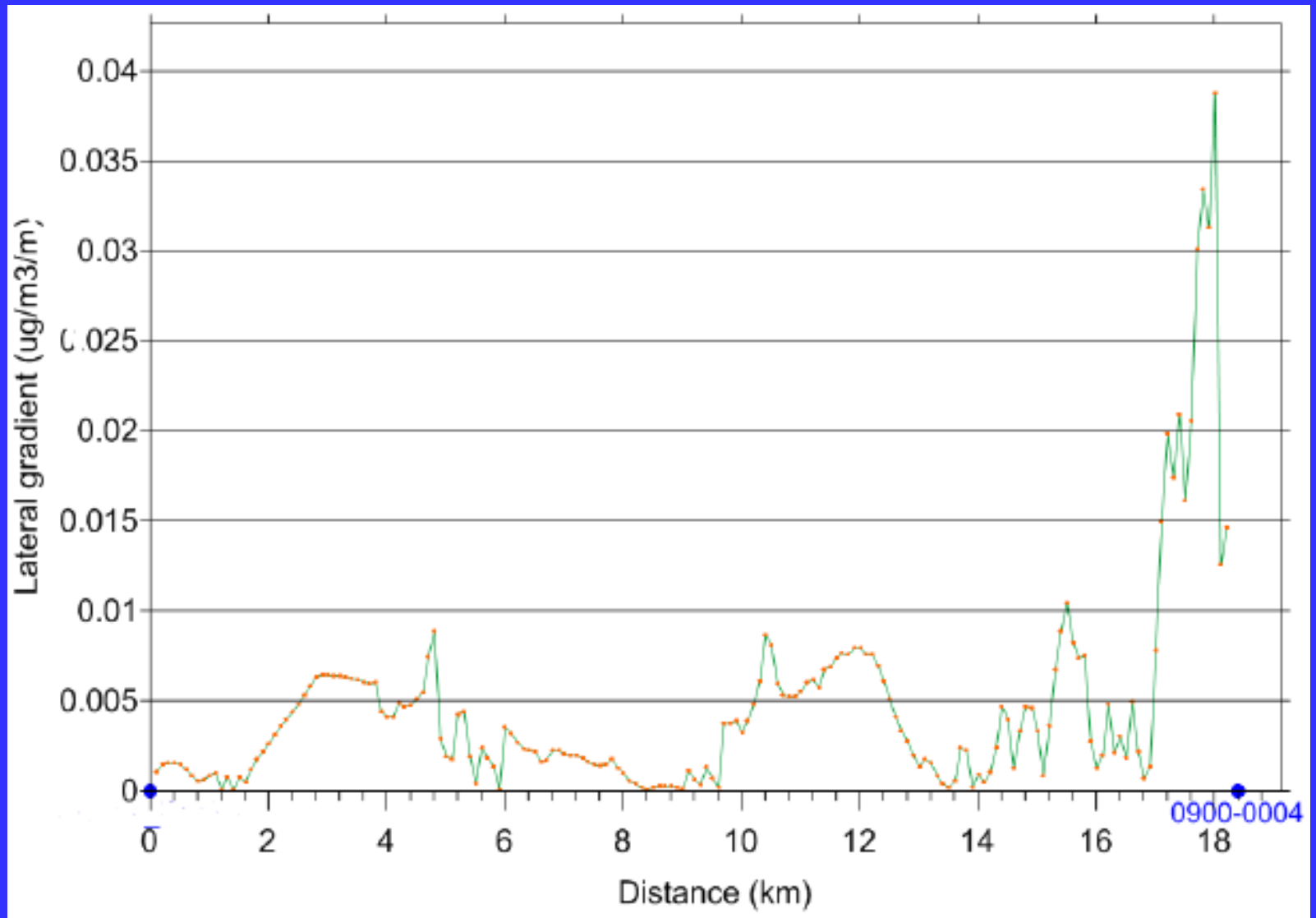
- Facilities within 10 km of SIA included in cumulative modeling
- 20D screening applied to facilities > 10 km
- Significant conc. gradient analysis applied to remaining facilities
  - Each facility's total emissions modeled through dominant stack
  - Three columns of receptors w/100m spacing
  - Longitudinal and Lateral gradient plotted for each candidate facility


Background Source
Project
UTM 17 North (km)
UTM 17 East (km)
3666
3665.5
3665
3664.5
3664
3663.5
3663
3662.5
3662
3661.5
3661
558
558.5
559
559.5
560
560.5
561
561.5
562
562.5
563

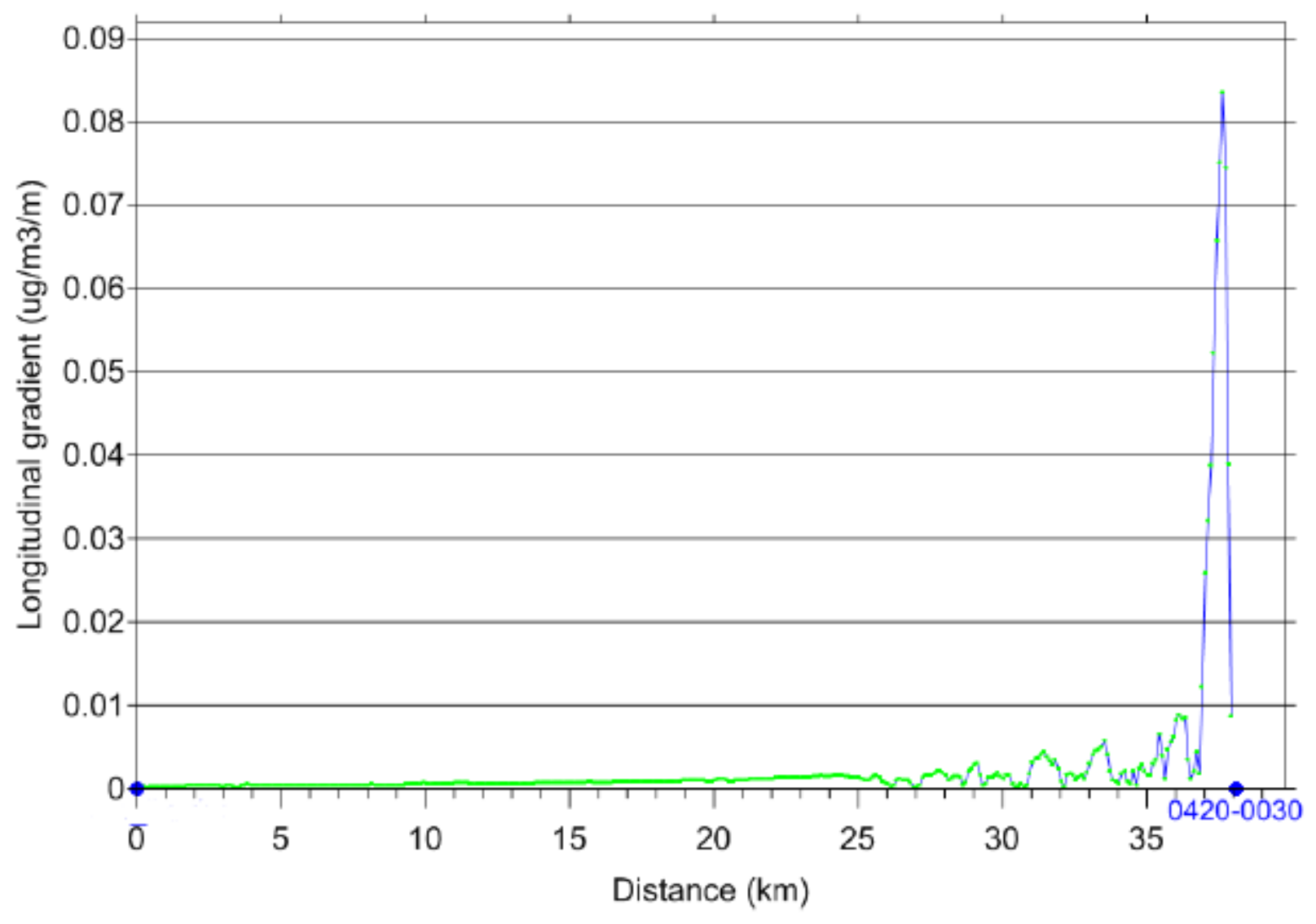
Longitudinal Gradient: Cement Facility



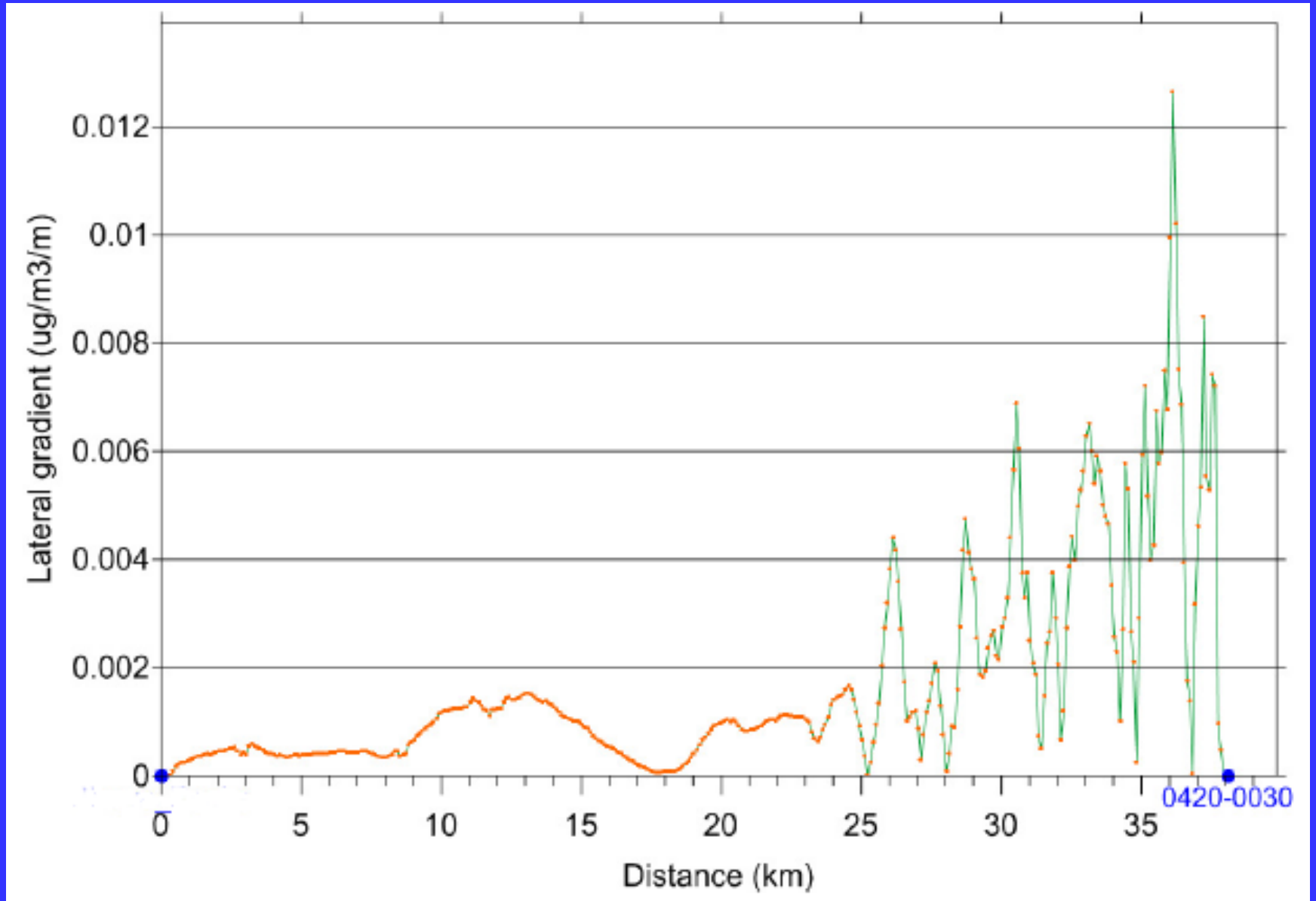
Lateral Gradient: Cement Facility



Longitudinal Gradient: Coal EGU



Lateral Gradient: Coal EGU



Facility	98th Percentile 1-Hr NO_2 Concentration at Project (ug/m3)
0420-0003	13.1
0420-0006	16.8
0420-0011	0.2
0420-0017	0.8
0420-0029	11.6
0420-0030	13.8
0420-0060	0.4
0420-0064	0.1
0420-0071	3.1
0420-0089	1.0
0560-0008	1.2
0560-0011	0.4
0560-0019	1.7
0560-0029	0.6
0560-0038	0.2
0560-0164	0.2
0560-0244	2.2
0560-0264	0.2
0740-0002	5.8
0900-0002	5.4
0900-0004	21.1
1860-0005	8.6
1860-0038	1.2

Max

NO_2 1-Hr Cumulative Modeling

- Cumulative modeling included:
  - Project facility-wide emissions
    - AERMOD and BLP used
  - Two background facilities within 10 km
  - Season and hour-of-day temporal monitoring data background
- Modeling passed at 84% of 1-hr NO_2 Standard

Questions?

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