Dispersion Modeling vs Reality: Tips for Plant Design

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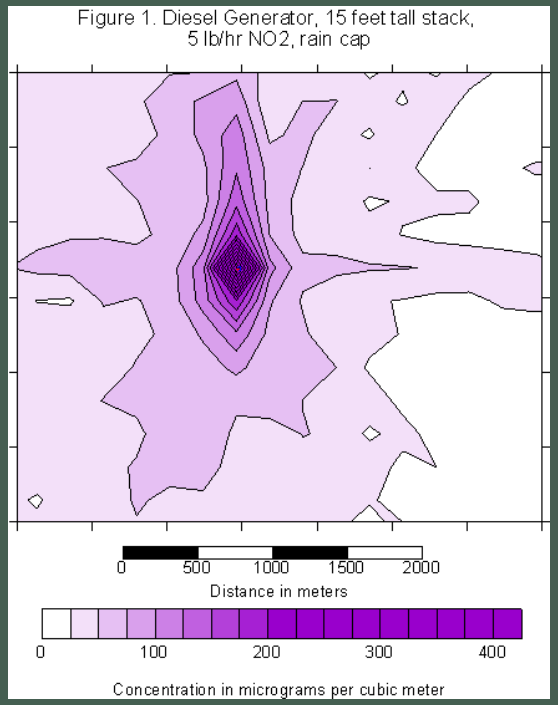
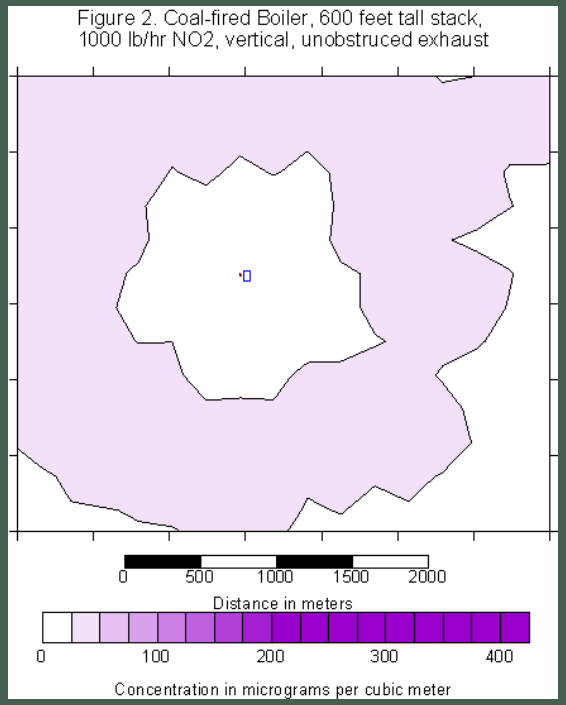
Agenda

- Stack design
- Dominant wind direction
- Downwash and stack heights
- Ambient air access
- Limit operation
- Early coordination with modeler

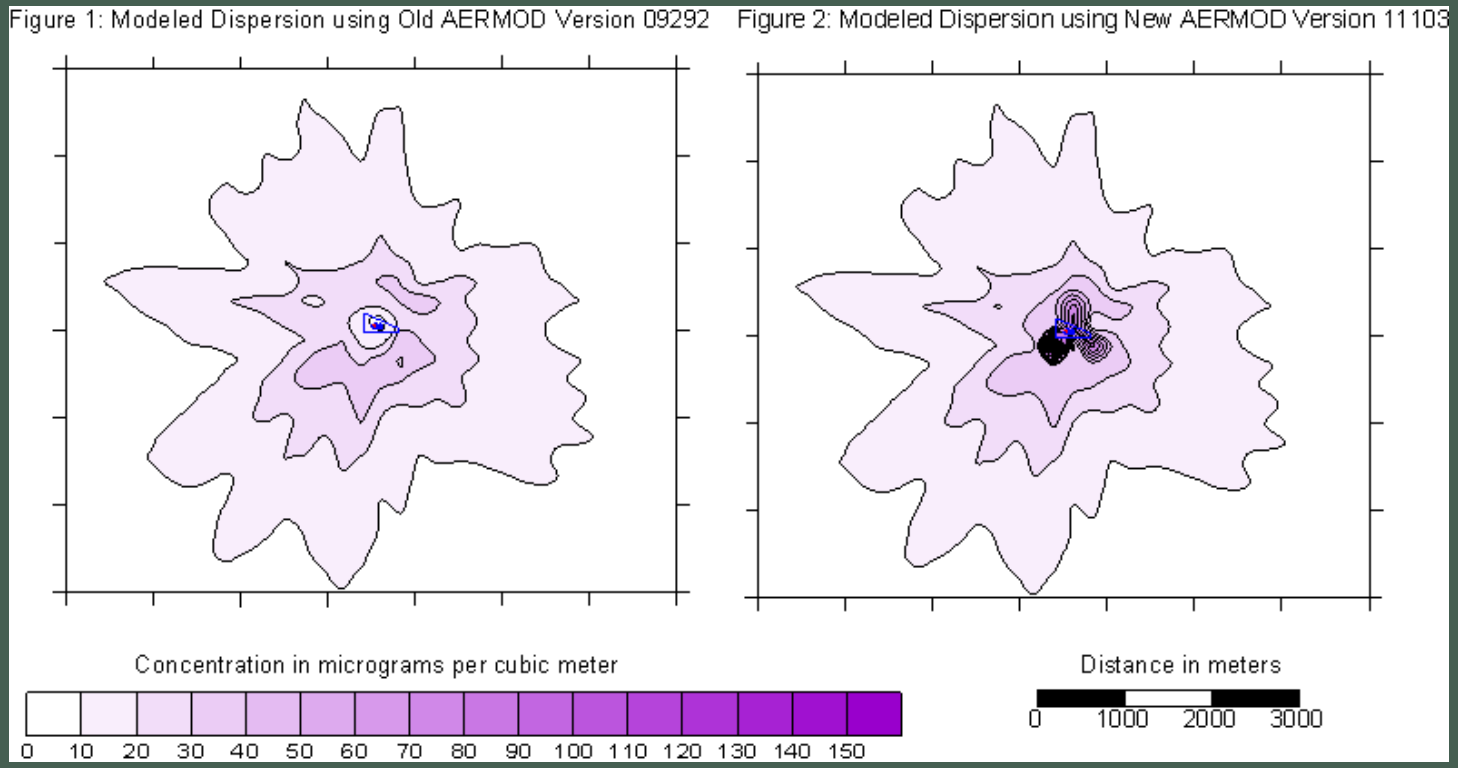


Emergency Generator



Coal-fired Boiler

More Than Just Emissions

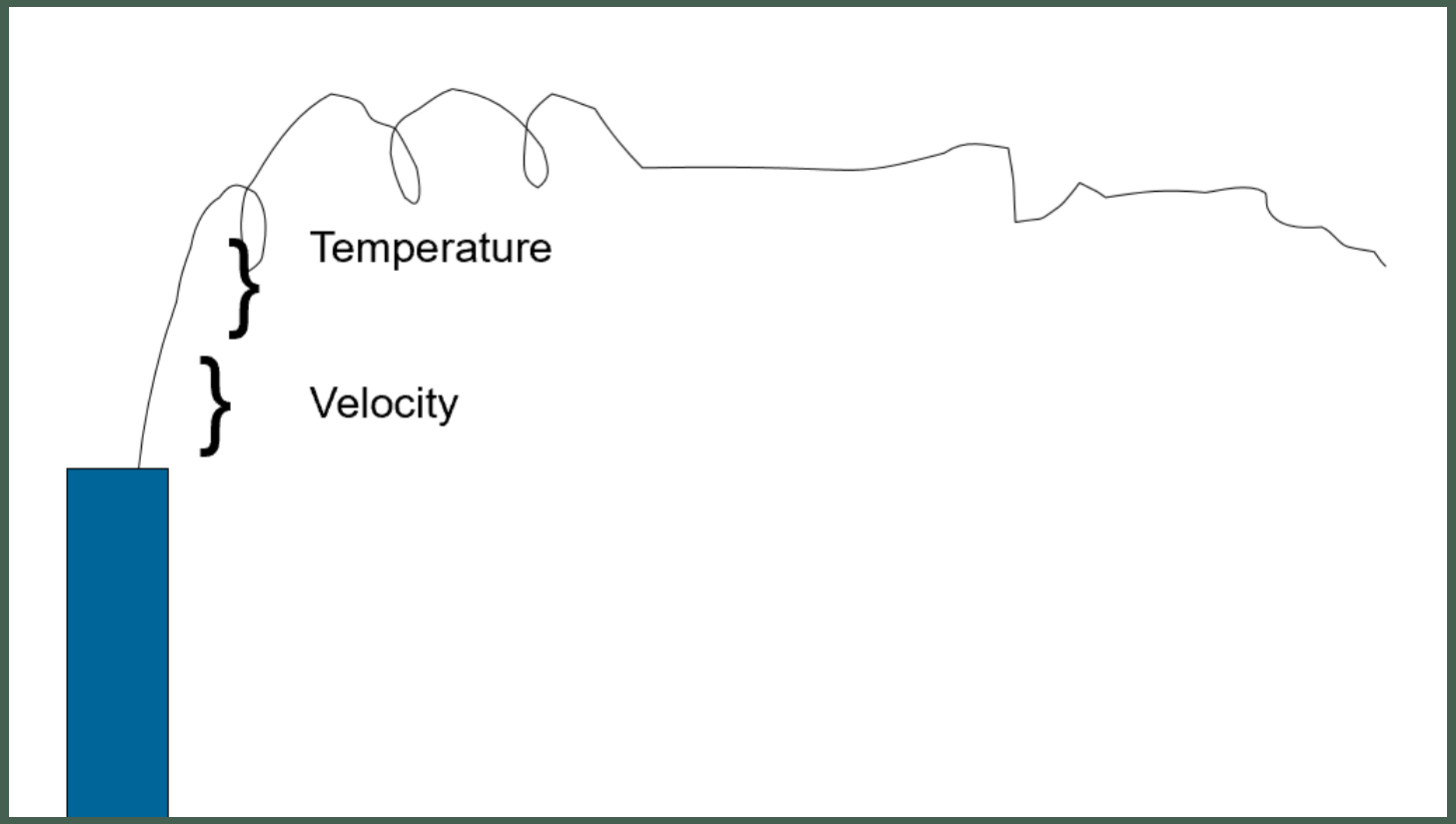


AERMOD Version Change

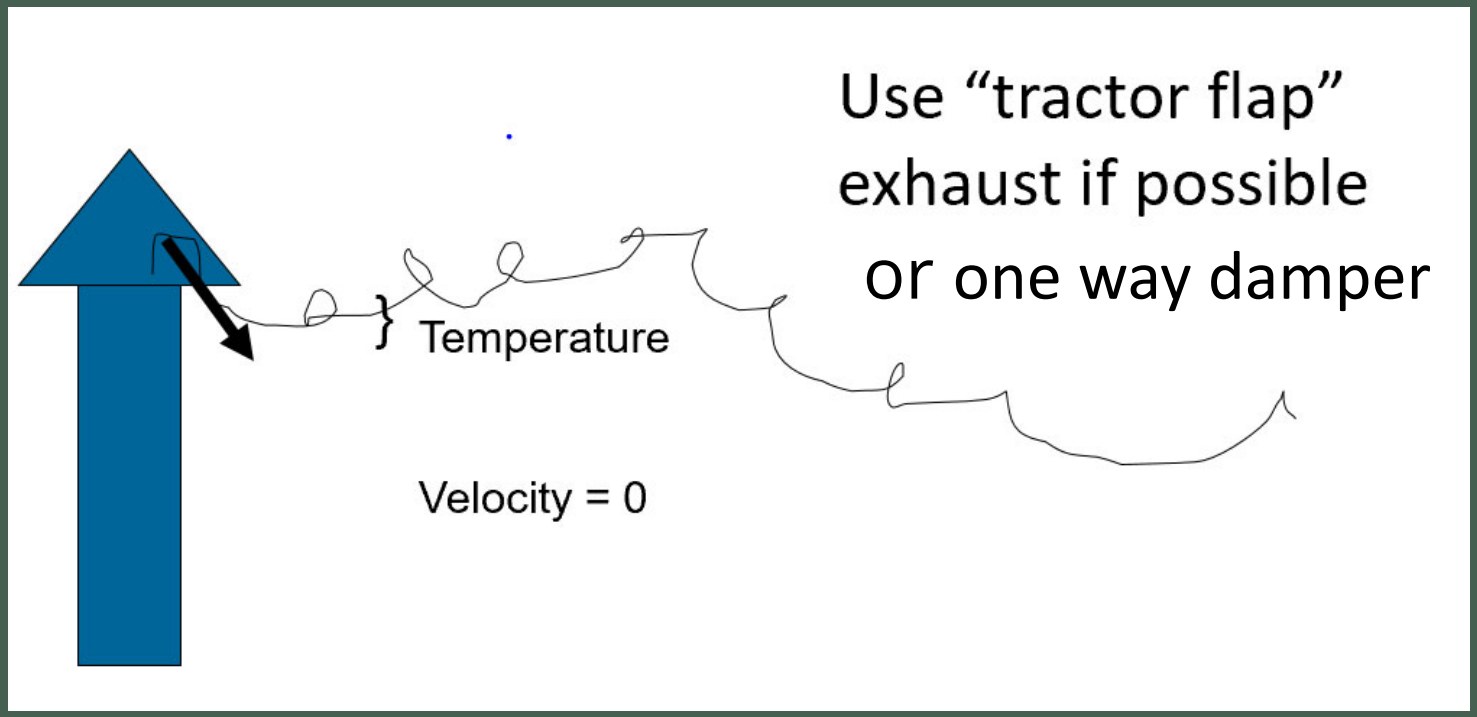
Change to downwash (BPIP-PRIME) algorithm

How Accurate Do Modeling Inputs Need to Be? (My Personal Tolerance Rules of Thumb)

- Height 1 foot or < 10%
- Diameter 6 inches or < 5%
- Velocity < 5%
- X,Y location 5 feet
- Elevation 1 feet
- Temperature 20°F
- Emissions 2%



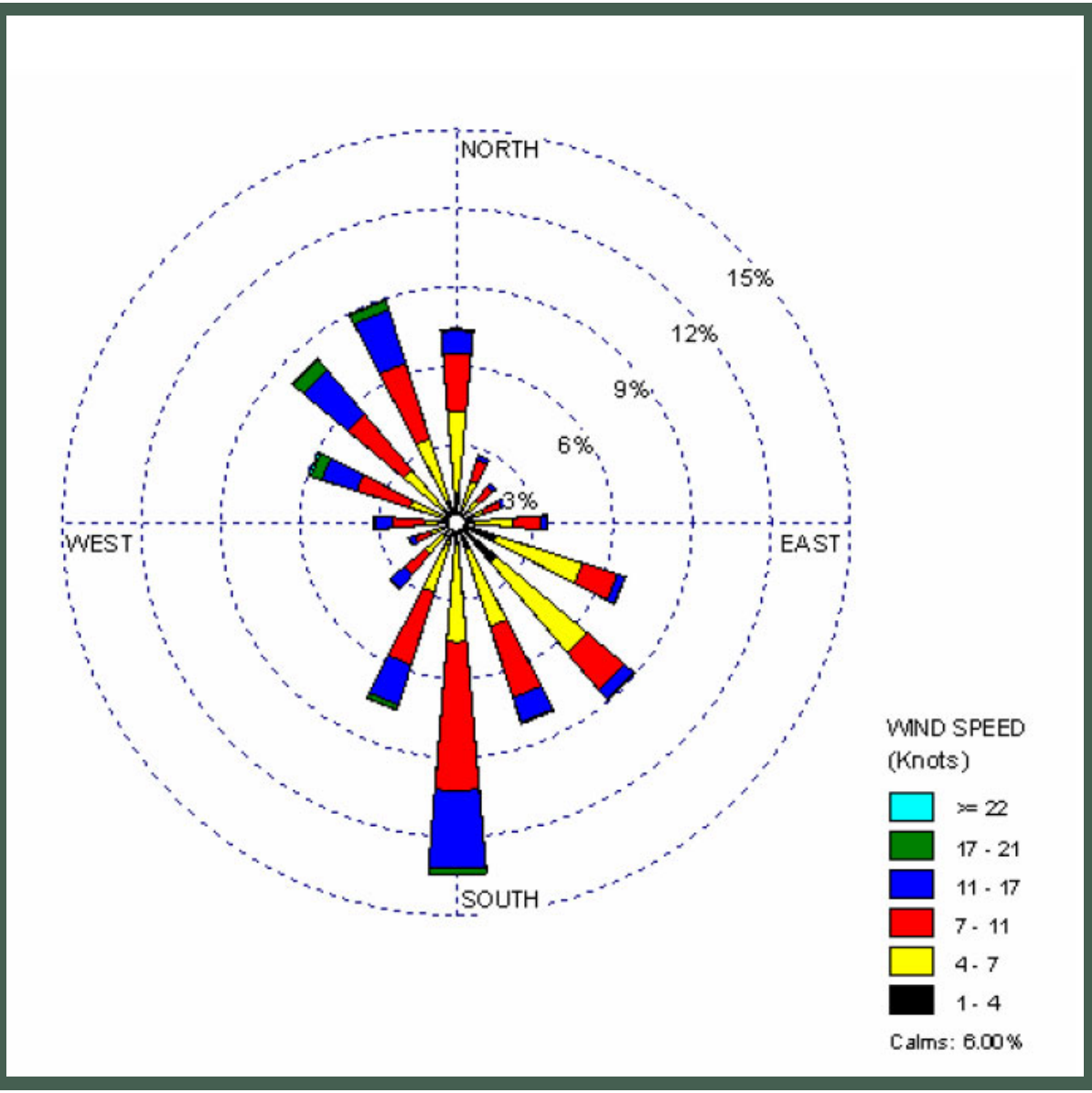
Initial Stack Dispersion

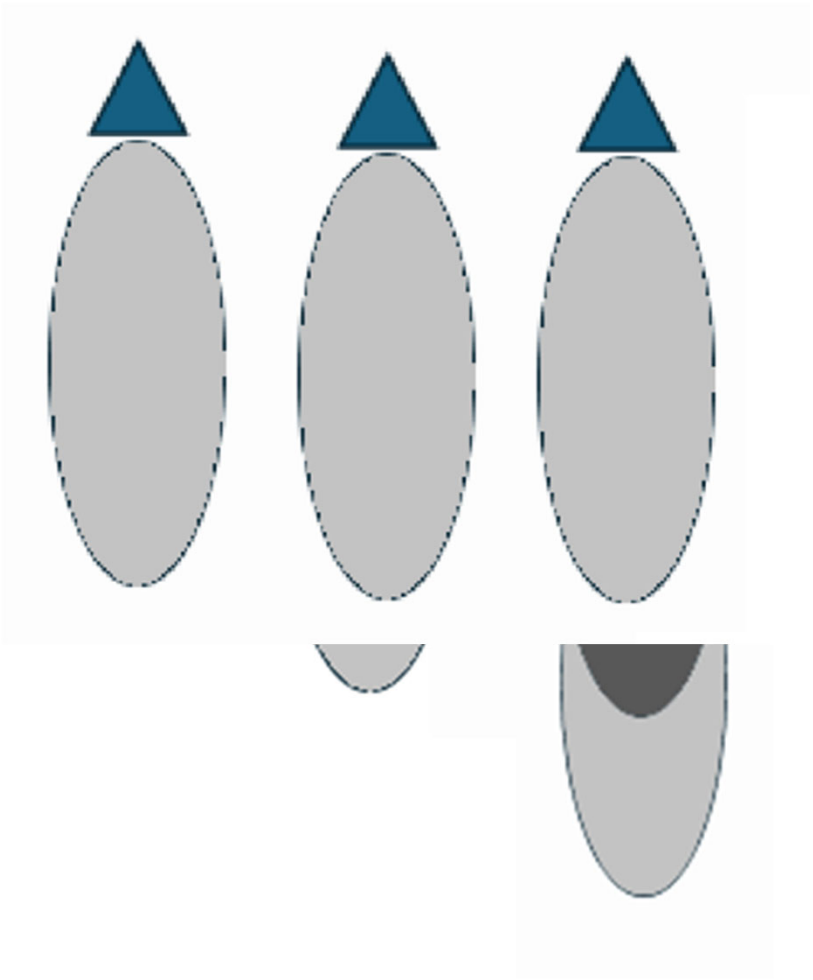


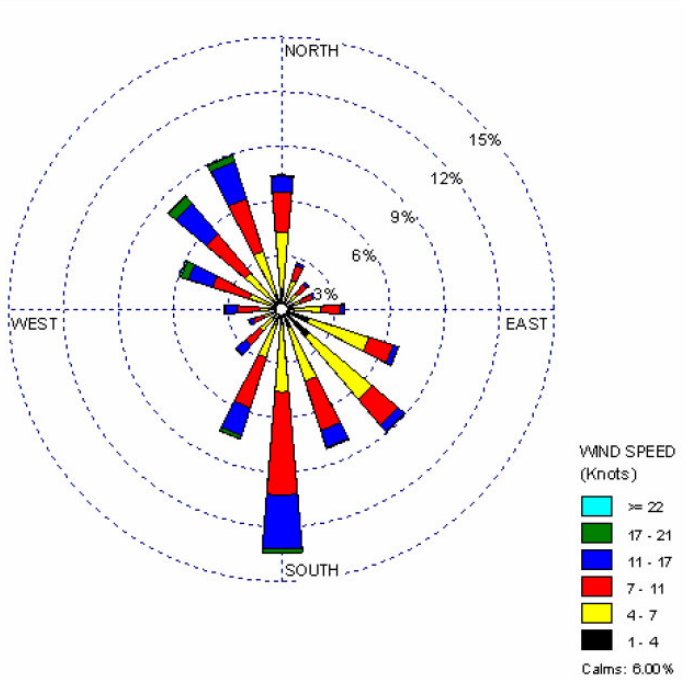
Rain Caps are Evil

Throttling the stack is not allowed

Windrose


NORTH
15%
12%
9%
6%
3%
WEST
EAST
SOUTH
WIND SPEED
(Knots)
>= 22
17 - 21
11 - 17
7 - 11
4 - 7
1 - 4
Calms: 6.00%

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WIND SPEED
(Knots)
>= 22
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4 - 7
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Calms: 6.00%

Examine the meteorological data to determine which time period is the high concentration

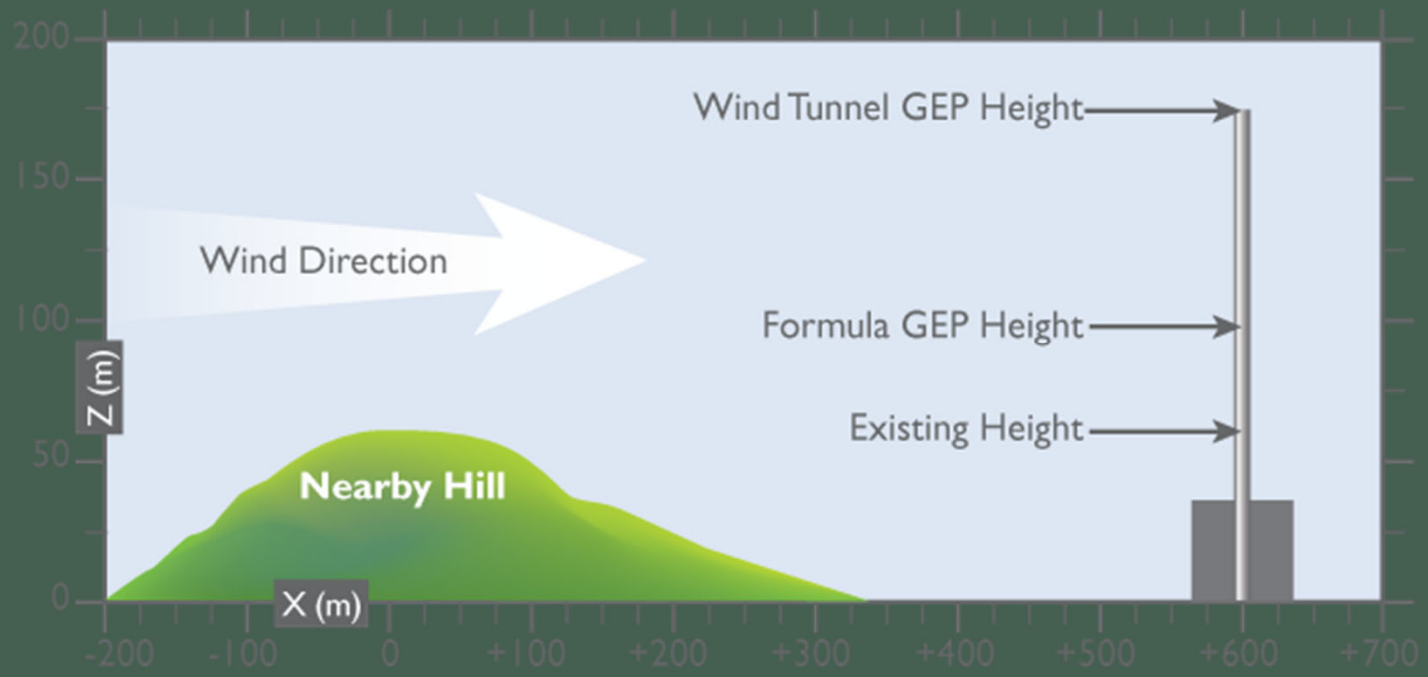
Hour	1	2	3
Wind Speed (m/s)	0	0	0
Wind Direction	0	0	0
Temperature (K)	275.9	276.4	274.9
Precip Code	0	0	0
Precip Rate (mm/hr)	0	0	0
Relative Humidity (%)	78	75	81
Cloud Cover (tenths)	0	0	0
Surface Roughness (m)	0.1494	0.1494	0.1494
Bowen Ratio	0.83	0.83	0.83
Albedo	1	1	1
Convective Mix Height (m)	-999	-999	-999
Mechanical Mix Height (m)	-999	-999	-999
Sensible Heat Flux (W/m2)	-999	-999	-999
Surface Friction Vel (m/s)	-9	-9	-9
Convective Vel Scale (m/s)	-9	-9	-9
Vert Potential Temp (K/m)	-9	-9	-9
Monin-Obukhov Length (m)	-99999	-99999	-99999
Wind Ref Height (m)	10	10	10
Temp Ref Height (m)	2	2	2
Station Pressure (mb)	949	950	950

“When” is the high concentration?

How High Does My Stack Need To Be? (My Personal Tolerance Rules of Thumb)

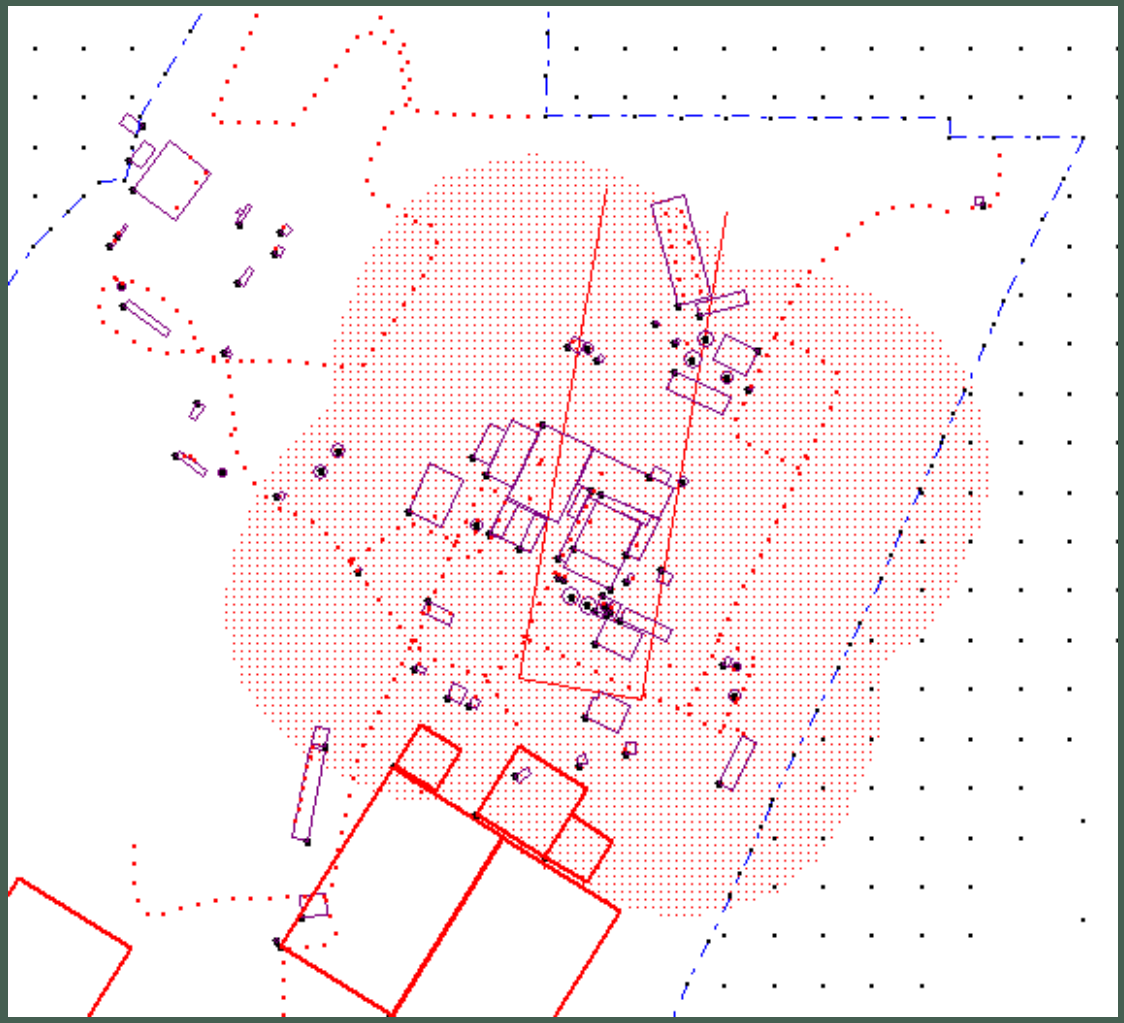
- At least 10 feet higher than the nearest, tallest building
  - The dominant structure might not be the building on which the stack is located
- NOT equal to GEP
  - Or you'll end up with overly tall stacks
- You can't find out the best height without modeling

Good Engineering Practice (GEP) stack height



- Maximum stack height allowed in model
- Roughly 2.5 times building height
- Dominant building can be a building on which the stack is not located
- BPIP-Prime algorithm

Downwash
“Shadow”



Receptors

- Fence line
  - Physical barrier
  - Not the same as the property line
- Keep sources as far from fence as possible
- Ambient Air defined in 40 CFR 50.1(e) as
  - “that portion of the atmosphere, external to buildings, to which the general public has access”

What is Ambient Air?

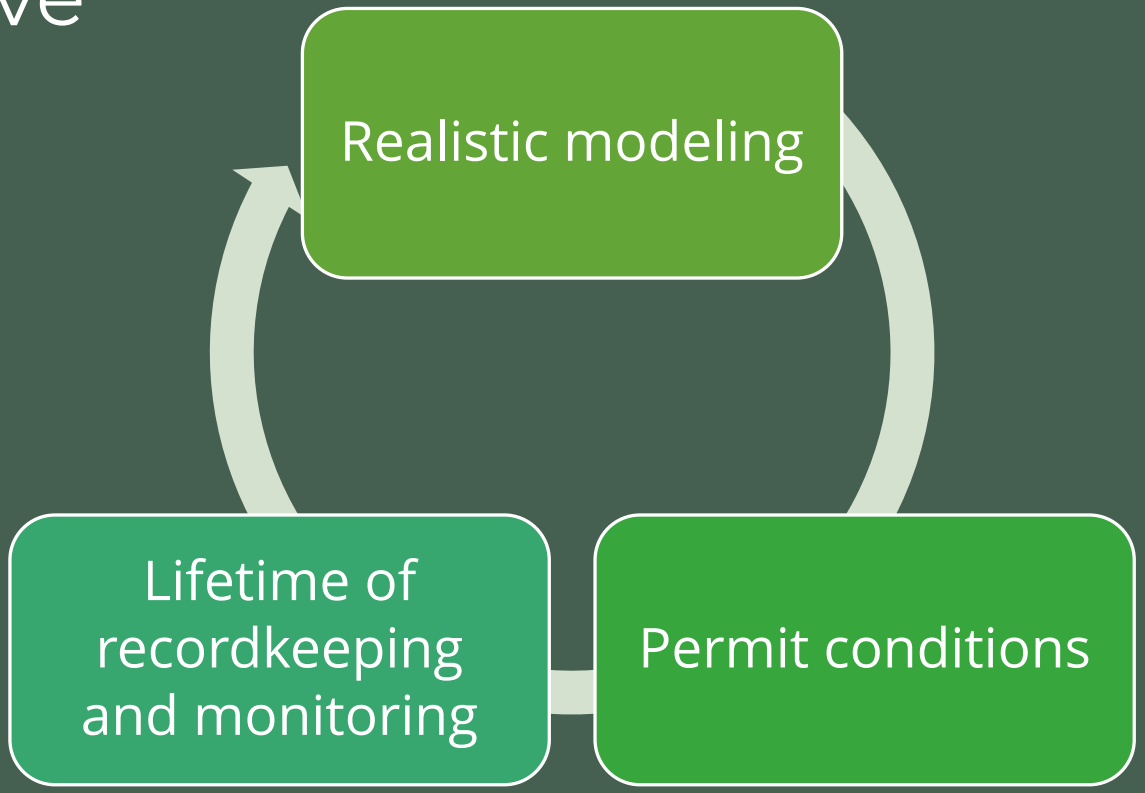
Ambient Air

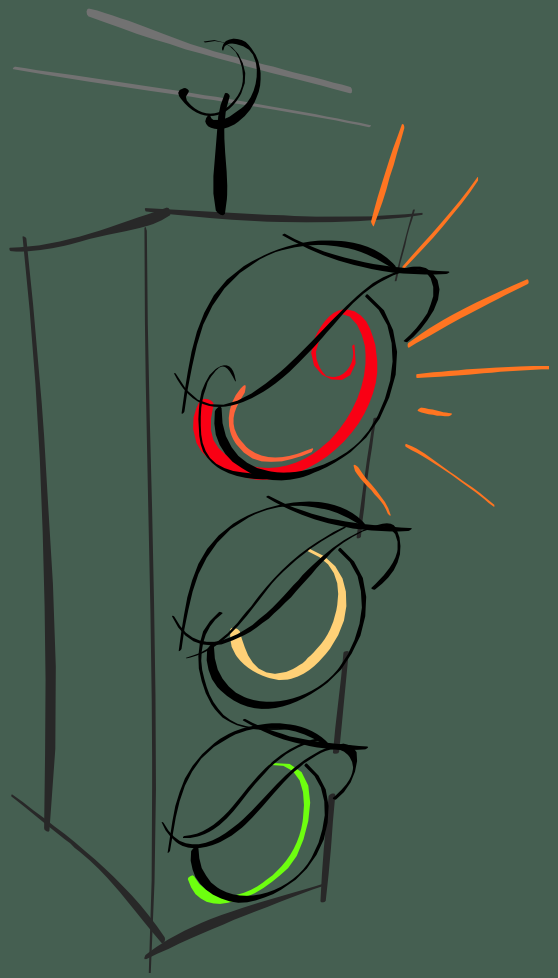
- Accessible to the general public
- Three-strand barb-wire fence and “no trespassing” signs
- Roads where access is not controlled

Not Ambient Air

- Unfenced boundary along a river that is clearly posted and regularly patrolled by security guards
- A fence or physical barrier prevents public from entering
- Fenced pieces of plant property, even if noncontiguous
- Privately-owned space

Start Conservative





Limiting the Operation of Sources

- Wind speed > threshold (piles)
- Hour of day
  - Emergency equipment
- Season
- Month
- Day of week
- Combination of the above

Each limit becomes a permit condition

Make Full Use of Modeling Options

- Ambient ratio method
- Beta options
- Intermittent operation policy
- Scrutinize provided data for neighboring plants
  - Work with neighbors
- Add controls to avoid modeling or to stay under significance levels

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Summary

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