



Assessment of the Biosecurity of Animal Mortality Size Reduction Using Horizontal Grinders Prior to On-Farm Composting

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African Swine Fever

- \$40 Billion Industry in US
- Hemorrhagic fever (similar to Ebola virus) but only affects pigs (i.e., humans can't catch it)
- Highly contagious to pigs
- Viral disease
 - Double enveloped virus
 - High to low pathogenic strains
- Transmission
 - Direct contact with bodily fluids
 - Ingestion of contaminated pork products
 - Feral swine
 - Clothing, vehicles, equipment
 - Biological transport by soft ticks and other insects





African Swine Fever Outbreak Mitigation Efforts

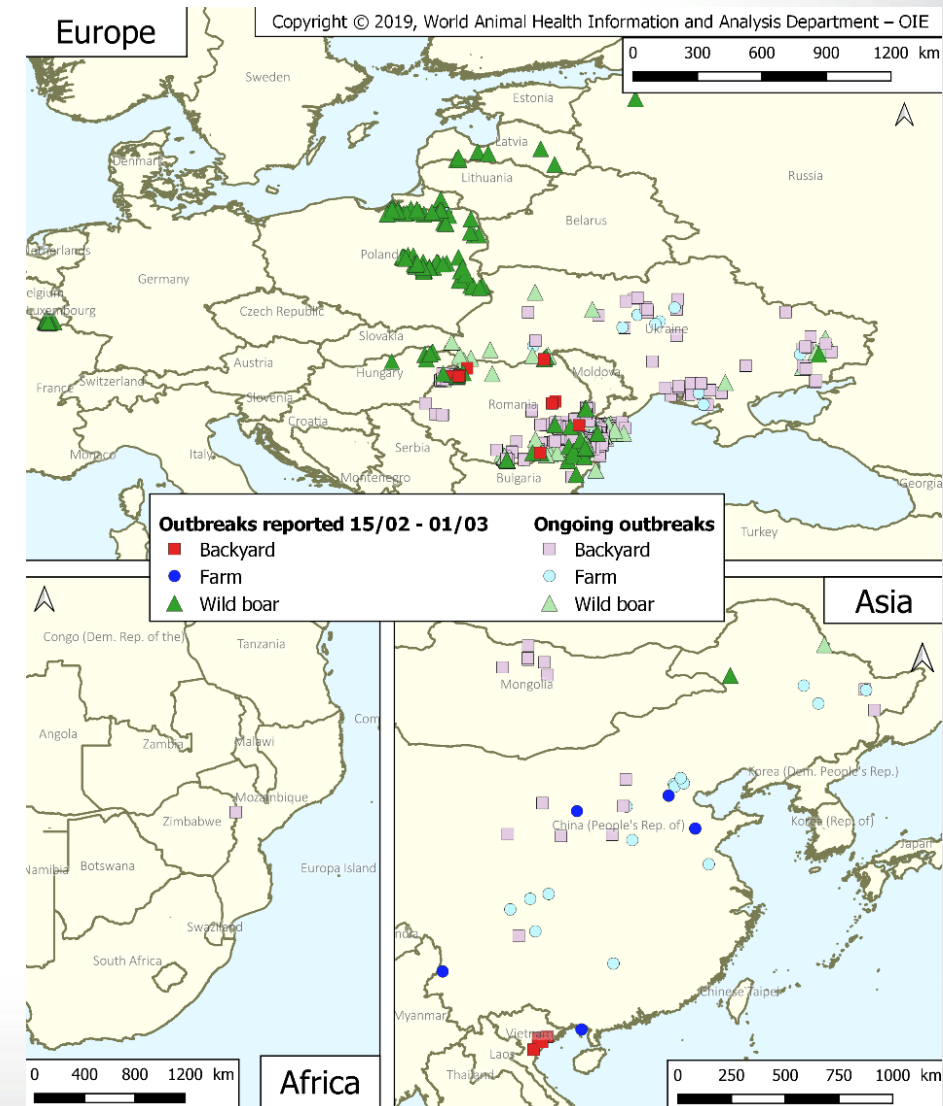
- Rapid depopulation
- May include feral swine in impacted area
- Controlled swine movement (~1 million pigs/day)
- Mortality management
- Inactivation of virus
 - 70 °C (160 °F) for 30 minutes
 - Hydrogen peroxide
 - Virkon S
 - Peracetic acid
 - Citric acid
 - Household bleach





Current Outbreak

- Started in Eastern Europe
- Spread across Asia and into Belgium
- Serious concern from USDA/APHIS, states, and pork industry of potential outbreak in U.S.
- EPA is support agency to USDA agricultural depopulation, decontamination, and disposal mission under ESF #11
- NHSRC currently has an IA with USDA to evaluate grinding as pre-treatment for carcass disposal
- Joint group (APHIS, VA DEQ, NC DEQ, NC Dept. Ag, EPA, industry) focused on mortality management and ASF





Mortality Management Approaches

- Potential need for 3 million lb/day disposal capacity
- Safe, on-farm management is preferred; composting is popular management technology in NC and other states
- Composting whole large animals can take up to a year; grinding can reduce the time to a month
- Grinding equipment such as that used in rendering plants has high capacity but limited availability and long lead time
- Evaluation of horizontal grinders (big industrial scale wood chippers) to grind carcasses, along with a carbon source, prior to composting
 - Evaluation of biosecurity of grinding operations





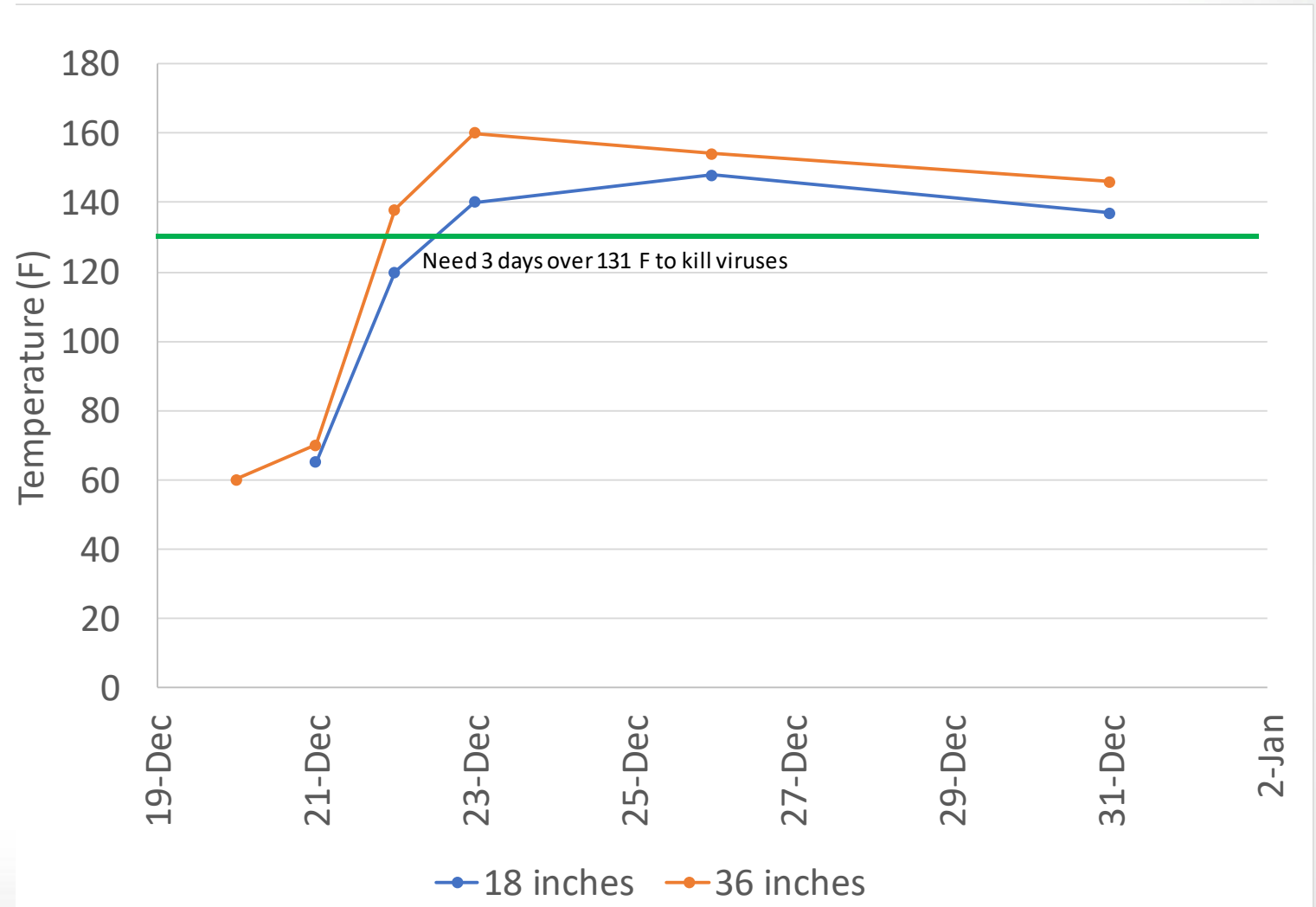
Small-Scale Pre-Test

- Knowns

- Ground up pigs with carbon source compost very well
- 131 °F for 3 days = target conditions for virus inactivation*

- Unknowns

- Can grinders be used off the shelf?
- Will virus particles escape the process?



Data from ground pig composting test in VA, Dec 2018

*40 CFR Part 503



EPA Objectives

- Assess biosecurity of grinding operations
 - Focus on potential air emissions of viral particles
 - Modeling to support development of USDA/APHIS SOP
- Contributions to APHIS Standard Operating Procedure (SOP)
 - Distance from fenceline to set up grinding operations
 - Maximum wind speed for go/no go decision
 - Run several scenarios based on projected conditions in Iowa and NC





Approach – Data Acquired

- Measure emissions from grinder for emission factor calculation
 - Position air sampling devices as close to end of conveyor where visible particles are being entrained into air
 - High Volume (1000 L/min) PM₁₀ sampler (catch PM < 10 μm)
 - Dry Filter Unit (DFU) (900 L/min) sampler (catch total filterable PM)
 - Emission factor in units of ng pig DNA/kg processed pigs
- Perimeter air monitoring
 - Hi Volume PM₁₀ sampler/DFU paired
 - Number of samplers limited to available equipment
- Meteorological data from the Horticultural Research Center





Test Layout August 2019

Windrow

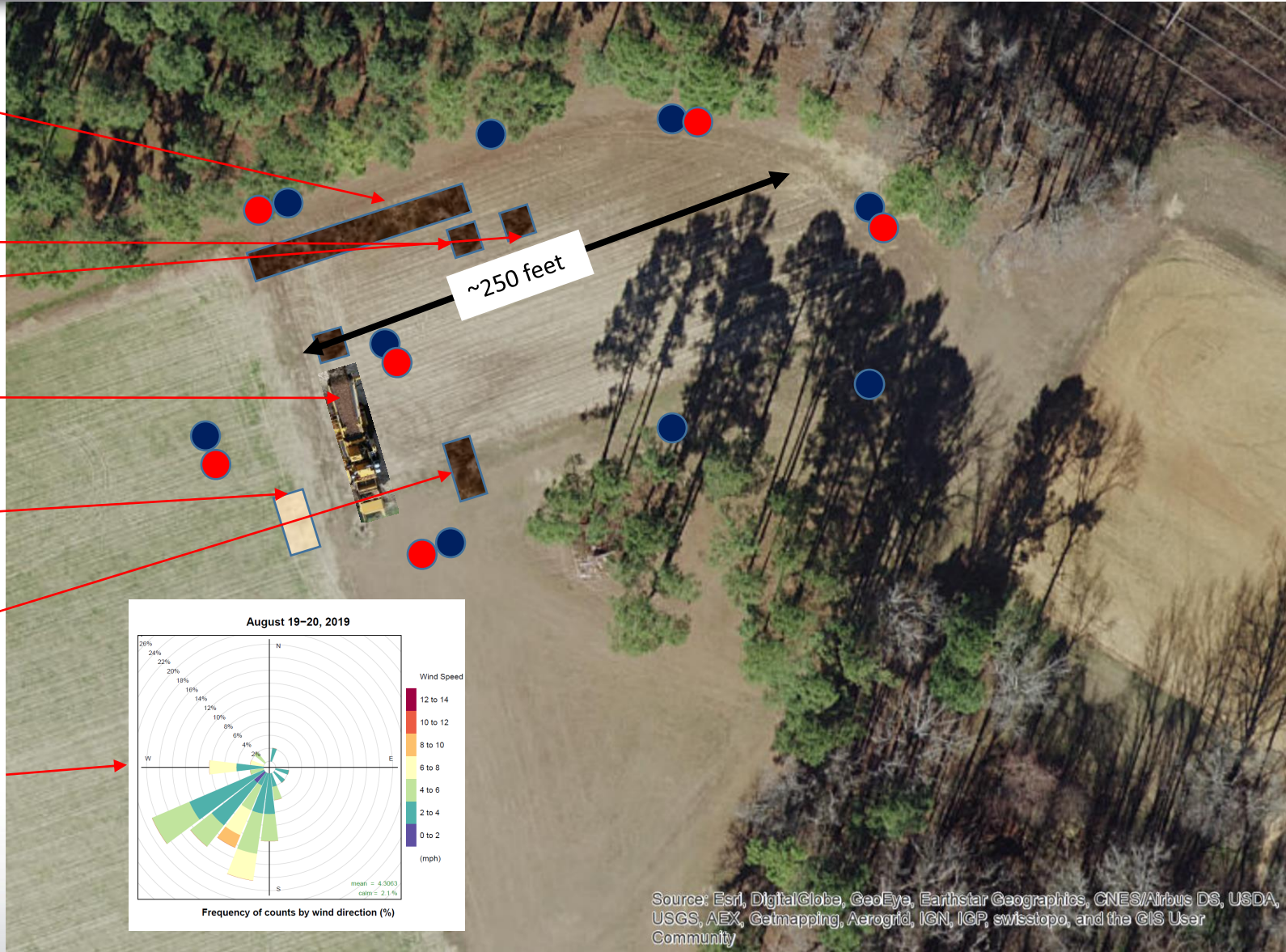
AGB Test Locations

Grinder

Carcass Material

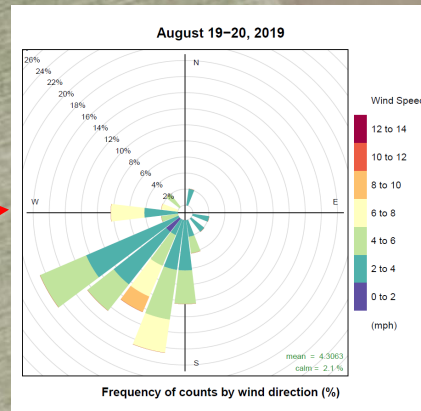
Carbon

August Wind Roses



● EPA DFU Sampling Locations

● EPA PM-10 Sampling Locations





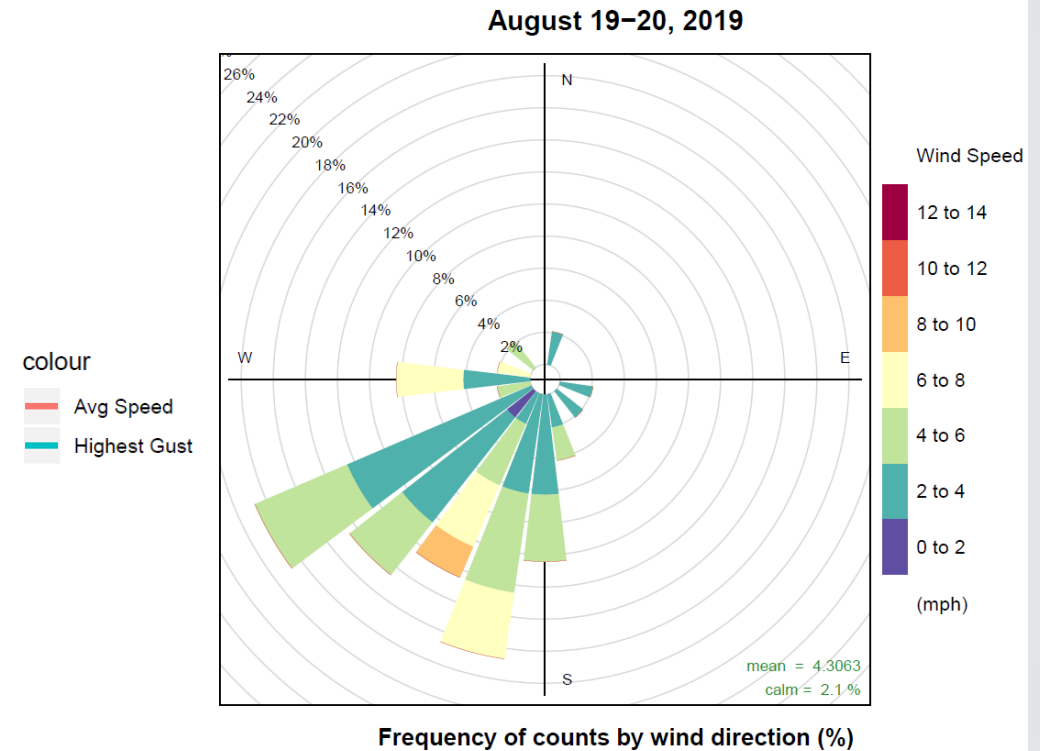
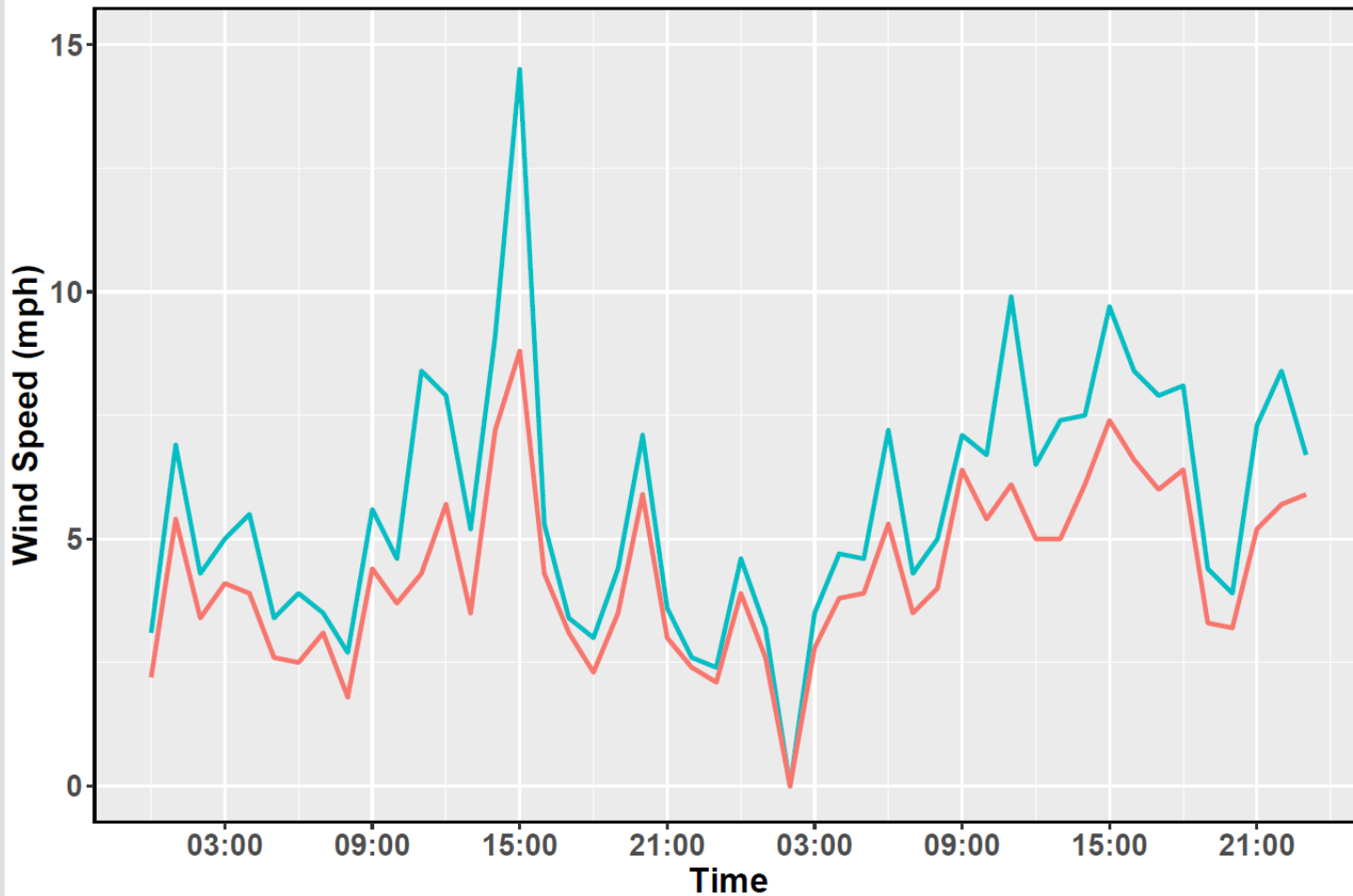
Approach – Sampling Schedule

- February 21, 2019
 - Sampling with DFUs to test porcine DNA assay
- August 19, 2019
 - Background Sampling (1500-1600)
- August 20, 2019
 - Perimeter Sampling (0930-1600)
 - Grinder sampling test 1 (1035-1105)
 - Grinder sampling test 2 (1348-1425)
 - Downwind post-test sampling (1600-1700)





Meteorological Conditions 8/19 – 8/20



Limitations

- Were not able to acquire samples during pressure washing of grinder
- Not feasible to catch and analyze entire effluent from grinder
- Unable to sample PM emissions isokinetically like from a stack; samples may be biased towards smaller or larger particles



Uninvited Observers

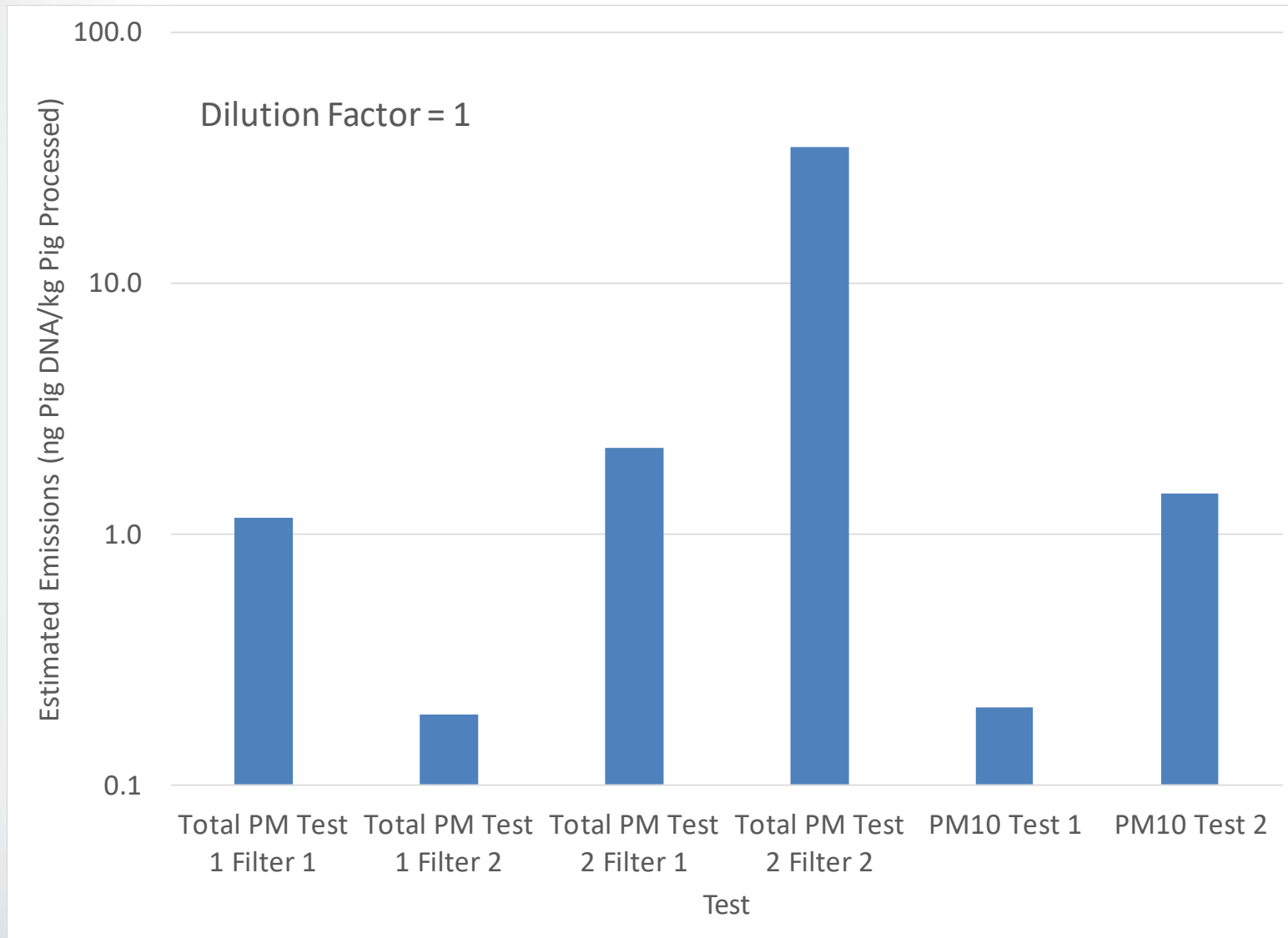


August 20, 2019 Test Description

- Test 1
 - 11,325 kg of mortalities processed in 30 minutes
 - 22,650 kg/hr (1.2 million lb/day)
- Test 2
 - 15,402 kg of mortalities processed in 37 minutes
 - 24,650 kg/hr (1.3 million lb/day)
- DFU and High Volume PM₁₀ Sampler Co-Located at Grinder
- DFU at 8 perimeter locations
- High Volume PM₁₀ Sampler Co-Located with DFU at 5 Locations



Estimating Emission Factor* (ng pig DNA/kg Pig Mortality Processed)

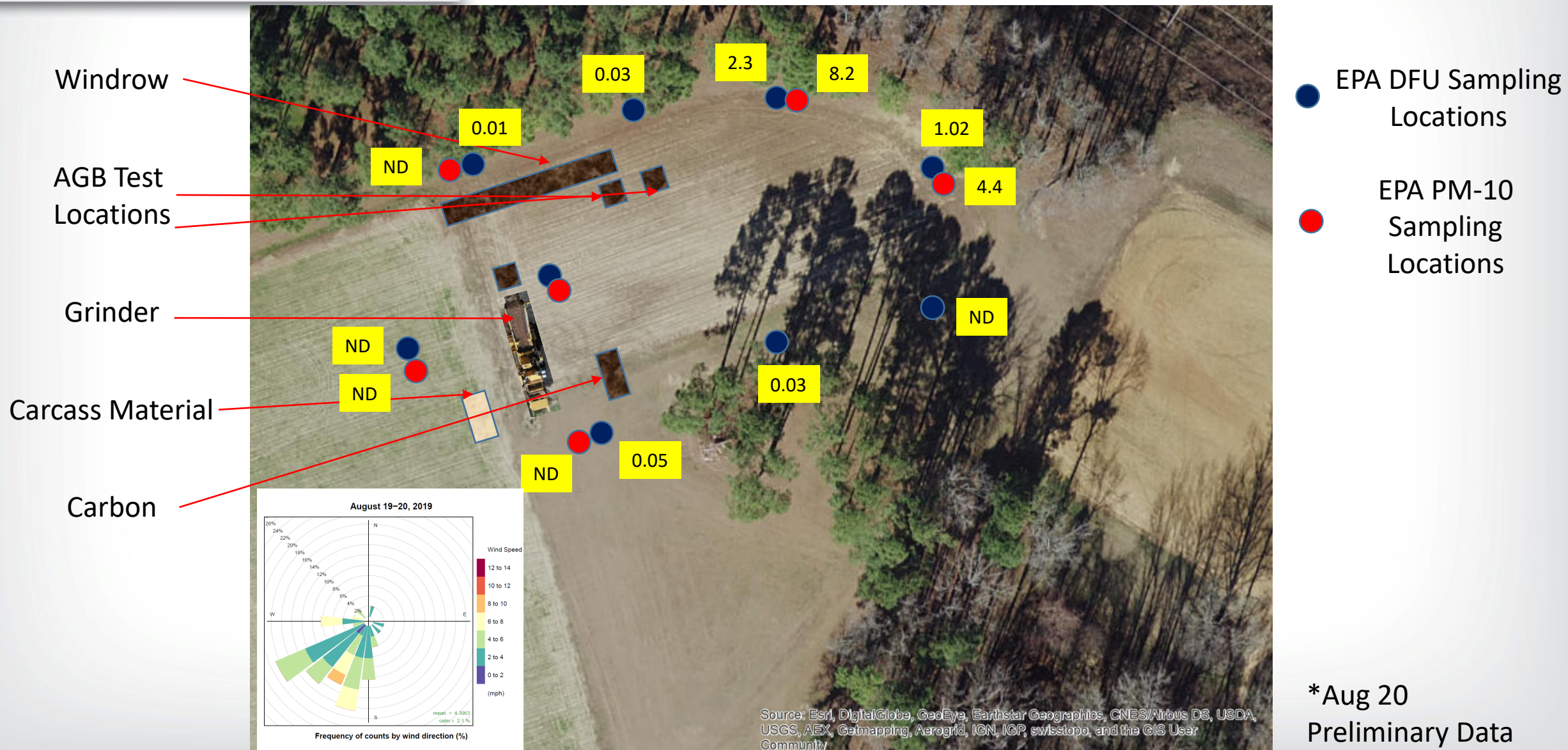


From initial observations, it appears that between 8 and 30% of the measured particulate was emitted as PM10 as measured at the conveyor belt outlet

*Aug 20 Preliminary Data



Perimeter Samples* ng Pig DNA/m³





Results from August 20 Test

- It appears that significant fractions of the particles emitted by grinding operation are in the PM_{10} size fraction.
- Perimeter samples are consistent with that observation
- Perimeter sample concentrations are consistent with wind direction

- Big question – what is infectious dose and how can USDA include that parameter in these decisions?



Next Steps

- Need to use air modeling to compare perimeter samples with emission factor estimates in order to estimate dilution factor
- Air modeling can be used to estimate fence line concentrations at various distances from grinding operation
- Air modeling can be used to estimate wind speeds to determine go/no go decisions to commence grinding





Disclaimer

DISCLAIMER: The U.S. Environmental Protection Agency through its Office of Research and Development collaborated in the research described here under Interagency Agreement 18-9200-0497 with USDA/APHIS. It has been subjected to the Agency's review and has been approved for publication. Note that approval does not signify that the contents necessarily reflect the views of the Agency. Mention of trade names, products, or services does not convey official EPA approval, endorsement, or recommendation.





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