Wind Turbine Informational Meeting August 20, 2019 @ 2pm, North Annex

NOAA/NWS Q & A

Jessica Schultz, Radar Program Manager, Radar Operations Center, Norman Oklahoma and James Alton, Warning Coordination Meteorologist, NWS of Lincoln, IL– on conference call to answer questions

Local NWS: Rick Shanklin, Acting Meteorologist-in-charge/Warning Coordination Meteorologist; Pat Spoden, Science and Operations Officer, NWS of Paducah, KY; Ryan Sharp, Lead Forecaster, NWS of Louisville, KY

Have you ever witnessed the interference of a Doppler signal by a wind farm? Examples
Jessica: yes, issue all over the country. Look at radar app on phone Dodge City, TX and Lincoln, IL
What is the likelihood of interference from a 590' turbine farm for a Doppler system?
Jessica: very likely, depending on how close the turbine is to the radar; 590' is industry standard (approximately 180 meters), industry is typically using 180 meters or higher. Depending on how close the turbine is to the radar that will increase the interference and the concerns to the data
Kent Scheller, USI Professor of Physics: asks the dependence of distance, NOAA screening tool, as well as, NWS indicates areas in Red, Orange, Yellow, and Green. Can you comment the likely hood of and severity of those zones as presented to us on your website?
Jessica: The Red Zones – 4 kl (2 ½ miles) radius from Doppler radar site is NO BUILD zone, NWS highly discourages developers from building in first 4kl; orange zone (10-11 miles from Doppler radar site) is considered moderate to high imp0act zones; yellow zone is considered low to moderate impact zone; and green is considered low to minimal impact zone; anything in the red or orange zone have high concerns
Scheller: Asks, so anything within the red and orange zones, radar would have difficulty with?
Jessica: level of severity will increase the closer it is to radar. I wouldn't say if its outside that radius it wouldn't impact, it going to be lesser impact if it were closer
Scheller: So even outside those radii you would till witness some kind of interference?
Jessica: yes
Relative effects of a wind farm in the red, orange, yellow, green zones?
Have you ever given a maximum height recommendation for a wind farm to avoid interference of a Doppler? (Rush Co-300')
Jessica: Its part of the analysis process as well. We can talk to developers about potentially lowering height to reduce impact through the radar, but it is highly dependent on terrain and location of where the developers planning on putting the turbines. With this particular project, since we have not received project information from developer, we cannot speak of any specifics
Have you ever given a recommendation for a safe distance from a Doppler site for wind farm installations?
Jessica: distance at which it has minimal impact on data, answer yes. When a developer submits the project to us for analyses, we provide them with maps and other information how far the turbines would need to be placed for it to be I n green zone; basically low to minimal impact. Part of our analysis process is we tell developers what type of impact we're expecting and where they can locate the turbines of least impact as possible

Have you ever done an NTIA analysis on a 590' turbine?
Jessica yes, large majority of projects we look at are 590' or taller. Since October, we have looked at over 200 projects across the country this height or taller.
Scheller: Have you been asked to do NTIA analysis for Posey or Gibson County?
Jessica: No
Has the presence of wind turbines generated false tornado alerts in your Doppler algorithms?
Jessica: Yes, the contaminants or clutter produced by turbine data do cause algorithms, not just tornado algorithms but other algorithms too.
They provide false alerts. One thing to make sure everyone understands is the main issue with turbines is that blades spin, there is not presently a way to address the spinning clutter or removing clutter in processing of radar data. So we do not have a way to remove turbine data. The radar interprets the movement of the blades as being real weather, so it does cause false alarms in our algorithms.
Are there any mechanisms (hardware or software) to eliminate the effects of a wind farm on a Doppler system?
Jessica: no research that is viable to provide any type of solution to remove that type of clutter from data at the moment in time. Once the turbines are built its going to be in data. There is no way around it. We do have some techniques using dual polarization of radar that allows to remove some of those effects from things like precipitation measurements but really main concern is the velocity data-important to storm detection & tornado detection, presently no way to remove clutter from data
Nick Adams (Vanderburgh): how are you quantifying that data?
Jessica: clarifies, how does this affect our abilities to detect tornados? James Alton can speak of IL tornado from December
James Alton: to answer question...the blades are spinning, the warning forecaster has to be aware and know where the blades are and farm. NWS has an overlay in the software that displays radar data in system. It outlines geographic area of where complete wind farm is. Speaking of Dec. 1, 2018 Taylorsville, IL – supercell had a history of producing tornados, as we noticed that cell moving toward wind farm (height of blade only went up 500') did not go up to 600'. Blades in wind farm only affected the yellow area, the tip of the blade was in yellow area denoting that tip of blade is impacting second elevation slice we're looking at. Since we knew where farm was, knew storm was moving towards that area, warning forecaster fast to make decision, keep warning in place because data is corrupted; cannot tell if rotation in storm so kept warning going. Forecaster looked at data knew where wind farm was, kept warning in place. Three factors to leave warning in place: was night, no spotters, history of supercell. Forecaster had difficulty determining what was going on inside storm, radar doesn't know what is going on over wind farm, so NWS uses weather spotters in area
Scheller: so at night you're really blind?
James Alton: to a certain degree, yes, but not completely yes. Forecaster has to know area, and has to know storm history, warn forecaster can err on side of caution and go with best judgement. Unfortunately, because blades are spinning, NWS doesn't get good velocity data not just in first or second slice, - it can go even higher because of the turbulence the wind farm itself creates because of spinning lades in the area.
Posey Co: what if blades are shut down if storm approaching?

Jessica: shutting off blades is what NWS calls "CURTAIL AGREEMENT". If developer is willing to be participant in that they must sign a legally binding agreement that they will shut down turbines in the event of severe weather in the area. Then that has the potential to greatly reduce the concerns in the velocity data

Nick Adams: do the turbines have a brake in place to keep them from spinning; what keeps "mother nature" from spinning blades?

Posey Co: they have brake and clutch

Scheller: How far from designated orange area will wind farm effect signal

Jessica: it's about 25-30 miles' average for most down radial from wind farm. How much data will have some degree of corruption, also depends on how tall and how close to radar. The taller they are and the closer they are to the radar that down range will be

Posey Co: At the time this Doppler was started we were under Paducah control, about 3 years later they decided we didn't have good enough coverage so they came up with Owensville location. Would Paducah over shadow, could it pick through this being that far away?

Rick Shanklin: meeting back then was called Modernization Transition.. SRN International with NWS determined radar location to cover under 4000'. Study done to determine best location to "focused optimal sighting area"

Have you ever been unable to detect a tornado signal due to presence of a wind farm in proximity of a Doppler installation?

What legal resource do you have in case of ta known interference of a Doppler signal by a wind farm?

Jessica: there is no legal recourse from NOAA

Terry Hedges: NOAA has no jurisdiction over developer to prevent turbines from anything?

Jessica: that is correct

What recommendations prior to installation have you made to wind farm developers in an effort minimize interference of a Doppler systems by a wind farm?

Jessica: we recommend lowering height of turbines, placing turbines farther away from radar, "CURTAIL AGREEMENT", encouraging developers to align turbines radially with the radar – line turbines up as much as possible so they can contaminate as little spread of radar data as possible.

Scheller: so recommendations are not legally binding?

Jessica: correct. One "CURTAIL AGREEMENT" legally binding and have yet to find a developer willing to sign agreement

Can you describe to us the signal issues encountered during tornadic events in Taylorsville, IL and Ft. Drum, NY due to wind farms? Were NTIA analyses conducted for these sites?

James Alton: Taylorsville, IL turbine blade height 490', all towers in yellow or green areas; blade height doesn't reach second level used during storm prediction. As storm moved into area, velocity data was lost, couldn't see if any rotation; storm had history of producing tornados, NWS lost ability to see velocity data inside storm; couldn't tell what storm was doing as it moved over wind farm area. Other products seen on radar were affected. Reflectivity was "garbled" as well but able to make out

Had a supercell moving through low top supercell rotation in lower levels of atmosphere as soon as it passed through area it had strong rotation & tornado on ground. We kept warning in place due to the history of storm and location of wind farm, and it was night

Jessica: Ft. Drum, NY Dept. of Defense Forecaster were unable to see particular storm develop. There is a history of wind farms affecting rapidly developing storms. NTIA analysis was done on Ft. Drum wind farm – it is the oldest wind farm NWS has on record of 2006-time frame
What were the basic criteria used to determine the location of our KVWX installation?
Have you had any NTIA Analysis requests for a wind farm installation in Gibson Co, IN?
In the event of a wind farm interference, can higher level scans be conducted without loss of information or coverage?
Jessica: lowest scan of radar most critical detecting storms & tornados. When forecasters have to look higher ever elevation higher is lost data and situational awareness about what's going on, not else to compensate low level data is lost
Scheller: so its low level scans turbine would most directly affect?
Jessica: yes, absolutely
Can a wind farm have located in close proximity to a Doppler unit cause damage to that unit due to the strength of the reflected signal?
Jessica: yes, it is possible if it were very close to radar. Radar does have some protectors of reflected signals, we encourage developers to build outside "NO BUILD" zones because it can significantly corrupt data, it would render data useless
Posey Co: if NWS can issue document on impact of wind farms in area
Jessica: we can't say if turbines are built anywhere in radar line of sight it won't have 0 impact or radar; all we can say is we mentioned these suggestions to developer & "CURTAIL AGREEMENT"
Posey Co: would you be able to provide whether developer agreed to recommendations
Jessica: yes
Posey Co: could you clarify if NTIA analysis was done could you inform government agencies to whether developer followed these recommendations
Jessica: yes. Voluntarily on developers as whether they want to follow or not
--Low level scans are most affected by wind turbines
--as close as they want to be to radar and as tall as turbines are going to be it is a possibility we'll have to keep in mind that even if they are proposing outside "no build" zone it still might be considered a "no build" zone because of the number of elevation angles they contaminating
Scheller: what factors affect that?
Jessica: elevation, terrain, turbine height & blade length
Hans Schmitz, Posey Co: so we know this is going to corrupt real time radar applications, are there private or public products based upon this radar that would also be disrupted
Jessica: yes, this is corrupting to base data or contaminating reflect activity & velocity whether third party displays or app on phone the contaminated data is going to show up
James Alton: NWS found out from TV meteorologist in area they were in area near wind farm – their weather app used told them it was snowing where they were, and it wasn't
App looked at radar and temp, said getting precipitation and it was snow because of the interference, it was actually a clear day.
Jessica: false positives happen all the time, it affects third party vendors in area of wind farms too
Jim McDonald, Gibson County Atty: if the county enters into a "CURTAIL AGREEMENT" with developer and prior to signing it, would you review that agreement and give your

recommendations for analysis on agreement prior to signature and what would the turnaround time take once you have something like that, how much time would it take to analyze it?
Jessica: "CURTAIL AGREEMENTS" are between NOAA and developers. Because it would have to go through NOAA lawyers, it could take upwards of 6 months to have signed agreement
McDonald: counties aren't signing till you review it?
Jessica: NOAA reviewing is part of the process
Scheller: is the NTIA analysis part of the reviewing process?
Jessica: yes
Scheller: only NOAA & developer can enter into agreement?
Jessica: yes