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Measuring Manure Freeboard Using a Laser Measure- A Continued Discussion

By: Gerald May, Michigan State University Extension Educator

Madonna Benjamin, Michigan State University Extension Swine Veterinarian

Last fall I, along with co-author Madonna Benjamin, wrote an article “Measuring manure depth in the PEDV era” (available at: http://msue.anr.msu.edu/news/measuring_manure_depth_in_the_pedv_era) recommending pork producers use a laser measure device to determine the below slat freeboard and calculate manure depth, rather than a stick or tape measure. We reported the laser measure worked well in the manure pit environment but I was later asked if the below slat measurements with the laser device were comparable to a standard measuring tool such as a steel tape measure. The honest answer was “no”. I learned to use the device above the slats by taking measurements then using a tape measure for comparison but once I was comfortable with the device only the laser was used to measure the freeboard below the slats.

This spring I had the opportunity to revisit the topic by collecting multiple measurements as two below slat pits were being emptied. Table 1 provides the comparison between the measured freeboard from the top surface of the slats to the surface of the manure below using the laser measure and a steel retractable carpenter’s tape measure.

Table 1: Comparison of below slat freeboard depth collected using a laser measuring device and a carpenter tape measure

Measurement	Laser Measure*	Tape Measure*	Difference*
#1	49.50	49.75	0.25
#2	52.50	52.50	0.00
#3	56.25	56.50	0.25
#4	20.50	20.50	0.00
#5	23.75	24.00	0.25
#6	26.00	25.75	0.25
#7	65.50	65.00	0.50
#8	66.75	67.00	0.25

*All measurements were collected in inches rounded to the nearest ¼ inch

A paired t-Test using Microsoft Excel data analysis indicates there is no significant difference between the two sets of measurements that were collected. True, when building a house it would be unacceptable for the studs to vary up to ½” in length but for the accuracy required when determining below slat freeboard, or to calculate manure depth, a laser measure is an acceptable measuring tool.

So why is this important? In the PEDV era there continues to be both circumstantial and scientific evidence of PED virus remaining viable for extended periods of time in stored manure. Late last summer personal communications from producers reported pigs showing clinical signs of PEDV after being exposed to stored manure. Also in 2014, Dr. Steve Tousignant with the Swine Vet Center, St. Peter, MN, tested manure from 15 barns 4 months post PEDV infection. Thirteen of the barns were PCR positive for the PEDV and 2 of

the barns were positive in a bioassay study to confirm the presents of viable PED virus. Dr. Tousignant’s report is available from the National Pork Board at: <http://porkcdn.s3.amazonaws.com/sites/all/files/documents/PEDVResearch/Tousignant-14-246-Main.pdf>

Virus such as PEDV, may remain viable in stored manure for at least 4 months as indicated in Tousignant’s report. One could speculate that other virus such as PDCoV, TGEV and bacteria such as Erysipelas spp. and Hyodysenteriae spp. may also re-infect the herd through routine practices that expose pigs to stored manure. Measuring manure freeboard with a stick or tape measure should be avoided when possible. Measuring freeboard with a laser measure provides an accurate assessment of the remaining manure storage volume and measurement to calculate manure depth.

Give Them a Break...Rest Duration for Market Hogs

By: Tom Guthrie, Michigan State University Extension Educator, Jackson, MI
Dr. Madonna Benjamin, Michigan State University, Swine Extension Veterinarian

It is known that loading is one of the most stressful events for market hogs. In addition to loading, factors such as noise vibrations, mixing, fighting, careless driving, weather conditions are just a few other influences that may impact the quality of rest of market pigs during transit. Furthermore, allowing pigs the opportunity to recover from transport stress is crucial in regard to meat quality and animal welfare (Warriss, 2003). The lack of recovery issue during transport may be illustrated by the case of fatigued pigs, which represent a significant portion of transport losses (Benjamin, 2005). However, the majority of fatigued pigs will recover if given enough time to rest (2 to 3 h), but further exposure to stressful events may lead to death in these animals (Ritter et al., 2009b).

A more recent study conducted by Gouman et al., 2013, evaluated the extent to which the duration of the rest time given to near-market-weight pigs after an initial exposure to exercise affected their recovery from subsequent exercise. In this respective study, pigs weighing approximately 245 lbs. were randomly allocated to 1 of 3 treatments, consisting of rest periods of either: 35 minutes, 75 minutes, or 150 minutes. Groups of pigs were exercised in a hallway. A session of exercise consisted of walking at a moderate pace in a handling course, up and down a bridge (6 times each) over a total distance of 1,640 feet (Gouman et al., 2013). The bridge was made of aluminum and consisted of 2 ramps (slope: 19.4°) joined by a horizontal platform. The same handler walked each group of pigs using a paddle to hit the floor 3 times every 15 seconds and using the voice every 5 seconds. On the bridge, a handling board was used to push reluctant pigs up or to block pigs trying to turn back. Each pig was tapped with a paddle, twice on the back on the way up and twice on the way down. After completing the course, pigs were returned to their individual pens. Pigs were then given a rest period of either 35, 75, or 150 minutes. After the assigned rest period elapsed, all pigs were moved a second time through the handling course in the same way, returned to their pens, and then given a rest period of 150 minutes (Gouman et al., 2013). Recovery from the second exercise was assessed using measures of heart rate, respiratory rate, skin temperature, and posture.

Gouman and coworkers (2013) reported that the pigs allowed to rest for 75 minutes after the first exercise experienced no detrimental effect of the second exposure to exercise on cardiac and respiratory responses or on handling time. Exposure to exercise resulted in similar increases in heart rate to those found during loading under commercial conditions. Pigs that were assigned the 150 minute resting period after the first exercise required less time to complete the handling course during the second exercise period compared to pigs receiving 35 and 75 minute resting periods, respectively. In contrast, pigs that were allowed to rest for 35 minutes after the first exercise event were more susceptible to stress during the second exercise period and the second rest period. However, when these pigs were given more than 35 minutes to rest during the second resting period they eventually recovered (Gouman et al., 2013). Therefore, indicating that a lack of rest after an initial exposure to exercise makes pigs more susceptible to stress during the second exercise and rest periods.

Gouman and others (2013) study shows the importance of the length of a rest period. If pigs are not initially given enough rest to recover from exposure to exercise, there will be a detrimental effect on the recovery from subsequent exposure to the same exercise.

In conclusion, it is imperative for producers, load out crew members and transporters to possess the skill set to identify the signs or the onset of fatigue in market pigs. It is evident that allowing pigs to have the opportunity to rest and recover in the incidence of fatigue is advantageous for the pig. Consideration of designating an area or pen inside

the barn for pigs that express signs of fatigue when load outs occur creates a space for these respective pigs to rest while other hogs are being loaded. In some cases, designating a resting area for fatigued animals to recover gives more flexibility for management decisions to be made, such as when that respective animal would be loaded and transported. It is also important to keep in mind other potential stressors of transportation and unloading and how these may impact a pig that has already shown signs of fatigue before that respective pig is loaded onto the transport trailer.

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Do H₂S Monitors Belong on the Swine Farm?

By: Dr. Madonna Benjamin, Michigan State University, Swine Extension Veterinarian

Visiting Michigan swine production sites at the time of manure transfer we wondered: "Should Hydrogen Sulfide (H₂S) monitors be used on swine production sites during manure transfer?"

"We lost 200 head of finishing pigs to hydrogen sulfide poisoning during routine manure pumping. We were walking back from lunch with assignment to scrape pens and fortunately, our father recognized the ominous silence as we neared the finishing barn. Had he not been with us, three of his children would have walked into the same fate as those pigs. Stories and experiences similar to this one are emotional but not surprising. By using the appropriate monitoring safety equipment and guidelines during agitation, potentially fatal situations can be avoided.

Hydrogen sulfide is a toxic colorless, flammable gas a by-product of anaerobic bacterial reduction of sulfates. Any time manure is being agitated or when shallow-pit plugs are pulled there is a potential for airborne concentrations of H₂S to become elevated, potentially putting both workers and pigs at risk of being overexposed

The H₂S concentration considered immediately dangerous to life and health (IDLH) is 100 ppm. Above 600 ppm, a person can die after only one or two breaths. It is important for farms to identify situations and practices where there may be increased amounts of airborne H₂S. Field studies have shown that H₂S concentrations can exceed this level quickly during slurry agitation with concentrations recorded as high as 1,300 ppm

Human Detection and Awareness:

Human exposure to hydrogen sulfide is primarily through inhalation. The "rotten egg" smell can be detected at low levels, but with continuous low level exposure or at higher concentrations the ability to smell the gas - even though it is still present - is lost. The ability to smell H₂S may begin to dull at 50 ppm. You CAN NOT depend on your sense of smell for indicating the continuing presence of H₂S or for warning of hazardous concentrations

MIOSHA's (Michigan Occupational Safety and Health) Occupational Health Standard Part 700 -

Agriculture specifies that an employee's average 8-hour airborne exposure cannot exceed 10 ppm or 1 mg/m³. A hog farmer in Michigan is required to follow MIOSHA health and safety standard requirements.

H₂S awareness training on swine farms in Canada has proven effective in changing attitudes regarding safety of employers and employees. Hydrogen sulfide monitors are being used when liquid manure is being agitated or when pits plugs are pulled within barns systems. Training for H₂S covers properties of H₂S, exposure limits, detection, and the importance of standard operating procedures and emergency response plans. Pork producers should be quick to appreciate the importance of H₂S monitors. First, they provide early detection of the gas within a facility. This knowledge, when coupled with employee training, helps people understand when to immediately exit that facility. The monitor can also be used to determine if, after turning on the ventilation, the H₂S level is lowered and it is safe to enter. Individual monitors can be purchased for a reasonable cost of \$130.00 or up to \$1000.00. depending on battery life and sensory levels.

Non-Human toxicity:

Similar to stories of coal miners, the pig might be the unsuspecting canary. Anecdotally, it is not unusual for producers and veterinarians to find one or a few dead pigs housed in pens that have "dead air" or limited air exchange during or immediately after manure transfer. It is known that H₂S is sometimes released during manure agitation. While the number of cases submitted to Iowa State University Veterinary Diagnostic Laboratory (ISUVDL) due to H₂S toxicity are relatively few, the true incidence of H₂S intoxication is likely to be underreported. Field observations by Drs. Steve Ensley, Wilson Rumbelha and Kent Schwartz at ISUVDL suggest that livestock death typically occurs the same day as manure agitation in barns with deep pits. Warning signs are inconsistently present but may include mucosal, corneal, conjunctival, and/or respiratory tract irritation. ISUVDL is currently working on diagnostic biomarkers in serum and urine of affected pigs. If you are aware of similar cases please contact ISUVDL.

Rescue and recovery:

If overcome by H₂S, it is important to note that a

rescuer has only about six minutes to apply CPR. The (victim or the rescuer) will require a self-contained breathing apparatus (SCBA) -like firefighters wear - to enter the space and, most likely, recover the exposed individual. The majority of hydrogen sulfide poisonings (approximately 86%) occur in confined spaces and many poisonings are the direct result of others trying to help co-workers in need. Use of H2S monitors and training help avoid these tragic outcomes.

MSUE Pork Team - Recommendations for farmers during manure transfer.

1. The hazards of working in and around manure pits should be communicated to farmers
2. Ventilation rates should be increased before, during and after agitation
3. Workers should leave a confinement building during agitation of manure

4. Wear an H2S monitor
5. When pulling pit plugs increase the ventilation rate for 10 minutes prior to pulling pits.
6. Never allow slurry to accumulate less than 6 inches from the bottom of the flooring.
7. As part of the emergency plan, have proper respiratory protection and a rescue capability in place before entering a manure pit.

Publication References:

CDC on Hydrogen Sulfide <http://www.cdc.gov/niosh/topics/HydrogenSulfide/>

Prairie Swine Centre . Hydrogen Sulphide Awareness Workshop <http://www.prairieswine.com/pdf/1306.pdf>

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