SWINE HEALTH INFORMATION CENTER
FINAL RESEARCH GRANT REPORT

Pilot study to evaluate the use of a fluorescent powder (Glo Germ) to study the transfer of contamination from livestock trailers to the center alleyway and pens in the barn during marketing events. Project #19-147 SHIC

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Industry Summary:

Currently, many livestock trailers in the United States are not washed, disinfected or dried between loads of market pigs due to the lack of trailers, truck washes and other swine transport related infrastructure. If livestock trailers or other carrying agents associated with the marketing event become contaminated, it is unlikely that the contamination is mitigated unless specific procedures, such as washing are performed. Under these circumstances, the livestock trailer, truck and driver returning directly from a swine slaughter plant are likely frequently contaminated with live infectious PRRSv or PEDv or both when they enter a growing pig site to haul the next load.

Objective: The objective of this pilot study was to determine if a fluorescent powder (Glo Germ) (Glo Germ Co, Moab, UT) could be used to study the transfer of contamination from livestock trailers to the center alleyway and pens in the barn during marketing events.
Methods: Three growing pig sites, with the same load-out design and owned by a single production system, were used for the pilot study. At the first site, 54 grams (g) of dry fluorescent powder was poured directly over and spread evenly onto dry wood chips on the floor of the livestock trailer. At the second site, 54 g of dry fluorescent powder was mixed with 0.25 kilograms (kg) of dry wood chips in a large plastic bag. At the third site, 216 g of dry fluorescent powder was mixed with approximately 0.5 L of OB gel and 0.25 kg of dry wood chips in a large plastic bag. At each site, the fluorescent powder or the fluorescent powder mixture was spread evenly on the floor of the livestock trailer just inside the roll-up door that opens to the chute before the pigs were loaded. A driver and loading crew of 3 or 4 people loaded the pigs according to the production system's standard loading procedures where the driver entered the trailer through a side door at the rear of the trailer and was not allowed to cross the line of separation between the trailer and the load-out chute.
Results: At the third site, where 216 g of fluorescent powder mixed with OB gel was used, the transfer of contamination from livestock trailers to the pens inside the barn was confirmed by the detection of fluorescent powder on the bottom of the load-out crews boots, on their cutting board, in the chute, load-out alleyway, center alleyway of the barn and in the first 3 pens adjacent to the load-out alleyway, on both sides of the center alleyway.

Implications: The results of this pilot study confirmed that during marketing events, contamination from livestock trailers can be transferred from the trailer to the center alleyway and pens where the remaining pigs in a group are housed and that a fluorescent powder may be used to study the transfer of contamination from livestock trailers during marketing events.

Keywords: swine, contaminated livestock trailers, market load-outs, biosecurity, transportation

Scientific Abstract:
Objective: The objective of this pilot study was to determine if a fluorescent powder (Glo Germ) (Glo Germ Co, Moab, UT) could be used to study the transfer of contamination from livestock trailers to the center alleyway and pens in the barn during marketing events.
Methods: Three growing pig sites owned by a single production system were used for the pilot study. Each site had the same load-out design. At the first site 54 grams (g) of dry fluorescent powder was poured directly over and spread evenly onto dry wood chips on the floor of the livestock trailer. At the second site, 54 g of dry fluorescent powder was mixed with 0.25 kilograms (kg) of dry wood chips in a large plastic bag. At the third site, 216 g of dry fluorescent powder was mixed with approximately 0.5 L of OB gel and 0.25 kg of dry wood chips in a large plastic bag. At each site, the fluorescent powder or the fluorescent powder mixtures were spread evenly on the floor of the livestock trailer just inside the roll-up door that opens to the chute before the pigs were loaded. A driver and loading crew of 3 or 4 people loaded the pigs according to the production system's standard loading procedures.
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Introduction

The swine industry has focused much of its efforts on implementation of biosecurity practices in swine breeding herds; while relatively less attention has been paid to biosecurity in the wean-to-finish phase of production. It has been estimated that 55% of groups of growing pigs that are negative for porcine reproductive and respiratory disease virus (PRRSv) at placement are positive at marketing, suggesting that PRRSv was introduced sometime during the growing period causing economic losses of approximately $2.29 per pig placed due to higher mortality and slower growth (Holtkamp, 2012). A recent study by researchers at Iowa State University demonstrated that 93% of 70 wean-to-finish groups from PRRS stable sow farms placed in high pig density areas became infected with wild-type PRRSv (Moura et al., 2019). Although information on how frequently groups of growing pigs are infected with porcine epidemic diarrhea virus (PEDv) is not available in the literature, lateral introduction of the virus in growing pigs adversely affects average daily gain (ADG), average daily feed intake (ADFI) and

reduces growth (Alvarez J et al 2015). In one swine production system, the introduction of PEDv during late finishing reportedly reduced ADG by 21.4% (Pavlovic, 2018). Additionally, when growing pigs become infected with PRRSv or PEDv, they serve as a source of virus that may increase the incidence of outbreaks in swine breeding herds, where economic consequences can be much larger. Data from the Swine Disease Reporting System demonstrates that significant increased detection of PRRSv in breeding herds are typically preceded by increased detection in growing-finishing pigs, supporting the hypothesis that the growing pig population is a major source of virus in the swine industry (Trevisan et al., 2019).

Because groups of pigs in the United States are typically marketed over several weeks, the opportunity exists for pigs still on feed to become infected during a marketing event. The pigs remaining in the group are then subject to the production losses and become a source of virus for other swine farms. It has been demonstrated that livestock trailers can serve as a source of transmission for PRRSv and PEDv (Dee et al, 2004 and Lowe et al, 2014).

For pigs remaining on feed to become infected during a marketing event, a series of failures is required. First, the livestock trailer, driver, truck or other carrying agent associated with the marketing event is contaminated with live infectious virus. Second, there is a failure to mitigate that contamination. Third, the virus is transferred from the contaminated livestock trailer, or other contaminated carrying agent, to the remaining pigs in the group as the pigs destined for market are loaded. Because swine slaughter plants receive animals from many sources daily, PRRSv and PEDv are likely present in the unloading area of swine slaughter plants and it has been demonstrated that the livestock trailers used to haul pigs to market are frequently contaminated with virus while at the slaughter plant (Lowe et al, 2014). The driver as well as the cab of the truck may also serve as potential carrying agents for the viruses. Currently, many livestock trailers in the United States are not washed, disinfected or dried between loads of market pigs due to the lack of trailers, truck washes and other swine transport related infrastructure. If livestock trailers or other carrying agents associated with the marketing event become contaminated, it is unlikely that the contamination is mitigated unless specific procedures, such as washing are performed. Under these circumstances, the livestock trailer, truck and driver returning directly from a swine slaughter plant are likely frequently contaminated with live infectious PRRSv or PEDv or both when they enter a growing pig site to haul the next load. For pigs remaining in the group to become infected during loading, viral contamination must be transferred from the contaminated livestock trailer, driver or other carrying agents to the pigs in the barn. Unfortunately, little research has been done to assess how frequently this occurs or to assess alternative biosecurity measures to reduce the frequency.

In a previous study, fluorescent powder (Glo Germ) was used to evaluate if the addition of a bench entry system in a commercial swine facility with a shower reduced the likelihood of personnel introducing environmental contamination into a swine farm (Anderson et al., 2018). The objective of this pilot study was to determine if a fluorescent powder (Glo Germ) (Glo Germ Co, Moab, UT) could be used to study the transfer of contamination from livestock trailers to the center alleyway and pens in the barn during marketing events.

Methods

Three growing pig sites owned by a single production system were used for the pilot study. Each site had the same load-out design (Figure 1). A 6-meter load-out alleyway with solid sides led from the center alleyway of the barn to an enclosed chute that was approximately 4 meters long. Prior to loading, an approximately 2.5 cm layer of fresh wood chips were evenly spread on the floor of the chute. The production system washes, disinfects and dries livestock trailers hauling market hogs, but not between every load. For the pilot, the livestock trailers were unwashed when they arrived at the growing pig site, with one exception.

At the first site 54 grams (g) of dry fluorescent powder was poured directly over and spread evenly onto dry wood chips on the floor of the livestock trailer. At the second site, 54 g of dry fluorescent powder was mixed with 0.25 kilograms (kg) of dry wood chips in a large plastic bag. At the third site, 216 g of dry fluorescent powder was mixed with approximately 0.5 L of OB gel and 0.25 kg of dry wood chips in a large plastic bag. At each site, the fluorescent powder or the fluorescent powder mixture was spread evenly on the floor of the livestock trailer just inside the roll-up door that opens to the chute before the pigs were loaded (Figure 2).

A driver and loading crew of 3 or 4 people loaded the pigs according to the production system's standard loading procedures (Figure 1). The driver entered the trailer through a side door at the rear of the trailer and was not allowed to cross the line of separation between the trailer (Zone 1) and the load-out chute (Zone 2). One member of the crew (Person 1) moved pigs from the center alleyway of the barn, through the load-out alleyway and up the chute. They were not allowed to cross the line of separation between the trailer (Zone 1) and the load-out chute (Zone 2). The remaining members of the loading crew moved pigs to be loaded from the pens to the center alleyway and then partially down the center alleyway until they were transferred to Person 1 who moved them down the center alleyway through the load-out alleyway and up the chute. All of the members of the load-out crew could move without restriction inside Zone 2 and they frequently walked in the same section of the center alleyway. Approximately 170 pigs were loaded per trailer. During and after all pigs had been loaded, a fluorescent light was used to scan the floor of the chute and load-out alleyway to detect the fluorescent powder. After all pigs were loaded, the same light was used to scan the floor of the center alleyway and pens from which pigs were marketed.

Results

At the third site, where 216 g of fluorescent powder mixed with OB gel was used, the transfer of contamination from livestock trailers to the pens inside the barn was confirmed by the detection of fluorescent powder on the bottom of the load-out crews boots (Person 1), on their cutting board, in the chute, load-out alleyway, center alleyway of the barn and in the first 3 pens adjacent to the load-out alleyway, on both sides of the center alleyway (Figures 3, 4, 5 and 6). Fluorescent powder in the pens was only observed in the 3 meters closest to the center alleyway, where Person 1 typically stood to let the pigs pass in the center alleyway. The use of dry fluorescent powder mixed with the wood chips proved challenging when the wind was blowing, as it was at the first study site. Much of the dry fluorescent powder and wood chips were blown away from the back of the trailer before the first pigs were loaded. Adding OB gel to the mixture more closely represented the mixture of wood chips, feces and urine present on unwashed livestock trailers and served to hold the mixture in place when the wind was blowing. However, at the first and second study sites, when 54 g of dry fluorescent powder was used without OB gel,

fluorescent powder was detected in the load-out chute and load-out alleyway, but none was detected in the center alleyway or pens inside the barn.

Several other observations were made while conducting the pilot study. Multiple opportunities for contaminated wood chips to be transferred from the livestock trailer to the load-out chute were observed. 1) Once pigs were on the trailer, they occasionally lost their footing while lunging forward off their back legs, which propelled significant amounts of wood chips from the livestock trailer onto the chute. 2) On several occasions, pigs that had already stepped on the trailer managed to return to the chute. 3) A driver and member of the load-out crew violated the line of separation between the livestock trailer and chute. With a fluorescent light, the investigators were able to document that fluorescent powder was transferred from the trailer to the load-out chute during the loading procedure at all three study sites.

The fluorescent powder adhered strongly to the wood chips. This was the case regardless of whether the fluorescent powder was mixed with OB gel or not. Person 1 of the load-out crew would regularly step in the area of the chute where fluorescent powder was observed. However, when the woodchips were dry, as was the case during most of the first load after new woodchips had been placed on the floor of a clean chute, very little fluorescent powder could be observed anywhere except in the chute. The dry wood chips did not stick to the bottom of their boots and the fluorescent powder did not appear to be easily transferred from the woodchips to their boots. However, as feces and urine began to accumulate in the chute, load-out alleyway and center alleyway, Person 1 of the load-out crew began to collect it on their boots, which created a paste to which the woodchips and fluorescent powder easily adhered (Figure 6). It appeared that this markedly facilitated the transfer of contaminated wood chips back to the center alleyway and even to the pens inside the barn (Figures 4 and 5).

Implications

The results of this pilot study confirmed that during marketing events, contamination from livestock trailers can be transferred from the trailer to the center alleyway and pens where the remaining pigs in a group are housed. Dry woodchips on the floor of the chute appeared to inhibit the transfer of contamination on the boots of the load-out crew but as feces and urine began to accumulate on the chute, the inhibition quickly dissipated. The results also demonstrate that a fluorescent powder may be used to study the transfer of contamination from livestock trailers during marketing events. Studies to evaluate alternative loading strategies to reduce the likelihood of transferring contaminated material from livestock trailers to the center alleyway and pens inside the barn are planned.

Acknowledgments:

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Figures

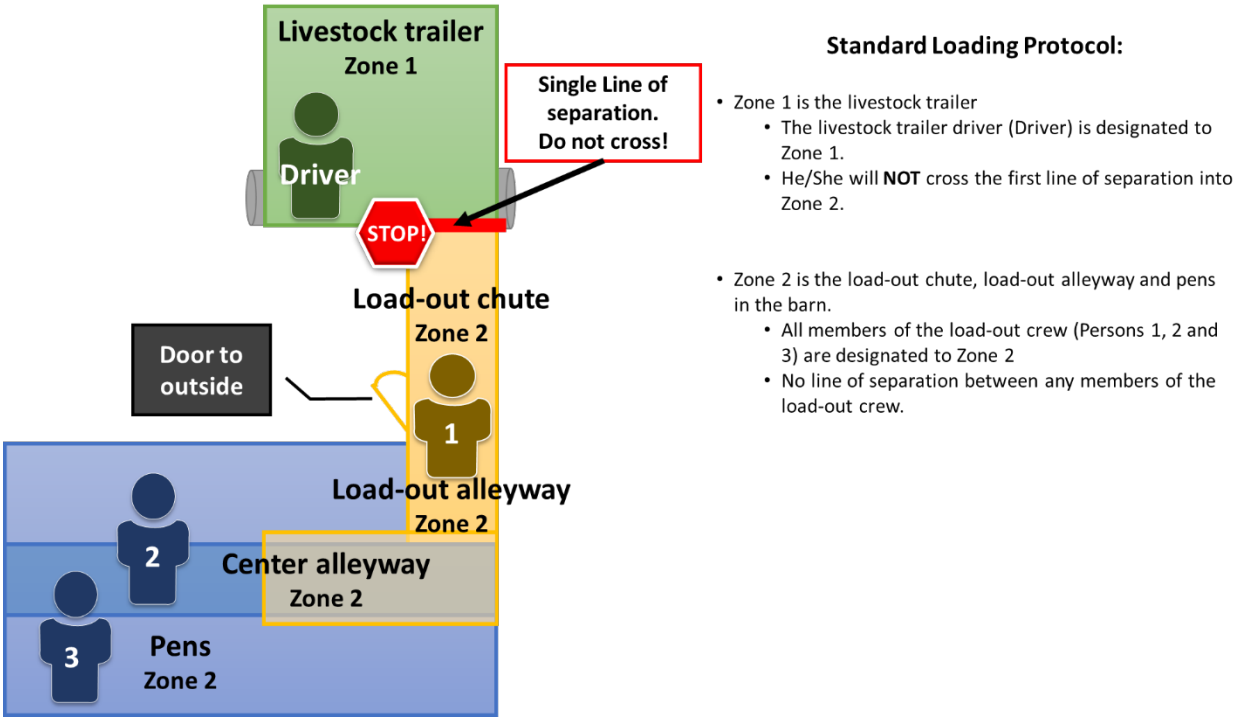

Figure 1. Load-out design for standard loading protocol.

Figure 2. Mixture of fluorescent powder, OB gel and wood chips spread evenly on the floor of the livestock trailer just inside the roll-up door that opens to the chute before the pigs were loaded.

Figure 3. Fluorescent powder detected in the load-out chute.

Figure 4. Fluorescent powder detected in the pens inside the barn.

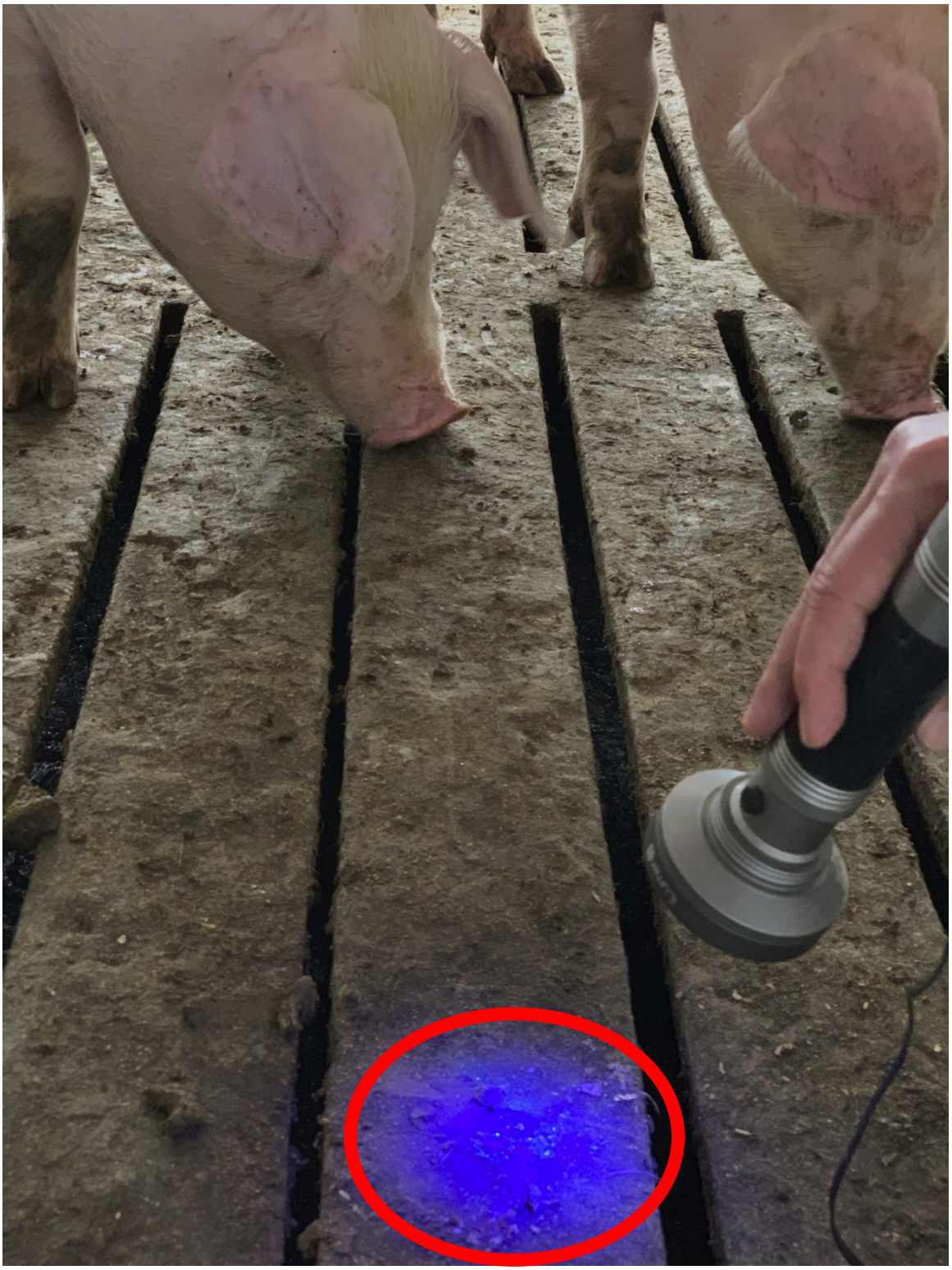

Figure 5. Fluorescent powder detected in the pens inside the barn.

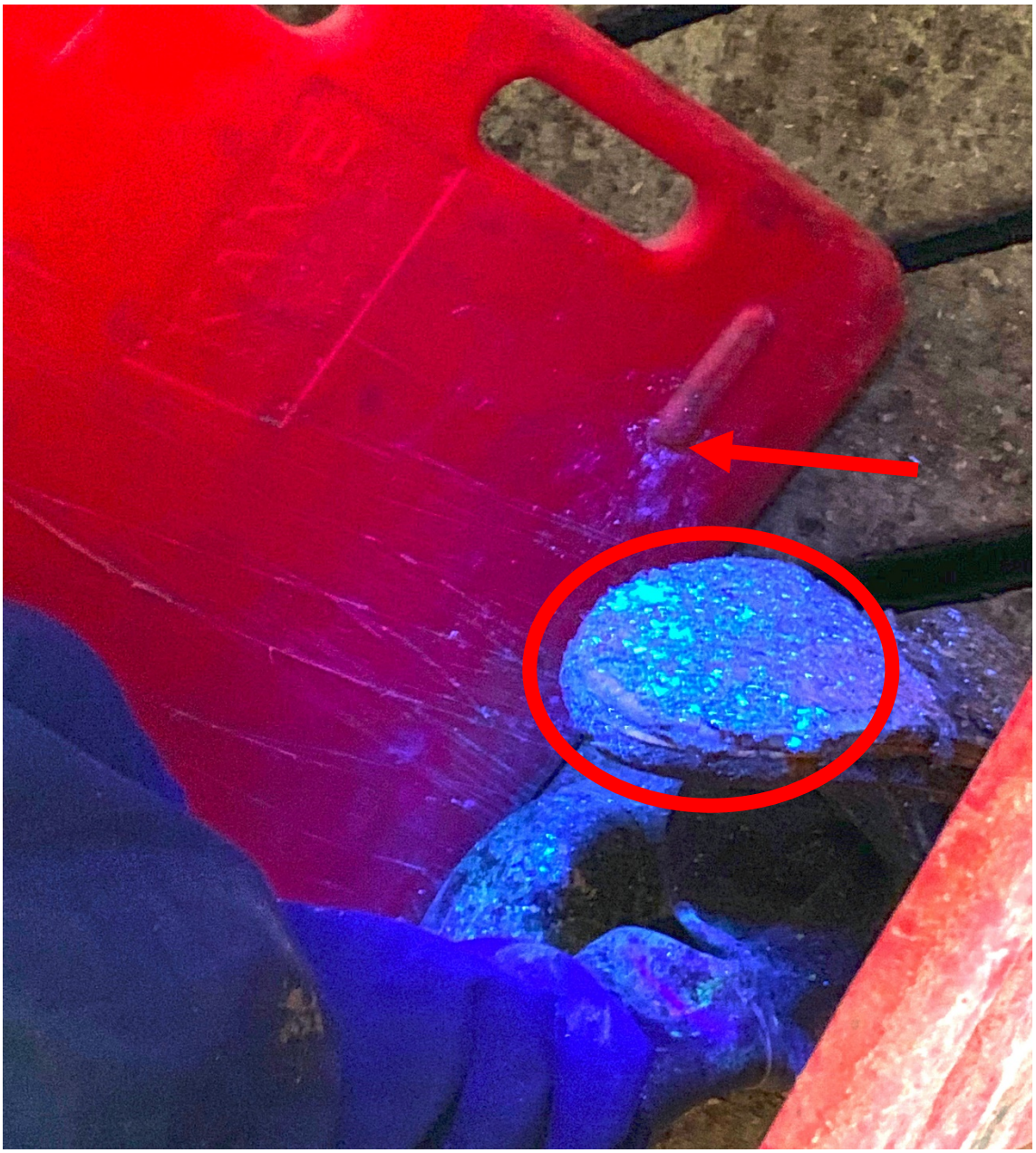

Figure 6. Fluorescent powder detected on boots and of load-out crew (Person 1) and cutting board.