

1. SWINE HEALTH INFORMATION CENTER

FINAL RESEARCH GRANT REPORT FORMAT

Project Title

Ongoing support and expansion of the Standardized Outbreak Investigation Program

Project Identification Number

SHIC Project #25-053

Principal Investigator

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Institution

Iowa State University

Date Report Submitted

June 10, 2026

Industry Summary:

The Standardized Outbreak Investigation Program (SOIP), funded by the Swine Health Information Center (SHIC), was developed to address a critical gap in swine biosecurity: while many biosecurity control measures exist, little research has focused on identifying the specific hazards and pathogen entry routes those measures are intended to prevent. As a result, biosecurity resources are often applied inefficiently. SOIP uses disease outbreak investigations as opportunities to conduct systematic biosecurity hazard analyses, identify likely pathways of pathogen introduction, and prioritize risks that warrant intervention.

Launched as a web-based application and industry database in January 2024, SOIP enables veterinarians and producers to conduct standardized outbreak investigations and securely store findings in a centralized database. By aggregating information across multiple investigations, the system allows the swine industry to identify recurring biosecurity risks and learn from collective experiences.

The project's objectives were to provide ongoing support for the SOIP platform, improve training resources, increase adoption of the application, enhance database and data extraction capabilities, and develop company- and industry-level benchmarking reports.

The SOIP web-based application and investigation database were maintained and supported by Iowa State University's Department of Veterinary Diagnostic and Production Animal Medicine (VDPAM). Support activities included user management, technical troubleshooting, software improvements, and maintenance of a dedicated support email (soip@iastate.edu). Adoption of the platform continued to grow. By June 1, 2026, 124 investigations have been completed using the SOIP web-based application.

Training resources were developed through collaboration with SES Inc., resulting in two comprehensive training modules, including 17 video covering both application use and outbreak investigation methodology. The project also promoted industry engagement through meetings, demonstrations, outreach articles, and direct collaboration with producers and veterinary clinics. A widely distributed article, Lessons Learned from SHIC's Standardized Outbreak Investigation Program to Date, summarized major findings from completed investigations and highlighted opportunities for improving biosecurity across the industry.

Database functionality was enhanced to allow users to export investigation data directly to Excel with customizable filters. Additionally, company- and industry-level benchmarking reports were developed to compare the frequency of pathogen entry events and associated hazard ratings. These reports help companies identify strengths, weaknesses, and opportunities for improvement in their biosecurity programs. Preliminary work also demonstrated the potential to use artificial intelligence tools to analyze narrative investigation data and identify common themes.

Overall, the project strengthened the infrastructure needed to conduct standardized outbreak investigations and biosecurity hazard analyses across the U.S. swine industry. By improving data collection, training, reporting, and

industry participation, SOIP provides a practical framework for identifying significant biosecurity risks, prioritizing interventions, reducing disease outbreaks, and improving preparedness for emerging and transboundary animal diseases. The long-term goal is to enhance herd health, productivity, and the global competitiveness of the U.S. pork industry through more effective, evidence-based biosecurity practices.

Please indicate if you plan to submit this full report for peer-reviewed publication: Yes ☐ No ☒

If you plan to submit this full report for publication, SHIC will only post the industry summary on its website and will delay posting of the full final report according to the terms of the contract (Publication Section 5a).

Key Producer Outcomes:

- SOIP helps identify pathogen entry routes, enabling producers to target the highest-priority biosecurity risks
- Since 2024, 124 outbreak investigations have been completed using the SOIP web-based application
- Company and industry-level benchmarking reports help producers compare biosecurity risks against industry averages and identify improvement opportunities.

Keywords: biosecurity, outbreak investigation, biosecurity hazard analysis, benchmarking reports, transboundary disease preparedness

Scientific Abstract:

The Standardized Outbreak Investigation Program (SOIP), funded by the Swine Health Information Center (SHIC), was developed to address a critical gap in swine biosecurity: while many biosecurity control measures exist, little research has focused on identifying the specific hazards and pathogen entry routes those measures are intended to prevent. As a result, biosecurity resources are often applied inefficiently. SOIP uses disease outbreak investigations as opportunities to conduct systematic biosecurity hazard analyses, identify likely pathways of pathogen introduction, and prioritize risks that warrant intervention.

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weaknesses, and opportunities for improvement in their biosecurity programs. Preliminary work also demonstrated the potential to use artificial intelligence tools to analyze narrative investigation data and identify common themes.

Overall, the project strengthened the infrastructure needed to conduct standardized outbreak investigations and biosecurity hazard analyses across the U.S. swine industry. By improving data collection, training, reporting, and industry participation, SOIP provides a practical framework for identifying significant biosecurity risks, prioritizing interventions, reducing disease outbreaks, and improving preparedness for emerging and transboundary animal diseases. The long-term goal is to enhance herd health, productivity, and the global competitiveness of the U.S. pork industry through more effective, evidence-based biosecurity practices.

Introduction:

While biosecurity control measures have long been a focus of research, methods for identifying the most significant biosecurity hazards that lead to the introduction of pathogens into swine herds are lacking. In other words, much research has focused on biosecurity control measures as solutions, with very little research focused on identifying the significant biosecurity hazards or problems the solutions are intended to address. This has frequently resulted in a relatively inefficient and ineffective application of the right solutions to the wrong problem.

Outbreak investigations provide valuable opportunities to identify and prioritize biosecurity risks. As the saying goes, “never let a good crisis go to waste.” Although outbreaks are clearly crises, they can also serve as important learning opportunities if approached intentionally. When investigations are conducted as a comprehensive, systematic analysis of biosecurity hazards in the production system, they yield insights that guide resource prioritization to strengthen biosecurity.

Hazard analysis, when applied to biosecurity on swine farms, involves gathering and evaluating information about potential pathways for pathogens to enter a susceptible herd. These investigations help assess current biosecurity practices, highlight strengths and weaknesses, and identify opportunities to improve disease prevention efforts.

While each investigation provides valuable insights, a centralized database is essential for identifying patterns and learning from multiple investigations over time. The SOIP investigation database offers a unique opportunity to leverage the collective experience of the entire industry.

The Swine Health Information Center (SHIC) funded the development of a Standardized Outbreak Investigation Program (SOIP) in 2021. The Standardized Outbreak Investigation Program is used to conduct investigations of outbreaks on sow farms as an integrated biosecurity hazard analysis and epidemiological investigation.

In January of 2024, a web-based application and database for SOIP was launched to make it easier for veterinarians and producers to use and capture data from investigations of breeding herds in a secure industry-wide database.

Objectives:

The objectives of this project were to provide ongoing support for the SOIP; improve training; drive adoption of the web-based application to populate the database and share lessons learned; develop and test the database and data extraction processes; and develop summary reports at the company and industry levels.

Materials & Methods:

Provided ongoing support for the SOIP web-based application and database

Providing ongoing support and administration of the SOIP application was a continuous activity throughout the project. The support included setting up new companies (Companies) and users (Company Administrators and Company Representatives) at the request of producers and veterinarians, troubleshooting reported issues, incorporating user feedback and suggested changes, and collaborating with the programmer to improve the application over time.

The web-based application was developed and is hosted by the Department of Veterinary Diagnostic and Production Animal Medicine (VDPAM) at Iowa State University. With support from this grant, VDPAM programmers maintained the server, code, and database.

A dedicated program email address (soip@iastate.edu) allowed producers and veterinarians to request access, report issues, and seek assistance. Multiple Program Administrators monitored this email address to ensure prompt responses. Azure DevOps, a cloud-based Microsoft program, was used to log bugs, tasks and issues with the application reported by users or identified by the Program Administrators.

Improved training. Training materials on using the SOIP web-based application and on the methodology for conducting effective outbreak investigations were created under an SHIC agreement with SES Inc. The investigators collaborated with SES on this work to conceptualize which information should be included in the training and how best to convey the material to veterinarians and producers.

Additionally, the investigators responded to producers and veterinarians one-on-one as questions arose and provided tutorials upon request when producers or veterinarians were added to the program.

Drove the adoption of the web-based application to populate the database and share lessons learned. A descriptive analysis of the data in the SOIP investigation database was conducted in October 2025. At the time of the analysis, the SOIP database contained data on 87 completed investigations at sow farms across 24 companies. Most of the investigations were done for PRRSV (65) and PEDV (19). The analysis was done using all 87 investigations, regardless of pathogen. The frequency of entry events during a standard 28-day investigation period. A key component of the investigation is a subjective evaluation of how likely each entry event may be associated with an outbreak. This evaluation is based on information collected in the investigation form. Investigators must assign a high, medium, or low hazard rating to each entry event based on its likelihood of being linked to the outbreak. Although an objective scoring system could offer advantages, a subjective approach allows investigators to weigh all available information within the broader context, including site location, season, weather conditions, and other factors that may influence the assigned hazard ratings. The frequency with which the entry events were rated high, medium or low was analyzed.

The investigators met with production companies and swine veterinary clinics. When requested, the investigators will continue to meet with companies and veterinary clinics in person or via virtual meetings to demonstrate the value of the SOIP web-based application. The meetings included a demonstration of the program. Access to the application was granted at the end of the meeting.

Developed and tested the database and data extraction processes.

The database framework was evaluated and modified, when necessary, to ensure it efficiently supported data retrieval requests. This involved optimizing data retrieval methods of the data to ensure accurate and reliable extraction that is compatible with further data analysis.

Developed summary reports at the company and industry levels. Company and industry-level reports were developed to summarize the frequency of entry events and hazard ratings for multiple investigations. The reports summarize all investigations completed for a company in the SOIP investigation database and the results are benchmarked against the industry-level results for all investigations completed for all companies in the SOIP investigation database. The reports may be filtered by pathogen, investigation type (outbreak vs. prospective), and production phase (breeding vs. growing pig). These reports provide valuable insights and aid in identifying trends and areas for improvement at the company level. The company and industry-level benchmarking reports will help identify strengths, gaps, variation, and opportunities for improvement in biosecurity.

Results:

Provided ongoing support for the SOIP web-based application and database. As of June 1, 2026,

- Total users: 142 added
- Completed investigations: 124
- Company coverage: 24 unique companies

- Investigations completed per company:
 - Ranged from 1 to 25 investigations per company.
 - Average ~5.2 investigations per company.

For the duration of the project (April 2025–April 2026), Program Administrators handled over 105 email exchanges initiated via the dedicated program email address (soip@iastate.edu). During the project, 25 tasks were logged in DevOps, to be resolved by the programmers.

Improved training. The training videos were divided into two modules (Table 1). Module one includes twelve episodes covering the use of the SOIP web-based application. Module two includes five modules covering the purpose, terminology and process for conducting effective investigations with the SOIP application. The training videos produced by SES may be accessed at <https://www.swinehealth.org/investigation-instrument/> (accessed 6/10/2026).

A written guide titled “Standardized Outbreak Investigation Program User Support Guide” covers the same contents that is in the videos in Module One. The written guide is available at <https://www.swinehealth.org/wp-content/uploads/2025/12/SHIC-SOIP-User-Support-Guide-12-1-25.pdf> (Accessed June 22, 2026).

Table 1. SHIC training videos available for the SOIP.

Module 1
• Episode 1: The Organization of the SOIP • Episode 2: How to Add a Company Representative in the SOIP • Episode 3: Who Can Delete Sites, Users, and Companies in the SOIP • Episode 4: How to Set Up Sites and Build Site Maps in the SOIP • Episode 5: How to Delete or Edit Existing Sites in the SOIP • Episode 6: Overview of the Pre-Investigation Survey Section of the SOIP • Episode 7: Overview of the Questionnaire Section of the SOIP • Episode 8: How to Edit an Existing Investigation in the SOIP • Episode 9: How to Update Master Mapping Information in the SOIP • Episode 10: How to Unlock a Locked Investigation in the SOIP • Episode 11: How to Interpret a Detailed Report in the SOIP • Episode 12: How to Interpret an Executive Summary in the SOIP
Module 2
• Episode 1: The Purpose of the SOIP • Episode 2: Terminology Used in the SOIP • Episode 3: The Process for Conducting an Outbreak Investigation – The Investigation Phase • Episode 4: The Process for Conducting an Outbreak Investigation – The Investigation Form • Episode 5: The Process for Conducting an Outbreak Investigation – The Post-Investigation Phase

Drove the adoption of the web-based application to populate the database and share lessons learned. An article titled “Lessons Learned from SHIC’s Standardized Outbreak Investigation Program to Date” was authored by the investigators for SHIC. The article was initially published in the January 2026 SHIC eNewsletter and was posted on the SHIC website (<https://www.swinehealth.org/lessons-learned-from-shics-standardized-outbreak-investigation-program-to-date/>). Summaries of the article were published by the National Hog Farmer, The Iowa Pork Industry Center, Pork Business, Farms.com and other industry news outlets. The article summarized all 87 completed pathogen investigations in the SOIP database at the time of analysis. While biosecurity risks vary by producer and farm, analyzing this industry-level data highlights trends that provide guidance on where to prioritize time and resources to strengthen biosecurity at the national level.

The investigators met with five production companies/swine veterinary clinics, three in person and two by virtual meetings. The meetings included a demonstration of the program. These meetings have been very successful in driving adoption. Feedback on the web application from these meetings is being collected and will be used in the future to

enhance the web application. The investigators also completed one investigation of a PRRSV outbreak in July of 2025 for a production system to demonstrate the value of the SOIP application.

Developed and tested the database and data extraction processes.

The data from investigations in the SOIP web application can be extracted and exported to an Excel file with one click. This feature is available to all users of the SOIP web-based application. Only data from investigations to which users have access may be exported, and a filter feature allows producers and veterinarians to export a subset of those investigations. Producers and veterinarians may filter by company, site, primary pathogen, investigation name, report date and investigation type. Likewise, the investigators, as Program Administrators in the SOIP web-based application, may export the data for all of the investigations to be used for analysis and development of outreach articles (e.g., Lessons Learned from SHIC’s Standardized Outbreak Investigation Program to Date) for the industry. A screenshot of the data extraction and export to Excel is shown in Figure 1.

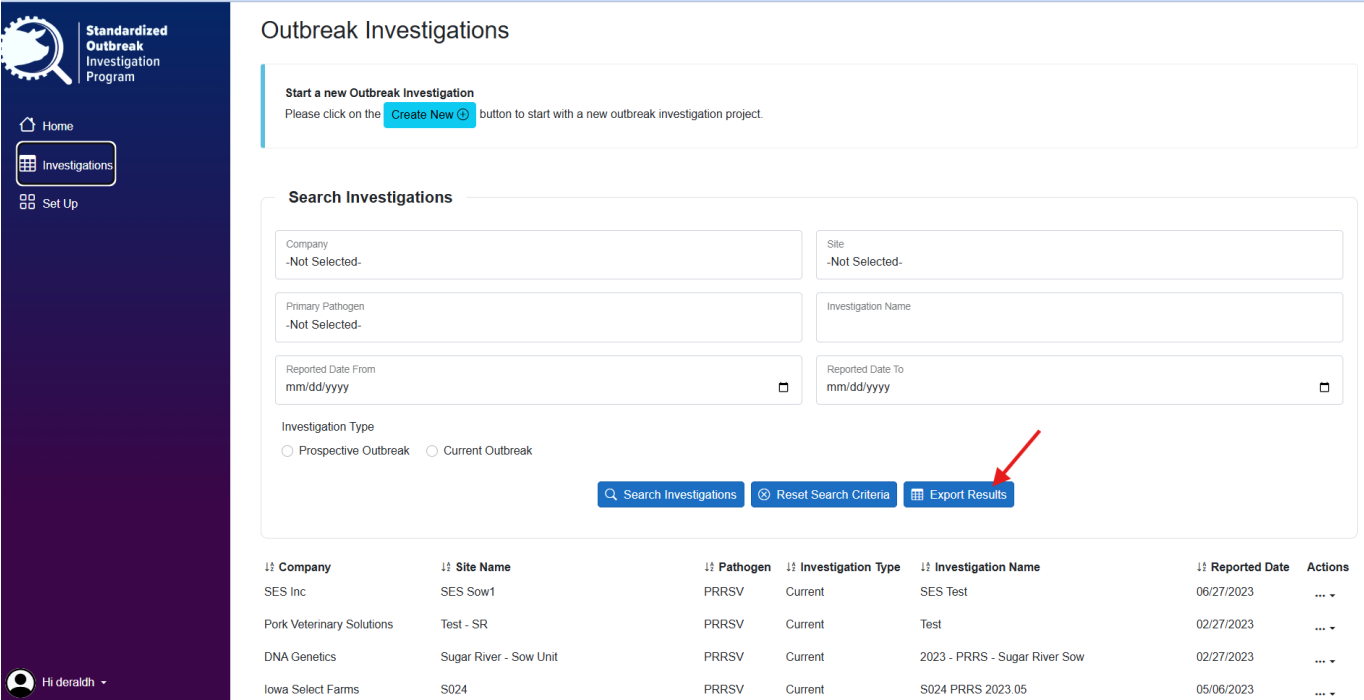


Figure 1. Screenshot of data extraction feature in SOIP.

Developed summary reports at the company and industry levels. Table 2 shows an example of the information summarized in the company and industry-level benchmarking reports. Other information for specific biosecurity practices and hazards captured via closed-ended questions is also included in the reports for each entry event. Figure 2 shows an example of the information included in the reports for the cull sow removal entry event. A mockup of an example of a company-level report benchmarked against the industry is shown in Appendix A. The report in Appendix A includes charts for the cull sow removal event only as an example.

While not part of this project, the investigators have conducted pilot work using artificial intelligence (AI) to assess and analyze open-ended information collected during investigations. These narrative data are stored as text within the SOIP investigation database. Appendix B provides an example of a simple analysis conducted using the text entered for the cull sow removal entry event from all completed investigations. Microsoft Copilot was used for the analysis because, under the licensing agreement between Iowa State University and Microsoft, information entered into the platform remains confidential and is not used outside the institution’s protected environment.

Table 1. Frequency of entry events for a single company benchmarked against the industry.

	Industry	Company
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	Entry events / 1,000 sows (28 days)	Entry events for a 4,000 sow farm annually	Entry events / 1,000 sows (28 days)	Entry events for a 4,000 sow farm annually	Index of entry events (Company / Industry)
On-farm employees enter farm	119.50	6,214	138.29	7,191	1.16
Feed or feed ingredients delivered to farm	4.92	256	6.68	347	1.4
Semen delivered to farm	2.79	145	2.28	118	0.8
Weaned pigs hauled from farm	2.32	121	1.80	94	0.8
Veterinarians, vendors, other visitors and off-farm personnel enter the farm	2.00	104	2.85	148	1.4
New tools and supplies delivered to farm	1.74	91	3.64	189	2.1
Garbage collection from farm	1.72	89	1.66	87	1.0
Cull sows hauled from farm	1.03	53	0.95	49	0.9
Repair/service personnel working outside barns	1.00	52	3.13	163	3.1
Repair/service personnel working inside barns	1.21	63	2.55	132	2.1
Mortalities removed from farm	0.84	43	0.00	0	0.0
Breeding replacements entered into herd	0.64	33	0.38	20	0.6
Manure removed from farm	0.25	13	0.50	26	2.0
Transferred tools and supplies delivered to farm	0.27	14	0.59	31	2.2
Propane, fuel and CO2 delivered to farm	0.25	13	0.70	36	2.8

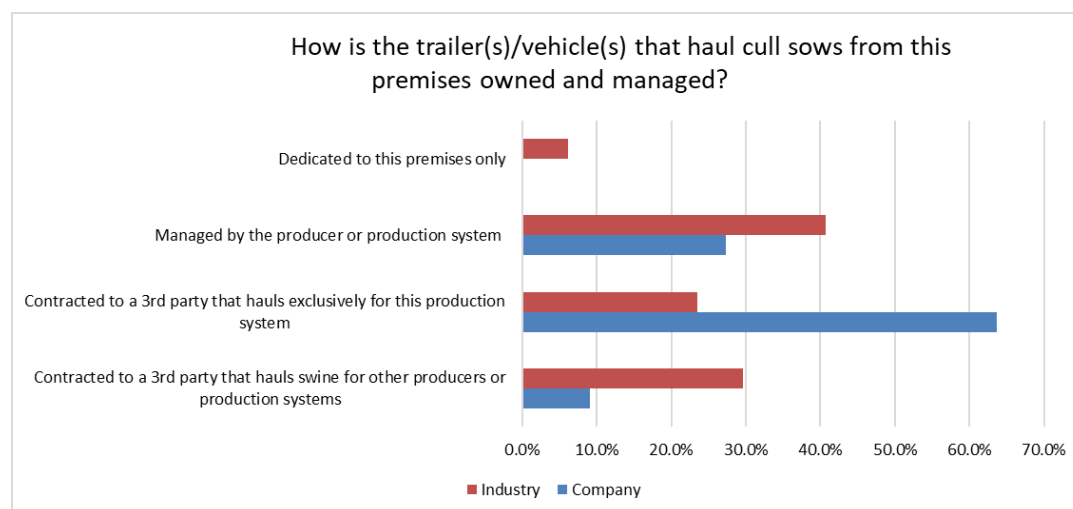


Figure 2. Example of the information included in the reports for the cull sow removal entry event.

Discussion:

This project supported and further developed the SOIP web-based application. This tool helps veterinarians and pork producers investigate disease outbreaks, identify critical biosecurity hazards, and allocate resources to eliminate those risks. The activities and deliverables are a continuation of over a decade of work by the investigators to develop the approaches, terminology, investigation forms and reports to systematically and comprehensively conduct outbreak investigations.

The SOIP web-based application and investigations database allows producers and veterinarians to enter information collected from outbreak investigations and to create reports that identify biosecurity hazards and summarize outbreak investigation findings. Training resources were developed and delivered to educate veterinarians and pork producers on conducting effective outbreak investigations, biosecurity hazard analysis, using the web-based application, and interpreting reports from outbreak investigations.

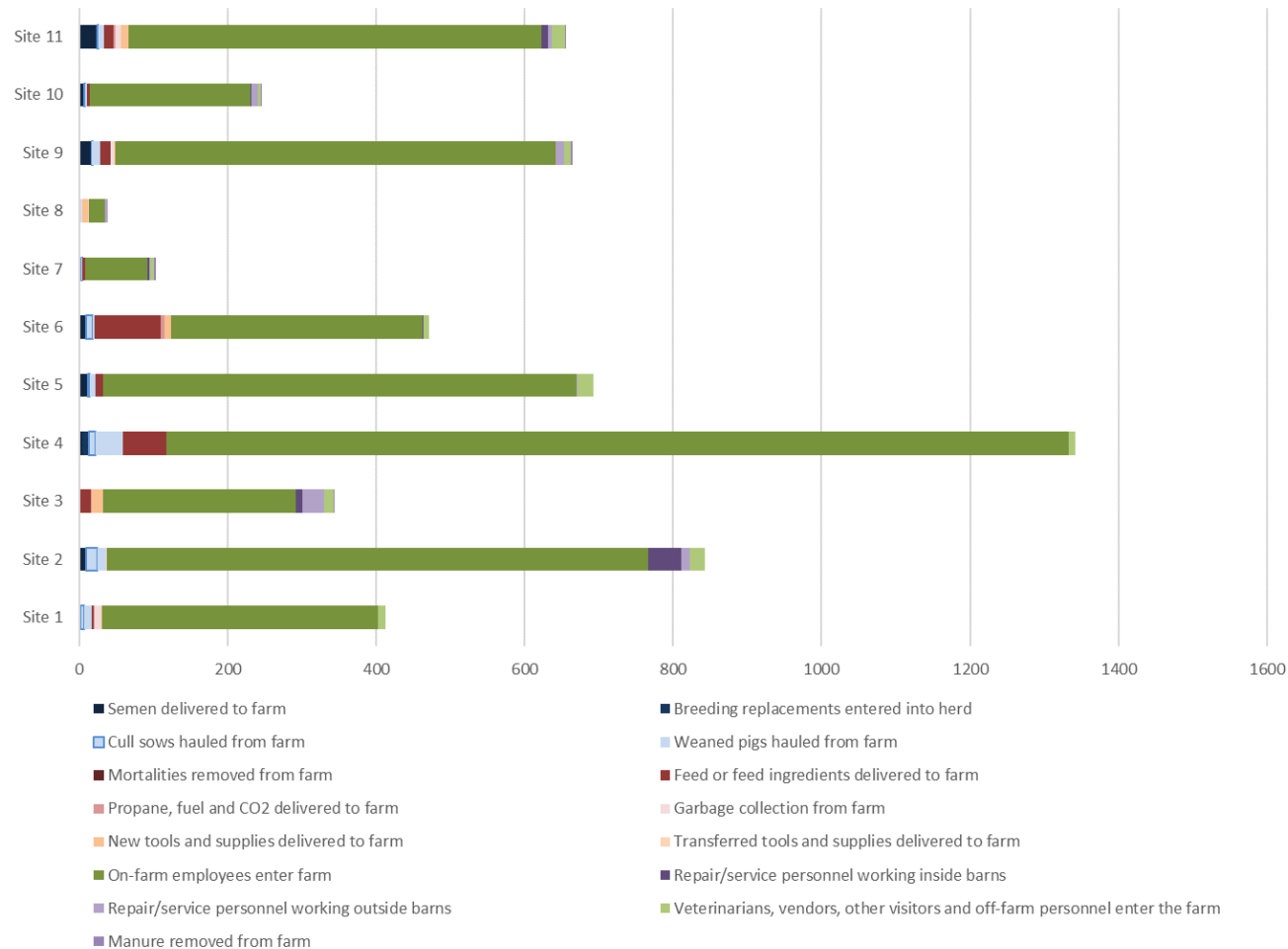
The outcome expected from this project is an increased number of veterinarians and pork producers conducting systematic, standardized, and comprehensive outbreak investigations and biosecurity hazard analysis. With their collective findings, gaps in US swine herd biosecurity can be identified more rapidly, and solutions applied to decrease the incidence of disease outbreaks over time, increase herd productivity, and improve global competitiveness. This improvement in biosecurity will help prevent the introduction of transboundary diseases to the US, and when transboundary diseases are introduced, veterinarians and pork producers will be ready to respond by identifying the most significant biosecurity hazards and routes of transmission to slow the spread and help control the pathogen.

Appendix A. Company and industry-level reports

Filters

Investigation type (Select all that apply) [prospective, retrospective]
Pathogen (Select all that apply) [PEDV, PRRSV, SVA, PDCoV, MHP, IAV-S, APP, PRCV]
Phase of production (Select all that apply) [breed-to-wean]
Time (Select start and end date)
Site name (Select all that apply)

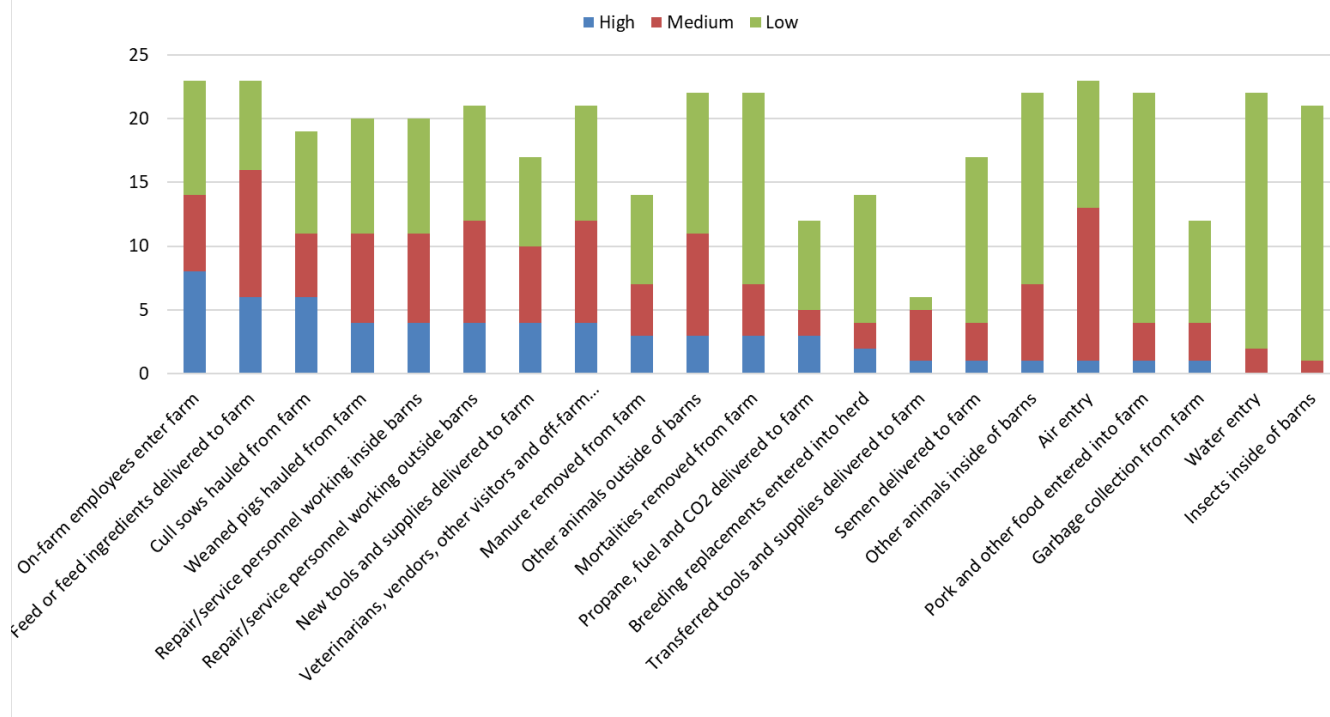
Frequency of entry events during the investigation period by site for single Company..



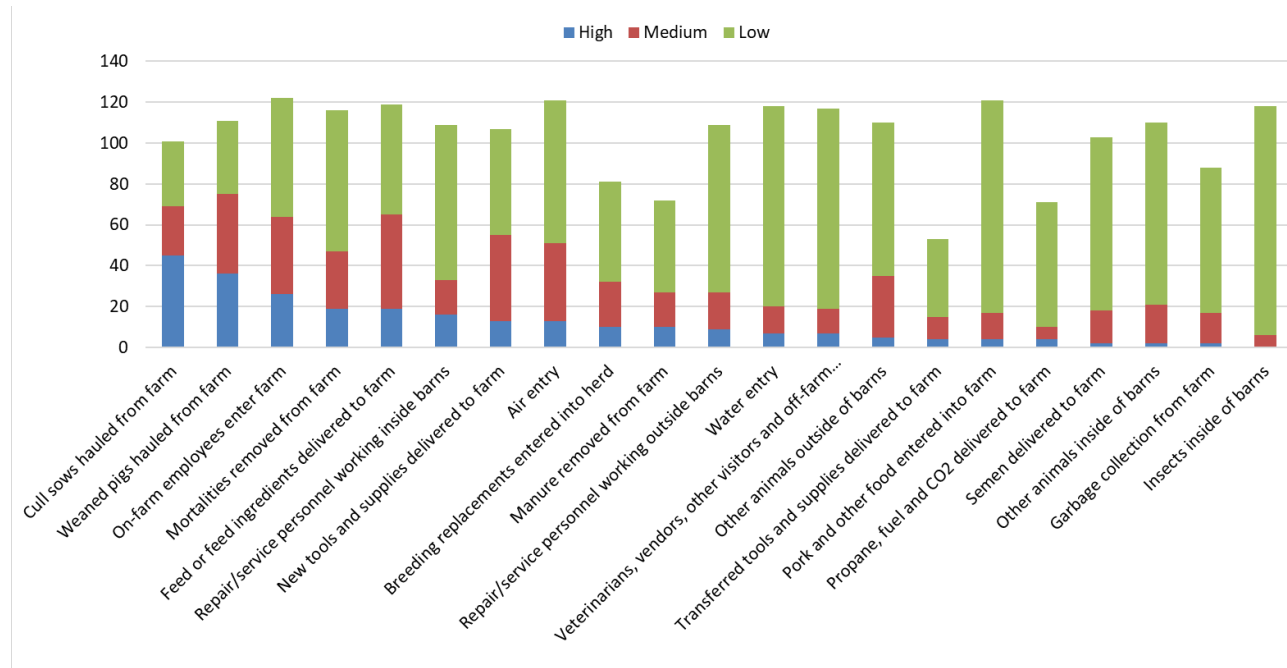
Frequency of entry events for Company benchmarked against industry.

	Industry		Company		
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Frequency of event hazard ratings by entry event, ranked by the number of times rated high: Company



Frequency of event hazard ratings by entry event, ranked by the number of times rated high: Industry

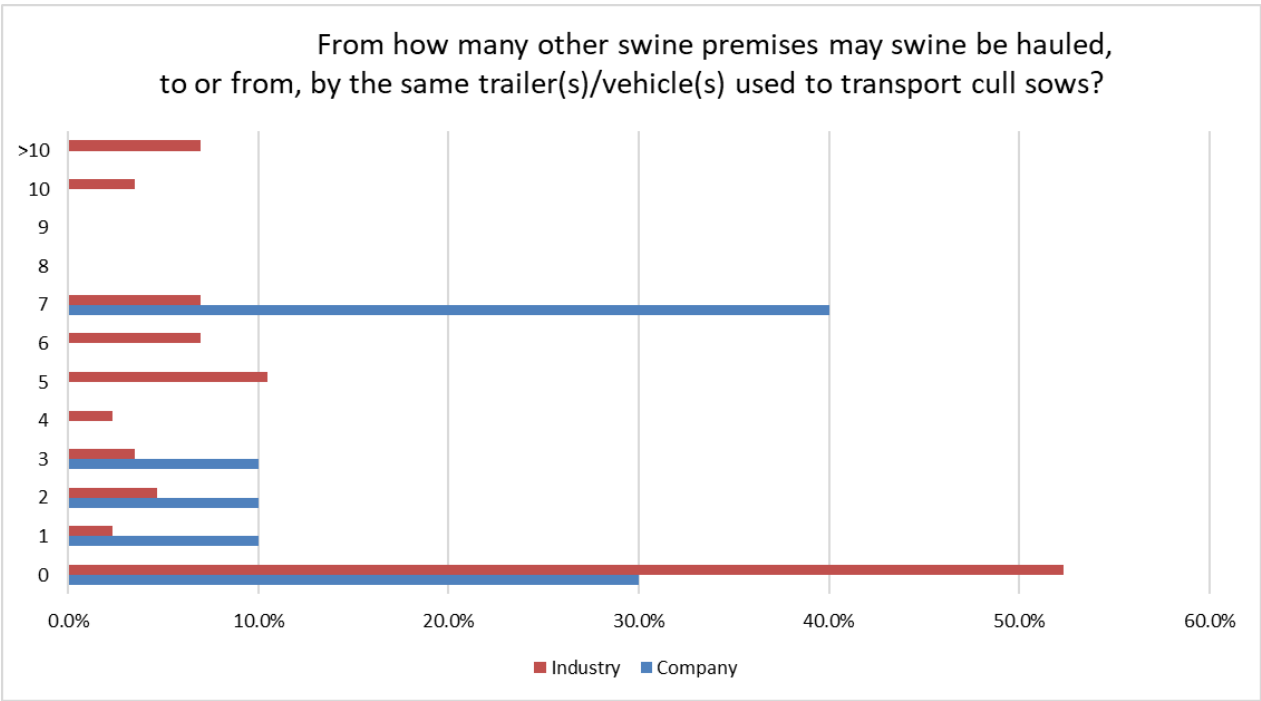
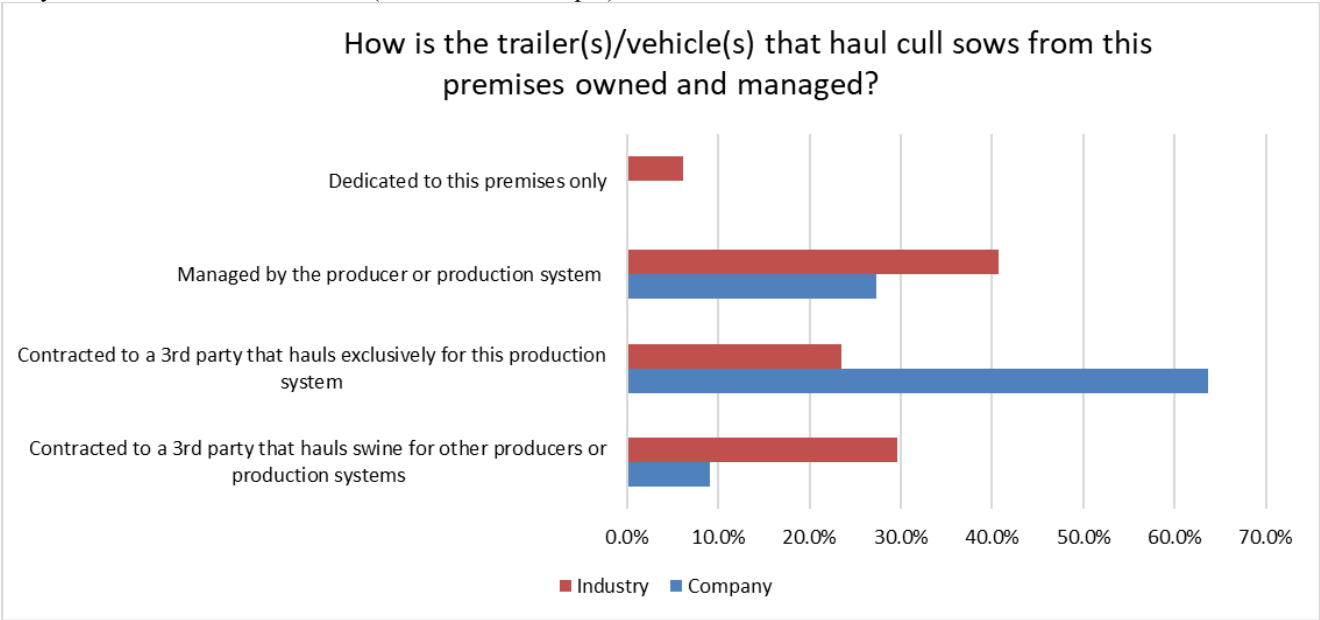


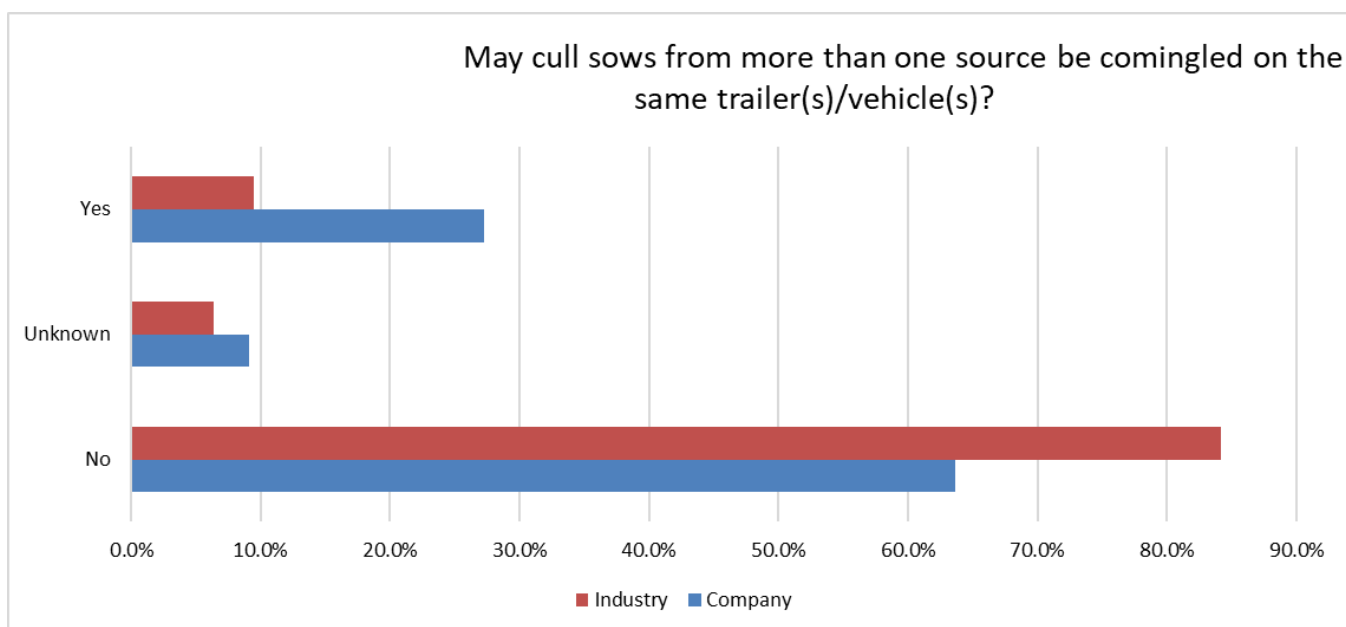
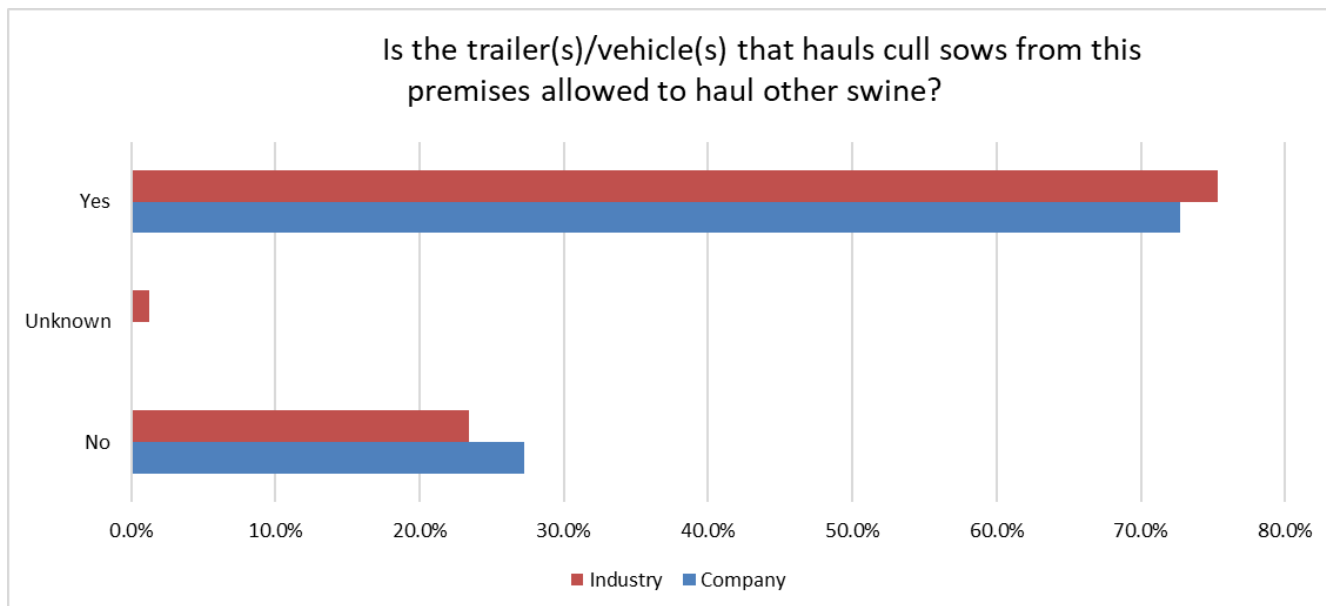
Summary of biosecurity hazards and control measures for entry events: Company and Industry

Filters

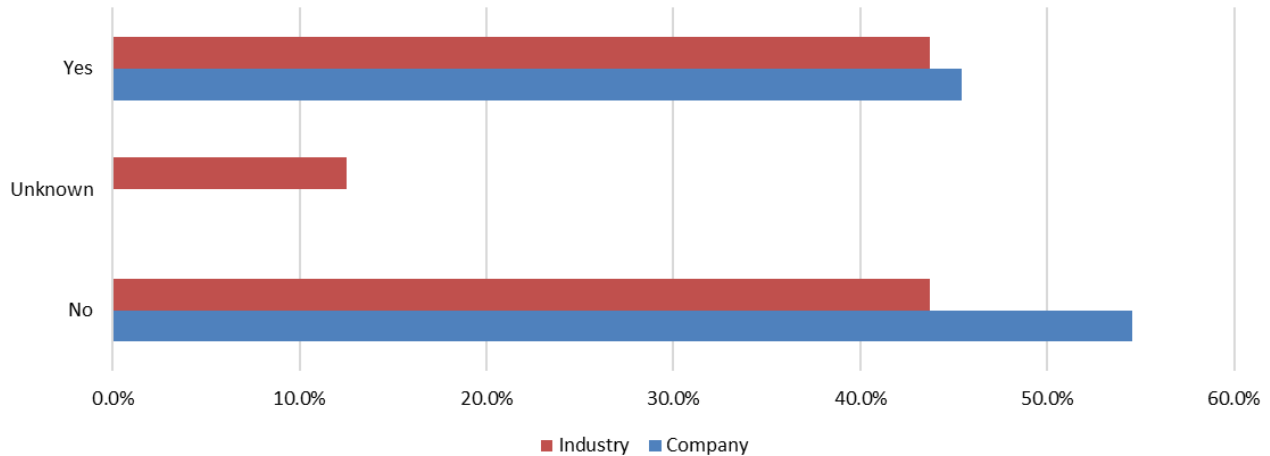
Entry event (Select all that apply) [all entry events]

Entry event: Removal of cull sows (shown as an example)

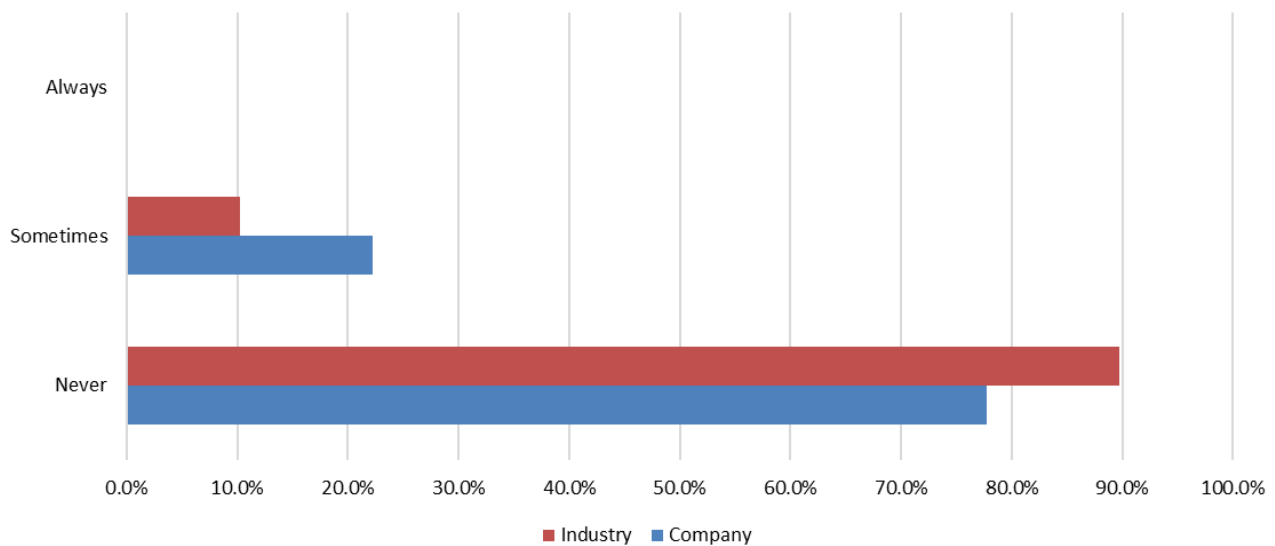




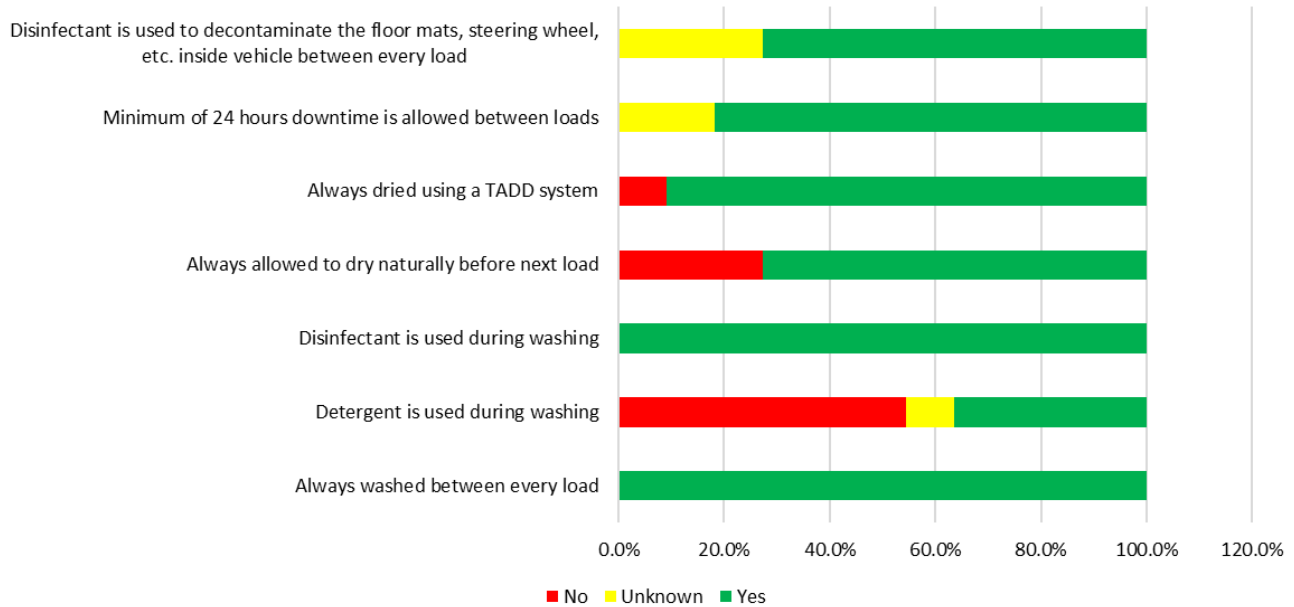
Are pathogen positive animals ever knowingly hauled on the trailer(s)/vehicle(s) that transport cull sows from this premises?



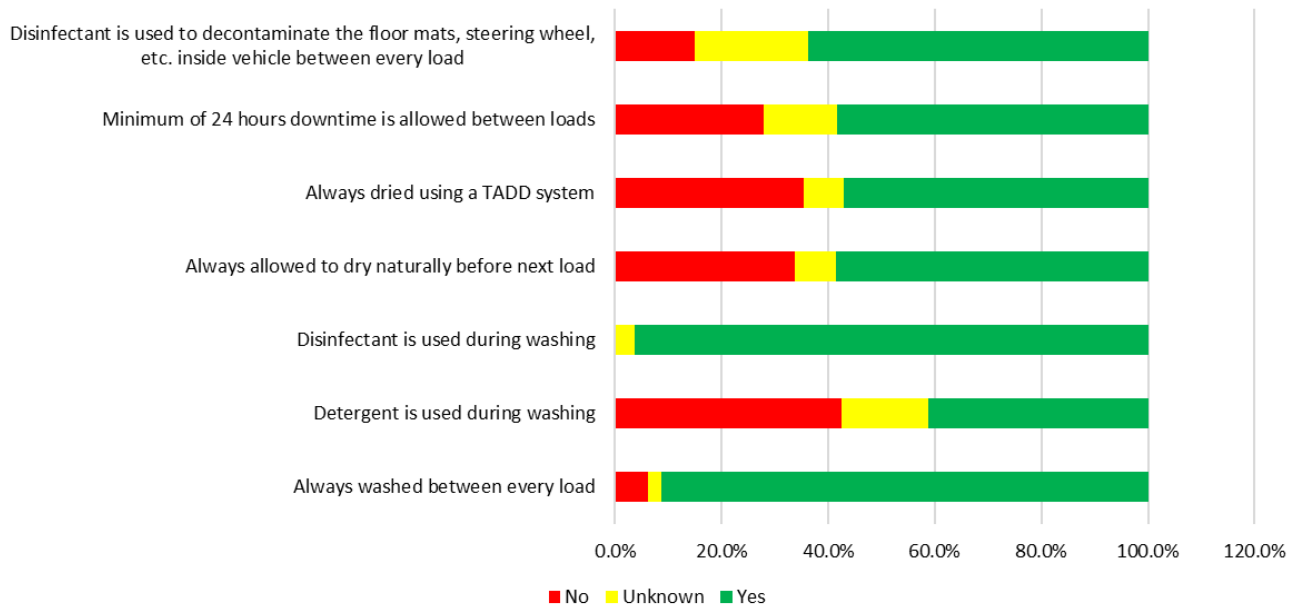
Are environmental swabs collected from the trailer(s)/vehicle(s) that transport cull sows from this premises and tested for the pathogen by PCR?



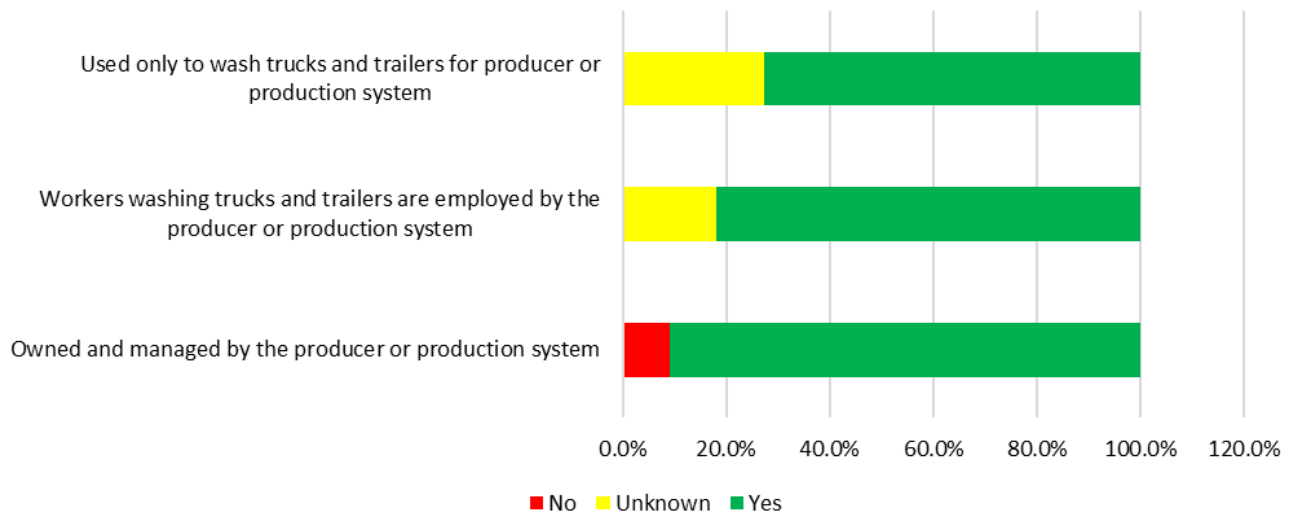
Company: What sanitation and decontamination procedures are used on the trailer/vehicle(s) that haul cull sows from this premises?



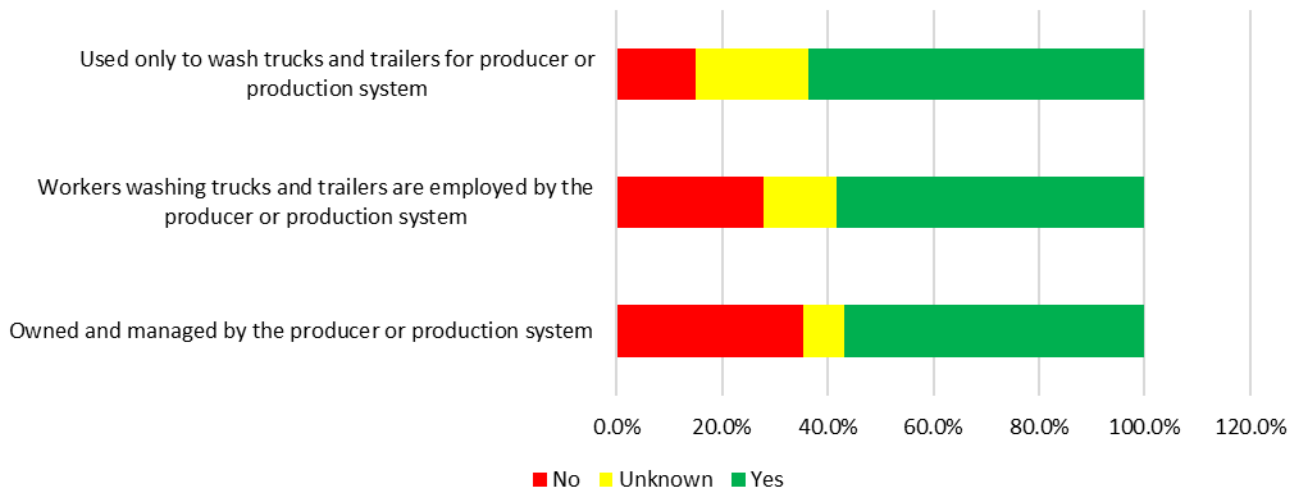
Industry: What sanitation and decontamination procedures are used on the trailer/vehicle(s) that haul cull sows from this premises?



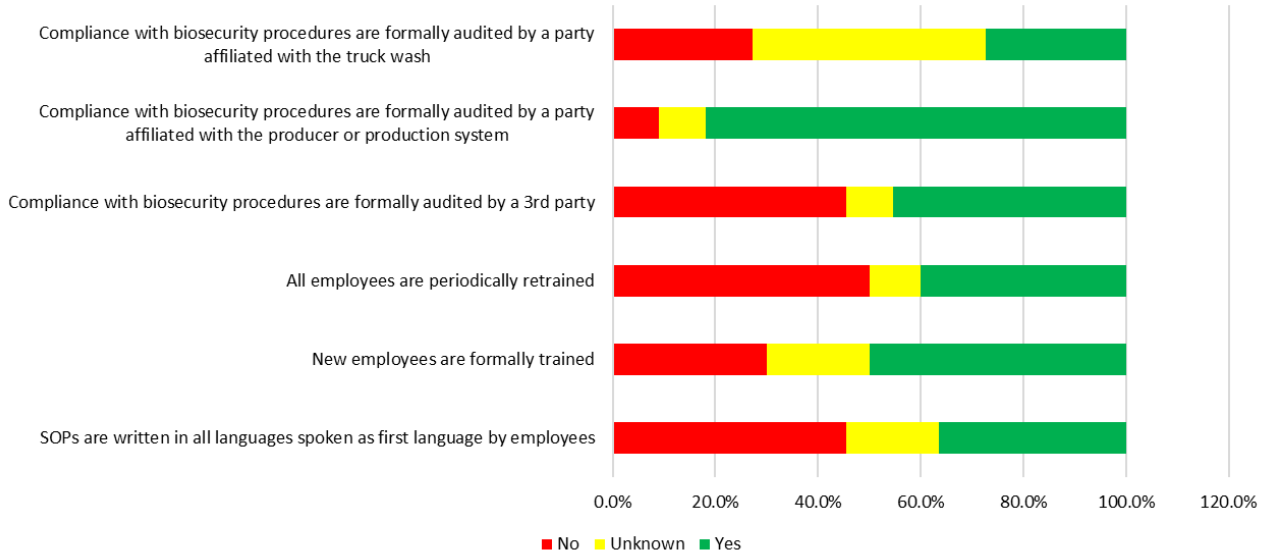
Company: How are the truck washes where trailer/vehicle(s) that haul breeding replacements are washed owned and managed?



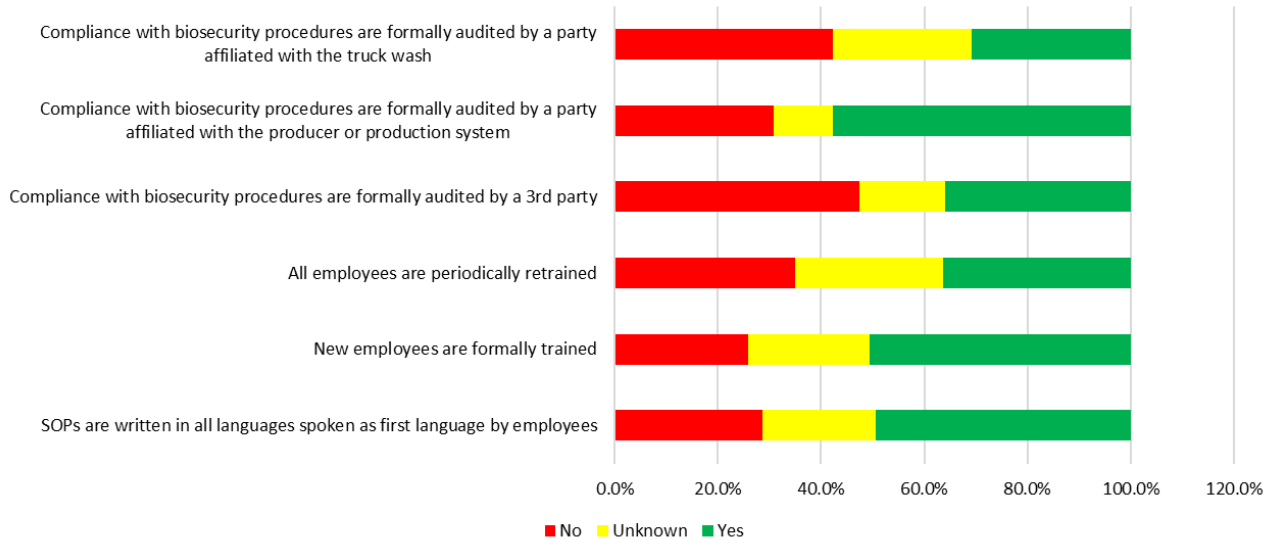
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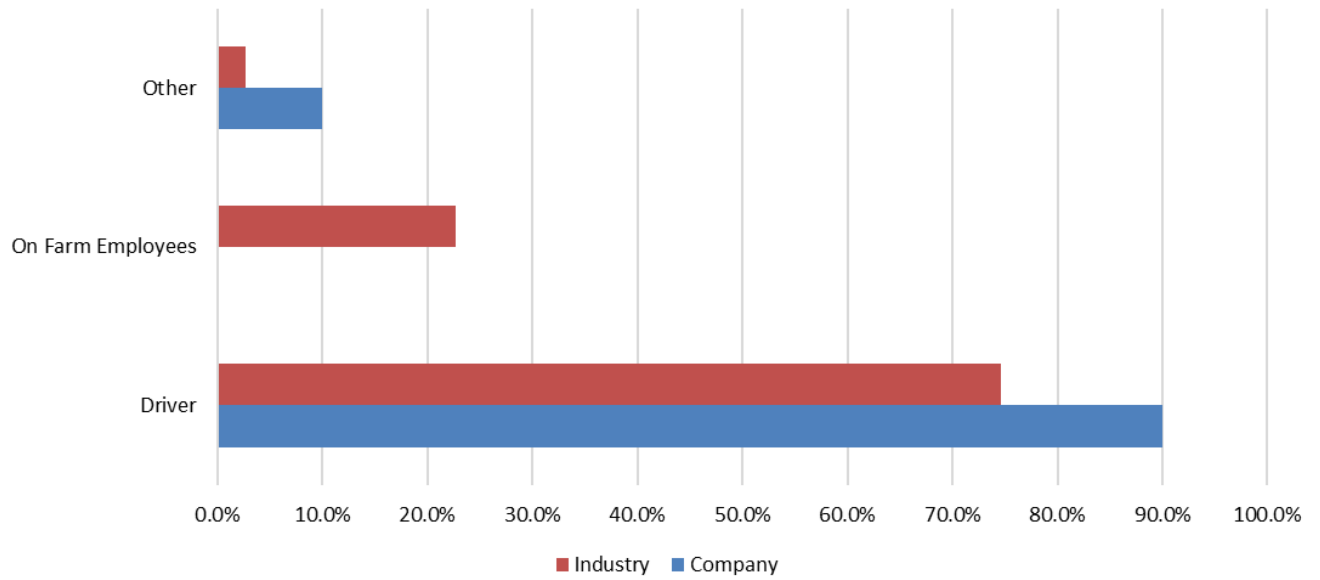
Company: What biosecurity procedures, training and auditing are done for the truck washes where trailer/vehicle(s) that haul cull sows are washed?



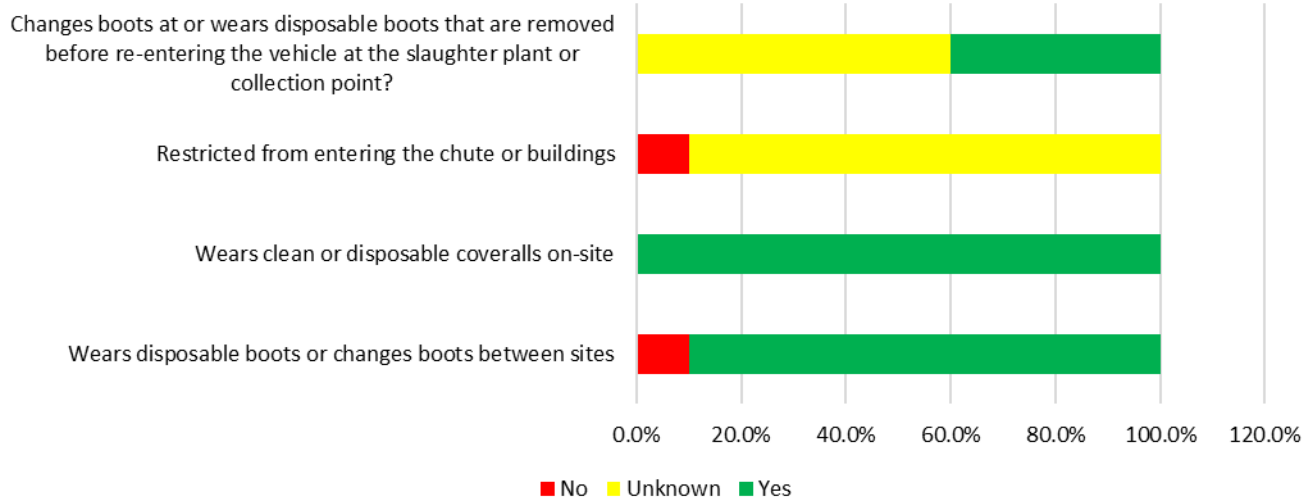
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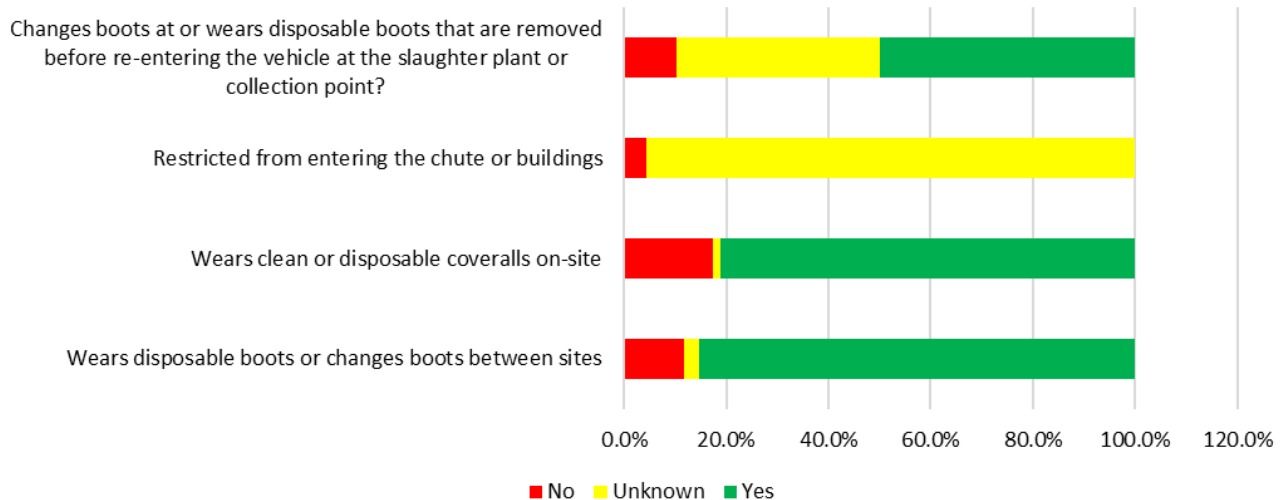
Who loads/unloads the cull sows in the trailer?



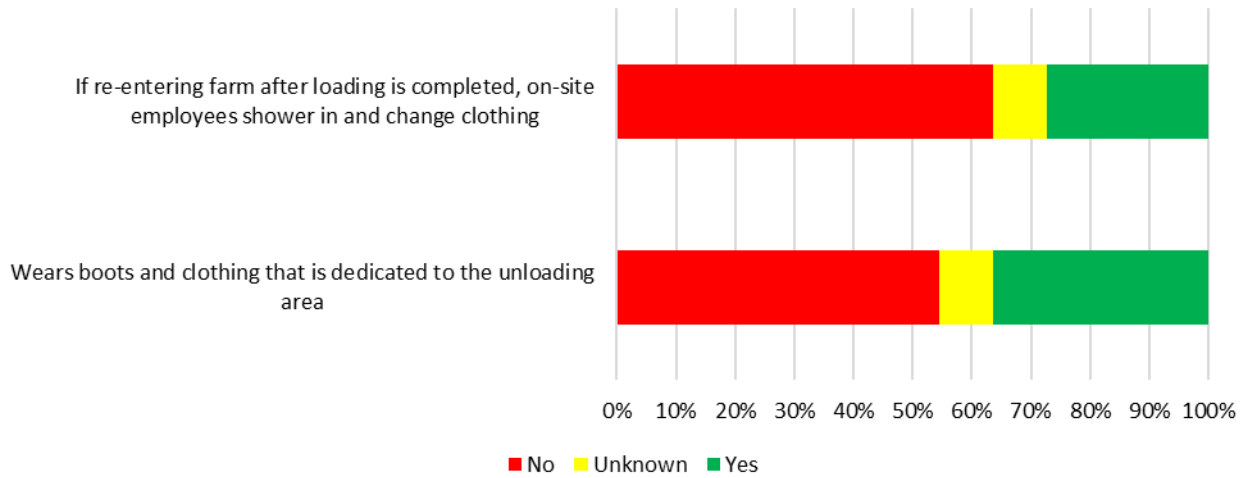
Company: What biosecurity procedures are followed by the driver of the trailer / vehicle(s) that haul cull sows from this premises?



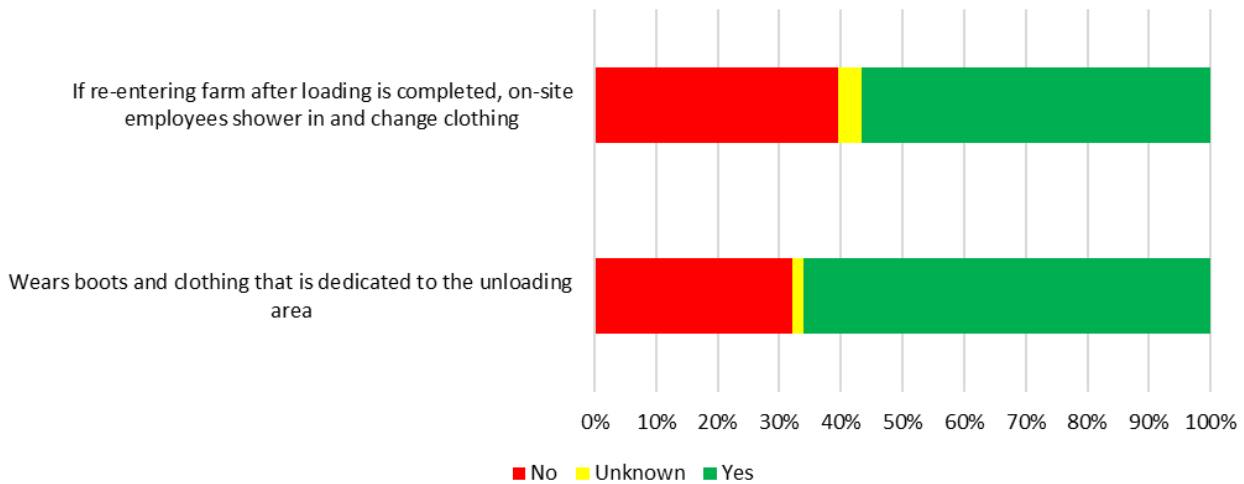
Industry: What biosecurity procedures are followed by the driver of the trailer / vehicle(s) that haul cull sows from this premises?

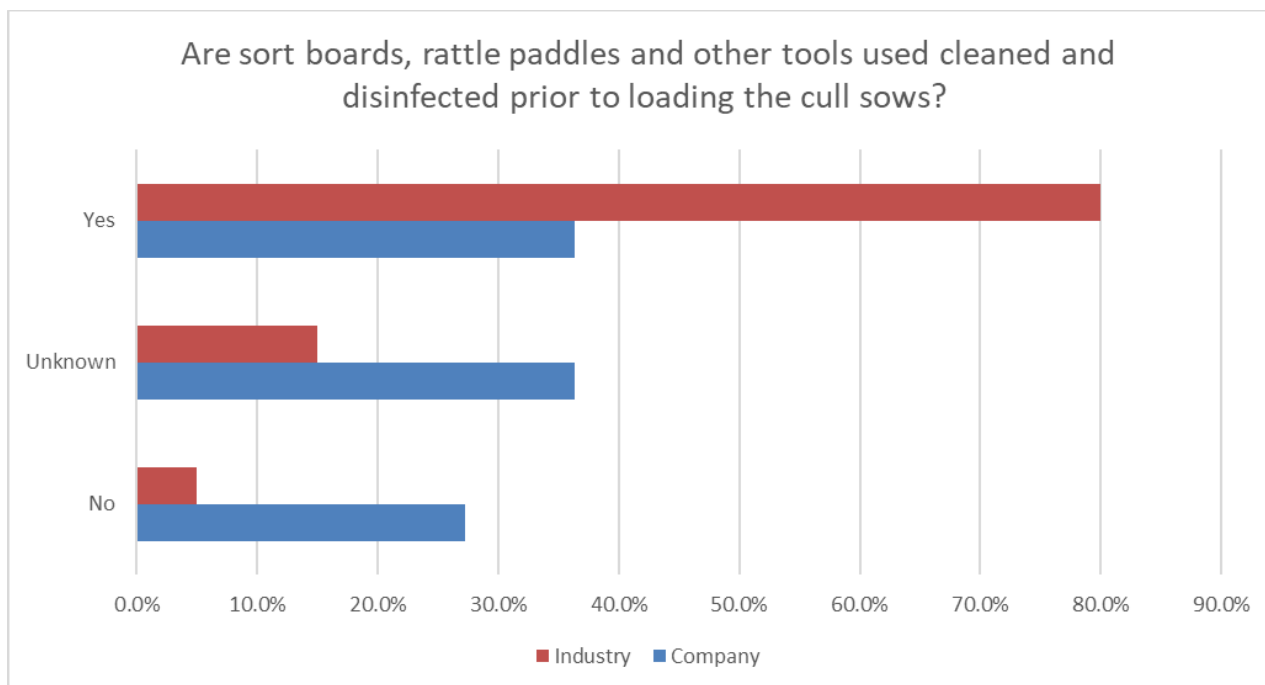


Company: What biosecurity procedures are followed by the on-site employees that load cull sows for this premise?

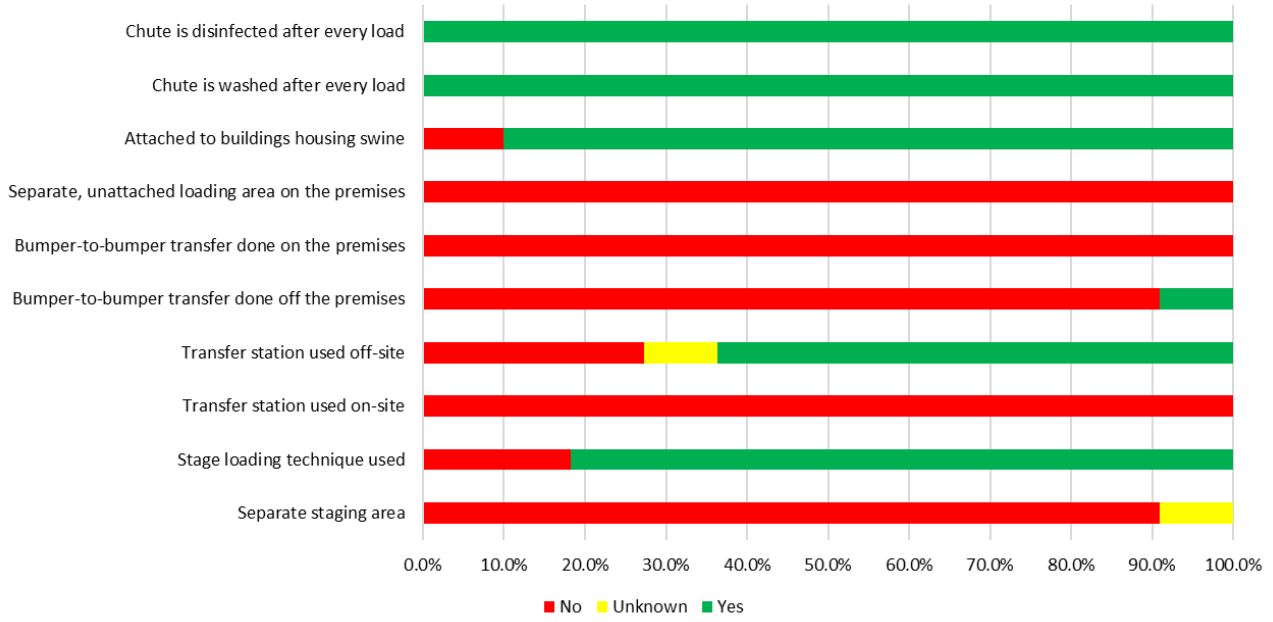


Industry: What biosecurity procedures are followed by the on-site employees that load cull sows for this premise?

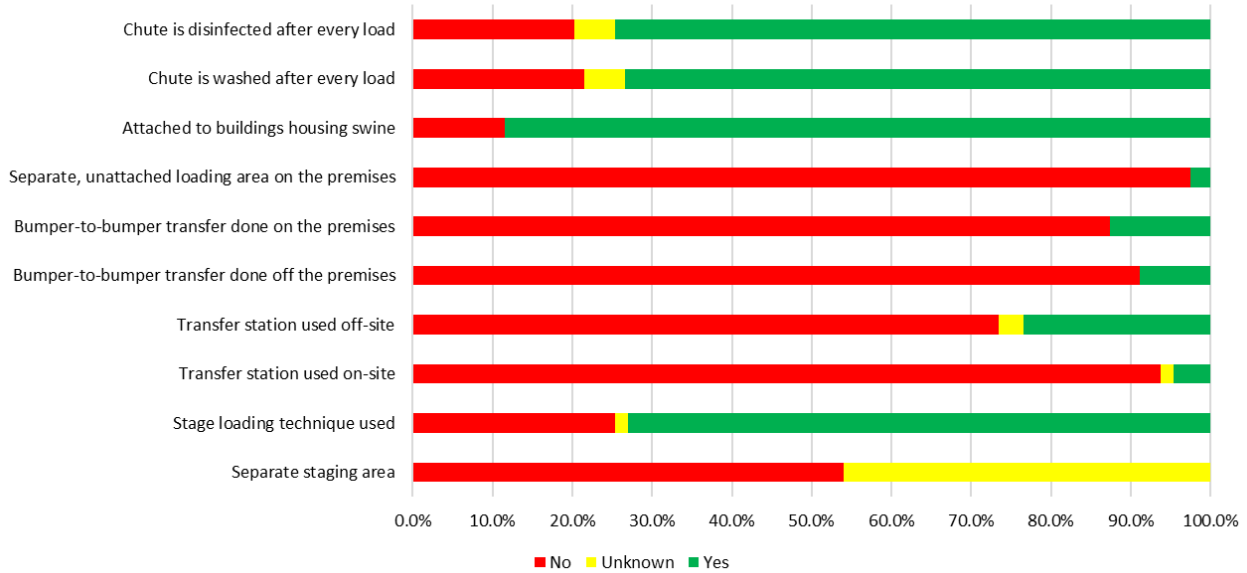




Company: How is the loading area for cull sows designed?



Industry: How is the loading area for cull sows designed?



Appendix B. Summary of open-ended comments for the cull sow removal entry event.

How generated

1. All investigations in the SOIP database were exported to Excel using the new data extraction feature in the SOIP application
2. All completed, non-excluded investigations (124) were identified. Investigations were excluded if:
 - a. Done for demonstration purposes
 - b. Done for swine farms that did not include the breed-to-wean phase of production
 - c. Incomplete (event hazard ratings assigned for 10 or fewer entry events)
3. All comments from completed investigations were copy and pasted to a Word document.
4. The Word document was uploaded to Microsoft Copilot.
5. The following prompt was entered: "Summarize the comments in this file."

The result (copied and pasted directly from Copilot without edit)

Summary of Cull Sow Transport & Loadout Comments

1) Primary Risk Theme: Transport-Related Contamination

- Cull sow trailers, trucks, and drivers are repeatedly identified as **high-risk vectors** due to:
 - Contact with **markets, buying stations, and other farms** (often PRRS-positive environments).
 - **Shared or non-dedicated equipment** (trailers hauling culls, weaned pigs, gilts).
 - **Third-party haulers** with limited oversight or unknown practices.
- Even when protocols exist, **risk hinges on consistent execution**, especially by drivers.

Key issue:

→ Contamination may occur **before arrival (market exposure)** and not be fully mitigated by washing.

2) Truck Wash and Decontamination Gaps

Common deficiencies include:

- **Inconsistent washing quality**
 - Organic matter often remains on trailers.
- **Inadequate disinfection**

- Incorrect dilution, poor coverage, or reliance on ineffective tools.
- **Suboptimal drying (TADD)**
 - Lack of surface temperature monitoring.
 - Systems not reaching effective temperatures or leaving moisture.
- **Cab and equipment sanitation overlooked**
 - Interiors frequently not cleaned/disinfected.
- **Limited auditing and verification**
 - Many processes rely on trust rather than measurement.

Key issue:

→ Wash systems exist but are frequently **not validated or consistently effective**.

3) Biosecurity Breakdowns During Loadout

Recurring concerns:

- **Weak or poorly enforced lines of separation (LOS)**
- **Inadequate staged loading design or execution**
 - Many facilities not built to support proper staging.
- **Employee cross-over risks**
 - Workers returning to barns without showering or changing properly.
- **Driver rule violations**
 - Entering chutes or failing PPE protocols.
- **Shared chutes**
 - Used for culls + gilts/weaned pigs → cross-contamination risk.

Key issue:

→ Even with protocols, **facility design and human behavior limit effectiveness**.

4) Facility & Design Limitations

Frequent structural problems:

- Chutes:
 - Drain **back into barns** or high-traffic areas.

- Made of **wood or difficult-to-clean materials**.
- Not dedicated (shared across flows).
- Staging areas:
 - Too small or absent → repeated loading cycles increase risk.
- Transfer stations:
 - Often **unwashed, uncovered, or poorly designed**.
 - Allow cross-traffic between trailers.

Key issue:

→ Infrastructure often **undermines biosecurity protocols**.

5) Transfer Stations = Major Vulnerability

- Common problems:
 - No cleaning/disinfection between loads.
 - Mixing of animals from multiple farms.
 - Unknown status of incoming trailers.
 - Bumper-to-bumper transfers with **high contamination potential**.
- Some stations act like **aggregation points for pathogens**.

Key issue:

→ Transfer points are repeatedly flagged as **high-risk hubs**.

6) Downtime and Scheduling Risks

- Many loads occur with:
 - **<24-hour downtime** between uses
 - Sequential loading from multiple farms
- Mixing schedules:
 - Cull loads near gilt or weaned pig movements increase risk.

Key issue:

→ Insufficient downtime limits effectiveness of sanitization.

7) Inconsistent Training & Compliance

- Frequent lack of:
 - Formal training programs
 - Routine audits
 - Enforcement mechanisms
- Biosecurity often dependent on:
 - Individual behavior rather than systems
- New or contract drivers often **poorly trained or unverified**.

Key issue:

→ Biosecurity is **not standardized or consistently enforced**.

8) Common High-Risk Behaviors Identified

- Loading trailers without knowing prior load history
 - Drivers entering chutes or violating LOS
 - Employees returning to barns without:
 - Showering
 - Changing clothes/boots
 - Washing processes that:
 - Spread contamination back into barns
 - Using shared trailers across different pig flows
-

9) Relative Risk Assessments Across Cases

- Most systems: **Medium to High risk**
- Lower-risk systems had:
 - Dedicated trailers
 - Strong staged loading
 - Effective wash + TADD + downtime
- Even “low-risk” ratings acknowledge:

- **Intrinsic risk of cull movements cannot be eliminated**
-

10) Recurring Recommendations

Across sites, consistent recommendations include:

Transport & Equipment

- Dedicate trailers by animal class and health status
- Improve truck wash:
 - Validate disinfectant concentration
 - Monitor surface temps during TADD
- Clean/disinfect **truck cabs and equipment every load**

Loadout Process

- Implement or improve **true staged loading**
- Establish and enforce clear **clean/dirty lines**
- Require **full PPE compliance**
- Ensure employees **shower/change before re-entry**

Facilities

- Redesign:
 - Chutes (better drainage, materials)
 - Staging areas (capacity + separation)
 - Transfer stations (cleanable, segregated)
- Prevent wash water from entering barns

Management

- Create **formal training and audit programs**
 - Track trailer usage and sanitation
 - Increase **biosecurity accountability and documentation**
-

Bottom Line

Across all investigations, cull sow removal is consistently identified as:

☞ **An inherently high-risk process driven by:**

- Exposure to contaminated markets
- Imperfect sanitation systems
- Facility design limitations
- Human compliance variability

☞ **The greatest vulnerabilities occur at:**

1. Truck wash (failure to fully decontaminate)
2. Transfer stations (cross-contamination hubs)
3. Loadout areas (failure to prevent pathogen entry into barns)

Revised 1/25