Swine Health Information Center 2024 Plan of Work
Strategic Priorities

A. Improve Swine Health Information

1. **Domestic disease monitoring through veterinary diagnostic laboratory data collation.** A coordinated surveillance system across US pork production for endemic disease is beneficial. The Swine Disease Reporting System (SDRS) takes advantage of the willingness of the major veterinary diagnostic laboratories to share data through an infrastructure enabled by support from SHIC. Advisory members to SDRS provide feedback through periodic meetings regarding possible improvements or enhancements to the SDRS which would enable it to become more helpful, informative, timely and actionable. Expansion of reporting trends in pathogen or syndromic prevalence at VDLs and regional trends will be explored. Epidemiological use of the diagnostic data to further inform the pork industry of regional trends, future predictions, and emerging disease detection will be considered. Examples could include:
    a. Increasing bacterial disease monitoring through characterizing *Streptococcus suis* strain virulence, typing hemolytic *Escherichia coli* strain detection, and identifying *Glaesserella parasuis* serotypes.
    b. Reporting the prevalence and trends of co-infections over time and expanding the VDLs which contribute to the confirmed disease diagnoses through histopathology and tissue evaluation by pathologists.
    c. Correlating data from packing plant condemnation reports to forecast trends and define the relationship between condemns and endemic disease prevalence or tissue diagnosis.
    d. Expanding the number of public and private veterinary diagnostic laboratories in the US and across North America which contribute data to domestic disease reports.
    e. Regional reporting of pandemic and novel influenza strains including neuraminidase and hemagglutinin gene detection frequency, recombination, and trends over time.
2. **Domestic disease monitoring through voluntary reporting to the Morrison Swine Health Monitoring Project.** As a voluntary reporting system enabled through infrastructure support from SHIC, MSHMP provides a foundation for industry capacity to report system level disease, respond rapidly, and maintain business continuity. The project will help to identify industry needs through participant input with a goal to make the data more actionable for enrolled participants and help in response to emerging health challenges. Additional analysis projects using the MSHMP data will be explored to enhance value to participants and encourage more producers to participate as voluntary reporting of data will translate to value across all producers.
3. **Information sharing website for Japanese encephalitis virus for US stakeholders.** With SHIC support, a JEV information sharing website was developed and made available for stakeholders to have a centralized source of information on JEV ecology, clinical signs, epidemiology, economic impacts, and response. Content of the website will be monitored and updated as needed to ensure the latest information remains available.
4. **Strategic summary of SHIC swine health and disease work-to-date.** With new data and diseases emerging at a rapid pace, maintaining informative summaries of knowledge gained for stakeholders is a challenge. A strategic approach to developing research questions over time and ensuring all research builds upon previous foundational work is needed. Best practices for a long-term SHIC research strategy and clear organization of knowledge will be explored.
5. **Webinars to inform veterinarians and producers about emerging swine health issues.** Veterinarians are challenged to stay abreast of new technologies and emerging pathogens associated with disease. The goals of the webinar series are to 1) share experiences and management options to foster communication and inform discussion about emerging diseases and

2) keep pace with industry chatter about current health challenges. Webinars will be offered quarterly or as needed in response to emerging health topics.

6. **Maintaining up-to-date swine disease fact sheets.** The swine disease fact sheets are a commonly accessed information resource from the SHIC website. The content of each sheet, as well as the need for new sheets to be developed, will be monitored to ensure the latest information remains available.
7. **Ensure timely and valuable communications across all stakeholder audiences.** Information sources may have disparate conclusions that require consolidation, validation and summarizing to help ensure producers are provided up-to-date and accurate information to make decisions. This analysis of information may require a panel of experts to help provide context to novel swine health technologies or advancements. Further, ensuring effective communication across different stakeholder audiences, such as state animal health officials and state pork producer associations, may require tailored messaging platforms or targeted relaying of information.

B. Monitor and Mitigate Risks to Swine Health

8. **CBP and high-risk product importation and traveler entry at borders.** The risk of emerging or foreign animal disease introduction at the US border, including at seaports and airports, is due in part to importation of both legal and illegal products. Additionally, high-risk traveler entry, such as those individuals who have recently visited ASFV-positive farms, pose a risk to the US industry. SHIC will work with CBP and research partners to identify high risk imports through analysis and interaction of product data, such as country of origin, disease status of region, likelihood of pathogen contamination, product type (such as a swine feed ingredient), risk of pests (such as rodents and insects), transport route and timeline, and potential exposures enroute. Investigations may include modeling risk, product confiscation and testing for pathogens, and identifying high risk products for inspection or other mitigations. Continued communication with CBP on high-risk travelers who lacked secondary screening will help inform risk and mitigation of ASFV introduction through travel.
9. **Global disease monitoring to identify and inform international swine disease risks.** The global disease monitoring reports relies on both official and unofficial verified sources of information to improve understanding of disease status in countries around the world. Continued efforts in validation and verification of reporting for inclusion to maintain timely and accurate reporting will be prioritized. Projects to enhance reporting will be considered, such as developing an international veterinary diagnostic laboratory network to provide standardized reporting from other countries and artificial intelligence tools for mining online data for signals of unusual syndromes in swine or specific disease indicators. Investigate how to overcome barriers to swine disease information in countries or regions where outbreaks are unreported or unreliable. Engage and foster relationships with international stakeholder groups to build and compile a global information network in high and low volume pork production countries around the world. Individuals with international disease experience will be asked for their input and analysis of unofficial disease reports from other countries, including swine veterinarians, technical service veterinarians, pork producers, veterinary diagnostic laboratorians, and genetics or pharmaceutical company representatives.
10. **Foster information sharing with government and allied industry through international animal health organizations.** Understanding the origin and progression of emerging, re-emerging, and novel infectious diseases is critically important to preventing epidemic and pandemic outbreaks. The World Organization for Animal Health (WOAH) and Food and Agriculture Organization of the United Nations (FAO) facilitate international health information sharing through building and maintaining databases of diseases in member countries. Interacting with these entities and other swine disease centered programs could provide lessons for the US pork industry about monitoring, analysis, preparedness, and response for emerging diseases.

11. **Adoption and measuring implementation of wean-to-harvest biosecurity research outcomes.** Research projects funded through the FFAR/SHIC/NPB wean-to-harvest biosecurity research program will develop fundamental tools and technologies to improve biosecurity in the post-weaning phases of pork production. An important next step is ensuring that sharing knowledge results in adoption and measuring implementation extent to estimate return on investment. Mechanisms for wean-to-harvest biosecurity accountability and collaboration across systems for the protection of the entire US industry will be investigated.
12. **Enhancing biosecurity of mortality management practices to reduce disease transmission back to farm.‡** Mortality management continues to be a risk for pathogen spread within the farm and to other sites, to wildlife, and to transport vehicles. Improved understanding of effective interventions that enhance biosecurity of mortality management and reduce the risk of pathogen spread from mortalities is needed. Investigations into risk factors as well as entry and contamination mechanisms for all types of mortality management will be pursued, including incineration, composting, and rendering, with a goal of identifying tools or technologies for enhancing biosecurity within each type. Cost-effective methods to successfully decontaminate mortality removal equipment needs to be investigated and validated.
13. **Transportation biosecurity of live pig and market haul.‡** Pork production in the US is highly efficient in part due to highly specialized and segregated production which requires high volume transportation of pigs between production phases, packing plants, or secondary markets. Transport biosecurity is essential to reduce the risk of transportation serving as a means of disease introduction and spread. Novel technologies for cost-effective transport biosecurity will be investigated with and without water as well as defining the ROI for strategic or targeted transport biosecurity, such as identification of highest risk vehicles, loads or routes.
14. **Novel air filtration technologies for cost-effective bioexclusion on grow/finish sites.‡** Air filtration on sow farms is utilized for bioexclusion of pathogens but the traditional technology is generally considered too costly for installation on nursery or grow/finish sites. Novel, outside-the-box, cost-effective approaches to air filtration will be explored as a tool for bioexclusion and as a barrier to personnel biosecurity compliance on grow/finish sites. For example, dust mesh coverings may be more practical and feasible for both odor and virus control.
15. **Packing plant biocontainment for reducing pathogen spread back to the farm.‡** Pathogen transfer back to the farm from first points of concentration continues to challenge producer opportunity for profit and risk emerging disease control. Packing plant contamination of swine pathogens in lairage is a risk to trailers and transport vehicles/personnel that return to farms where they will contact live pigs. Identifying and validating best practices for enhanced biosecurity at packing plants will be pursued using endemic diseases as indicators of pathogen risk and control. Inclusivity of innovative, cost-effective solutions for packing plants alongside farms is critical to protect the US industry from emerging diseases.
16. **Cull sow and secondary market biosecurity and disease surveillance.** Monitoring disease surveillance and spread in the cull sow and secondary market swine populations is an industry challenge. Best practices for detecting emerging pathogens, reducing the risk of disease transmission, and maintaining biosecurity through these channels will be investigated.
17. **Engineering biosecurity controls through site construction design or strategic renovation.** Biosecurity which utilizes engineering controls as opposed to administrative controls removes the human error component to biosecurity compliance. There is a need for resources on evidence-based design for new farm site construction and strategic renovation of existing facilities that involves builders as part of the biosecurity team. Buildings could include swine barns, feedmills, packing plants, and truck washes. Building a library of strategic design considerations to increase biosecurity engineering controls is needed, including practical low-cost retrofitting of older facilities. For example, the ease of handwashing during flow of personnel entry and exit, a checklist of necessary deign components for staged loading or loading ramps, a process for

routine maintenance of biosecurity hazards that develop as facilities age, and building finisher sites with a biocontainment focus for odor and virus emissions.

18. **Defining spillover risks of emerging diseases from wean-to-market pigs to sow herds.** Data from the domestic swine disease monitoring reports revealed that 2 months prior to an increase in PRRSV prevalence in sow herds, there is a preceding increase in PRRSV prevalence in wean-to-market pigs. This data indicates a spillover risk from post-weaning pigs to breeding herds. Further epidemiological links and biosecurity hazards will be identified for routes of pathogen spread between these production phases.

C. Respond to Emerging Disease

19. **Emergency disease preparedness and response planning in coordination with state, federal and industry stakeholders.** Working in collaboration with the swine industry organizations as well as other stakeholder groups (US SHIP, NPB, NPPC, AASV, NAMI, USDA, CDC, FSIS, DHS) to collectively plan emergency response for foreign or transboundary swine disease incursion. Assist in filling gaps of research and information necessary to prevent, prepare and respond to diseases which impact the US pork industry. Identify needs for protecting the US pork supply chain and US food security in emergencies due to swine or human disease, such as the COVID packing plant shut down. ASFV continues to be a monitoring and mitigation priority with the objective of using information to prevent US introduction. Modeling will be explored to define the ASFV response goals and extent of spread within specific timeframes post-introduction (i.e., during 72-hour standstill) to maximize resources and target highest ROI activities. Modeling may include outcome variables, including time to baseline production, time to stability, time to determine location of disease, and time to resume trade. Through coordinating with the other pork industry organizations, SHIC will continue to participate with research to inform effective national prevention, response, and recovery programs to minimize impact on the US industry.
20. **Validating feedmill decontamination protocols to reduce feed transmission risk.** Along with feed industry stakeholders (AFIA, IFEEDER, ANAC, USB), consideration of next steps to validate feedmill cleaning and disinfection protocols will be investigated to ensure effective removal of pathogen transmission risk from mills post-contamination.
21. **Investigating production and swine health impacts of porcine astrovirus, kobuvirus and sapovirus as emerging pathogens.** Additional information is needed to fully characterize PKoV, PSaV, and PoAstV lineages as potential causative agents of disease in swine and understand prevalence across the US industry. Targeted retrospective analyses of suckling and postweaning cases of respiratory and enteric disease may be useful to enhance knowledge of these potentially emerging agents.
22. **Improving diagnostic tools, understanding of pathogenesis, and interpretation of test results for porcine circovirus types 2, 3 and 4.** PCV2 diagnostic testing has significantly increased through processing fluids and additional information is needed to interpret test results within the context of the clinical field setting. Investigations will evaluate rationale for increased PCV2 testing, interpreting high levels of PCV2 detection in the absence of histology, role of serologic testing, as well as vaccine compliance and association with protection to assist in interpretation. Questions have been raised around what PCR Ct value for PCV2 in different sample types and tissues can be a defined cut-off for vaccine failure. Further insight into a standardized PCV3 case definition for sows, pathogenicity in the presence of co-factors, use of processing fluids and other sample types for PCV3 surveillance, and the role of PCV3 co-infections with PRRSV and PCV2 would benefit the industry. Additionally, identification of novel circoviruses such as PCV4 may require investigation and confirmation that current circovirus diagnostics would detect a potential incursion.
23. **Utilizing the web-based Standardized Outbreak Investigation Program to identify high risk events for pathogen entry.** Biosecurity hazards identified through the SOIP resource help farms mitigate risk for introduction of emerging disease. To ensure that the members of the Rapid

Response Teams are available to respond to emerging disease outbreaks (non-regulatory FAD) quickly and effectively if requested by producers, support for member training, expansion and deployment is needed. Training and conducting exercises will be needed for effective use of the web-based platform for Rapid Response Team members. The web-based platform has been developed for standardized data capture online and enables utilization of data for machine learning and shared conclusions. Use of the generated and historical data to identify the frequency of biosecurity hazards across the US industry over time will be explored as well as the best mechanism by which standardized data summaries and lessons learned are provided as routine outputs. Further utility of the SOIP will be considered, such as:

a. Database integration with programs such as AgView and POMP for leveraging use of outbreak data and integration of traceability of site relationships and disease management information, respectively. Opportunities for leveraging biosecurity hazard data with laboratory diagnostic data and production data could provide additional value.
b. Risk based assessments could be performed based on SOIP data collected and a benchmarking report could help to evaluate biosecurity competencies and gaps. Benchmarking would allow comparison of farm standards across the industry and could be used in the absence of an outbreak to identify biosecurity hazards that require mitigation to reduce disease introduction risk. An objective risk scoring system could be adapted to SOIP data. A biosecurity hazard analysis or audit could be utilized for a biosecurity certification program for farms and packing plants.
c. To enhance effective and rapid response, as well as increase biosecurity of investigations, the use and validation of virtual technologies for SOIP data generation will be evaluated.

24. **Identification of early disease outbreak warning signals from industry data.** Early warnings of an emerging disease provide the opportunity for early diagnostic confirmation leading to more effective containment and recovery. Analysis of farm and regional data from the MSHMP for early disease warning signals have been investigated. Further development and validation of early disease warning technologies will be explored to improve sensitivity of detection and disease outbreak prediction capabilities.
25. **Rapid deployment of research funds for a newly emerging disease.** There is no predicting when or where the next emerging disease will appear. SHIC needs to be prepared with funds in place that can be quickly mobilized to support filling the immediate research gaps following an outbreak. This research will provide producers and their veterinarians with critical information that they will need to effectively respond to the disease outbreak.
26. **Diagnostic assay development for confirming efficacy of cleaning and disinfection protocols.** Protocols designed for cleaning and disinfection are designed to prevent pathogen transmission through contact with contaminated environmental surfaces, such as those on pens, trailers, ramps and other service equipment. Assessing the effectiveness of these protocols would be beneficial through diagnostic tests that have several characteristics, such as being cost-effective, easy to use with minimal required training, pen-side, and having the ability to distinguish between pathogen genome and infectivity. Validating C/D protocol efficacy through the development of these diagnostic assays could be important for containing an emerging production disease and in preparation for an effective FAD response.

D. Surveillance and Discovery of Emerging Disease

27. **Population based sample types (oral fluids, processing fluids) for emerging disease testing.** These sample types provide opportunities for broad diagnostic surveillance in an easy-to-collect sample type representing a large population of pigs in the herd. Oral fluids are the predominant sample type for endemic disease monitoring in the US swine industry. Processing fluids are frequently collected on sow farms to survey litters and assess gestational transmission. Investigation into the expanded utility of these sample types for detection of emerging disease introduction will be conducted and compared to current practices. This may include modeling

percent and frequency of US herd and premises represented in surveillance and determining the diagnostic sensitivity/specificity in experimental settings or in countries endemic for transboundary swine diseases not currently present in the US. An example could be investigating the possible utility of processing fluids for JEV surveillance on sow farms.

28. **Tongue tip fluids as a diagnostic sample to target risk-based mortality populations**. Tongue tip fluids enable mortalities to be screened at a population level in an easy-to-collect sample type. Continued exploration around potential use cases for tongue tip fluids when compared to current practices across all phases of production for emerging swine diseases, such as an objective comparison of tonsil scrapings and tongue tips with other sample types. Best practices will be developed (collection, handling, processing, submission), sensitivity/specificity for individual pathogen surveillance defined, as well as field and laboratory techniques identified for enhanced capability of virus isolation from tongue tip fluids.
29. **Pan-diagnostic assay development for co-infections or identifying unknown emerging diseases**. Genome-based technologies (multiplex PCRs, next-generation sequencing) for emerging disease detection and co-infections continue to be advanced to reduce costs per test and increase ease of bioinformatics analysis. Investigations into potential use and validation of genome-based assay technologies and analysis algorithms for rapid and early detection of new emerging swine pathogens, as well as simultaneous detection of multiple pathogens, will be pursued for cost-effective broad-based surveillance tools.
30. **Environmental sample types for emerging disease surveillance and efficacy of cleaning and disinfection protocols.** Environmental dust has been determined to be a sensitive sample type representing an airspace such as a pig barn or feed bin. Further, testing insects such as flies has also been reported as a sample type representative of local environmental contamination. Further validation of environmental sample types are needed, such as validating standardized collection protocols, determining sensitivity and specificity for endemic pathogen surveillance, identifying techniques to improve virus isolation capabilities, and use for confirming efficacy of C/D on environmental surfaces. Cost-effective models for environmental sampling, such as spatially balanced surveillance, will be explored for potential use.
31. **Whole genome sequencing as a forensic diagnostic tool and epidemiological resource.** As whole genome sequencing increases, expanding the analysis capabilities of reference sequence data will enable detection of emerging pathogens, understanding forensic links between regional and site-to-site farm introductions, help inform biosecurity, and identify trends across laboratories. PRRSV ORF5 sequence only covers <5% of the genome and WGS is needed to define percent recombination and distance from MLV vaccines. Obtaining WGS remains challenging when Ct values are high (≥30 Ct), such as during collection towards the end of PRRSV elimination or in population sample types (i.e., oral fluids, processing fluids, tongue tip fluids). Techniques to increase success of WGS in low genome quantity samples will be investigated to improve the ability to interpret results. Overcoming barriers and providing resources for depositing and analyzing whole genome sequences in publicly available databases for broad use will be investigated. Capabilities, strengths, weaknesses, and costs will be examined to determine its use as an effective forensic tool.
32. **Expanding use of diagnostic fee support to assist in early detection of emerging disease.** There continues to be incidents of increased morbidity/mortality where 1) an etiology is not identified and the presumed etiology is negative on routine testing or 2) there is a strong supposition that the identified pathogen is not the primary causative agent of the outbreak. In these cases, it is beneficial to pursue a definitive diagnosis and support further diagnostic testing. Support for these follow-up diagnostic cases is offered after producers have funded the initial diagnostic testing. Diagnostic fee support helps to ensure that an emerging disease is identified quickly and accurately for rapid response and protection of the industry. Enhancing utility and overcoming barriers to broader use of this support program will be explored, such as expanding

submissions to veterinarians and diagnosticians, increasing ease of submission, or incentivizing participation for adoption of compatible cases.

33. **Increasing utility of VDL submissions as an effective surveillance stream for detection of emerging disease.** Submissions to veterinary diagnostic laboratories can be effective surveillance streams for detection of foreign or emerging diseases. Improvements in VDL submissions could assist in the coordination of a national swine health surveillance system to prepare, detect, and rapidly respond to emerging diseases. Working in cooperation with the pork industry organizations and VDLs, barriers will be investigated for submitting routine and necropsy sample types that may be case-compatible with foreign animal diseases or that could help identify domestic, endemic diseases that may be emerging. Further understanding of potential incentives for VDL submissions to include accurate detailed information to accompany samples, such as clinical signs and premise identification numbers, would also provide value. This would facilitate a quick and effective US response.
34. **Investigate the clinical relevance and epidemiology of newly identified agents in VDL submissions associated with swine disease.** The veterinary diagnostic laboratories may find novel bacteria and viruses that are associated with clinical signs of disease in swine. Having support available to increase understanding of the novel agent's epidemiology and pathogenicity is important to further clarify their role in clinical disease. Further, analysis of the potential production and economic impact to US pork producers will help prioritize actions.

E. Swine Disease Matrices

35. **Updating bacterial and viral swine disease matrices to prioritize swine pathogens.** Review and revise if needed the swine virus and bacterial disease matrices. A routine schedule will be maintained to evaluate the matrices for potential revision needs based on the changing global or US disease statuses. Diseases are assessed for scoring on the matrices based on risks to the US swine industry and production impact.
36. **Using the swine bacterial and viral disease matrices as guidelines for research to enhance swine disease diagnostic capabilities.** As new information on emerging bacterial or viral pathogens are discovered through SHIC's surveillance or other routes, there may be needs to support improved diagnostic capabilities. Needs for diagnostic sensitivity and specificity validation for prioritized viruses or bacteria in the swine disease matrices using clinical samples and tissues will be considered.

‡FFAR/SHIC/NPB Wean-to-Harvest Biosecurity Research Program priorities.