

# General guidelines for porcine reproductive and respiratory syndrome regional control and elimination projects

Enrique Mondaca, DMV, PhD; Laura Batista, DVM, PhD; Jean-Paul Cano, DVM, PhD; Edgar Díaz, DVM, MSc; Reid Philips, DVM; Dale Polson, DVM, PhD

## Summary

Porcine reproductive and respiratory syndrome (PRRS) continues to be a costly disease affecting the swine industry worldwide. While veterinarians have developed a variety of strategies to control and eliminate the disease from pig herds, the risk of re-infection remains high even with the best current practices of management and biosecurity. The repeated failures of non-coordinated control and elimination efforts and the ease with which the disease is transmitted from one herd to another strongly

suggest that a regional approach will be necessary. The regional approach for fighting PRRS proposes control in areas of high PRRS prevalence and high pig density, while elimination is potentially feasible in areas of low PRRS prevalence and low pig density. The purpose of this document is to outline a plan to implement PRRS regional control and elimination projects. The plan consists of five phases: evaluate the feasibility of the project, identify pig-related facilities in the area, classify pig sites according to their PRRS virus infection status, design PRRS

control strategies, and execute and monitor these PRRS control strategies. Eventually, the focus of individual projects will be to merge with adjacent regional projects and, depending on overall infection risk and feasibility, pursue PRRS elimination.

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## Resumen - Lineamientos generales para proyectos de control y eliminación regional del síndrome reproductivo y respiratorio porcino

El síndrome reproductivo y respiratorio porcino (PRRS por sus siglas en inglés) continúa siendo una enfermedad costosa que afecta a la industria porcina en todo el mundo. A pesar de que los veterinarios han desarrollado diversas estrategias para controlar y eliminar la enfermedad de los hatos de cerdos, el riesgo de reinfección sigue siendo alta aún con las mejores prácticas de manejo y bioseguridad actuales. Los repetidos fracasos de los esfuerzos no coordinados de control y eliminación y la facilidad con la que la enfermedad se transmite de un hato a otro, fuertemente sugieren que será necesaria una estrategia regional. La estrategia regional para combatir el PRRS propone el control en áreas de alta prevalencia del PRRS y de alta densidad porcina, mientras que la eliminación es potencialmente viable en áreas de baja prevalencia del PRRS y baja densidad porcina. El propósito de este escrito es pre-

sentar un plan para implementar los proyectos de control y eliminación del PRRS. El plan consta de cinco de fases: evaluar la viabilidad del proyecto, identificar las instalaciones existentes en el área relacionadas con cerdos, clasificar los sitios porcinos de acuerdo con su estatus de infección del virus de PRRS, diseñar estrategias de control contra el PRRS, y ejecutar y monitorear estas estrategias de control del PRRS. Eventualmente, el enfoque de proyectos individuales será el de unirse con proyectos regionales adyacentes y, dependiendo del riesgo general de infección y la viabilidad, buscar la eliminación del PRRS.

## Résumé - Directives générales pour des projets régionaux de limitation et d'élimination du syndrome reproducteur et respiratoire porcine

Le syndrome reproducteur et respiratoire porcine (SRRP) continue d'être une maladie coûteuse affectant l'industrie porcine à travers le monde. Bien que les vétérinaires aient développé une variété de stratégies pour

limiter et éliminer la maladie des troupeaux porcins, le risque de réinfection demeure élevé malgré les meilleures pratiques actuelles de régulation et de biosécurité. Les échecs répétés des efforts non-coordonnés de limitation et d'élimination, et la facilité avec laquelle la maladie est transmise d'un troupeau à l'autre suggèrent fortement qu'une approche régionale sera nécessaire. L'approche régionale pour combattre le SRRP propose la maîtrise de la maladie dans les régions à prévalence élevée de SRRP et à forte densité de porcs, alors que l'élimination est potentiellement réalisable dans les régions à faible prévalence de SRRP et à faible densité de porcs. Le but du présent document est d'élaborer un plan pour mettre en place des projets régionaux de limitation et d'élimination du SRRP. Le plan est en cinq phases: évaluer la faisabilité des projets, identifier les installations porcines dans la région, classer les sites porcins en fonction de leur statut d'infection pour le SRRP, élaborer des stratégies de limitation du SRRP, et finalement exécuter et surveiller ces stratégies. Éventuellement, le focus de projets individuels sera de fusionner avec des projets régionaux adjacents et, selon le risque d'infection global et la faisabilité, poursuivre l'élimination du SRRP.

Boehringer Ingelheim Vetmedica, Inc, St Joseph, Missouri.

**Corresponding author:** Dr Enrique Mondaca, 809 Abbey Road, Northfield, MN 55057; Tel: 507-645-6867; Fax: 507-645-6867; E-mail: [enrique.mondaca-fernandez@boehringer-ingelheim.com](mailto:enrique.mondaca-fernandez@boehringer-ingelheim.com).

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The economic impact of porcine reproductive and respiratory syndrome (PRRS) has been recognized worldwide, and several studies on the cost of PRRS have been generated through the years. In 1990, Polson et al<sup>1</sup> estimated losses at US \$236 per sow due to infertility, abortions, stillbirths, and neonatal mortality. Then, in 2005, Neumann et al<sup>2</sup> reported a total cost of \$560 million per year due to PRRS in the United States. This study also reported that 88% of the total cost of PRRS is due to the effect of the virus in postweaning pigs (ie, poor feed efficiency, high mortality, and suboptimal average daily gain). In a recent study by Holtkamp et al,<sup>3</sup> the total cost of PRRS to the US swine industry was estimated at \$640 million annually. However, in Holtkamp's report,<sup>3</sup> the growing-pig herds accounted for 55% of the total cost, down from 88% in the 2005 study.

It is known that pigs and semen are sources of PRRS virus (PRRSV) transmission between herds, but currently other sources of infection are thought to be of great importance, as well. Torremorell et al<sup>4</sup> reported that over 80% of new infections in a commercial system in the United States were due to area spread from neighboring units, movement of pigs in PRRSV-contaminated transport vehicles, and lack of compliance with biosecurity protocols. Airborne transmission appears to play an important role in PRRSV transmission, implying that farms located in pig-dense areas are at greater risk of contracting PRRS. The term "area spread" is used to describe the situation where virus appears to move among farms within an area. While the exact mechanism of transmission remains unidentified, recent studies support the hypothesis that long-distance airborne transport of PRRSV (up to 9.1 km) can occur.<sup>5</sup>

Coordinated efforts will likely be necessary to effectively combat diseases like PRRS and other emerging swine diseases, rather than isolated efforts on individual farms, which are often frustrated by the reappearance of the disease. The regional approach for fighting PRRS proposes control in areas of high PRRS prevalence and high pig density, while elimination is potentially feasible in areas of low PRRS prevalence and low pig density. On the basis of previous experiences by various researchers and industry efforts in conducting pilot projects of regional PRRS control,<sup>6-8</sup> a general five-phase plan is proposed as follows: assess the feasibility of the project, identify pig-related sites in the

project's area, characterize the pig sites in the region, design PRRS control strategies, and execute and monitor PRRS control strategies.

## Phase 1: Assess the feasibility of the project

### Objective

The objective of the first phase is to determine if the region's pork industry meets the minimal requirements to start a regional project of PRRS control. The local pork industry players will initiate a meeting to discuss and analyze the six key components of the project shown in Box 1.

Participants responsible for Phase 1 are people involved in the initial meeting or those selected by them. The execution period is the 4 months after the initial meeting.

### Methodology

The support of local practitioners and producers is fundamental to provide leadership, coordination, and cooperation in the regional group. Information must be collected about regional density of pig sites, PRRS prevalence in the area, composition of the local swine industry, and flow of pigs in and out of the area.

The regional group will be in charge of contacting sponsors for funding the project. At the time of writing, potential resources for funding, materials, labor, and expertise are federal government with grant money ([www.usda.gov](http://www.usda.gov)), legislators, National Pork Board with grant money ([www.pork.org](http://www.pork.org)), local and state pork producer associations, state universities and veterinary colleges, local veterinary clinics, producers and production systems, the American Association of Swine Veterinarians with an annual grant ([www.aasv.org](http://www.aasv.org)), and other supporting institutions. Note that the cited sources of funding are subject to change over time. The regional group will appoint a person to be the direct contact between the group and the funding and support entities. It is highly recommended

that this person be closely related to the local swine industry. Responsibilities of the local coordinator are outlined in Box 2. The regional group will establish guidelines for preserving confidentiality and appropriately sharing necessary information among the participants in the project. Documents include a project participants' registration format, a project status updater, and templates for participation, confidentiality, and hold-harmless agreements. Suggested resources for project management and communication are Basecamp (37 Signals, Chicago, Illinois), a project management program that is identity and password protected and allows for shared documents to be posted and accessed by all members ([www.basecampHQ.com](http://www.basecampHQ.com)) and by other electronic communication tools, including e-mail, Skype (Microsoft, Luxembourg), and GoTo-Meeting (Citrix, Santa Barbara, California). Members of regional projects should participate in workshops held throughout the calendar year that are intended for regional group members and associated active participants or supporters. The main purpose of the workshops is to share information on new and updated projects, to support or coach those considering launching new projects in their regions, and to review key questions and knowledge gaps regarding regional control of PRRS and what research efforts are in process to address them.

### Note for all execution periods

Months in the phase(s) are only estimates. Projects can and will advance faster or slower depending on pro-activeness of project leader(s) and local responsiveness to requests. During the progress of the project, some regional groups may finish the five individual phases at different paces, ie, there might be some overlap of the phases. However, a phase will not be completed until all the sites in the project have finished all the assignments required.

#### Box 1: Key components of a regional porcine reproductive and respiratory syndrome (PRRS) control project

1. Participation of local producers and practitioners
2. Characterization of area pork production and PRRS prevalence
3. Funding sources
4. A local coordinator for the project
5. Agreement to share specific information
6. Communication with other regional groups

**Box 2:** Profile of the local regional project coordinator of a regional porcine reproductive and respiratory syndrome (PRRS) control project

**A. Job description**

To coordinate activities and manage resources in support of one or several PRRS regional control and elimination projects

**B. Reports to**

Project's regional group

**C. Duties and responsibilities**

1. Promote and facilitate communication between regional group and stakeholders (ie, veterinarians, producers, universities, government agencies, and advisory group):
  - a. Schedule
    - i. Local group meetings
    - ii. Stakeholders meetings
  - b. Assemble periodical newsletters
  - c. Prepare and send mass e-mails
  - d. Manage and update project Web site
2. Organize and maintain useful databases, such as:
  - a. Stakeholders directory
  - b. Farm location directory
  - c. PRRS virus status per farm
3. Track and communicate programmed activities and completion of milestones
4. Assist local veterinarians and producers to schedule sample collection
5. Assist on sample submission to diagnostic laboratories
6. Assist on diagnostic results tracking and organization
7. Input Production Animal Disease Risk Assessment Program survey information
8. Keep records on expenses related to the project
9. Prepare quarterly summaries for stakeholders

**D. Term of employment**

Variable

**E. Qualifications**

1. Excellent organization skills
2. Ability to communicate technical information to multiple audiences
3. Knowledge of the local swine industry
4. Proficient with Word, Excel, and Internet navigation

## Phase 2: Identify pig-related sites in the project's area

Information from this phase and from Phase 3 will constitute the foundations for the Phase 4 strategies for PRRS control.

### Objective

The objective of this phase is to identify the general characteristics of the pork industry within the region at the site level, ie, number of sites and their locations, production type, PRRS status information (available historical enzyme-linked immunosorbent assay, polymerase chain reaction, and sequencing).

Participants responsible for Phase 2 are local veterinarians and producers, who will provide the information; the project coordinator(s), who will collect data; and the external supporting team, which will

generate maps. The execution period is the 4 to 6 months after the initial meeting.

### Methodology

The coordinator must contact local swine-industry participants to obtain basic information about pig sites and pig-related sites in the area. It is fundamental to obtain the geographical location (latitude-longitude) of farms, slaughter plants, feed mills, transport sanitation facilities, exhibition pigs, and external suppliers. If the site location has not been determined by latitude-longitude coordinates, they must be acquired using a global positioning system device or a Web-based service such as Google Earth (Google, Mountain View, California). In states where USAherds (<http://usaherds.org/>) database is current and functional, the project coordinator may interact with this consortium to obtain all necessary information.

Information about PRRS status – assumed or confirmed – and type or phase of production will be included. A mapping software program such as ArcView (ESRI, Redlands, California) may be used to generate maps to visualize the distribution of pig sites in the region and the PRRS status of each site.

## Phase 3: Characterize the pig sites in the region

In this phase of the project, data from individual operations will be collected to create a region's database, classifying the sites by PRRSV infection status.

### Objectives

The objectives of this phase are to determine actual PRRSV infection status, animal flow, and risk of becoming infected.

Participants responsible for Phase 3 are local veterinarians, who will be in charge of collecting samples, performing risk assessments, and providing information; project coordinator(s), who will collect data; and the supporting team that will analyze the data. The execution period is the 4 to 12 months after the initial meeting.

### Methodology

The project's participants will confirm PRRSV infection status of all sites in the region in order to categorize the sites. A baseline sampling strategy will be determined by the regional group and supporting parties, according to the general guidelines proposed by Holtkamp et al,<sup>9</sup> and the prevalence of PRRSV infection and the distribution PRRSV isolates will then be determined within the area.

Information provided by the local veterinarians and producers will be used by the local coordinator to record pig movement into and out of the area and establish swine-network connections within the area.

In this phase of the project, Production Animal Disease Risk Assessment Program (PADRAP) surveys ([www.padrapp.org](http://www.padrapp.org)) will be applied by site to determine the risk of becoming PRRSV infected, and the participants will sign confidentiality agreements and permissions to access PADRAP information.

All collected information will be used to classify sites in the area according to the model proposed by Holtkamp et al.<sup>9</sup>

The use of ArcView is suggested for mapping the geographical locations of sites and

to visualize type of production, PRRSV infection status, size of site, and routes of pig movement, among other features.

It is suggested that all swine facilities execute basic farm biosecurity protocols.<sup>10</sup>

## Phase 4: Design PRRS control strategies

On the basis of the information obtained in Phases 2 and 3, the local group will outline the guidelines for herd, flow, and neighboring plans to reduce overall PRRSV infection prevalence in the area.

### Objectives

The objectives of this phase are to design herd and flow strategies that are coordinated within neighborhoods.

Participants responsible for Phase 4 are local veterinarians, who will design herd plans and will discuss neighborhood guidelines, and the project coordinator(s) and supporting team, who will organize and coordinate control interventions. The execution period is the 6 to 15 months after the initial meeting.

### Methodology

The local group will organize the region by neighborhood or township, depending on specific characteristics such as proximity, natural barriers, and pig flow.

The local group will also design strategies for PRRS control by site, supporting neighborhood guidelines and consistent with the first four steps of the five-step process shown in Figure 1. The strategies to control PRRS include gilt acclimation, herd closure, depopulation-repopulation, live-virus inoculation, modified-live vaccination, inactivated-virus vaccination, test and removal, and partial depopulation.

In anticipation of emergencies in the operation, contingency plans or courses of action must be designed, discussed, and posted.

## Phase 5: Execute and monitor PRRS control strategies

In this phase, the local group will implement specific strategies to maintain or reduce PRRSV infection prevalence by farm and neighborhood.

### Objectives

The objectives of this phase are to execute and monitor PRRS control strategies by site and neighborhood.

**Figure 1:** The five-step process form to be filled out by producers in order to design a strategy for regional control of porcine reproductive and respiratory syndrome (PRRS) on their farms. ADG = average daily gain; FE = feed efficiency.

Producer: \_\_\_\_\_ Date: \_\_\_\_\_

### 1. Identify desired goals

What would you consider an improvement or win with respect to PRRS in your operation?

Performance ADG, FE, mortality, culls...	Clinical signs Cough, abortions...	PRRS Status Negative or stable

### 2. Determine current status

Describe your current PRRS situation

Clinical observations What signs, when, how long?	Performance effects Mortality, slowed growth...	Diagnostics Serum, oral fluids, tissues

### 3. Understand current constraints

Describe your operation

Site/flow/system Type, ownership	Biosecurity Proximity, trucks...	Other diseases PCV2, <i>Mycoplasma</i> ...	Opinion leaders Vet opinion/involvement

Possible next steps:	Notes:
<input type="checkbox"/> Meeting (producer, vet, manager) <input type="checkbox"/> Farm visit <input type="checkbox"/> Additional diagnostics <input type="checkbox"/> PRRS risk assessment <input type="checkbox"/> Biosecurity discussion/education <input type="checkbox"/> Other _____	

### 4. Develop solution options

### 5. Implement and monitor preferred solution

Participants responsible for Phase 5 are local veterinarians, who will implement herd plans and surveillance strategies, and the project coordinator(s) and supporting team, who will coordinate interventions and analyze results. The execution period is the 16 to 60 months after the initial meeting.

## Methodology

The local group will implement herd and neighborhood plans for PRRS control, follow a biosecurity protocol to prevent the spread of PRRSV,<sup>10</sup> and monitor preferred solutions. Sampling strategy will depend on the specific characteristics of each site, neighborhood, or region.

Eventually, the focus of individual projects will be to merge with adjacent regional projects and, depending on overall infection risk and feasibility, pursue PRRS elimination.

## Conclusion

After more than 2 decades of unsuccessfully fighting PRRS in non-coordinated control and elimination efforts, it is desirable to combat PRRS utilizing a coordinated, regionalized approach. A summary describing the basic steps to initiate and execute projects of PRRS control using a coordinated, regional approach has been outlined here. This document proposes a five-phase process to implement programs of regional control and elimination of PRRS: evaluate the feasi-

bility of the project; identify pig-related facilities in the area; classify pig sites according to their PRRSV infection status, and design, execute, and monitor PRRS control strategies. Implementation of these basic guidelines will vary depending on the specific characteristics of the local swine industry in different regions, but should always be based on the principles of cooperation, good communication, and coordination between producers, veterinarians, and supporting entities.

## Conflict of interest

Boehringer Ingelheim Vetmedica, Inc, sponsored development of the protocol and, at the time of writing, employed all of the authors. Currently, Dr Laura Batista is an independent consultant.

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