Animal Disease Management – Assessment and Way Forward

Livestock and Dairy Development Department

Punjab Government Efficiency Improvement Programme

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List of Abbreviations

ADIO	Assistant Disease Investigation Officers
ADSR	Animal Disease Reporting and Surveillance
BCA	Benefit: Cost Analysis
BQ	Black Quarter Disease
CBAH	Community-Based Animal Healthcare

DFZ	Disease-Free Zone
EMPRES	FAO Emergency Prevention Systems
FAO	Food and Agriculture Organisation of the United Nations
GMP	Good Manufacturing Practices
GoP	Government of the Punjab
GPS	Global Positioning System
HACCP	Hazard and Critical Control Points
L&DD	Livestock and Dairy Development (Department)
LEGS	Livestock Emergency Guidelines and Standards
ND	Newcastle Disease
OIE	*Office Internationale des Epizooties* or World Organisation for Animal Health
PDMA	Punjab Disaster Management Authority
PFA	Punjab Food Authority
PGEIP	Punjab Government Efficiency Improvement Programme
PRMP	Punjab Resource Management Programme
PVMC	Pakistan Veterinary Medical Council
PVS	Performance of Veterinary Services
SOPs	Standard Operating Procedures
UVAS	University of Veterinary and Animal Sciences

List of Figures

It should be noted that the BSI Symbol and UKAS Accreditation mark signify that Crown Agents operate a documented Quality Management System registered with the British Standards Institution to the international quality standard BS EN ISO 9001:2008. The scope of this registration specifically covers the provision of consultancy services in revenue enhancement and expenditure and debt management including customs, taxation and trade, institutional development, engineering and procurement management, advice and reform.

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Executive Summary

Introduction

From 2003, the Government of the Punjab introduced change and reform with support from the Asian Development Bank's Punjab Resource Management Programme (PRMP). A second phase began in 2007, which includes the Punjab Government Efficiency Improvement Programme (PGEIP) with goals of improved service delivery and strengthened resource management, focussing on two pilot departments. The Livestock and Dairy Development Department (L&DD Department) is one of two Departments selected for reform. In this Department, technical input requirement was identified in four key areas: *Preventive Health, Skills & Training, Breed Improvement/ Preservation* and *Extension*. This report describes findings and recommendations from 22 consultant work-days (substantially reduced from planned input) in April, 2012. The report covers the principle tasks completed, namely: (i) a review of the animal preventive health regime, (ii) assessment of disease reporting, disease monitoring and forecasting, and (iii) livestock emergency response planning.

Vaccination is an important component of the animal health regime. Although adequate, quality vaccine is produced for certain diseases, for others, notably foot and mouth disease (FMD), the vaccine supply is inadequate. Plans for disease-free zones and a Province-wide vaccination campaign will greatly exceed existing capacity to supply.

The L&DD Department utilises substantial resources for curative veterinary services, but these would more appropriately be provided through private service delivery. The preventive health aspects of the Department's work and its regulatory functions should be its major work. If the Department moves from curative to preventative work, it will be necessary to ensure that the poor livestock owners are not excluded from the curative service, for example, by establishing community-based animal health care.

Diagnostic laboratories have difficulties in acquiring and retaining technical staff. Most lack internationally recognised accreditation. All services are provided free, but there appears to be scope for cost recovery for some tests.

There are currently plans to establish a Milk and Meat Safety Agency, which will help change the low level of central veterinary involvement in public health aspects of meat and dairy products. Draft legislation has been prepared (Milk and Meat Safety Act), but the absolute need for this is not clear. The draft Punjab Animal Health Act was reviewed and suggestions made for revision.

Existing plans for a disease-free zone in Cholistan require more work. The plans are ambitious, but are still not specific, for example, as to the disease(s) from which freedom will be sought. Some gaps in the Department's implementation plan were identified and recommended additions are specified.

Assistant Disease Investigation Officers (ADIO) make monthly, routine disease reporting from the Districts to the Directorate, Animal Disease Reporting and Surveillance (ADSR). The sensitivity of reporting is sub-optimal. There is room for more passive surveillance, for example from abattoir recording, and active surveillance, for example, participatory epidemiology and sampling surveys. Disease data are currently managed with software that is not performing well: it should be replaced and updated to improve analysis and mapping functionality.

Currently three-monthly surveillance reports are produced. Vaccination forecasting is done annually. There is a need to make these more responsive and more frequent. Regular, summary feedback reports should be provided to District Officers submitting disease data.

The L&DD Department makes plans each year for flood disasters and the Department was very involved in the response to the 2010 disaster. To enhance its response and planning capacity, a three-day training in Livestock Emergency Guidelines and Standards was carried out for twenty-two participants from the central Department, District offices, the Punjab Disaster Management Authority and the University of Veterinary and Animal Sciences. The training was extremely positively received.

Recommendations

Recommendations are provided where relevant throughout the body of this report, but are brought together here for ease of reference.

1. It is recommended to increase vaccine production capacity and to consider the supply chain consultancy's findings in conjunction with this mission's assessment.
2. It is recommended that more samples from FMD cases are analysed at the Veterinary Research Institute (VRI) laboratories to ensure that appropriate vaccine is manufactured and/or procured and that the authorities continue to send samples to the World Reference Laboratory for foot and mouth disease (Pirbright, UK) for serotyping and genotyping.
3. For diseases for which the VRI can more easily produce adequate vaccine, it is recommended that coordination between different working tiers of field services is improved.
4. It is recommended to trial a private curative service delivery system in one or more Districts.
5. To ensure that poor livestock owners in outlying communities have access to a private service, it is recommended to establish community-based animal health care (CBAH) on a pilot basis, in areas where professional veterinarians or diploma-level Veterinary Assistants are unwilling to work for the available remuneration from treating animals of remote, poor livestock-owning communities.
6. To ensure quality and standards, it is recommended that regulations are revised so that paraprofessional veterinary workers, such as CBAH workers, are included on a register maintained by the Pakistan Veterinary Medical Council (PVMC) and/or a register under the jurisdiction of the Government of the Punjab (GoP).
7. It is recommended that Government subsidy of vaccination continues, although private approaches must be considered.
8. It is recommended that vaccine production and products are certified by an authority and that only licensed products are permitted to be administered to animals.
9. it is recommended that clear and workable standard operating procedures (SOPs) are drafted for each important disease and circulated and applied at field level.
10. For the laboratory sector, it is recommended to:
    - Establish laboratory technician training skill development modules.
    - Charge fees for laboratory diagnostic tests for commercial units.
    - Review procurement modalities.
    - Accredit the Provincial Laboratory to ISO 17025 standard.
    - Review budget for District Laboratory consumables (currently Rs 20,000 per year).
11. It is recommended that the Animal Health Act (rather than the Milk and Meat Safety Act) covers animal identification, movement control and tracing, which are also required for more effective disease control.
12. It is recommended that the need for a specific Milk and Meat Safety Act is reviewed.
13. It is recommended that there is greater central veterinary involvement in the public health sector in the Punjab.
14. It is recommended that consideration be given to extending the Punjab Food Authority's mandate so that its work is integrated with the new Milk and Meat Safety Agency.
15. As a requirement for disease-free zones or compartments it is recommended that legal expertise is obtained for properly refining primary legislation, that is, the Animal Health Act, and for drafting secondary legislation, that is, the specific regulations that will govern the disease-free zones or compartments
16. A list of recommended edits to the draft Punjab Animal Health Act (2011) is shown in Appendix A. In addition, it is recommended that the list of scheduled diseases cited in The

Punjab Animal Health Act (2011) should be revised, resulting in a new list of Pakistan notifiable diseases based on World Organisation for Animal Health (OIE) notifiable disease lists.

17. It is recommended that (i) the detailed requirements to achieve a disease-free zone (DFZ) are drafted, (ii) the expected increase in revenue from sales of livestock/products resulting from the DFZ are assessed, and (iii) a benefit : cost analysis (BCA) is run. Furthermore, it is recommended that (i) specific requirements of importing countries are discussed and bilateral terms of trade agreed with them, and (ii) a BCA should be run for this scenario, perhaps involving compartments (specified premises) rather than a DFZ.
18. It is recommended that the following items are added to the current DFZ/compartment implementation plan:
    - Description of the functional relationships of subcomponents of the compartment,
    - A strategy for clear separation of the compartment from potential sources of infection and describe this and demonstrate it exists,
    - Plan to monitor animal movements (after identification),
    - Define (i) specific diseases for which the area will be “disease-free” and (ii) the species covered.
19. It is recommended that, through the Animal Husbandry Commissioner, the Provincial Veterinary Authority requests the OIE to conduct a Performance of Veterinary Services (PVS) assessment.
20. it is recommended that:
    - Regular disease reporting from abattoirs (by veterinary Meat Inspectors) is established,
    - Field laboratories are made more functional and laboratory test results better integrated with disease reports from the field,
    - Personnel are trained in participatory epidemiology techniques and information is gathered and reported on the seasonal incidence of important diseases in geographically different parts of the Province,
    - ADIOs are rewarded for reporting disease by encouraging them to do so (and replacing any fear of reprimand),
    - ADIOs are provided with global positioning system (GPS) devices so that they can identify and report coordinates of disease outbreak sites.
    - Farmers are encouraged to report specific diseases of concern by integrating surveillance with extension, informing farmers what to report and to whom/how, and
    - Sampling surveys are designed according to the requirements of demonstrating disease-freedom in the planned disease-free zones.
21. it is recommended that:
    - For disease data entry and analysis, the Department obtains an updated version of TADinfo from the Food and Agriculture Organisation of the United Nations (FAO), requesting this through the Animal Husbandry Commissioner and sending updated administrative boundary names to FAO.
    - For advanced mapping of disease outbreak information, the Department uses a dedicated programme such as ArcGIS. This could be obtained by sharing a licensed copy (such as the Urban Unit’s) or by purchasing its own copy. In addition, training in use of this programme is required for a senior officer.
22. It is recommended that the Directorate, ADRS subscribes to and follows international alerts to complement the ADIO reports.
23. It is recommended that regular summary disease status reports are sent by email to each District.

24. It is recommended that the vaccine requirement forecast is derived from: known seasonal disease incidence, up-to-date disease outbreak intelligence, livestock census data combined with target vaccine coverage for each specific disease, knowledge of where particular diseases are more severe and, finally, where outbreaks are occurring in neighbouring areas.

1. Animal Health Regime and Procedures

1.1 Vaccination

Key vaccine technical issues highlighted during assessment are:

- For some specific, important diseases (for example, haemorrhagic septicaemia (HS) and sheep and goat pox), the Veterinary Research Institute (VRI) makes sufficient high quality vaccine for effective disease control.
- Due to inadequate travel allowance for District Officers, spatial vaccination coverage varies, with better coverage in easily accessible animal populations near District Livestock Offices.
- There is a foot and mouth disease (FMD) vaccine supply shortage.
- Emerging FMD serotypes/strains require research to ensure vaccine is effective.
- Cold chain difficult to maintain for some vaccine, such as Newcastle disease (ND).
- Farmer awareness of the benefit of routine vaccination may be lacking.
- Unfulfillable demand may occur in disease outbreak conditions.
- Use of unregistered homeopathic vaccine may confuse some farmers about the efficacy of vaccination in general.
- Next year mass-vaccination with 100% coverage is planned, subsidised by the Government of the Punjab (GoP).

The provision of adequate FMD vaccine is a clear priority for the sector. Very large quantities of vaccine will be required both for the planned mass vaccination campaign and for planned establishment of a disease-free zone (DFZ), see section below. FMD vaccination is mainly carried out in large ruminant species currently, that is cattle and buffaloes, but sheep and goats are also susceptible and will need to be covered in the DFZ. FMD vaccination is biannual. With an estimated Province population of over 120,000,000 ruminant animals, the FMD production/ procurement needs are vast and require careful planning. Even in the DFZ and surrounding buffer zone a projected requirement of 15 million doses may be estimated in the first two years (ignoring small ruminant species), calculated as follows:

- 1.5 million cattle in DFZ and surrounding buffer zone = 3.0 million head to vaccinate,
- primary vaccination and two six-monthly boosters in first year = 3 doses per head,
- two six-monthly boosters in second year = 2 doses per head,
- five doses x 3.0 million = 15 million doses for large ruminant population only.

Vaccine supply chain issues will be reported from a separate consultancy. It is **recommended** to increase vaccine production capacity and to consider the supply chain consultancy's findings in conjunction with this mission's assessment.

It is **recommended** that more samples from FMD cases are analysed at the VRI laboratories to ensure that appropriate vaccine is manufactured and/or procured and that the authorities continue to send samples to the World Reference Laboratory for FMD (Pirbright, UK) for serotyping and genotyping.

For diseases for which VRI can more easily produce adequate vaccine, it is **recommended** that coordination between different working tiers of field services should be improved. For example, the Extension Service's messages should be better coordinated and integrated to link vaccine supply with improved farmer uptake.

1.2 Curative to Preventative Policy

Treatment of sick animals is a major component of the animal health regime and is provided free-of-charge by the L&DD Department through a network of Veterinary Hospitals, Dispensaries and District Livestock Offices. Yet economists consider curative services as a solely private good that should be paid for by the livestock owner. There are some personnel/ remuneration issues that adversely affect the curative service at present and these could be alleviated by a move to privatisation of the curative service, for example:

- Unfilled staff positions in some Districts (e.g. around 80% vacancies in Khushab District where 17 out of 21 posts are reportedly vacant).
- Monthly allowance for field visits (transport, petrol-oil-lubricants for vehicle) is Rs 45/-, which means that even though 18 Districts have mobile units, staff may be reluctant to go to the field.
- Inadequate budget (Rs 20,000 *per annum*) for both vehicle and laboratory maintenance.

At the same time, it will be politically challenging to persuade the general public that the cessation of free/ subsidised Government curative service is appropriate: a carefully managed publicity campaign will be required as well as assurances that the poorer livestock owners are not excluded from a privatised service delivery system. Even so, the L&DD Department should move away from providing a curative service. It is **recommended** to trial a private delivery system in one or more Districts.

To ensure that poor livestock owners in outlying communities have access to a private service, it is **recommended** to establish community-based animal health care (CBAH) on a pilot basis, in areas where professional veterinarians or diploma-level Veterinary Assistants are unwilling to work for the available remuneration from treating animals of remote, poor livestock-owning communities. It will be necessary to review the legislation to ensure that a cadre of CBAH workers can legally provide these services to farmers. An NGO with experience in the sector should be contracted for start-up and training. CBAH workers should work under the overall management of a professional veterinarian, who should resupply them with medicines and vaccine and pass on disease reports to the veterinary authorities.

Regulatory functions that govern the veterinary profession are public good activities and are rightfully performed by the Government. To ensure quality and standards, it is **recommended** that regulations are revised so that paraprofessional veterinary workers, such as CBAH workers, are included on a register maintained by the Pakistan Veterinary Medical Council (PVMC) and/or a register under the jurisdiction of the GoP.

Vaccination is described as “a pure private good” in various project reports, but is better considered as a mixed public/ private good, because vaccination of a herd provides some protection for neighbouring herds; failure to vaccinate can jeopardise wider disease-free status and the ability to trade for all. Therefore, it is **recommended** that Government subsidy of vaccination continues, although private approaches must be considered. For example, vaccine production could continue at the GoP Veterinary Research Institute, but vaccine administration could be carried out by private operators under contract with the Government. It is **recommended** that vaccine production and products are certified by an authority and that only licensed products are permitted to be administered to animals. In connection with this, the VRI should strive to achieve ‘good manufacturing practices’ (GMP) status according to international standards and its vaccine products should be tested (for example at the National Veterinary Laboratory) and registered/ licensed by the GoP.

Consistent with its strategy for disease control, it is **recommended** that clear and workable standard operating procedures (SOPs) are drafted for each important disease and circulated and applied at field level. A start has been made by the Department, but more SOPs are required and the existing ones need to be made more detailed and specific. There is an opportunity to apply these SOPs at field level to help the process of change from curative to preventative animal health services.

1.3 Diagnostic Laboratories

Some key issues were highlighted in the technical assessment of this sector, and these are summarised below.

- There is no known locally-available specific laboratory training (equivalent to Veterinary Assistant diploma).[1] Repeatedly, laboratory staff who are trained on-the-job are lost and new personnel have to be trained up.
- Personnel issues,
  - Little opportunity for vertical promotion and so experienced staff are lost.
  - Unlike District Veterinary Officer posts, there is a lack of private income-earning opportunity, and so laboratory positions are less attractive. Some laboratories have vacancies.
  - Trained medical laboratory technicians are hard to retain in veterinary laboratories because remuneration is better in the medical sector.
- Laboratory diagnostic services are free-of-charge.
- The purchase procedure is sometimes unworkable for key product requirements, although simplified in December 2009.
  - The procedure apparently discourages companies from participating in competitive tender.
  - For example, recently no company bid to supply FMD ELISA kits.
- Laboratories lack accreditation status (laboratory accreditation schemes based on ISO 17025: 2005) including routine quality assessment procedures.
- The budget (Rs 20,000 per annum) for District Laboratory consumables, including glassware and reagents as well as vehicle maintenance is insufficient.
- District laboratories have outdated equipment as most were established in 1970's.

Punjab's opportunity to exploit competitive advantages on international markets requires credible conformity to international standards of laboratory diagnosis. Non-recognition of test results is a potential technical barrier to trade. ISO 17025, the international standard for testing laboratory quality systems, can help secure international recognition of laboratory test results.[2] Evidence of veterinary diagnostic laboratory conformation to international standards follows inspections by internationally recognised laboratory accreditation bodies, such as from the Pakistan National Accreditation Council. [3]

The lack of budget for laboratories to purchase consumables may be partially addressed by introducing fees for tests performed for larger, commercial farms. Following from the findings in the assessment, for the laboratory sector, it is **recommended** to:

- Establish laboratory technician training skill development modules.
- Charge fees for laboratory diagnostic test for commercial units.
- Review procurement modalities.
- Accredit the Provincial Laboratory to ISO 17025 standard.
- Review budget for District Laboratory consumables (currently Rs 20,000 per year).

[1] During the final workshop, a representative of UVAS stated that such courses have recently been developed at the institution, though awareness of these courses appears to be limited at present.

[2] For more information see, for example, UNIDO (2009) *Complying with ISO 17025 – A Practical Guidebook*

[3] See http://www.pnac.org.pk/

1.4 Public Health

At present there is relatively little central veterinary involvement with public health aspects of meat and dairy products. Abattoir and cattle market management and inspection of meat and dairy products are the responsibility of District Government.

A new Milk and Meat Safety Agency will be established with support from a DFID-funded project. Proposed new legislation, the draft Milk and Meat Safety Act, is associated with this new agency. The objective of the agency is to promote milk and meat export.[4] It is planned that it will supervise implementation of a hazard and critical control points (HACCP) approach with technical assistance from a private company (HACCP North, Belgium). This may be set up in on a trial basis in pilot area(s). Animal identification and traceability will be components of the HACCP approach. It is currently proposed that ID and tracing are covered by the Milk and Meat Safety Act, but these activities could be covered under the Animal Health Act. The need for the Milk and Meat Safety Act is not entirely clear.

It is **recommended** that the Animal Health Act covers animal identification, movement control and tracing, which are also required for more effective disease control. It is **recommended** that the need for a specific Milk and Meat Safety Act is reviewed.

It is **recommended** that there is greater veterinary involvement in the public health sector in the Punjab. This is consistent with the current, global 'One Health' agenda.[5] Animals are the source of a large proportion of emerging infectious diseases.

The Punjab Food Authority (PFA) is already established and is covered by existing legislation: the PFA is primarily concerned with food in shops. It is **recommended** that consideration be given to extending the PFA's mandate so that its work is integrated with the new Milk and Meat Safety Agency.

1.5 Legislation

The Punjab Animal Health Act (2011) and The Milk and Meat Safety Act (2011) have been drafted. The legislation was reviewed: proposed amendments to the Animal Health Act are shown in the Appendix. Other related legislation, the Punjab Food Safety Authority Act and the Pakistan Halal Regulatory Authority Act, was not reviewed.

The Milk and Meat Safety Act concerns the proposed new Milk and Meat Safety Agency, but the case for this legislation is not clear. The Punjab Food Authority already exists and its mandate could be broadened to cover milk and meat. Animal identification and traceability, which are components of the Milk and Meat Safety Act, could be included in the Animal Health Act: see recommendations in Public Health section, above.

As a requirement for disease-free zones or compartments (see relevant section, below) it is **recommended** that legal expertise is obtained for properly refining primary legislation, that is, the Animal Health Act, and for drafting secondary legislation, that is, the specific regulations that govern the disease-free zones or compartments

A list of **recommended** edits to the draft Punjab Animal Health Act (2011) is shown in Appendix A. In addition, it is **recommended** that the list of scheduled diseases cited in The Punjab Animal Health Act (2011) should be revised, resulting in a new list of Pakistan notifiable diseases based on the OIE notifiable disease lists, shown in Appendix A.

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[4] Dr Rasheed Mahmood, personal communication.

[5] FAO defines One Health as "*a collaborative, international, cross-sectoral, multidisciplinary mechanism to address threats and reduce risks of detrimental infectious diseases at the animal-human-ecosystem interface*". http://www.fao.org/ag/againfo/home/en/news_archive/2010_one-health.html

1.6 Disease-Free Zone / Compartments

1.6.1 Definitions and Requirements

The OIE (*Office Internationale des Epizooties* or World Organisation for Animal Health) defines zones and compartments that can enable international trade in the presence of specific animal disease in a country or region. The key difference between a zone and a compartment in this context is that a zone is a geographical area of the province or country, but a compartment is not. By contrast, a compartment consists of establishments (e.g. farms, feed suppliers, processing plants) not necessarily geographically connected, but with biosecurity management practices in common. According to OIE definitions of zones and compartments:

- *A **zone** is a clearly defined part of a country, with (i) a distinct animal subpopulation, (ii) animals having a distinct health status with respect to a specific disease, and (iii) surveillance, control and biosecurity measures that are required for the purpose of international trade.*
- *A **compartment** is one or more establishments (premises in which animals are kept) with (i) a common biosecurity management system, (ii) an animal subpopulation with distinct health status with respect to a specific disease or specific diseases, and (iii) surveillance, control and biosecurity measures that are required for the purpose of international trade.*

For the purpose of trade, an exporting country must satisfy an importing country's requirements for animal health. The importing country must be satisfied that the animal health status is appropriately protected.

The components required for making a zone or compartment are clearly stated in OIE documentation and are summarised in the Appendix. Compartmentalisation requires a high level of cooperation between industry and government. Zoning or compartmentalisation can enable a staged approach to disease control, with resources concentrated where they have most effect. The strategy can enable export once the agreed target of disease control or eradication has been reached, but in reality it is difficult to achieve OIE requirements.

The OIE addresses issues pertaining to zones or compartments at country-level, not province. For example, the OIE's national-level *Performance of Veterinary Services* (PVS) assessment is carried out for national veterinary services. PVS and the ensuing OIE *Gap Analysis* can support a veterinary service's credibility with importing countries and may also give direct guidance on the exporting country's ability to establish zones or compartments. Thus, it is desirable that a PVS is carried out.

Associated with zones or compartments, there are trade issues for both the exporting and importing countries to address:

Exporting country

- Demonstrate to the importing country that it has implemented the recommendations in the OIE *Terrestrial Animal Health Code* for establishing and maintaining a zone or compartment.
- Make an assessment of the resources needed and available to establish and maintain a zone or compartment for international trade purposes. In particular, Veterinary Service resources include human and financial resources and technical capability.

Importing country

- Evaluate the Veterinary Services of the exporting country (e.g. risk assessment, current health status, OIE standards).
- Determine whether it accepts such an area as a zone for the importation of animals and animal products. Recognise the zones or compartments when the appropriate measures recommended in the OIE Terrestrial Code are applied and the Veterinary Authority of the exporting country certifies that this is the case.

It should be borne in mind that achievement of recognised disease-free status is not a prerequisite for international trade in live animals or, more particularly, animal products such as

meat. Trade can take place between two countries having similar disease statuses: bilateral agreements can be reached. The veterinary authorities of the importing country can specify requirements that protect its own national herd without necessarily demanding that disease-free zones or compartments (which are extremely difficult to achieve) are established by the exporter.

1.6.2 L&DD Department Plan and Feasibility

Three contiguous Districts in Cholistan region in Bahawalpur Division have been selected for establishment of a DFZ: Bahawalpur, Bahawalnagar and Rahim Yar Khan. The proposed DFZ has its eastern border with India and is bounded by a river in the west. Four DFZ establishment phases are envisaged and the planned durations and activities in each phase are shown in the Appendix.

In the current plan, the terms 'DFZ' and 'compartment' appear to be used interchangeably, but they have specific and different meanings as defined above. Other unclear areas are (i) the diseases from which the zone/compartment will be declared disease-free (there is a general statement "vaccinations against notifiable diseases e.g. FMD, BQ") and (ii) the livestock species involved. There are serious issues concerning the feasibility of the plan assuming that FMD is a target disease, namely,

1) All cloven-hoof species are susceptible, not only cattle and buffaloes, and other species must be included in plans, such as for vaccination and movement control.
2) One boundary of the DFZ is the frontier with India. Thus, the Pakistan veterinary authorities have no jurisdiction whatsoever over the territory across the proposed boundary of the DFZ. FMD is a very highly infectious disease and wind-borne spread can occur over kilometres.
3) Vaccine requirements are projected to be around 15 million doses in the first two years for DFZ and surrounding buffer zone in the first two years for large ruminants alone. This greatly exceeds current supply capacity.

It is **recommended**, therefore, that (i) the detailed requirements to achieve a DFZ are drafted, (ii) the expected increase in revenue from sales of livestock/products resulting from the DFZ are assessed, and (iii) a benefit : cost analysis (BCA) is run. Furthermore, it is **recommended** that (i) specific requirements of importing countries are discussed and bilateral terms of trade agreed with them, and (ii) a BCA should be run for this scenario, perhaps involving compartments (specified premises) rather than a DFZ.

It is **recommended** that, through the Animal Husbandry Commissioner, the Provincial Veterinary Authority requests the OIE to conduct a PVS assessment. Comparing international requirements with the Department's plan, it is **recommended** that the following items are added to the current DFZ/compartment implementation plan:

- Description of the functional relationships of subcomponents of the compartment,
- A strategy for clear separation of the compartment from potential sources of infection and describe this and demonstrate it exists,
- Plan to monitor animal movements (after identification),
- Define (i) specific diseases for which the area will be "disease-free" and (ii) the species covered.

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2. Disease Monitoring, Surveillance and Forecasting

2.1 Introduction

Monitoring concerns the continuing work by the L&DD Department to assess the disease status of the animal population of the Punjab. Thus, it can include the routine recording, analyses and distribution of animal disease information.

The term *surveillance* describes a more active system, implying that some form of directed action will be taken when the data indicates that an animal disease level is above a certain threshold. For a notifiable disease, the threshold may be a single case. In this way, the work of the Directorate, Animal Disease Reporting and Surveillance, is a combination of disease monitoring and surveillance.

2.2 Disease Reports from the Field

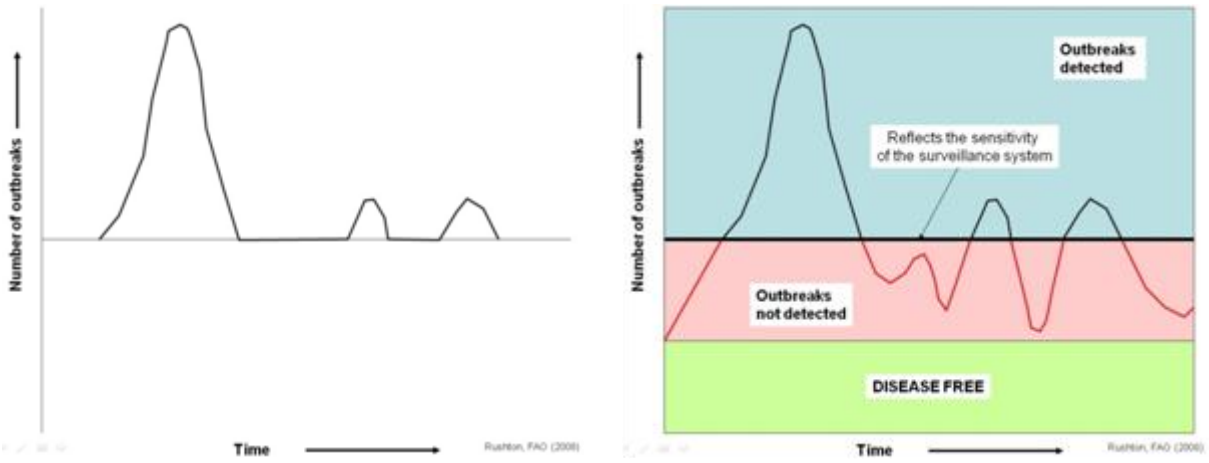
2.2.1 Monthly Disease Reporting

Key findings concerning disease reporting from field offices are:

- Each District (ADIO) is required to submit a Monthly Notifiable Disease Report. It is sent by post or email and data are entered manually by a Data Manager in Lahore.
- Disease diagnosis and reporting are based on clinical signs only. Laboratory diagnosis, if different, is not reported.
- Not all Districts provide regular, monthly reports because (i) District Officers may fear reprisal for not having effectively prevented the disease and (ii) the travel allowance is too low (Rs 45/-) and there is no additional provision for 'POL', that is, vehicle petrol, oil and lubricants.

The inevitable result of under-reporting from the field is that central level epidemiologists receive an incomplete picture of the disease situation because the sensitivity of reporting is sub-optimal. This phenomenon is illustrated graphically below.

Figure 1: How surveillance sensitivity affects detection and reporting of disease outbreaks.



Apparent outbreaks, outbreaks reported. **Actual disease status.**

To reverse the problem with under-reporting, it is necessary to change any culture of fear and reprisal associated with this activity. Reporting officers should be congratulated and praised for good reporting and not castigated for being the cause of the outbreak. Disease happens and it is important that the Provincial Veterinary Authority is as aware as possible of the true status of animal disease in the Province so it can more effectively plan preventive measures. The

sensitivity of passive surveillance is also increased by stimulating direct farmer reports through appropriate publicity, that is, what to report and to whom to report it.

2.2.2 Active and Passive Disease Surveillance

Passive disease surveillance refers to the routine reporting that arises from the general public and livestock owners/ keepers reporting disease suspicions to the veterinary authorities. A key issue at present is that passive disease reporting is from quite limited sources. Routine disease surveillance data collection and reporting appears to be lacking from some important sources such as abattoirs.

Active disease surveillance implies actively going out and searching for evidence of disease. This may be in the form of a randomised sampling survey (usually sero-surveillance where blood samples are checked in the laboratory for antibodies that provide evidence of past infection) or through active disease searching involving participatory epidemiology. The L&DD Department has some positive past experience with participatory disease searching from work done with the Global Rinderpest Eradication Programme in Pakistan. Tools such as Seasonal Calendars and Proportional Piling were effective in elucidating valuable information about the seasonal incidence of diseases in different localities and the farmers' perceptions of the ranked importance of these diseases. Such information is very valuable for planning vaccination campaigns (i) at the right time of the year and (ii) that best address farmers' needs. There is a need to consider how to integrate local disease searching with the regular reporting from the field. For example, the ADIOs could be trained in participatory disease searching techniques and required to provide seasonal calendars and disease ranking results. ADIOs are required to visit eight to ten farms per month, but they have limited reimbursement for field travel. If this is addressed, participatory epidemiology could become a regular component of their work.

Sero-surveillance will be required to demonstrate disease freedom in disease-free zones or compartments. Sero-surveillance is used to show coverage of vaccination campaigns.

2.2.3 Surveillance Recommendations

In view of the findings above, it is **recommended** that:

- Regular disease reporting from abattoirs is established (by veterinary Meat Inspectors),
- Field laboratories should be made more functional and laboratory test results better integrated with disease reports from the field,
- Personnel are trained in participatory epidemiology techniques and information is gathered and reported on the seasonal incidence of important diseases in geographically different parts of the Province,
- ADIOs are rewarded for reporting disease by encouraging them to do so (and replacing any fear of reprimand),
- ADIOs are provided with global positioning system (GPS) devices so that they can identify and report coordinates of disease outbreak sites.
- Farmers are encouraged to report specific diseases of concern by integrating surveillance with extension, informing farmers what to report and to whom/how, and
- Sampling surveys are designed according to the requirements of demonstrating disease-freedom in the planned disease-free zones and vaccination coverage (for diseases for which laboratory tests exist that differentiate vaccinated animals from those with antibodies due to past infection).

2.3 Software for disease data analysis and reporting

The two systems currently in use do not perform well for disease reporting. These systems are (i) TADinfo and (ii) the L&DD Department's recently designed website-accessed database. TADinfo has impressive reporting functions, but the Department uses a very outdated version that was designed when the Province had only 26 Districts (it now has 36 Districts) and, therefore, data entry according to current District and *tehsil* names is impossible. TADinfo does not have

advanced mapping functions, although basic maps can be easily generated when disease and geospatial data are entered.

The L&DD Department database has been created to cater for the needs of all Directorates of the Department and it functions extremely well for many of these needs. However, for disease reporting it has limitations. For example, there are data entry issues relating to exclusive choices for, for example, laboratory test or samples submitted (in reality, different types of samples can be submitted from one outbreak and several types of lab test carried out). TADinfo has modules for designing surveys for sero-surveillance or for vaccination: it would require a huge amount of programming work to give the L&DD Department's database the disease data entry, analysis and reporting functions that are already built in to TADinfo.

In view of the above findings, it is **recommended** that:

- For disease data entry and analysis, the Department obtains an updated version of TADinfo from the Food and Agriculture Organisation of the United Nations (FAO), requesting this through the Animal Husbandry Commissioner and sending updated administrative boundary names to FAO.
- For advanced mapping of disease outbreak information, the Department uses a dedicated programme such as ArcGIS. This could be obtained by sharing a licensed copy (such as the Urban Unit's) or by purchasing its own copy. In addition, training in use of this programme is required for a senior officer.

2.4 Monitoring, reporting and forecasting

Currently, disease monitoring depends primarily on the monthly reports submitted by ADIOs. It is **recommended** that the Directorate, ADRS subscribes to and follows international alerts to complement the ADIO reports. For example, disease alerts are available from ProMED-mail, FAO Emergency Prevention Systems (EMPRES – Animal Health) and from OIE. [6]

The as-is reporting routine includes a quarterly, high-level Consultative Group Meeting in which Directors, University Laboratory personnel and others discuss the disease data and trends in the previous three months. From this, a Surveillance Report is produced and is circulated to:

- Animal Husbandry Commissioner (who may forward relevant parts to OIE),
- Administrative Section (Secretary of L&DD Department and Deputy Secretary, Technical),
- Four Directors of Animal Health, each responsible for a Region of Punjab (from July 2012, there will be nine Divisional Directors), and
- Academics such as the Dean of Veterinary Sciences.

The consultant was told that the quarterly Surveillance Report is not produced regularly. In any case, a three-monthly report regime could be improved upon by having more responsive, up-to-date reports as well. Reports are needed immediately from outbreaks of listed diseases as well as follow-up reports according to OIE reporting modalities. This information must be transmitted via the Directorate ASDR to the Animal Husbandry Commissioner with minimum delay. It is assumed that provision for such rapid reporting already exists in the system.

It is highly desirable to provide regular feedback to District Officers who submit disease data. It is **recommended** that regular summary disease status reports are sent by email to each District. These feedback reports should summarise disease data analysis and inform and motivate the ADIOs. The summary reports should include maps of disease locations in the Province: this is not only the best way to display spatial disease data, but can also be a means to encourage

[6] See: http://www.promedmail.org, http://www.fao.org/foodchain/empres-prevention-and-early-warning/en, and http://www.oie.int/animal-health-in-the-world/the-world-animal-health-information-system/info-list-rss

reporting by pointing out Districts that have not reported to encourage non-reporters to comply with the reporting requirements (a benign "name-and-shame" approach).

The disease forecasting mechanism should be regulated to keep the veterinary staff alert and updated. Disease forecasting needs to be made more specific to the different animal species structure and the different geographic factors that pertain to different parts of the Province. Findings from participatory epidemiology (see above) will provide very valuable information on expected seasonal incidence of disease that will make the forecasts and planning more relevant and accurate.

At present vaccine requirements are determined over one year in advance. An annual vaccine plan is unresponsive to changing needs in the face of disease outbreaks. An alternative approach is to establish a vaccine bank and use it according to actual needs, rather than give each District office specific targets every single year. It is **recommended** that the vaccine requirement forecast is derived from: known seasonal disease incidence, up-to-date disease outbreak intelligence, livestock census data combined with target vaccine coverage for each specific disease, knowledge of where particular diseases are more severe and, finally, where outbreaks are occurring in neighbouring areas.

3. Disaster Preparedness

3.1 Background

In the past decade, the Punjab has experienced two very serious natural disasters: the 2005 earthquake and the 2010 floods. Both affected livestock-owning communities and required coordinated response from the GoP. Flooding is a regular and expected problem in the Province for which preparedness and planning is required by the L&DD Department. Therefore, the L&DD Department requested training in Livestock Emergency Guidelines and Standards (LEGS)[7] for key personnel responsible for emergency preparedness planning and response coordination.

3.2 LEGS Training

A three-day training course was carried out at the University of Veterinary and Animal Sciences (UVAS), Lahore. Twenty-two participants were drawn from the L&DD Department in Lahore, District Officers, UVAS staff and representatives of the Punjab Disaster Management Authority (PDMA). Details of the participants are given in the appendix.

The objectives of the course were that, by the end of the training the course participants would be able to:

- Describe and apply the LEGS approach,
- Identify appropriate livelihoods-based livestock interventions in emergency response,
- Design and implement these interventions according to LEGS standards and guidelines, and
- Prepare and implement a 'Livestock Emergency Fighting Plan' in their respective areas of working.

The modular course contained six sessions over the three days of training, namely,

Session 1: Introduction to LEGS (the structure of the handbook, cross-cutting issues and common standards)

Session 2: Livelihoods, livestock and emergencies background

Session 3: Preliminary assessment (Key tool – 3 Assessment Checklists)

Session 4: Response identification (Key tool – Participatory Response Intervention Matrix)

[7] See www.livestock-emergency.net

Session 5: Analysis of technical interventions and options (Key tools - decision trees, timing tables, advantages and disadvantages tables, and standards and indicators/ guidance notes)

Session 6: Monitoring and evaluation (Key tools - standards and indicators/ guidance notes, M&E checklists)

The evaluation forms returned by the participants at the end of the training were very positive, with all participants stating that the course objectives had been met. When asked to describe the training in one word, the responses were: "useful, good, informative, excellent, measurable, fantastic, participatory". The single most popular response was "excellent".

Appendix A: The Punjab Animal Health Act, 2011

The table below show recommended edits to the draft legislation.

Chapter	Section & subsection	Proposed change
1	2	Add definition of “notifiable/notified disease”
1	2 (a)	Add “and other domesticated animals, including dogs and cats”
1	2 (i)	Add “donkey”
1	2 (p)	Add “Village Veterinary Worker” and “Community-based Animal Health Worker”
1	2 (r)	Add “including paraprofessional veterinary workers who are registered according to Government regulation”
2	3 (1)	Add “according to OIE standards for disease-free zones and compartments”
2	4 (1) (c)	Add “including border inspection posts and procedures”
2	9 (2)	Add “... and notifiable disease has been confirmed” [to avoid obligation for payment for any and every report from general public]
2	17	Add “(3) Veterinary services may be provided wholly by the private sector, under Government regulation”
2	21 (2)	Specify if poultry have to be identified or are exempt.
3		Advisable to invite specialised animal welfare organisation to offer to contribute here. For example, the Brooke, an NGO with a long-standing programme in the Punjab, may be willing to offer free legal advice.[8]
Schedule 1	Ch 2 sect 3	Revise list of diseases. For example, remove rinderpest (now eradicated world-wide); add highly pathogenic avian influenza. Consider using OIE notifiable diseases list – see below. Not all these diseases occur in Pakistan (e.g. tsetse-borne trypanosomosis), but the comprehensive list below can be used to refine the Punjab list.

[8] For contact details, see website http://www.thebrooke.org.pk

OIE Listed Diseases, 2012[9]

Multiple species diseases

Anthrax

Aujeszky's disease

Bluetongue

Brucellosis (*Brucella abortus*)

Brucellosis (*Brucella melitensis*)

Brucellosis (*Brucella suis*)

Crimean Congo haemorrhagic fever

Echinococcosis/hydatidosis

Epizootic haemorrhagic disease

Equine encephalomyelitis (Eastern)

Foot and mouth disease

Heartwater

Japanese encephalitis

New world screwworm (*Cochliomyia hominivorax*)

Old world screwworm (*Chrysomya bezziana*)

Paratuberculosis

Q fever

Rabies

Rift Valley fever

Rinderpest

Surra (*Trypanosoma evansi*)

Trichinellosis

Tularemia

Vesicular stomatitis

West Nile fever

Cattle diseases

Bovine anaplasmosis

Bovine babesiosis

Bovine genital campylobacteriosis

Bovine spongiform encephalopathy

Bovine tuberculosis

Bovine viral diarrhoea

Contagious bovine pleuropneumonia

[9] http://www.oie.int/animal-health-in-the-world/oie-listed-diseases-2012/ accessed 11 April 2012

Enzootic bovine leukosis
Haemorrhagic septicaemia
Infectious bovine rhinotracheitis/infectious pustular vulvovaginitis
Lumpy skin disease
Theileriosis
Trichomonosis
Trypanosomosis (tsetse-transmitted)

Sheep and goat diseases
Caprine arthritis/encephalitis
Contagious agalactia
Contagious caprine pleuropneumonia
Enzootic abortion of ewes (ovine chlamydiosis)
Maedi-visna
Nairobi sheep disease
Ovine epididymitis (*Brucella ovis*)
Peste des petits ruminants
Salmonellosis (*S. abortus ovis*)
Scrapie
Sheep pox and goat pox

Equine diseases
African horse sickness
Contagious equine metritis
Dourine
Equine encephalomyelitis (Western)
Equine infectious anaemia
Equine influenza
Equine piroplasmosis
Equine rhinopneumonitis
Equine viral arteritis
Glanders
Venezuelan equine encephalomyelitis

Swine diseases
African swine fever
Classical swine fever
Nipah virus encephalitis
Porcine cysticercosis

Porcine reproductive and respiratory syndrome

Swine vesicular disease

Transmissible gastroenteritis

Avian diseases

Avian chlamydiosis

Avian infectious bronchitis

Avian infectious laryngotracheitis

Avian mycoplasmosis (*M. gallisepticum*)

Avian mycoplasmosis (*M. synoviae*)

Duck virus hepatitis

Fowl typhoid

Highly pathogenic avian influenza and low pathogenic avian influenza in poultry (as per Chapter 10.4. of the Terrestrial Animal Health Code)

Infectious bursal disease (Gumboro disease)

Newcastle disease

Pullorum disease

Turkey rhinotracheitis

Appendix B: Key Persons Met

Key persons met (in order of meeting)

PGEIP

- Muhammad Ahsan Rana, Civil Service Reform Specialist, **PGEIP**
- Asad Zahoor, Organisational Development and Business Process Re-engineering Expert, **PGEIP**
- Hassan Nasir Jamy, Organisational Development Expert and Coordinator, **PGEIP**
- Suleman Yaqub, Human Resources Specialist, **PGEIP**
- Badar Mahmood, IT Specialist, **PGEIP**
- Imran Rizvi, Communications Specialist, **PGEIP**

Meeting – Introduction to L&DD Department

- Dr Shahid Hussain Bukhari, **Director**, Animal Disease Reporting and Surveillance, **L&DDD**
- Dr Naveed Anwar Malik, Animal Disease Reporting and Surveillance, **L&DDD**
- Dr Muhammad Rasheed, (Disease-Free Zones), Animal Disease Reporting and Surveillance, **L&DDD**
- Dr Haji Munir Ahmad, (Microbiology/Laboratory), Animal Disease Reporting and Surveillance, **L&DDD**
- Dr Farhat Awan, Animal Disease Reporting and Surveillance, **L&DDD**
- Dr Javed Iqbal, Veterinary Officer, Animal Disease Reporting and Surveillance, L&**DDD**
- Dr Muhammad Muddassir Nadeem, Animal Disease Reporting and Surveillance, **L&DDD**

Secretariat Meeting

- Hamed Yaqoob Sheikh, Secretary, **L&DDD**
- Khalid Awais Ranjha, Additional Secretary, **L&DDD**

Technical Meeting – Treatment and Prophylaxis

- Dr Shahid Hussain Bukhari, **Director**, Animal Disease Reporting and Surveillance, **L&DDD**
- Dr Liaquat Ali, DLO Kasur, **L&DDD**
- Dr Muhammed Hafeez, DDLO, **L&DDD**
- Dr Nasir Mohammed Sandhu, DDLO, **L&DDD**
- Dr Asif Rafiq, AD (Extn), office of DG (Extn) , **L&DDD**
- Dr Haider Ali Khan, DE (Reporting) , **L&DDD**
- Dr Tariq Mustafa, ADIO, **L&DDD**
- Dr Naveed Anwar Malik, VO, **L&DDD**
- Syed Altaf Hussain, DM, **L&DDD**
- Dr Tajammal Hussain, DLO, **L&DDD**

Technical Meeting – Disease Reporting and Surveillance

- Dr Shahid Hussain Bukhari, **Director**, Animal Disease Reporting and Surveillance, **L&DDD**
- Dr Farhat Nazim Awan, Asst Dir Invest Officer
- Dr Muhammad Khalid Hazeem, Asst Disease Investigation Officer
- Dr Javed Iqbal, Veterinary Officer, **L&DDD**
- Dr Haji Muniz Ahmed, Dep Dir (DR) , **L&DDD**
- Dr Asif Rafiq, AD (E & P) , **L&DDD**
- Hassan Nasir, **PGEIP**
- Dr Arshad Mahmood, DD (Dis Surv), **L&DDD**
- Dr Abdul Rahman, DPRI, **L&DDD**
- Dr Haider Ali Khan, DD (P & E) , **L&DDD**
- Dr Syed Abbas Ali, Epidemiologist, **L&DDD**
- Dr Naveed Anwar Malik, Asst Information and Publicity Officer, **L&DDD**
- Dr Muhammad Muddassir Nadeem, VO (R) , **L&DDD**
- Syed Altaf Hussain, Data Manager, **L&DDD**

Technical Meeting – Laboratory Diagnosis and Accreditation

- Dr Shahid Hussain Bukhari, **Director**, Animal Disease Reporting and Surveillance, **L&DDD**
- Dr Anwar Hussein, Director Animal Health, **L&DDD**
- Dr Abdul Rehman, Director, **Poultry Research Institute**, Rawalpindi
- M. Yasin Tipu, Asst Professor (Lab Expert), **UVAS**
- Hassan Nasir, **PGEIP**
- Dr Farhat Awar, ADIO Prov Lab, **L&DDD**
- Dr M Khalid Hazeem, ADIO Prov Lab, **L&DDD**
- Dr Asif Rafiq, AD (E & P), o/o DG (Ext) , **L&DDD**
- Dr Haider Ali Khan, DD (P & E), **L&DDD**
- Dr Naveed Anwar Malik, **L&DDD**

Technical Meeting – Data Analysis

- Dr Shahid Hussain Bukhari, **Director**, Animal Disease Reporting and Surveillance, **L&DDD**
- Dr Qurban Hussain, Dir P & E, **L&DDD**
- Dr M Qaseem, Asst Chief Revamping Project, P & E Cell, **L&DDD**
- Dr Haji Munir Ahmad, DD (DR) , **L&DDD**
- Badar Mahmood, IT Strategy Expert, **PGEIP**
- Hassan Nasir, **PGEIP**
- Dr Arshad Mahmood, DD (Dis Surv) , **L&DDD**
- Dr Asrar Hussein, D C & E, **L&DDD**

- Dr Asif Rafiq, AD (E & P), o/o DG (Ext) , **L&DDD**
- Dr M Khalid Hazeem, ADIO Prov Lab, **L&DDD**
- Faraz Gul Khan, DBA, **L&DDD**
- Syed Altaf Hussain, DM, **L&DDD**
- Dr Naweed Anwar Malik, **L&DDD**
- M Nauman, DBA, **L&DDD**
- Dr Farhat Anwar, ADIO, **L&DDD**
- Dr Abdul Rauf, Dir L&DD BA, **L&DDD**

Technical Meeting at Veterinary Research Institute – Vaccine Production and Efficacy

- Dr Shahid Hussain Bukhari, **Director**, Animal Disease Reporting and Surveillance, **L&DDD**
- Dr Naweed Anwar Malik, **L&DDD**
- Dr Zafar-al-Ahsan Quereshi, Research Officer, **VRI**
- Dr Saeed Ahmad, Director, **VRI**
- Dr Ali Sattar, Div Head, R & D, **VRI**
- Dr Sajjad Hussain, BPO, **VRI**
- Dr Azmat Sultan, ADIO, **VRI**
- Dr Waheeda Rana, RO, **VRI**
- Dr Aqba Mushtar, VO, **VRI**
- Asma Aziz, Biochemist, **VRI**
- Dr Bushra Zamir, ARO, **VRI**
- Dr Summaiya Sattar, VO, **VRI**
- Dr Elina Ali, VO, **VRI**
- Dr Shahida Parveen, ARO, **VRI**
- D Abdul Whab Manzoor, VO, **VRI**
- Dr Sajjad Ali, VO, **VRI**
- Dr Zain-ul-Aliedin, VO, **VRI**
- Dr Saeed A Khan, ARO, **VRI**
- Dr Rahan Rafique, VO, **VRI**
- Muhammad Asad Raza, RO (T) , **VRI**
- Muhammad Asim, BPO, **VRI**
- Dr Janshed Iqbal, ARO, **VRI**
- Dr Sheikh Ahmed, RO, **VRI**
- Abdul Razam, VO, **VRI**
- Nadam Akram, VO, **VRI**
- Hassan Nasir, **PGEIP**
- Asad Zahoor, **PGEIP**

Others (and see lists of attendees of LEGS training and consultant's final workshop)

- Prof Dr Talat Naseer Pasha, **Vice Chancellor**, University of Veterinary and Animal Sciences, **UVAS**
- Prof Dr Habib Rehman, **Dean**, **UVAS**
- Prof Dr Muhammad Sarwar, **Dean**, Faculty of Animal Husbandry, **University of Agriculture, Faisalabad**
- Dr Muhammad Afzal, **FAO Project Coordinator**, *Progressive Control of FMD in Pakistan*
- Ch Hamid Malhi, **Director, Punjab Livestock and Dairy Development Board**
- Dr Shakeel Babar, **Team Leader**, Project Implementation Team, Punjab Economic Opportunities Programme, **PEOP**
- Dr Aftab Ahmad, **Deputy Team Leader**, Project Implementation Team, **PEOP**
- Dr Ghulam Habib, **Livestock Advisor**, Project Implementation Team, PEOP
- Jack Moser, Project Director, USAID Dairy and Rural Development Foundation Project
- Mazar Karim, Research Officer, Livestock Production Research Institute, Bahadurnagar, Okara

Appendix C: Disease-Free Zones and Compartments

International requirements for DFZ and compartments

The establishment of a disease-free zone has prerequisites that are spelt out in relevant chapters of the OIE Terrestrial Animal Health Code. In summary,

- The Veterinary Authority establishes the extent of a zone or compartment. This is based on natural, artificial or legal boundaries. The Veterinary Authority publicises it through official channels.
- The Veterinary Authority establishes the factors defining a compartment, using criteria of management and husbandry practices related to biosecurity, and publicises it through official channels.
- Animals and herds belonging to subpopulations must be recognisable as such through a clear epidemiological separation from other animals and all things presenting a disease risk.
- The existence of a valid animal identification system at the herd, flock or individual animal level, depending on the system of production. Relevant animal movements into and out of the zone or compartment should be well documented, controlled and supervised.
- Biosecurity plan describing (i) the partnership between the relevant industry and the Veterinary Authority, and their respective responsibilities, (ii) routine operating procedures, to provide evidence that surveillance is conducted and that live animal identification, traceability system and management practices are adequate.
- The biosecurity plan should include:
  - Information on animal movement controls
  - Herd or flock production records
  - Feed sources,
  - Surveillance results
  - Birth and death records
  - Visitor logbook
  - Morbidity and mortality history
  - Medications, vaccinations
  - Documentation of training of relevant personnel
  - Any other criteria necessary for evaluation of risk mitigation
  - Describes how the measures will be audited so that risks are regularly re-assessed and then measures adjusted accordingly

Seven issues require consideration in the application of zones and compartments:

1. Principles for defining a compartment
2. Separation from probable sources of infection
3. Documentation
4. Surveillance
5. Diagnostic procedures
6. Emergency response and notification
7. Supervision and control of a compartment within the livestock sector

1 Principles for defining a compartment

- Components of the establishments and/or premises that constitute the compartment.
- Description of livestock subpopulation.
- Description of functional relationships between components of the compartment.

2 Separation of a compartment from potential sources of infection

- Physical or spatial factors that affect biosecurity in the compartment.
- Infrastructural factors.

- Biosecurity plan.
- Traceability system.

3 Documentation of factors critical to the definition of a compartment

- Clear evidence that biosecurity, surveillance, traceability, management and control practices (as defined for the compartment) are being applied.

4 Surveillance for the agent

- The necessary surveillance and means to implement it.
- Effective surveillance at the national level.
- Documentation of the surveillance.

5 Diagnostic capabilities and procedures

- Diagnostic laboratory testing should support surveillance.
- Laboratories should have rapid reporting procedures.

6 Emergency response and notification

- Early detection, diagnosis and identification is critical.

7 Veterinary Authority's supervision and control of a compartment within the livestock sector

- Authority's role is well defined.
- Capacity to fulfil its functions.
- Effective relationships with livestock sector producers.

The L&DD Department Phased Plan for DFZ establishment [10]

Phase I (3 months)

- Identification and announcement of proposed area
- Notification of area with communication to OIE through CVO
- Provision the technical leadership
- Registration of livestock / animal holders
- Identification and Registration of animals / Livestock farms

Phase II (3 months)

- Awareness activities for farmers of the area on advantages of disease free compartment
- Establishment of Fattening of animals Models
- Production Models through Breeding
- Quarantine camps and laboratories at exit entry points
- Vaccinations against notifiable diseases e.g. FMD, BQ
- Intensified disease surveillance and reporting

[10] Internal document, "*Establishing Disease Free Zone / Compartment in Cholistan, Punjab, Pakistan*," courtesy Dr Rasheed.

Phase III (6 months)

- Legal movement control on exit and entry points
- Encouraging private sector investors to put up export slaughterhouses and meat processing plants
- Provision of best treatment and diagnostic facilities in the area
- Computerization of livestock services and record
- Establishing marketing network in the area
- Monitoring and Evaluation system

Phase IV (3 months)

- Enforcement of Legal Framework in area
- Establishment of Meat development structure / Farms and processing plants
- Regular Provision of best treatment and diagnostic facilities in the area
- Data Sharing with national and international level
- Regular surveillance and reporting of diseases
- Regular Monitoring and Evaluation activities with feedback system

Appendix D: Livestock Emergency Guidelines and Standards

LEGS course participants, 19-21 April 2012

Name of Officer	M/ F	Place of Posting	Depart-ment
Dr. Shahid Hussain Bukhari		Director, ADRS, L&DD, Lahore	L&DD Dept
Dr. Farhat Nazir Awan	F	ADIO (Micro), Provincial Diagnostic Laboratory, Lahore	L&DD Dept
Dr. Naveed Anwar Malik		VO, Provincial Diagnostic Laboratory	L&DD Dept
Dr. Haider Ali Khan		Deputy Director (AH)	L&DD Dept
Dr. Sana Riaz Chaudhary	F	VO, Shamkey Bhattian	L&DD Dept
Dr. Samina Anwer	F	VO, CVH, Sahiwal	L&DD Dept
Dr. Tehseen Nusrat Chatha		ADIO, Khushab	L&DD Dept
Dr. Muhammad Aslam Khan Niazi		ADIO, Mianwali	L&DD Dept
Dr. Riaz Ahmed Khan		VO, Khudian, Kasur	L&DD Dept
Dr. Zaheer Ahmad		VO (H) Civil Veterinary Hospital Rahim Yar Khan	L&DD Dept
Dr. Farhat Abbas		VO (H) Civil Veterinary Hospital Makhdoom Rasheed, Multan	L&DD Dept
Dr. Abdul Hameed		VO (H), Civil Veterinary Hospital, Muzaffar Garh.Kot Addu	L&DD Dept
Dr. Mohammad Tariq Iqbal		Assistant Disease Investigation Officer Layyah.	L&DD Dept
Dr. Mohammad Tariq Buzdar		VO (H) In-charge Civil Veterinary Dispensary Bharti , Dera Ghazi Khan.	L&DD Dept
Dr. Muhammad Iqbal		DDLO (AH), Chiniot	L&DD Dept
Dr. Riaz Ahmed		DDLO, M.B.Din	L&DD Dept
Dr. Nayyar Maqsood		VO, Narowal	L&DD Dept
Dr Akhtar Ghlam Mustafa		DDLO (AH), Sialkot	L&DD Dept
Mr. Muhammad Sajjad		Assistant Director (Admin), PDMA, Punjab	PDMA
Mr. Afaq Haider		Superintendent (Operation), PDMA, Punjab	PDMA
Prof. Dr. Muhammad Arif Khan		Chairman, Dept of Clinical Medicine and Surgery, UVAS, Lahore	UVAS
Dr. Aneela Zameer Durrani	F	University of Veterinary and Animal Sciences, Lahore	UVAS

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