National Ovine Johne's Disease Control and Evaluation Program

National Workshop on Control Strategies

A Review of the NSW Approach

17 and 18 April, 2001 – AMA House, Barton ACT

Terms of Reference for National Workshop

(from NOJDPAC 11 OOS Paper 6)

1. "In the light of current knowledge of the regional prevalence of OJD, to examine strategies which will lead to the control of OJD, and recommend optimal control strategies for different zones, but in particular for higher prevalence regions."

2. "To examine strategies available for the on-farm control of OJD, and assess the impact of on-farm control strategies on regional control; and recommend appropriate on-farm control strategies."

3. "Provide a report on the outcomes of the Workshop to the TSC Chair by 1 February 2001."

Statement of Purpose of Workshop (after recent NOJDPAC meeting)

The purpose of this MLA sponsored workshop is to facilitate a structured discussion by national and state OJD technical advisers of a number of proposals for change to the on-farm strategies currently applied in NSW for controlling the spread of OJD, particularly within and from high disease prevalence areas.

The NOJDP Program Advisory Committee support and MLA funding for the workshop is premised on the view that the on-farm control strategies for OJD that are adopted in NSW have significant implications for other states and the control component of the NOJDP.

The workshop will consider and rank available control strategies for OJD in NSW in the context of the changing epidemiological situation in NSW, recent advances in scientific knowledge and the broader social and economic circumstances in which control of OJD in NSW is set, particularly in the high prevalence area.

All available on-farm control options will be considered, with due regard given to regional OJD control objectives within NSW and current agreed national control objectives, in order that practical and achievable strategies for controlling further spread of OJD within and from NSW are identified and documented. Although the optimal control strategies for NSW, particularly for high prevalence areas, may be immediately appropriate only within NSW, such recommendations may also be relevant within and around any other high prevalence area that is identified elsewhere in the future.

The sole objective of the workshop is to identify practical and achievable strategies for controlling further spread of OJD in NSW, particularly within and from the major high disease prevalence area - within the context of the existing, biological, epidemiological, social, economic, political and financial situation.

National Ovine Johne's Disease Control and Evaluation Program

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Program

Day 1 The Current Disease Situation and Potential Control Strategies

9.00 am **Welcome** - Robin Vandergraaff, Chair

9:05 am **Opening and Expected Outcomes from the Workshop -** John Kerin

9:15 am **Workshop Procedures** - Denis Hussey

9:30 am **Setting the Scene: OJD Control and Zoning in Australia to Date -** Bruce Allworth

9:45 am **Lateral Spread of OJD Infection -** Evan Sergeant/Steve Whittaker
Recently recognised in NSW as an important pathway for the spread of OJD to previously uninfected properties, "lateral spread" between adjoining properties appears likely to be a problem for effective regional control of OJD in NSW. Evidence that "lateral spread" is occurring and is now a significant source of new property infection in NSW will be presented.

Session 1

10:00 am **The Disease Control Context -** Denis Hussey
This session will discuss the non-biological aspects of the NSW environment with which any adopted disease control strategies will interact, including political, social, economic, legal, administrative and financial aspects.

Session 2

11.00 am **Potential Control Objectives and Strategies -** Denis Hussey

This session will cover:

1. potential on-farm and regional objectives for OJD control in NSW, particularly in high disease prevalence areas
2. current on-farem and regional control strategies in NSW, particularly in high disease prevalence areas
3. potential new control strategies for NSW, particularly for high disease prevalence areas

The aims are

- to examine the on-farm control objectives for OJD in NSW to see what is realistic with current technology and knowledge about this disease and its distribution in NSW,
- to allow participants to identify possible shortcomings in current control strategies and policies in NSW,
- to list and broadly examine all potential control strategies and to get an understanding of their potential application - but without making any choices at this stage, and
- to identify any limitations upon appropriate new control strategies for NSW under the current SD&Rs, particularly in high disease prevalence areas.

1:00 pm Lunch

2:00 pm ***continued:*** **Control Objectives and Strategies**

3:00 pm **Proposed Changes to Control Policy in NSW -** Ian Roth

The aim of this presentation is to summarise proposals for managing OJD in NSW with a "Three Zone" system of Residual, Control and Proposed Protected in which disease control policies will be varied according to the disease situation in each area but consistent with the overall need to minimise spread. Issues to be considered will include proposals for reducing movement restrictions in the NSW restricted zone, permitting the trading of vaccinated sheep between infected and suspect properties in the NSW residual zone and reducing the spread of infection from the NSW residual zone.

Session 3

3:15 pm **Risks to Effective Control of OJD in NSW and Proposals for Disease Control in NSW to be based on Risk Management**
- Denis Hussey

This session will identify and discuss:

1. the major risks to effective control of disease spread in NSW - including biological and politico-social risks. This session will identify critical links between effective on-farm control and effective regional control
   The aim is to identify and agree on the significant risks to effective control of further spread of OJD within and from NSW in terms of the on-farm strategies for control of OJD in NSW

2. acceptable risks from sheep trading in NSW and ways to balance the interest of affected individuals in continued trading against the communal interest in maximum disease control.
   The aim is to discuss:
   i. acceptable risk from different perspectives – particularly from the perspective of states with little or no OJD infection to date,
   ii. ways to facilitate a legal trade in affected stock in NSW and thereby obtain better compliance with movement restrictions. (The overall risk of spread under a low or controlled risk system for trade may be less than from a potentially nil-risk system - such as total quarantine - if there is poor compliance with the supposedly nil-risk policy.)

6:00 pm **CLOSE FOR DAY 1**

7:00 pm Workshop Dinner - Venue to be advised.
This will be an informal working evening - participants who miss the dinner may find themselves behind the play on the second day!

Day 2 Identifying Optimal Disease Control Strategies for Containing the Spread of OJD in NSW

Session 4

8:30 am **Identifying practical and achievable strategies for on-farm control of OJD in NSW** - Denis Hussey

Consensus from the technical participants at the workshop will sought on:

1. The most practical and achievable disease control objectives for NSW, particularly for the high prevalence areas

The aim is to create by consensus a list of principal control objectives for OJD that are likely have broad support.

2. The most practical and achievable disease control strategies for NSW, particularly in the high prevalence areas (matched to control objectives).

The aim is to ensure that appropriate control strategies for each control objective are identified

It is also an objective of this session to identify:

3. Any limitations or conditions likely to be required by individual stakeholders before any such strategy for control of OJD in NSW can be endorsed and supported by stakeholders.

The aim is to identify and discuss concerns that particular stakeholders might have with the identified optimal strategies for control of OJD in NSW and the conditions these stakeholders might require before endorsing such strategies.

12:00 pm Lunch

Session 5

1:00 pm **Controlling OJD in NSW – How will it be achieved?** - Denis Hussey

The objective of this session is to reflect on the objectives and strategies identified as optimal for control of OJD in NSW in Session 4 to ensure that there is a consensus amongst participants that such strategies, if adopted, would provide more effective control than existing strategies.

The aim is to ensure any recommendations made to TSC or NOJDPAC for national endorsement and facilitation of control policy changes in NSW are practical and rational within the broader environment in which the strategies will operate. This will include some consideration of whether it is likely or not that responsibility will be accepted by the appropriate authority for the key elements of activities identified as necessary for the identified control strategies. If there are any strategies under consideration for which implementation is unlikely or inappropriate at this time (for reasons other than the disease control objectives), these strategies should be deleted at this stage.

2:30 pm Conclusions and Recommendations - Denis Hussey

The aim of this session is to draft a summary of the findings and any recommendations of the workshop for submission to TSC and NOJDPAC

3:45 pm Concluding Remarks - John Chudleigh

4:00 pm Close

Participation by all delegates at the final session will be critical to effective outcomes from the workshop. Please do not arrange your travel to require your departure before 4:00 pm.

NATIONAL WORKSHOP ON OVINE JOHNE'S DISEASE CONTROL STRATEGIES
17th & 18th April, 2001 – AMA House, Barton ACT

"THE RULES OF ENGAGEMENT"

The workshop will be opened by Mr John Kerin and chaired by Dr Robin Vandegraaff.
Mr Denis Hussey will act as "facilitator" of the workshop.

The format for this workshop has been modelled roughly on the format used in the United States for National Institutes of Health Consensus Development Conferences which make critical technical recommendations for changes to national human health policies (eg RDA's for nutrients, therapeutic regimes and drug prescribing policies).

Essentially, under this format there are two types of participants in the workshop – "core participants" and "non-core participants".

In the "cut-and-thrust" of the debate on key technical issues in the workshop, core participants have priority for whatever time is available, both for asking and answering questions.

Non-core participants however are more than just observers and may be invited to speak at an appropriate time by the facilitator, often but not always at the request of a core participant, on any particular issue in which the non-core participant has special expertise. However, this is not an opportunity for "Dorothy Dix" questions. The facilitator determines who is to speak at any time including who will answer any question put by a non-core participant. (The facilitator will be well briefed on the background and interests of all participants including non-core participants.) There are also opportunities for questions and statements from non-core participants, but priority is given to the core participants.

The focus of this arrangement is always upon allowing the facilitator to obtain decisions and recommendations from the meeting based on the consensus of the core participants. The non-core-participants are only involved in this process to the extent that they contribute to the discussion with arguments that are persuasive to the core participants.

This format is very outcome focussed, with a specified requirement in advance of the meeting for decisions and recommendations on particular key issues.

Core participants are expected to come to the meeting with an understanding of the outcomes expected and the decisions and recommendations to be made, a good knowledge of the background to the issues and a willingness to contribute to and endorse the consensus decisions that are reached and to make recommendations accordingly. Non-core participants must come prepared to contribute to the discussion when asked and well focussed on how to make any points they believe to be critical to the debate in the more limited time available to them, but with the clear understanding that core participants have priority and this will be strictly controlled by the facilitator. . If you are having trouble imagining how it will work, think about Geoffrey Robinson's "Hypotheticals" on your ABC.

To assist the consensus development process, seating at the meeting is carefully planned by the facilitator to maximise opportunities for constructive debate from all participants according to these rules
Please accept this notice as a your invitation to the National OJD Control Strategies Workshop.

The proposed agenda for the workshop, a list of invited participants and several briefing papers describing some proposals from NSW for change to control policies are attached.

We look forward to your active contribution to this workshop.

NATIONAL OVINE JOHNE'S DISEASE CONTROL AND EVALUATION PROGRAM
NATIONAL WORKSHOP ON CONTROL STRATEGIES
Canberra, April 17th-18th, 2001

PRINCIPLES AND STRATEGIES FOR CONTROL OF OVINE JOHNE'S DISEASE

Prepared by NSW Agriculture – 4th April 2001

Summary

There is evidence in NSW that, despite the application of measures to reduce spread of OJD in accordance with the NOJDP, within and between flock transmission and particularly lateral (neighbour) transmission is still occurring at a level which threatens the viability of the control aspect of the program in this state.

Lack of short term control in NSW will drastically reduce the number of potential options for long term OJD management in Australia.

NSW requires access to new control strategies to reverse the current situation.

New control strategies are needed to:

- *reduce prevalence in infected flocks,*
- *protect uninfected/low-risk flocks and low-risk zones,*
- *allow increased trading options for low risk sheep from affected flocks,*
- *encourage producer support and compliance with the program.*

Implementation of such strategies will require access to measures such as:

- *financially assisted infected flock profiling,*
- *financially assisted Property Disease Reduction Plans,*
- *use of vaccine for strategic disease control,*
- *grading of movement restrictions according to risk.*

Introduction

Objective number three of the National Ovine Johne's Disease Control and Evaluation Program (NOJDP) is '*to minimise further spread of OJD during the evaluation phase'*.

The National Control Strategies Workshop has been convened to review current OJD control strategies, identify deficiencies, and recommend modifications to enhance containment of the disease during the control and evaluation phase of the program.

Background

Control of ovine Johne's disease is an essential component of the national program, as defined by the Morris Hussey Report, 31 January 1998, and implemented under the NOJDP. The recommendations in the report 'are based on the judgement that the best path forward is to implement a collection of measures aimed at containing and progressively reducing infection in a manner consistent with the eventual goal of achieving eradication'. However Morris Hussey clearly delineated control strategies (Property Disease Eradication Plans - PDEPs, and Property Disease Reduction Plans - PDRPs) from spread reduction strategies (zoning and movement restriction).

To date spread reduction has been based on:

- surveillance,
- implementation of quarantine measures on all flocks known or suspected of being infected,
- zoning - introduced on 1/7/99 to restrict the movement of non-assessed sheep from known endemic areas to areas of apparently lower prevalence.

On an individual property level, infected properties are quarantined, and owners have been encouraged to consider undergoing a Property Disease Eradication Plan (PDEP) with the aim of eliminating all infective organisms/sources of infective organisms from their land and flock. In some states assistance measures have been provided to producers undergoing PDEPs.

Owners of suspect properties have been encouraged to cooperate with investigations into the apparent presence/absence of disease. Limited incentive is offered in terms of removal of restrictions and possible accelerated entry into the MAP where the investigation returns negative results.

In addition, owners of infected properties who have not been able to undertake a PDEP have been encouraged to undertake disease management or disease reduction measures, including enterprise change, strategic culling, pasture management, nutritional and breeding management and parasite control programs, all designed to reduce the impact of OJD on their enterprise.

However despite the application and/or enforcement of all the above measures, there is now clear evidence of continued spread of infection within New South Wales including:

- spread by lateral transmission from identified infected properties to neighbouring land and flocks,
- spread by lateral transmission from as yet unidentified infected properties to neighbouring land and flocks,
- dissemination by forward movement from as yet unidentified infected properties.

Principles of Control

Effective control of OJD is dependent on:

- implementation of effective measures to limit spread through movement of sheep;
- implementation of effective measures to limit spread between neighbouring properties;
- support of producers for the program and compliance with measures implemented.

Measures in low prevalence regions/zones should be directed at early identification of infected flocks, to allow prompt action to identify other at-risk flocks and limit further spread. In higher prevalence zones identification of infected flocks is less critical, and measures should be directed at minimising spread from infected properties (both known and unknown), protecting identified low-risk flocks and enhancing trading opportunities for low risk flocks/mobs.

Thus, any control program must be based on a combination of:

- disease control on individual infected farms to reduce prevalence, and
- movement controls on infected farms and between zones of different prevalence to minimise spread by movements of sheep.

At the same time, the measures must receive the support of affected producers and their compliance with the program for it to succeed. This is a major failing of the current highly restrictive approach to OJD.

A risk-based approach to control is essential, as a no-risk approach is doomed to failure. There will always be some risk associated with any measures used, and it is essential that the likely risks associated with the various measures are carefully assessed and only measures that have an acceptable level of risk are implemented.

Potential strategies for control of OJD

The following strategies are or may be available for the control of OJD. Different combinations of strategies are likely to be applicable for use in different zones/regions, and programs should be designed to meet the control objectives for each zone. This list is not exhaustive.

- Restrictions on the movement of non-assured sheep between zones
- A risk-based approach to movement controls for infected/suspect flocks
- On-going surveillance programs for detection of infected flocks
- Prompt and thorough investigation of flocks identified by tracing or other means of surveillance

- Surveillance of neighbours of infected flocks to ensure early detection and implementation of control measures
- Subsidised MAP/assurance testing to identify low-risk flocks
- Implementation of disease reduction plans to reduce prevalence on infected farms
- Continued strict control over the use of vaccine – eligibility, identification of vaccinates, quarantine
- Vaccination or depopulation of infected flocks
- Pre-emptive vaccination or depopulation of high-risk suspect flocks
- Vaccination (compulsory or voluntary) of known infected and/or suspect flocks
- Vaccination (compulsory or voluntary) of flocks neighbouring known infected flocks
- Vaccination (compulsory or voluntary) of all flocks in the district/zone/catchment
- Use of adult vaccination for rapid reduction in level of excretion
- Use of voluntary vendor declarations when selling/purchasing sheep within a zone
- Development of options for trading between vaccinating flocks
- Development of group strategies to work together to control and/or eliminate the disease on an area/catchment basis
- Financial assistance for affected producers.

Limitations on proposed control measures

The following limitations on proposed control measures have been identified:

Limitation	**Proposed measures to overcome**
Availability of vaccine for wider use in RZ	♦ Negotiate amendments to NRA permit ♦ Eventually achieve Australian registration of the vaccine
Use of vaccine in CZ/PPZ/PZ	♦ Negotiate amendments to SD&Rs
Use of vaccine in adults	♦ Ongoing research project (more intensive research on individual animal responses/outcomes required)
Producer support/compliance	♦ Financial support ♦ Assistance with developing group strategies and management options ♦ Wider availability and use of vaccine ♦ Increased trading options ♦ Communication, consultation, education
Perception that disease is of little consequence	♦ Document mortalities and production losses
Implementation of disease reduction measures	♦ Infected flock profiling and increased trading options for low risk mobs (especially for studs) ♦ Financial assistance to undertake disease reduction measures ♦ Assistance for genetic salvage on studs
Early detection of flocks in low-prevalence regions	♦ Targeted surveillance programs (tracing) ♦ Non-targeted/random surveillance (MAP/surveys/abattoir surveillance) ♦ Use of most sensitive tests (PFC) ♦ Financial support for affected producers
Ongoing spread through	♦ Trade in low risk/vaccinated sheep only

permitted movements from infected/suspect flocks	♦ Trade between vaccinating properties only ♦ Infected flock profiles to identify low-risk sheep
Ongoing spread between zones	♦ Improved compliance with movement restrictions ♦ Auditing of movements ♦ Zoning according to known prevalence and major sheep movement patterns

Conclusion

Current control measures used under the National program are not preventing continuing spread of OJD, particularly 'local spread' around infected flocks.

New control strategies are needed to:

- reduce prevalence in infected flocks,
- protect uninfected/low-risk flocks and low-risk zones,
- allow increased trading options for low risk sheep from affected flocks,
- encourage producer support and compliance with the program.

Such strategies are interdependent and, in terms of disease control, synergistic. Basic measures such as:

- financial assistance to infected producers for profiling of prevalence and implementation of disease reduction measures
- access to vaccine where appropriate as part of an on-property disease reduction plan to reduce the impact of disease and the level of environmental contamination
- grading movement restrictions according to risk

are seen as essential components of any future regional OJD control program where disease incidence or socio/economic factors preclude implementation of financially assisted destocking.

end

NATIONAL OVINE JOHNE'S DISEASE CONTROL AND EVALUATION PROGRAM
NATIONAL WORKSHOP ON CONTROL STRATEGIES
Canberra, April 17th-18th, 2001

Example of local spread of OJD in NSW

Prepared by NSW Agriculture from data supplied by Rural Lands Protection Boards

The attached maps relate to a cluster of OJD infected properties in the southwest slopes area of NSW. The cluster includes 15 properties that are either known or presumed to be infected with OJD. Investigations to date have identified only one potential source of infection for this cluster, with the remaining properties infected through local spread, either by environmental spread between properties in water or air, or through shared facilities/grazing (e.g. on roads) or straying of sheep.

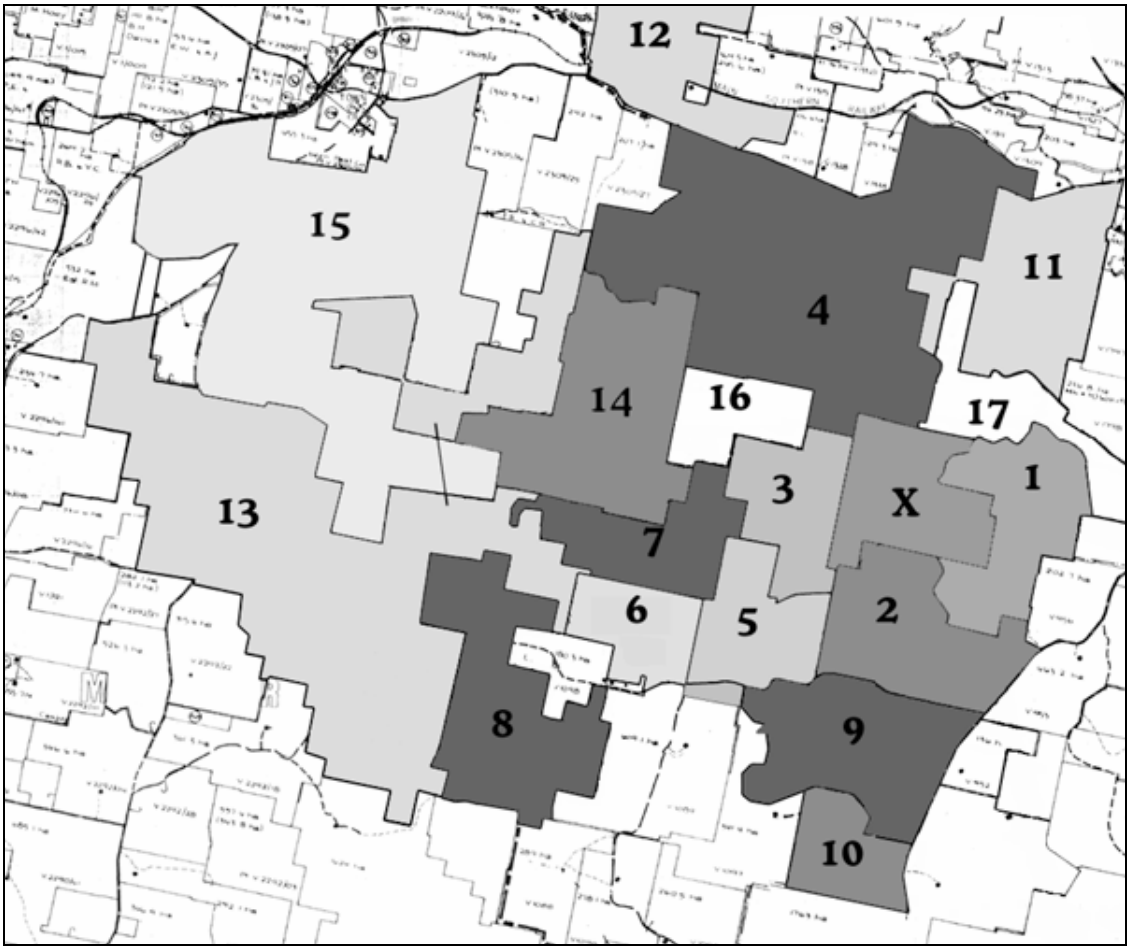
The history of the cluster is as follows:

Property	Year OJD confirmed	Comment
X	1997	Index property, introduced sheep from infected property at Goulburn in 1988, no other apparent source
1	1998	Probably infected from X, no other apparent source
2	1998	Probably infected from X, related to owner of X, no record of introduction from alternate likely source
3	1998	Probably infected from X, no other apparent source
4	2000	Probably infected from X, no other apparent source
5	1998	Shared facilities with property 3, no other apparent source
6	2000	Purchased land from property 5, no other apparent source
7 & 8	2000	Properties run together, abattoir trace in 2000, histo positive 12/00 on property 8, either neighbour spread or infected from property 7, no other apparent source
9	2000	Probably infected from either property 2 or property 5, no other apparent source
10	2000	Infected by sheep transfer from property 2 (same owner)
11	2001	PFC positive following abattoir trace in 2000
12	2001	PFC positive following abattoir trace in 2000
13	2000	Abattoir trace
14	2001	PFC positive 3/01 following abattoir trace in 2000, no other apparent source
15	2000	PFC positive 3/01 following abattoir trace (mixed lot), no other apparent source

Additional notes:

- Property X is close to the bottom of the catchment, suggesting that water-borne spread has not been a major feature in this cluster, although it cannot be ruled out between individual properties (see relief map).
- Property 16 was tested for OJD in 1998 with one seroreactor which was negative on histopathology. No further testing has been undertaken.
- Property 17 was tested for OJD in 1998 with several seroreactors, of which two were "suggestive" and one was negative on histopathology. The property has since destocked and restocked with different sheep, delaying further testing to clarify the status of the property.
- The eastern boundary of Properties 2, 9 & 10 is a major road.
- The property to the east of Property 1 is mainly cropping with limited summer grazing only.
- Properties 7 & 13 extend into a different catchment.
- To date no abattoir traces, no reports of clinical disease and no positive investigations on surrounding sheep properties. Some surrounding properties are cattle/cropping or have only recently stocked with sheep. Several others have been sampled and are awaiting PFC results.
- Properties were identified variously by abattoir surveillance, as neighbours or by notification of suspect cases.

END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NATIONAL OVINE JOHNE'S DISEASE CONTROL AND EVALUATION PROGRAM
NATIONAL WORKSHOP ON CONTROL STRATEGIES
Canberra, April 17th-18th, 2001

PROPOSED MODEL FOR CONTROL OF OVINE JOHNE'S DISEASE IN NEW SOUTH

Prepared by NSW Agriculture – 4th April 2001

Summary

In response to evidence of continued spread of OJD in NSW, it is proposed that the state be managed, for the purpose of OJD control, in three regions with policy graded according to known disease prevalence in each region.

Features of the model common to all regions include:

- *Continuation of surveillance and assurance programs.*
- *Pooled Faecal Culture will be the standard screening test for both surveillance and assurance.*
- *Profiling of prevalence on infected properties, and implementation of Property Disease Reduction Plans (PDRP), will underpin control activities.*
- *Vaccine will be required for strategic disease control as well as alleviation of losses.*
- *Pathways to implement and then verify disease elimination other than by total destocking will be available.*
- *Movement of sheep from infected properties not implementing PDRPs will be restricted to slaughter only.*

Features of the model which differ for each region include:

- *Emphasis on disease exclusion or detection/elimination in the low prevalence (Proposed Protected Zone – PPZ) region, including increased surveillance and mandatory monitoring of high risk flocks.*
- *Emphasis on disease reduction and containment in the moderate prevalence (Control Zone - CZ) region.*
- *Emphasis on disease reduction, particularly on a group or catchment basis, in the high prevalence (Residual Zone - RZ) region.*

- *Suspect properties will be able to progress status on the basis of an immediate negative investigation in the RZ, and on the basis of a negative investigation taking into account time constraints, in the CZ and PPZ.*

- *Infected properties implementing PDRPs will be able to trade low risk (including vaccinated) sheep according to the following table.*

Movements of low risk (including vaccinated) sheep from infected properties

Region of origin	*Region and property of destination*		
	RZ	*CZ*	*PPZ*
RZ	*Infected and Suspect properties*	*Infected properties (CVO approval)*	*Nil*
CZ	*Infected and Suspect properties*	*Infected properties (CVO approval)*	*Nil*
PPZ	*Infected and Suspect properties*	*Infected properties (CVO approval)*	*Infected properties* (CVO approval)*

* *exceptional circumstances only*

Introduction

Evidence of continuing spread of OJD in NSW, particularly lateral spread within infected foci, demonstrates the need for a revised approach to disease control. This paper outlines the proposed model for the future management of OJD in NSW. The model divides NSW into three regions based on known prevalence of OJD (see *Epidemiological assessment of ovine Johne's disease in New South Wales, Evan Sergeant for NSW Agriculture, February 2001*). The policy for control/exclusion of infection is graded accordingly, and there is a requirement for on-going revision of regional boundaries in response to altering circumstances. The model defines the regional or zone criteria, and highlights the major proposed policy changes.

Principles

NSW will effectively be divided into three regions:

- **RESIDUAL (HIGH PREVALENCE ZONE) - RZ**
- **CONTROL (MODERATE PREVALENCE/BUFFER ZONE) - CZ**
- **PROPOSED PROTECTED (APPARENT LOW PREVALENCE ZONE) - PPZ**

For the purposes of interstate movements, the low prevalence Proposed Protected Zone (PPZ) will continue to operate in the short term as part of the Control Zone (CZ).

However, if other parts of the eastern Australian CZ do not progress to Protected Zone (PZ) as expected by July 2002, consideration may be given to the option of imposing movement restrictions into the PPZ from CZ areas elsewhere in NSW or interstate where there is known higher prevalence of infection and/or low surveillance activity.

Within NSW itself, the minimum unit for implementation of zoning will be an RLPB division or equivalent. Placement of zone boundaries will be contingent on factors including previous and present trading patterns, known prevalence and producer attitude, and will also take into account future trade requirements and potential ability to meet zone criteria.

RESIDUAL (HIGH PREVALENCE ZONE) - RZ

Zone Criteria

- documented high prevalence of infection
- likely true flock prevalence > 30%
- likely high proportion of early infected flocks
- evidence of high within-flock prevalence on many properties
- strong local producer demand for access to disease control strategies
- evidence of continuing spread of infection within and between flocks in the region
- increasing flock mortalities causing socioeconomic hardship throughout the region
- loss of trading options causing socioeconomic hardship throughout the region

Policy

- containment within the zone

- enhanced on-property disease reduction
- increased trading options for low-risk sheep

Surveillance

- on-going surveillance with priority given to abattoir surveillance
- flocks identified by tracing able to progress immediately from Suspect to a higher status on the basis of a negative investigation

Testing

- use of pooled faecal culture (PFC) for all flock screening tests unless otherwise approved, on a case by case basis, by the NSW OJD State Coordinator
- surveillance and assurance status only able to be progressed by negative flock PFC

Assurance

- MAP participation, testing to MAP standard and check testing strongly encouraged and subsidised by the national program/state industry
- testing of potentially high risk neighbours to MAP assured flocks may become mandatory

On-property Disease Elimination/Control for Infected Properties

- voluntary Property Disease Eradication Plans (PDEP) only encouraged where reinfection from neighbours is not considered to be a major factor
- implementation of Property Disease Reduction Plans (PDRP) strongly encouraged
- vaccination permitted for strategic control and/or alleviation of future losses on all quarantined infected properties, with CVO approval, as a component of a PDRP
- profiling of on-property prevalence for all infected properties supported by continued abattoir surveillance, and in the case of MAP flocks and studs augmented by on-farm testing
- pathways to test out of infected status available where infection has been identified but there is subsequently little or no evidence of transmission within the flock
- pathways to test out of infected status available where there is evidence that infection which may have previously transmitted within the flock is no longer present following implementation of PDRP

Movements from Infected Properties

- regulated trade of low risk stock, including vaccinates, permitted from infected properties implementing PDRPs to infected and suspect properties within the RZ
- regulated trade of low risk stock, including vaccinates, permitted to infected properties within the CZ with CVO approval
- movements of stock from infected properties not implementing PDRP, to slaughter only

❑ CONTROL (MODERATE PREVALENCE/BUFFER ZONE) - CZ

Zone Criteria

- documented moderate prevalence of infection
- likely true flock prevalence < 15%

- likely moderate proportion of early infected flocks
- evidence of high within flock prevalence on some properties
- strong local producer demand for access to disease exclusion and control strategies
- presence of infected foci not adjacent to the RZ with possible evidence of continuing spread of infection within and between properties in those foci
- no evidence of independent foci of infection not related to the introduction of sheep from the high prevalence regions
- increasing flock mortalities causing socioeconomic hardship
- loss of trading options causing socioeconomic hardship

Policy

- containment and disease reduction/elimination within the infected foci
- surveillance and early detection of unidentified/new infections

Surveillance

- on-going surveillance with priority given to abattoir surveillance, tracing ex RZ and neighbour investigations
- suspect status maintained until investigation is able to establish presence or likely absence of infection
- monitoring of high risk flocks may become mandatory

Testing

- use of pooled faecal culture (PFC) for all flock screening tests unless otherwise approved, on a case by case basis, by the NSW OJD State Coordinator
- surveillance and assurance status only able to be progressed by negative PFC

Assurance

- MAP participation strongly encouraged and subsidised by the national program

On-property Disease Elimination/Control for Infected Properties

- voluntary Property Disease Eradication Plans (PDEP) only encouraged where reinfection by neighbours is not considered to be a major factor
- implementation of Property Disease Reduction Plans (PDRP) strongly encouraged
- vaccination permitted for strategic control and/or alleviation of future losses on all infected properties, with CVO approval following VetComm endorsement on a district basis, as a component of a PDRP
- profiling of on-property prevalence for all infected properties supported by continued abattoir surveillance, and in the case of MAP flocks and studs augmented by on-farm testing
- pathways to test out of infected status available where infection has been identified but there is subsequently little or no evidence of transmission within the flock
- pathways to test out of infected status available where there is evidence that infection which may have previously transmitted within the flock is no longer present following implementation of PDRP

Movements from Infected Properties

- regulated trade of low risk stock, including vaccinates, permitted from infected CZ properties implementing PDRPs to infected and suspect properties in the RZ

- regulated trade of low risk stock, including vaccinates, permitted from infected CZ properties implementing PDRPs to other infected properties in the CZ with CVO approval
- movements of stock from infected properties not implementing PDRPs, permitted to slaughter only

❑ PROPOSED PROTECTED (APPARENT LOW PREVALENCE ZONE) - PPZ

Zone Criteria

- evidence to support likely low prevalence of infection
- likely flock prevalence < 0.5%
- strong local producer demand for access to disease exclusion and control strategies
- no evidence of independent foci of infection not related to the introduction of sheep from the high or moderate prevalence regions
- should be separated from any part of the RZ by a section of the CZ
- evidence of producer support for eventual progression to Protected Zone (PZ) status, subject to revision of PZ criteria.

Policy

- containment of any identified infection
- immediate implementation of disease reduction/elimination measures on any identified infected property
- surveillance and early detection of previously unidentified/new infections
- regular monitoring of all neighbours of identified infected properties

Surveillance

- increased level of surveillance with priority given to ill thrift investigations, abattoir surveillance, tracing, annual neighbour investigations, check test surveys, other surveys
- suspect status maintained until investigation is able to establish presence or likely absence of infection
- monitoring of high risk flocks mandatory

Testing

- use of pooled faecal culture (PFC) for all screening tests unless otherwise approved, on a case by case basis, by the NSW OJD State Coordinator
- surveillance and assurance status only able to be progressed by negative PFC

Assurance

- MAP participation and check testing strongly encouraged and subsidised by the national program

On-property Disease Elimination/Control for Infected Properties

- voluntary Property Disease Eradication Plans (PDEP) strongly encouraged
- in the absence of PDEP, implementation of Property Disease Reduction Plans (PDRP) is mandatory
- vaccination permitted for strategic control and/or alleviation of future losses with CVO and VetComm approval on a case by case basis, as a component of a PDRP

- profiling of on-property infection supported by abattoir surveillance, and in the case of MAP flocks and studs augmented by on-farm testing
- pathways to test out of infected status available where infection has been identified but there is subsequently little or no evidence of transmission within the flock
- pathways to test out of infected status available where there is evidence that infection which may have previously transmitted within the flock is no longer present following implementation of PDRP

Movements from Infected Properties

- regulated trade of low risk stock, including vaccinates, permitted from infected PPZ properties implementing PDRPs to infected and suspect properties in the RZ
- regulated trade of low risk stock, including vaccinates, permitted from infected PPZ properties implementing PDRPs to infected properties in the CZ, with CVO approval
- regulated trade of low risk stock, including vaccinates, permitted from infected PPZ properties implementing PDRPs to other infected properties in the PPZ in exceptional circumstances, with CVO approval
- movements of stock from infected properties not implementing PDRPs, permitted to slaughter only

end

Epidemiological assessment of ovine Johne's disease in New South Wales

Prepared by Evan Sergeant for NSW Agriculture February 2001

Executive Summary

Data from the ovine Johne's disease surveillance program was analysed to estimate the current known and projected prevalence of ovine Johne's disease infected flocks in NSW. The data came from three main sources: property status and tracing data from Rural Lands Protection Boards; Laboratory testing data from NSW Agriculture's laboratory information system; and abattoir surveillance data from NSW Agriculture's abattoir surveillance database.

For the purpose of this analysis Rural Lands Protection Districts in NSW were allocated to one of three regions, on the basis of the prevalence of known infected flocks in each District at 31 December 2000. The high prevalence region comprised Central Tablelands and Goulburn districts, the moderate prevalence region comprised the remaining districts in the central and southern tablelands, and the south-west slopes and eastern Riverina areas, while the low prevalence region comprised the rest of NSW.

Key findings of this analysis were:

- The current prevalence of known infected flocks in these three regions was 0.07%, 1.6% and 9% for the low, moderate and high prevalence regions respectively;
- The projected current true prevalence of infected flocks in these regions was <1.2%, 8 – 14% and 30 – 39%, with an overall estimated prevalence in NSW of about 6 – 8% (2000 – 3000 flocks);
- The data suggests that within the moderate prevalence region prevalence may be higher in Braidwood, Yass and Young districts than in the other districts in this region;
- The current and projected distribution of infected flocks matches closely the pattern of sheep movements from known infected flocks;
- There was no evidence of any independent foci of infection not related to the introduction of infected sheep from higher prevalence districts;
- The major risk factor for OJD infection was proximity to known infected flocks – properties with one or more known infected neighbours were at a much greater risk of infection than properties with no infected neighbours;
- The major risk factor for spread of infection between districts was the movement of infected sheep;
- The current regulatory program is having little if any impact on spread between neighbouring properties;
- It should be assumed that *M a paratuberculosis* will survive and spread in any sheep-raising area of NSW (and Australia), although incidence of clinical disease may vary between regions;
- If effective measures to prevent further spread of disease and to identify new infected properties in low-prevalence regions are not implemented it is likely that the disease will be endemic in most of NSW within 15-20 years, with flock-prevalence up to or exceeding 10% in many districts;

All three data sources used in this analysis suffer from numerous potential and actual biases. In addition, the analysis relies on a number of assumptions that may or may not be valid. Therefore, these results represent indicative rather than definitive estimates, and should be interpreted with some caution. However, despite these

limitations, all three data sources supported the general thrust of these results. That is, there was clear evidence of clustering of the disease, a gradation of prevalence across the state, and that many areas are likely to have few if any infected flocks.

Introduction

Ovine Johne's disease (OJD) was first diagnosed in Australia in 1980, in central New South Wales (Seaman et al., 1981). Since that time it has spread progressively either through movement of sheep or from separate introductions from overseas or another interstate focus, so that by September 2000 more than 800 infected flocks had been reported in five of Australia's seven States (Sergeant, in press). Despite this, there are still large areas of Australia where the disease has never been diagnosed, or has been seen only in introduced sheep. A national ovine Johne's disease control program (NOJDP) has been implemented to limit further spread of the disease while research continues to evaluate possible future control or eradication strategies (Allworth and Kennedy, 2000). The NOJDP is planned to run for 6 years, from 1998 to 2004, with a mid-term review in mid-2001.

Critical elements of the NOJDP are surveillance to detect infected flocks, and a market assurance program (SheepMAP) to identify flocks with a low risk of being infected, as a source of disease free sheep for commercial producers and as replacements for infected flocks undergoing eradication. Traditionally in Australia, testing for paratuberculosis has relied on serology using the agar gel immunodiffusion test (AGID), with any reactors submitted to postmortem and histological examination to confirm or exclude infection (Whittington and Sergeant, in press; Sergeant, in press). More recently, techniques have been developed to allow reliable culture of ovine strains of *M a paratuberculosis* from tissues and faeces of infected animals (Whittington et al., 1998; Whittington et al., 1999). This technology has been extended further by the development of pooled faecal culture (PFC) as a flock-screening test for paratuberculosis (Whittington et al., 2000). PFC has been used routinely for OJD surveillance in New South Wales since 1999. At the same time, abattoir surveillance has also been introduced as an additional surveillance tool for detection of OJD.

Prior to 1996 OJD was essentially limited to NSW, and surveillance relied exclusively on owner reporting of suspect clinical cases. Since 1996, surveillance for OJD has increased and has relied primarily on the testing of high-risk flocks identified by tracing the movement of sheep onto and off infected properties, or as neighbours of infected properties. As a result, surveillance has concentrated on properties in known infected areas, or that have purchased sheep from these areas. Since mid-1997, market assurance testing has provided additional surveillance data, including some data for areas where little testing had been done previously. As a result of the increased level of surveillance, particularly during the interim surveillance program, the number of infected flocks in NSW increased dramatically from 158 at the end of 1996 to 599 by the end of 2000.

This report describes the epidemiological analysis of surveillance data for OJD in NSW. The specific objectives of the analysis were to:

1. Describe the current known prevalence and distribution of OJD in NSW;
2. Estimate the likely overall distribution and prevalence of OJD infected flocks in NSW;
3. Identify important risk factors in the spread of OJD and evaluate their relative importance;
4. Estimate the past and current rate of spread of OJD between flocks and zones/regions;
5. Review the potential spread and distribution of OJD in NSW if unchecked;
6. Identify possible control strategies to minimise the ongoing spread of OJD; and
7. Make recommendations as to alternative strategies for future control and surveillance for OJD in NSW.

Current prevalence and distribution of known infected flocks in NSW

The current prevalence of known infected (and suspected/under surveillance) flocks in NSW was calculated from data provided by Rural Lands Protection Boards Board (see Table 13, Map1). Prevalence by RLPB ranged from 0% (29 districts) to 10% in Central Tablelands. Because these estimates are based on known infected flocks identified by notification, tracing or abattoir surveillance these estimates will underestimate the true prevalence to a variable degree between districts.

To facilitate further analysis of the data, districts were allocated to one of three 'regions' based on their known prevalence of OJD. Districts with less than 0.5% known infected flocks were allocated to 'low-prevalence' (LP)

regions, districts with 0.5% to 5% were 'moderate-prevalence' (MP) and districts with >5% known infected flocks were 'high-prevalence' (HP) regions. There were two districts in the high prevalence region, 10 in the moderate prevalence region and 36 in the low prevalence region (see Table 1, Map 2). This regional break-up is intended for convenience of analysis and is not intended to dictate future zone boundaries.

Based on the available data, the regional prevalence of known infected flocks was estimated as 0.07%, 1.6% and 9% for low, moderate and high prevalence regions respectively, and the overall prevalence across NSW was 1.6%. A further 2.2% of flocks are suspect, and 6% are under surveillance.

Table 1: Prevalence of known infected flocks by region

Region	Districts	Infected flocks	Total flocks	Prevalence
LP	36	11	16783	0.07%
MP	10	186	11704	1.6%
HP	2	309	3388	9%
Total	48	506	31875	1.6%

Analysis of laboratory results

The results of all laboratory testing undertaken between 1 April 1998 and 31 December 2000 were analysed. Data on the number of tests undertaken and the number of tests positive were analysed by RLPB district and by region for all gel tests, histology and pooled faecal culture. For gel tests and histology each test represents one animal, whereas for pooled faecal culture each test represents a pool of normally 50 animals. The results of this analysis are shown in Tables 2 and 14. Overall 443,321 gel tests have been undertaken, with about 0.5% positive, 2,486 histological examinations with 23% positive, and 2,733 faecal pools with 6.3% positive. Overall, 25% of submissions for serology had one or more positives, 32% of submissions for histology were positive and 10% of submissions for pooled faecal culture were positive. The percentage of positive results increased with the prevalence of infection in the region of origin for all tests. About 20% of all tests were from the low-prevalence region, with only 0.2% of gel tests, 0.8% of faecal pools and 6% of histological examinations positive, well below the levels for the other regions.

Table 2: Summary of laboratory results by region

Test	**Region**	**Submissions**	**% +ve**	**Tests**	**% +ve**
Gel	LP	973	7%	78795	0.2%
Gel	MP	2017	25%	272100	0.4%
Gel	HP	752	47%	92426	1.0%
Gel	Total	3742	25%	443321	0.5%
Histology	LP	133	9%	349	6%
Histology	MP	631	25%	1518	17%
Histology	HP	344	52%	619	48%
Histology	Total	1108	32%	2486	23%
PFC	LP	220	1.4%	796	0.8%
PFC	MP	436	11%	1541	7%
PFC	HP	95	26%	396	16%
PFC	Total	751	10%	2733	6%

Results of property investigations

All laboratory submissions that could be identified to a unique property identifier were summarised for that property, to give a total number of tests per property for serology, histology and PFC, as well as whether they were positive on either histology or pooled faecal culture. Any properties with a positive histology or PFC result were regarded as positive investigations. These property investigations were summarised by region and the result of the investigation (see Table 3). Overall, 38% of investigations on properties in the high-prevalence region were positive, compared to 14% and 1.8% in the moderate- and low-prevalence regions respectively. Across all regions 16% of properties investigated were positive on either histology or PFC or

both. A considerable volume of testing which could not be identified to a specific property was excluded from this analysis.

Table 3: Summary of investigations by region for period 1/4/1998 to 31/12/2000

Region	# Investigations	# positive	% positive
LP	393	7	1.8%
MP	1105	154	14%
HP	370	142	38%
Total	1868	303	16%

These results are based on an analysis of laboratory investigations only, and therefore do not provide an unbiased estimate of the true prevalence of OJD in NSW. Nevertheless, they do provide an indicator of the relative frequency of diagnosis between regions. Generally, the majority of these investigations were undertaken in 'high-risk' flocks identified by tracing or as neighbours to known infected flocks, while the balance were mainly in flocks seeking entry to the SheepMAP. Thus, these estimates are likely to over-estimate the true prevalence of infected flocks to an unknown extent.

Table 4 shows the outcome of investigations by region and the quarter in which the investigation commenced. There is no obvious temporal pattern, with the proportion of positive investigations varying considerable between quarters. A decline in the proportion of positive investigations over time could indicate that control measures have been effective in slowing spread and that surveillance activities have 'caught up' to the spread that has occurred in the past. However, as surveillance is targeted at high-risk flocks, and particularly at flocks positive on abattoir surveillance in the last 6-12 months, the proportion of positive flocks would be expected to remain high. At this stage there is no specific evidence that control measures are failing to contain spread occurring by trading movements.

Table 4: Percentage of positive investigations by region and quarter

		Region			
Year	Quarter	LP	MP	HP	Total
1998	Qtr2	0.0%	12%	41%	14%
	Qtr3	2.5%	15%	37%	19%
	Qtr4	1.8%	15%	29%	14%
1999	Qtr1	7.7%	8%	36%	11%
	Qtr2	16.7%	7%	33%	10%
	Qtr3	11.1%	16%	67%	23%
	Qtr4	0.0%	13%	71%	17%
2000	Qtr1	0.0%	23%	25%	15%
	Qtr2	0.0%	20%	57%	19%
	Qtr3	0.0%	18%	50%	17%
	Qtr4	0.0%	11%	29%	12%
Total		1.8%	14%	38%	16%

Abattoir surveillance results

The results of abattoir surveillance undertaken in NSW from November 1999 to 31 December 2000 were collated and analysed. Only lines that were identified to a single Rural Lands Protection Board district were included in the analysis. Tables 5 & 15 and Maps 3 & 4 summarise the results of abattoir surveillance by region and district. Overall, 0.3% of lines from low-prevalence regions were positive or inconclusive (suggestive lesions identified but no acid-fast bacilli observed), compared to 7% and 30% of lines from moderate and high prevalence regions. At an individual district level, Yass, Braidwood and Young districts all had a substantially higher detection rate than other districts in their region, suggesting that these districts may have a prevalence intermediate between the high-prevalence region and the other districts in the moderate-prevalence region.

This data may also be substantially biased by the fact that not all lines have been confirmed to their district or property of origin and many properties may have had multiple lines examined. Thus the proportion of positive lines is only a crude measure of prevalence in a district or region. In addition, the flock- (or line-) sensitivity of abattoir surveillance is unknown, but is likely to be higher in high prevalence areas than low prevalence areas. Thus the proportion of positive lines will underestimate the true prevalence of infected flocks to a variable extent, depending on the district of origin and other factors (see section on estimated true flock-prevalence below). Despite these limitations, it is apparent that nearly half the lines examined by abattoir surveillance have been from the low-prevalence region, with only 13 positive and two inconclusive lines out of 4,383 lines examined.

Table 5: Summary of abattoir surveillance by region

Region	+ve	inc	-ve	Total	% +ve
Low-prevalence	13	2	4368	4383	0.3%
Moderate-prevalence	263	18	3646	3927	7.2%
High-prevalence	394	23	971	1388	30%
	670	43	8985	9698	7%

Prevalence estimation

Because of the insidious nature of the disease, and the large proportion of infected animals that are sub-clinical carriers, prevalence of JD is very difficult to estimate reliably and there are thus few published estimates of prevalence of paratuberculosis in sheep, either at the individual or flock level. Any estimates are also likely to substantially underestimate the true prevalence of the disease unless adjusted for the lack of sensitivity of the tests used.

Estimation of the prevalence of OJD is further complicated by the lack of sensitivity of available screening tests. At an individual level this is particularly of concern, as sero-prevalence estimates significantly underestimate the true prevalence of infected animals. Application of tests at a flock level reduces the bias somewhat due to the use of large sample sizes. However, even using large sample sizes the tests still have less than 100% flock-sensitivity. Prevalence estimates can be adjusted for the assumed sensitivity of the test, although this is further complicated by the fact that the flock sensitivity of a test is generally not known with any high degree of confidence, and may vary between flocks and regions, thus introducing further uncertainty into any prevalence estimates. Therefore, adjusted prevalence estimates are less precise than would normally be expected for a given sample size.

Performance of diagnostic/screening tests for OJD

Currently available flock-screening tests in Australia include serology (primarily AGID test), pooled faecal culture and abattoir surveillance. Flocks/animals with a positive screening test are generally followed up with a definitive test to confirm or exclude infection. Definitive tests for OJD currently include histopathology and tissue culture. At present pooled faecal culture is used only as a screening test, however it may also be used as a repeat test to confirm infection in previously pfc positive flocks (i.e. two pfc positive results are regarded as definitive). Flocks with a positive abattoir surveillance result are also subjected to further testing using serology and/or PFC and/or histology to confirm the presence of infection.

The performance of pfc and serology have been extensively reviewed and discussed elsewhere (Whittington et al., 2000; Whittington and Sergeant, in press;Kalis CHJ et al., 2000). Briefly, serology has a low and variable sensitivity and relatively high specificity (~99.9% for AGID). Animal-level sensitivity of serological tests is generally poor early in the course of infection, and increases as infection progresses, ranging from <10% in very early latent infections to >80% in clinical cases, and averaging about 25% in unselected sheep from infected properties (Marshall DJ et al., 1996; Huchzermeyer HF and Bastianello SS, 1991). The sensitivity of the AGID and ELISA are generally comparable, although they tend to detect slightly different populations of infected animals. The specificity of the ELISA tends to be lower than the AGID, depending on the cut-off chosen.

At a flock-level, recommended sample sizes for surveillance and assurance testing have been chosen to provide a 95% flock-sensitivity for a prevalence of 2%, assuming an animal-level sensitivity of 30% for serology and

about 40% for pooled faecal culture. Evaluation of the flock-level performance of the two tests used in parallel in 296 flocks in NSW suggest that serology is not achieving the desired flock-sensitivity, and that pfc is performing much better. In flocks with an estimated prevalence ≥ 2% pooled culture had an estimated flock-sensitivity of 96% compared to 85% for serology, while in flocks with a prevalence < 2% the estimated flock-sensitivities were 82% and 33% respectively (Sergeant et al., submitted.).

The flock-level sensitivity of abattoir surveillance is still not well characterised and is affected by a number of factors:

- animal-level sensitivity (affected by stage of disease in flock/animal);
- animal-level specificity;
- within-flock prevalence;
- distribution of the disease in the flock;
- representativeness of the line as a sample of the flock;
- number of animals sampled; and
- cut-off number of reactors to determine a positive result (in this case 1).

Therefore, flock-sensitivity will vary from flock to flock according to the above factors. At a regional or group level, flock-sensitivity is the proportion of infected flocks that are detected, and is affected by the range of prevalence and test performances in those flocks. Therefore, 'average' flock-sensitivity will also vary between regions, depending on these factors. Estimates from inspection of lines from known infected flocks range from 30% to 90% (unpublished data). Simulation studies also suggest that the flock-sensitivity of abattoir surveillance is probably as low as 30 - 35% in low prevalence areas/flocks and > 90% in high prevalence areas/flocks (unpublished).

As the sensitivity of a flock test is not a fixed value, performance of all screening tests will vary between flocks and regions, making estimation of sample sizes difficult and reducing overall confidence in prevalence estimates.

Estimated true flock-prevalence from surveillance data

The likely true prevalence of infected flocks was estimated from the available surveillance data. For each region, the total number of current infected, suspect and under surveillance flocks was determined from data provided by Rural Lands Protection Boards, as well as the numbers of properties identified as neighbours or forward traces from known infected properties and that did not have a status allocated. The estimated total number of infected flocks was calculated as the current number of infected flocks, plus a proportion of suspect and unidentified forward traced flocks, plus a proportion of under surveillance and unidentified neighbour flocks.

The values used to multiply the numbers of suspect, under surveillance and traced flocks were based on an analysis of tracing data to estimate the proportion of traced flocks that are likely to be infected (see Tables 9 & 10). These values were entered as BetaPert (smoothed triangular) probability distributions in an @Risk simulation model, with minimum, most likely and maximum values as shown in Table 6. The @Risk model was run for 1000 iterations to generate a probability distribution for the estimated prevalence in each region.

Overall, the predicted prevalence on a regional basis using this method ranged from < 0.2% in the low-prevalence region, to 6% – 10% and 30% – 40% in the moderate- and high-prevalence regions respectively (Table 6).

Table 6: Probability distributions for input values and predicted prevalence by region

Region	% Suspect/forward traces > Infected			% Under surveillance/ neighbours > Infected			Predicted prevalence distributions				
	min	mode	max	min	mode	max	Minimum	5%	Mean	95%	Maximum
LP	20%	30%	40%	10%	20%	30%	0.1%	0.2%	0.2%	0.2%	0.2%
MP	20%	30%	40%	20%	40%	60%	6%	6%	8%	9%	10%
HP	20%	30%	40%	30%	50%	70%	28%	32%	36%	41%	44%

Total	6%	6%	7%	7%	8%

Estimated flock-prevalence from abattoir surveillance data

The true prevalence of infected flocks was also estimated from abattoir surveillance data, after adjusting for the assumed sensitivity of abattoir surveillance under various scenarios of disease prevalence. Briefly, a Bayesian approach was used which allows combination of any prior information available on test sensitivity and specificity and disease prevalence with the available data to produce posterior probability distributions for flock-sensitivity and prevalence (Joseph et al., 1995).

In this case prior distributions for the flock-sensitivity of abattoir surveillance were based on simulated estimates for each region (details not shown) and prevalence distributions were based on the regional prevalence estimates derived from general surveillance as shown above. Specificity of abattoir surveillance was assumed to be close to 100%. The data from abattoir surveillance in Table 4 was used as input data, and the model was run for 25,000 iterations for each region, with the last 20,000 iterations used to estimate test sensitivity and disease prevalence.

The input distributions for assumed sensitivity and output distributions for prevalence are summarised for each region in Table 7. Map 5 shows the estimated median prevalence on a regional basis. Briefly, 95% probability intervals for flock-prevalence ranged from 0.04% – 1.2%, 8% – 14% and 30% – 39% for low-, moderate- and high-prevalence regions respectively. These results are sensitive to the value and strength of the prior distributions used, particularly for the flock-sensitivity of abattoir surveillance. Thus, if the estimates of sensitivity of abattoir surveillance are inaccurate, these prevalence estimates may under- or over-estimate the true prevalence accordingly. These estimates were slightly higher than the original estimates for the low- and moderate-prevalence regions and slightly lower for the high-prevalence region, but were comparable for the overall prevalence across NSW. They were also comparable to or slightly lower than estimates based on the results of laboratory investigations, suggesting that they are probably reasonable estimates of the true flock-prevalence in these regions.

Extrapolation to a state level suggests that about 6% – 8% of flocks (2000 – 3000 flocks) are likely to be infected across NSW. If the sensitivity of abattoir surveillance has been underestimated, or if the abattoir surveillance data is significantly biased these estimates may under-estimate the true prevalence substantially.

Table 7: Estimated flock-sensitivity of abattoir surveillance and flock-prevalence of OJD

		Percentiles of output distributions		
Region	Parameter	2.5%	median	97.5%
LP	Assumed Se	26%	35%	45%
	Prevalence	0.04%	0.4%	1.2%
MP	Assumed Se	45%	55%	64%
	Prevalence	8%	11%	14%
HP	Assumed Se	79%	89%	96%
	Prevalence	30%	34%	39%

Risk factors for spread of OJD

M a paratuberculosis is an obligate pathogen of animals, with transmission primarily through the faeco-oral route although transmission through milk or to the unborn foetus also occur (Sweeney RW, 1996). Thus, spread of infection between properties is generally dependent on the movement of animals, particularly through sale and purchase of infected animals (Sweeney RW, 1996).

Spread of OJD in Australia has been mainly due to the movement of infected sheep or by local spread between neighbouring flocks. There is no documented evidence of spread other than through contact with infected sheep, or grazing of land previously grazed by infected sheep, although indirect spread through air- or water-borne movement of infected faeces between neighbouring properties cannot be ruled out. Other potential mechanisms of local spread include shared grazing and facilities, common use of roads and straying sheep.

Further clarification of the relative importance and effect of each of these mechanisms is unlikely due to the difficulty in reliably separating their individual effects.

Risk of neighbours and trace forwards

The available surveillance and tracing data was analysed to evaluate the relative importance of spread to neighbouring properties and through the movement of sheep.

The status of all properties identified as neighbours of known infected properties was determined where possible, and duplications removed from the data. Flocks that did not have a status recorded were assumed to be of non-assessed or nil-assurance status. From this data the relative risk of ever having been infected was estimated for properties with one, two or three or more infected neighbours, compared to properties with no known infected neighbours. Overall, properties with one known infected neighbour were about 12 times more likely to be infected than those with no infected neighbours, increasing to more than 50 times more likely for properties with three or more infected neighbours (see Table 8). In the moderate prevalence zone only, the estimated relative risks were 7, 22 and 43 for having 1, 2 or ≥ 3 known infected neighbours respectively.

The proportion of neighbours resolved as infected was also estimated on a regional basis (Table 9). About 15% of all neighbours in the high-prevalence region have been confirmed infected, compared to 9% in the moderate-prevalence region. However, if only properties that have been resolved to a status other than suspect or under surveillance were included, these figures increased to 76% and 42% respectively. There was insufficient data for the low-prevalence region for it to be included in this or the following analysis of forward tracings.

Table 8: Relative risk of being infected increases with the number of infected neighbours

# IN Neighbours	# infected	Total	% IN	Relative Risk
0	29361	253	29614	0.9%	1
1	1548	175	1723	10.2%	12
2	279	95	374	25.4%	30
3 – 6	88	76	164	46.3%	54
Total	31276	599	31875		

Table 9: Percentage of neighbours infected by region

Status	MP	HP	Total
Resolved infected	90	210	300
Resolved negative	125	67	192
Unresolved	818	1169	1987
Total	1033	1446	2479
% of total infected	9%	15%	12%
% of resolved infected	42%	76%	61%

A similar analysis was also undertaken for forward tracings from known infected properties. 15% of traces originating from the high-prevalence region have been resolved as infected compared to 11% for traces from the moderate-prevalence region (Table 10). Again, these figures increased substantially to 42% and 23% if only properties that had been fully resolved were included.

Table 10: Percentage of traced properties infected by region of origin

Status	MP	HP	Total
Resolved infected	64	95	159
Resolved negative	218	129	347
Unresolved	313	403	716
Total	595	627	1222

% of total infected	11%	15%	13%
% of resolved infected	23%	42%	31%

Analysis of tracing flows

The distribution of forward tracings from known infected flocks was analysed to determine if the observed distribution of cases was consistent with the pattern of tracings. Map 6 shows the distribution of tracings between districts. The width of the base of the arrow is proportional to the number of tracings from that district to the corresponding destination district. Table 11 summarises the distribution of traces by region of origin and destination, and Table 16 & Map 7 show the total number of forward-tracings identified to each RLPB district. Only about 6% of all traces were to properties in the low-prevalence region, compared to 45% and 49% to the moderate and high prevalence regions respectively. Of the 135 tracings to the low prevalence region, less than half were from the high-prevalence region. These figures represent the total number of sheep movements recorded. As many properties have had multiple tracings identified to them the actual number of properties traced in each region is substantially lower (see Table 12). There was also a strong correlation between the number of tracings to a district and the number of known infected flocks in the district ($r^2 = 0.93$).

Table 11: Number of forward traces by region of origin and destination

	Region of destination			
Region of origin	LP	MP	HP	Total
LP	17	0	1	18
MP	66	780	169	1015
HP	52	222	923	1197
Total	135	1002	1093	2230

Table 12: Number of traced properties by region of origin and destination

	Region of destination			
Region of origin	LP	MP	HP	Total
LP	9	0	0	9
MP	49	467	79	595
HP	40	135	452	627
Total	98	602	531	1231

Thus the main risk factors for spread of OJD are proximity to infected flocks or introduction of sheep from an infected flock. Further elucidation of the mechanisms involved in neighbourhood spread was not possible from the data, and is unlikely to be possible except by a purposely-designed research project. Even then it is likely to be difficult to differentiate between the various mechanisms involved. The impact of both introductions and neighbourhood spread appears to vary between regions, as would be expected, presumably due to the varying length of time that flocks have been infected in different areas.

Rate of spread

It was not possible from the available data to estimate the rate of spread of OJD, either between flocks or between regions, or whether or not the rate of spread is changing. The data presented here is a result of spread that occurred mostly more than 3 - 5 years ago, and thus monitoring changes in rates of spread is virtually impossible in any realistic time-frame. Any analysis of rates of spread is also further complicated by the fact that many properties identified by tracing or as neighbours remain unresolved for some years, either due to the reluctance of producers to test, or to allow time for the disease to reach detectable levels in the flock.

However, the data does indicate that there is a high rate of spread between neighbouring flocks, particularly if allowed to occur unchecked over a long period. The rate of spread between neighbours appears to be substantially higher in high-prevalence regions, compared to moderate-prevalence areas, presumably because of the longer-standing infection with increasing prevalence and contamination allowing more opportunities for

spread. It is unlikely that any regulatory action taken to date has had any real impact on spread between neighbours.

The rate of spread due to movement of sheep is also substantial, although apparently considerably less than that for spread between neighbours. As this is the main mechanism of spread to new foci of infection this is of significant concern. Regulatory action on infected and suspect flocks and the introduction of zoning and movement restrictions are likely to have reduced the level of ongoing spread through the movement of sheep, although it has not been possible to measure this.

In the longer term it may be possible to monitor changes in the rate of spread through some proxy variable such as the time between infection and detection of new cases or the number of new cases detected in a region. These statistics must be interpreted with care, as they are subject to many biases, particularly associated with the level of effort being put into detection of cases in a district. Even then, they still represent the effects of spread that occurred several years ago, rather than current spread.

Potential distribution of ovine Johne's disease in NSW

There has been considerable debate in recent years over the potential distribution of OJD in NSW (and Australia), in terms of the ecology of *M a paratuberculosis* and its ability to survive and spread in adverse environments or under unfavourable conditions of soil type and climate.

There is no clear evidence, either in Australia or from the international literature of an effect of soil type on the survival and spread of *M a paratuberculosis*. There is some evidence from Spain that Johne's disease in sheep and goats was more prevalent in areas with more-acid soils (Reviriego FJ et al., 2000), while a review of Johne's disease in the USA found that evidence of any association of disease with soil type was equivocal (Johnson Ifearulundu YJ and Kaneene JB, 1997). Any assessment of the impact of soil type in Australia is likely to be severely confounded by the fact that historically the disease first appeared and spread in an area of predominantly acid soils. In addition, many of the sheep grazing areas of NSW suffer from varying degrees of soil acidity due to past and current pasture improvement practices, further complicating any such analysis.

Thus, although an effect of soil acidity on survival and spread of OJD cannot be ruled out, it is unlikely to greatly affect the distribution of the disease in NSW, except in the more extensive pastoral zones.

It has also been hypothesised that soil type may affect expression of the disease in infected animals (i.e. animals become infected at the same rate, but do not progress to clinical disease or progress at a slower rate). This was one possible finding suggested from a recent survey of infected flocks (I Lugton, personal communication). It also has a certain logical appeal, in that it is not unreasonable to suppose that deficiencies in some micro-nutrients may affect the ability of *M a paratuberculosis* to survive and multiply *in vivo*. This is particularly the case considering the highly specific nutrient requirements for culture of the organism *in vitro*. Despite this there is still no firm evidence to support or reject this hypothesis.

There has been little research on the survival and spread of *M a paratuberculosis*, particularly under Australian conditions. Ongoing research in NSW and Victoria is currently investigating the survival of sheep strains of *M a paratuberculosis* in soil and water under various conditions. Preliminary results suggest that the organism is capable of surviving for weeks or months in either faecal pellets or water under varying climatic conditions (R Whittington, personal communication). Thus, it appears likely that even under extreme climatic conditions such as occur in western NSW *M a paratuberculosis* will survive in water holes, around sheep camps or in other sheltered areas for long enough to infect other sheep.

It therefore appears reasonable to assume that *M a paratuberculosis* is capable of surviving and spreading in any sheep-producing area of NSW (and probably Australia). This hypothesis is further supported by the fact that OJD has been recorded in many countries with Mediterranean or semi-arid climates similar to that experienced in parts of western NSW. For example, Johne's disease has been recorded by the OIE as occurring in countries such as Spain, Greece, Israel, Saudi Arabia, Sudan, Lebanon, South Africa and Zimbabwe. In fact, in parts of Spain 50% – 60% of flocks are reported as being infected (Mainar Jaime RC and Vazquez-Boland JA, 1998; Juste RA et al., 1991). Obviously some areas are likely to favour survival and spread more than others, and as already discussed soil type and acidity may also affect survival and expression of disease, so that the incidence of clinical disease is likely to vary between regions.

The potential for spread and progression of OJD in currently low-prevalence areas can be extrapolated to some extent from experiences in higher prevalence districts. Anecdotal evidence suggests that OJD was probably first introduced into the Young Rural Lands Protection District in the late 1980's. Since that time there appear to have been multiple introductions from the central and southern tablelands, as well as local spread between neighbouring flocks. By 31 December 2000, 2.4% of flocks in the district were known to be infected, with a further 12.5% either suspect or under surveillance and 11% of lines examined by abattoir surveillance were positive. Thus the true prevalence of infected flocks in this district may be as high as 10% – 15%. Given this result, it is likely that similar progression would occur in other districts where conditions were suitable for spread. Therefore, in the absence of measures to prevent ongoing introductions and local spread, it is likely that the disease would be endemic in much of NSW within 15-20 years, with a flock-prevalence of ≥10% in many districts.

Control strategies

Current control strategies for OJD are based on a regulatory approach using quarantine, zoning and movement restrictions. This approach is likely to be reasonably successful in preventing spread of infection to previously free areas, and the establishment of new foci of infection, depending on the level of compliance of producers with movement controls. However it is unlikely to have a significant impact on neighbourhood spread in most instances.

Therefore a new approach is required to minimise further spread from current and new infected flocks to susceptible flocks in the surrounding area:

Possible measures include (but are not limited to):

- Continued restrictions on the movement of sheep between zones, based on a risk assessment approach and negative flock status;
- Continued restrictions on the movement of sheep off known or suspected infected flocks;
- Risk-based approach to continued trading for infected/suspect flocks in the residual zone;
- Prompt and thorough investigation of flocks identified by tracing in low prevalence districts;
- Pre-emptive vaccination or depopulation of infected and high-risk suspect flocks to minimise the risk of further spread in low prevalence districts;
- Ongoing surveillance programs in all zones for detection of infected flocks;
- Intensive surveillance of neighbours of infected flocks in low prevalence districts to ensure early detection and implementation of control measures;
- Prevalence reduction on infected farms through management changes and/or vaccination;
- Vaccination (compulsory or voluntary) of flocks neighbouring known infected flocks;
- Vaccination (compulsory or voluntary) of all flocks in the district/zone;
- Use of vendor declarations when selling/purchasing sheep within a zone;
- Development of group strategies to work together to control and eliminate the disease on an area basis.

Selection of appropriate strategies is required to meet the specific objectives of the control program in each zone. Development of OJD control strategies is the subject of a separate series of papers for the National Control Strategies Workshop and therefore is not discussed further here.

A risk-based approach to control (Infected Flock Profiles)

Current regulatory controls are based on a zero-risk approach to quarantine of infected and suspect flocks, through property quarantine and sale of sheep for slaughter only. This results in severe financial hardship for many producers, lack of support for the program and possibly non-compliance with the quarantine conditions.

The introduction of a risk-based approach to trading from infected and suspect flocks in the residual zone may allow easing of these restrictions on some flocks, subject to risk-management strategies, facilitating expanded trading opportunities and thus reducing the hardship on affected producers. This approach requires a detailed risk-assessment of each flock, and of the risk-management strategies in place to reduce prevalence and the risk

associated with sale sheep. Movements between properties that are assessed as not significantly increasing the risk of infection for the destination property or district additional movements may be allowed. For example, sale of vaccinated rams to other suspect or infected flocks within the residual zone.

Future surveillance requirements

Low-prevalence regions
Control in low-prevalence regions must rely on:

1. Minimising the risk of introducing OJD from higher prevalence regions;
2. Early detection of any infected flocks and prompt action to minimise local spread; and
3. Support of industry to implement the measures – failure of industry support will result in continuing spread of the disease.

To achieve these outcomes it is important that surveillance in these areas be maintained at a high level, with a multi-part approach, including:

- Continued abattoir surveillance to maintain confidence in the low-prevalence status of the region.
- Use of Property Identification Codes to identify slaughter sheep, facilitating reliable trace-back to the property and district of origin.
- Tracing from known infected flocks, with thorough investigation of traced flocks in the low-prevalence region for early detection of infection.
- More sensitive flock testing using PFC for SheepMAP, MAP equivalent and Check testing to ensure earliest possible detection of infected flocks

Moderate-prevalence region
This region will require a higher level of control to minimise spread within and out of the region. This will require the support of ongoing surveillance for the early detection of infected flocks in a similar fashion to the low-prevalence region.

High-prevalence region
Control in high prevalence regions must rely on methods to reduce prevalence and minimise spread between neighbouring properties, as well as minimising spread through trade in sheep.

If this approach were taken there would be a reduced emphasis on surveillance for the identification/quarantine of infected flocks. Instead, surveillance would be required to monitor the prevalence and severity of disease over time as the program progresses. Appropriate surveillance methods may include:

- Continued abattoir surveillance to provide ongoing monitoring of the severity and prevalence of OJD in these regions
- SheepMAP testing for flocks wishing to continue trading outside the region
- Check test or SheepMAP for flocks wishing to provide low-risk sheep within the region

Other surveillance issues

Abattoir surveillance
The effectiveness of abattoir surveillance as a surveillance tool is currently greatly hampered by the lack of a reliable sheep identification system. This has two significant effects on the surveillance value of the data:

1. Some infected lines cannot be reliably identified to their property of origin, particularly where they are part of ‘boxed-lots’ purchased from abattoirs.

2. Significant biases are present in the data associated with:

    - examination of multiple lines per property;

- identification of lines to the incorrect district;
- mis-identification of infected sheep to the wrong line;
- bias towards detection of larger flocks which are more likely to consign direct to the abattoir, and under-representation of smaller flocks selling through saleyards.

Data quality
All three data sources used in this study suffer from significant biases inherent to the nature of the data and the way it was collected. In addition, some of the data was either incomplete or in some cases incorrect. Substantial effort is required to ensure that the available data is complete and reliable, and systems are required to ensure that this is the case.

Discussion
The analyses presented here are based on passive surveillance data provided either by the Rural Lands Protection Boards or from NSW Agriculture's laboratory information system (Labsys), or from abattoir surveillance activities. As such, all these data sources suffer from a number of inherent biases and deficiencies, particularly in relation to representativeness and completeness of data. In addition, a number of simplifying assumptions have been made during the analysis of the data, in order to support some of the modelling techniques necessary to produce some reasonable estimates of OJD prevalence and distribution. Therefore, the results presented should be regarded as indicative estimates, rather than definitive.

Despite these limitations, this analysis presents some important findings that must be considered in any future planning for OJD surveillance and control:

- The current prevalence of known infected flocks in NSW is about 1.6%, with a further 8% of flocks currently either suspect or under surveillance;
- The true prevalence of infected flocks is probably around 6% – 8%, but may be higher or lower;
- There is no evidence to date of any independent foci of infection in the north or west of the State – extensive surveillance in these areas by serology, PFC and abattoir surveillance has found very few infected flocks, virtually all of which can be traced back to introductions from the endemic areas;
- OJD in NSW is still highly clustered, with the great majority of known and projected infected flocks in the central and southern tablelands and adjoining districts;
- Probably the greatest risk factor for OJD infection is being a neighbour of one or more infected flocks – this risk appears to be greater in the high-prevalence region, where the disease has been present for longer;
- The greatest risk factor for introduction of infection into a district is the introduction of sheep from an infected flock, particularly an infected flock in the high-prevalence region;
- The regional spread of OJD appears to follow closely the pattern of sheep movements from known infected flocks;
- The relatively few infected flocks identified to date in the low-prevalence areas is probably due to the comparatively low number of introductions into these areas from the higher-risk regions;
- Once established in the low-prevalence areas the disease is likely to spread further to neighbours and through sheep movements in much the same manner as in other districts;
- There may already be some infected flocks in these areas that are only recently infected and are still at too low a prevalence to be detected, as well as a few higher-prevalence flocks that are yet to be detected.

This analysis suggests that OJD is still limited in its distribution in NSW, but that there is likely to be a low number of unidentified infected flocks in the current low-prevalence regions. Identification of these flocks and implementation of measures to prevent continuing spread between neighbouring flocks are essential for the effective control of OJD in NSW.

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Appendix: Summary tables by Rural Lands Protection Board

Table 13: Prevalence of known infected flocks by RLPB and Region

Board	Zone	Region	# Flocks	# IN	# SU	# US	% IN (prevalence)	% SU	% US	Regional Prevalence
Armidale	CON	LP	2000	0	1	1	0	0.1%	0.1%	0.07%
Balranald	CON	LP	152	0	0	0	0	0.0%	0.0%	0.07%
Broken Hill	CON	LP	108	0	0	0	0	0.0%	0.0%	0.07%
Bombala	CON	LP	293	0	0	0	0	0.0%	0.0%	0.07%
Bourke	CON	LP	159	0	0	0	0	0.0%	0.0%	0.07%
Brewarrina	CON	LP	175	0	0	0	0	0.0%	0.0%	0.07%
Nyngan	CON	LP	600	0	2	0	0	0.3%	0.0%	0.07%
Casino	CON	LP	3	0	0	0	0	0.0%	0.0%	0.07%
Cobar	CON	LP	160	0	0	0	0	0.0%	0.0%	0.07%
Condobolin	CON	LP	1642	0	0	0	0	0.0%	0.0%	0.07%
Riverina	CON	LP	740	0	0	0	0	0.0%	0.0%	0.07%
Hunter	CON	LP	215	0	1	0	0	0.5%	0.0%	0.07%
Dubbo	CON	LP	1314	0	0	0	0	0.0%	0.0%	0.07%
Northern New England	CON	LP	1248	0	4	0	0	0.3%	0.0%	0.07%
Gloucester	CON	LP	12	0	0	0	0	0.0%	0.0%	0.07%
Grafton	CON	LP	7	0	0	0	0	0.0%	0.0%	0.07%
Hay	CON	LP	394	0	0	0	0	0.0%	0.0%	0.07%
Hillston	CON	LP	180	0	1	0	0	0.6%	0.0%	0.07%
Maitland	CON	LP	15	0	0	0	0	0.0%	0.0%	0.07%
Moss Vale	CON	LP	675	0	0	0	0	0.0%	0.0%	0.07%
Milparinka	CON	LP	43	0	0	0	0	0.0%	0.0%	0.07%
Narrabri	CON	LP	255	0	0	0	0	0.0%	0.0%	0.07%
Kempsey	CON	LP	20	0	0	0	0	0.0%	0.0%	0.07%
Tweed-Lismore	CON	LP	201	0	0	0	0	0.0%	0.0%	0.07%
Walgett	CON	LP	526	0	0	0	0	0.0%	0.0%	0.07%
Wanaaring	CON	LP	76	0	0	0	0	0.0%	0.0%	0.07%
Northern Slopes	CON	LP	520	0	0	0	0	0.0%	0.0%	0.07%
Wentworth	CON	LP	125	0	0	0	0	0.0%	0.0%	0.07%
Wilcannia	CON	LP	138	0	0	0	0	0.0%	0.0%	0.07%
Narrandera	CON	LP	978	1	3	0	0.1	0.3%	0.0%	0.07%
Coonabarabran	CON	LP	670	1	1	5	0.1	0.1%	0.7%	0.07%
South Coast	CON	LP	490	1	0	0	0.2	0.0%	0.0%	0.07%
Coonamble	CON	LP	390	1	3	3	0.3	0.8%	0.8%	0.07%
Tamworth	CON	LP	1157	3	4	7	0.3	0.3%	0.6%	0.07%
Mudgee-Merriwa	CON	LP	879	3	5	6	0.3	0.6%	0.7%	0.07%
Moree	CON	LP	223	1	4	0	0.4	1.8%	0.0%	0.07%
Wagga Wagga	CON	MP	1803	10	61	83	0.6	3.4%	4.6%	1.6%
Murray	CON	MP	1049	6	7	27	0.6	0.7%	2.6%	1.6%
Forbes	CON	MP	1540	13	72	72	0.8	4.7%	4.7%	1.6%
Cooma	CON	MP	668	6	12	27	0.9	1.8%	4.0%	1.6%
Gundagai	CON	MP	867	9	18	65	1.0	2.1%	7.5%	1.6%
Hume	CON	MP	963	21	37	117	2.2	3.8%	12.1%	1.6%
Young	CON	MP	1945	46	38	204	2.4	2.0%	10.5%	1.6%
Braidwood	CON	MP	565	14	21	42	2.5	3.7%	7.4%	1.6%
Molong	CON	MP	1104	31	20	46	2.8	1.8%	4.2%	1.6%
Yass	R/C	MP	1200	30	67	126	2.5	5.6%	10.5%	1.6%
Goulburn	RES	HP	1082	72	82	230	6.7	7.6%	21.3%	9%
Central Tablelands	RES	HP	2306	237	251	840	10.3	10.9%	36.4%	9%

Total	31875	506	715	1901		1.6%	2.2%	6.0%				

Table 14: Summary of OJD testing, 1/4/1998 to 31/12/2000 by RLPB

	Gel				Histology				Pooled Faecal Culture			
Board	Submissions	% +ve	Tests	% +ve	Submissions	% +ve	Tests	% +ve	Submissions	% +ve	Tests	% +ve
Armidale	306	7%	18128	0.1%	43	0%	75	0%	115	0%	384	0%
Balranald	3	0%	479	0.0%					1	0%	7	0%
Bombala	31	0%	2428	0.0%	5	20%	18	11%	3	0%	12	0%
Bourke	1	0%	1	0.0%					1	0%	7	0%
Braidwood	85	40%	17498	0.5%	27	30%	60	32%	14	50%	54	35%
Brewarrina	12	0%	1663	0.0%	2	0%	4	0%	1	0%	2	0%
Broken Hill	20	0%	671	0.0%	1	0%	1	0%	3	0%	23	0%
Central Tablelands	595	45%	73822	1.0%	262	52%	467	48%	69	28%	317	14%
Cobar	1	0%	17	0.0%								
Condobolin	15	0%	1623	0.0%	1	0%	10	0%				
Cooma	176	14%	16608	0.2%	48	8%	101	5%	71	4%	272	3%
Coonabarabran	33	3%	3078	0.1%	11	18%	23	13%	4	0%	9	0%
Coonamble	19	0%	1724	0.0%	8	13%	35	3%	7	0%	46	0%
Dubbo	121	2%	10347	0.0%	21	10%	47	6%	13	8%	46	7%
Forbes	203	23%	26781	0.4%	92	18%	265	11%	18	0%	94	0%
Gloucester	1	0%	1	0.0%								
Goulburn	157	51%	18604	1.0%	82	51%	152	48%	26	23%	79	27%
Grafton									2	0%	9	0%
Gundagai	148	24%	19693	0.3%	38	26%	130	15%	36	8%	120	4%
Hay	19	21%	3918	0.1%	2	0%	3	0%				
Hillston	10	20%	1931	0.1%	1	0%	1	0%	2	0%	11	0%
Hume	218	30%	26095	0.7%	82	45%	252	25%	83	19%	250	16%
Hunter	6	0%	296	0.0%	1	0%	1	0%				
Maitland	5	0%	12	0.0%					2	0%	3	0%
Molong	219	27%	27478	0.4%	66	32%	148	18%	44	11%	205	4%
Moree	15	20%	2945	0.2%	2	50%	3	33%				
Moss Vale	32	9%	1274	0.3%	2	50%	3	67%	6	17%	8	13%
Mudgee-Merriwa	1	0%	100	0.0%	21	5%	37	3%	1	0%	7	0%
Murray	223	15%	29050	0.2%	38	16%	91	11%	17	6%	68	1%
Narrabri	29	0%	1893	0.0%	1	0%	3	0%	3	0%	18	0%
Narrandera	25	0%	2237	0.0%	1	0%	3	0%	6	0%	29	0%
Northern New England	69	12%	5541	0.2%	10	10%	14	14%	9	0%	32	0%
Northern Slopes	8	0%	567	0.0%					2	0%	8	0%
Nyngan	19	0%	3810	0.0%	4	0%	48	0%				
Riverina	83	5%	5059	0.1%	2	0%	15	0%	15	0%	39	0%
South Coast	13	31%	2730	0.5%	4	25%	12	42%				
Tamworth	41	20%	4870	0.3%	10	20%	29	10%	16	6%	82	2%
Tweed-Lismore	1	0%	14	0.0%								
Wagga Wagga	180	14%	26556	0.2%	39	13%	67	12%	48	2%	125	1%
Walgett	8	0%	856	0.0%					2	0%	8	0%
Wanaaring	1	0%	187	0.0%								
Wentworth	4	0%	160	0.0%								
Wilcannia	3	0%	12	0.0%	1	0%	1	0%	1	0%	5	0%
Yass	202	34%	27681	0.6%	64	28%	149	28%	24	4%	80	1%
Young	363	30%	54660	0.3%	116	28%	218	18%	80	15%	266	8%
Total	3724	25%	443098	0.5%	1108	32%	2486	23%	745	10%	2725	6%

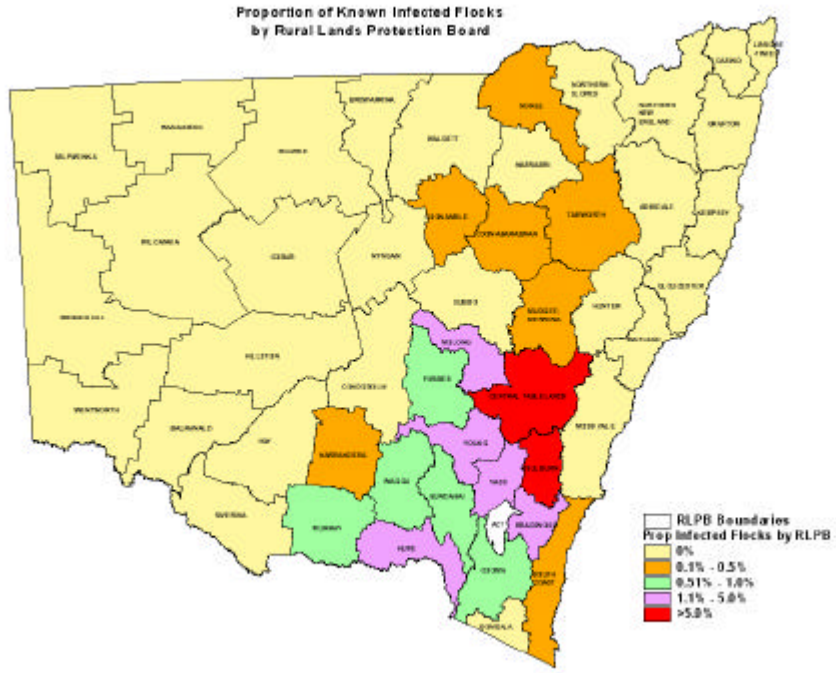
Table 15: Summary of abattoir surveillance by RLPB

Board	Zone	Region	Lines					
			+ve	inc	-ve	Total	% +ve	Regional prevalence
Armidale	CON	LP		1	445	446	0.2%	0.3%
Balranald	CON	LP			1	1	0.0%	0.3%
Broken Hill	CON	LP			51	51	0.0%	0.3%
Bombala	CON	LP		1	107	108	0.9%	0.3%
Bourke	CON	LP			141	141	0.0%	0.3%
Brewarrina	CON	LP			127	127	0.0%	0.3%
Nyngan	CON	LP			203	203	0.0%	0.3%
Cobar	CON	LP			107	107	0.0%	0.3%
Condobolin	CON	LP			204	204	0.0%	0.3%
Riverina	CON	LP	1		76	77	1.3%	0.3%
Hunter	CON	LP			34	34	0.0%	0.3%
Dubbo	CON	LP	1		1077	1078	0.1%	0.3%
Northern New England	CON	LP			82	82	0.0%	0.3%
Grafton	CON	LP			1	1	0.0%	0.3%
Hay	CON	LP			37	37	0.0%	0.3%
Hillston	CON	LP			33	33	0.0%	0.3%
Maitland	CON	LP			2	2	0.0%	0.3%
Moss Vale	CON	LP			14	14	0.0%	0.3%
Milparinka	CON	LP			13	13	0.0%	0.3%
Narrabri	CON	LP			75	75	0.0%	0.3%
Kempsey	CON	LP			1	1	0.0%	0.3%
Walgett	CON	LP	2		327	329	0.6%	0.3%
Wanaaring	CON	LP			24	24	0.0%	0.3%
Northern Slopes	CON	LP			82	82	0.0%	0.3%
Wentworth	CON	LP			4	4	0.0%	0.3%
Wilcannia	CON	LP			51	51	0.0%	0.3%
Tamworth	CON	LP			371	371	0.0%	0.3%
Narrandera	CON	LP	2		254	256	0.8%	0.3%
Coonabarabran	CON	LP	2		93	95	2.1%	0.3%
South Coast	CON	LP			2	2	0.0%	0.3%
Mudgee-Merriwa	CON	LP	5		109	114	4.4%	0.3%
Coonamble	CON	LP			115	115	0.0%	0.3%
Moree	CON	LP			105	105	0.0%	0.3%
Wagga Wagga	CON	MP	15	2	757	774	2.2%	7.2%
Murray	CON	MP	6		170	176	3.4%	7.2%
Cooma	CON	MP	3		139	142	2.1%	7.2%
Gundagai	CON	MP	23	3	412	438	5.9%	7.2%
Forbes	CON	MP	15	2	641	658	2.6%	7.2%
Young	CON	MP	80	5	670	755	11.3%	7.2%
Hume	CON	MP	14		228	242	5.8%	7.2%
Braidwood	CON	MP	17		79	96	17.7%	7.2%
Molong	CON	MP	24	2	258	284	9.2%	7.2%
Yass	R/C	MP	66	4	292	362	19.3%	7.2%
Goulburn	RES	HP	191	11	545	747	27.0%	30%
Central Tablelands	RES	HP	203	12	426	641	33.5%	30%

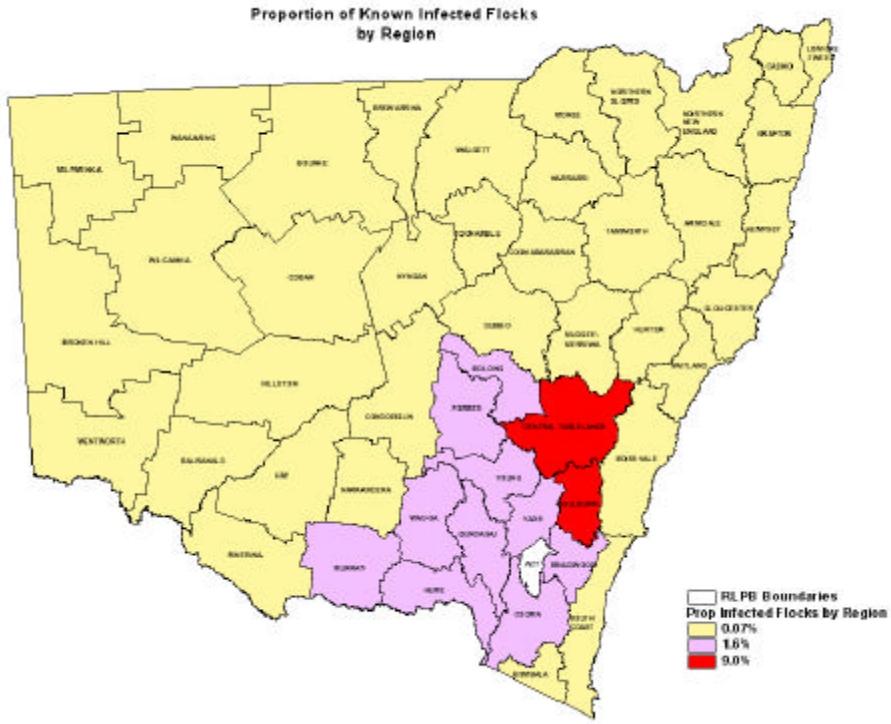
Table 16: Forward traces by Region of origin

	Region of origin			
Destination district	HP	MP	LP	Total
Armidale	2	15	1	18
Bombala	1	5		6
Bourke		1		1
Braidwood	6	34		40
Brewarrina	1	1		2
Central Tablelands	643	81	1	725
Condobolin	1	5		6
Cooma	2	42		44
Coonabarabran	5	2	3	10
Coonamble		1		1
Dubbo	13	6		19
Forbes	73	67		140
Goulburn	280	88		368
Gundagai	4	34		38
Hillston	1	1		2
Hume	3	107		110
Hunter	1			1
Molong	46	88		134
Moree		1	2	3
Moss Vale	2	3		5
Mudgee-Merriwa	10	13	3	26
Murray	5	5		10
Narrabri	2			2
Narrandera	1	4	2	7
Northern New England		2	1	3
Northern Slopes	5	1		6
Nyngan		2		2
Riverina	3	1		4
South Coast		1		1
Tamworth	3	1	5	9
Wagga Wagga	8	119		127
Walgett	1			1
Yass	21	64		85
Young	54	220		274
Total	1113	612	18	1743

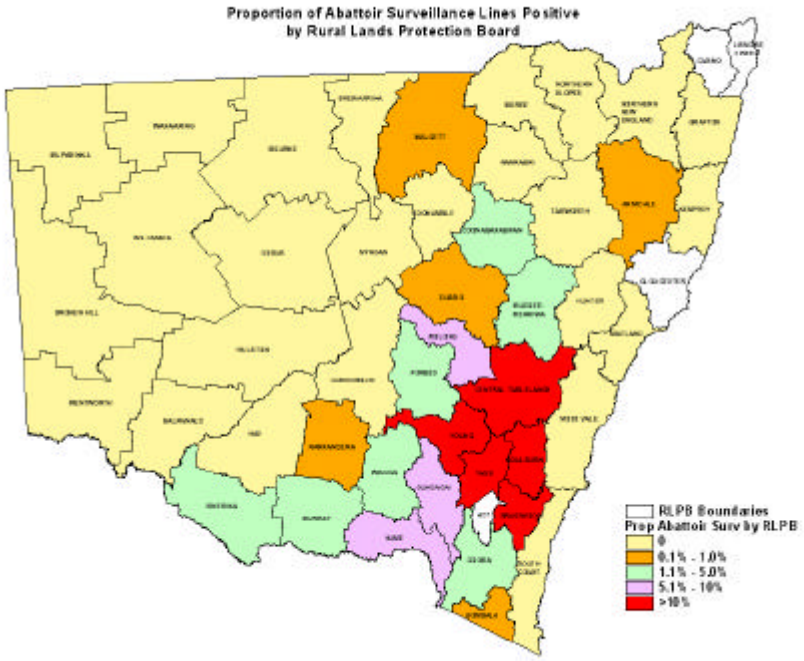
Map 1


Proportion of Known Infected Flocks
by Rural Lands Protection Board
RLPB Boundaries
Prop Infected Flocks by RLPB
0%
0.1% - 0.5%
0.51% - 1.0%
1.1% - 5.0%
>5.0%

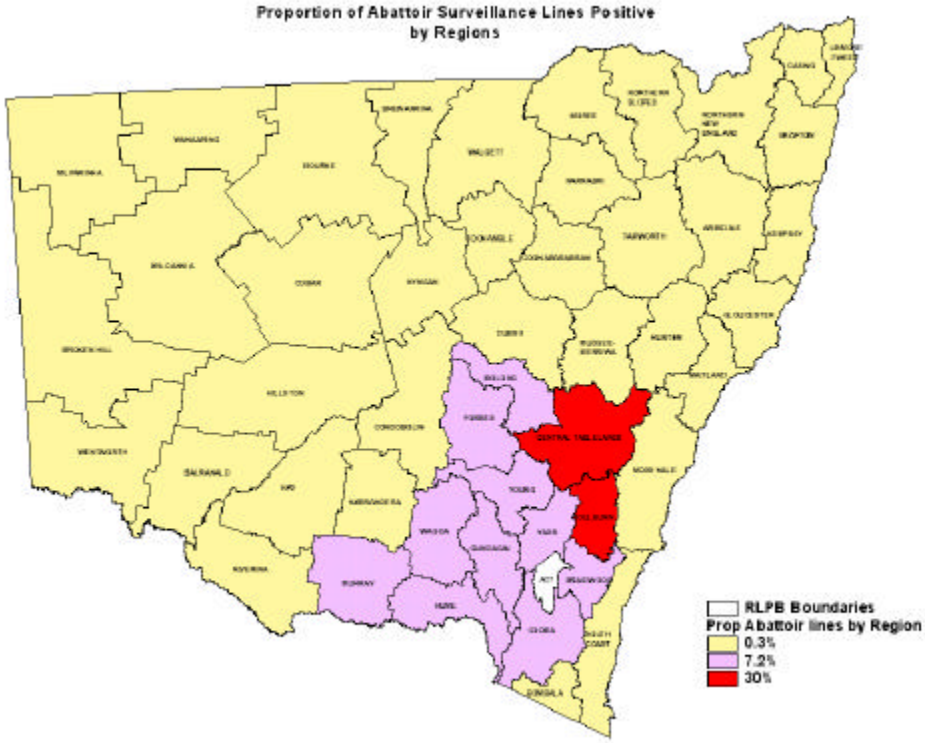
Map 2


Proportion of Known Infected Flocks
by Region
RLPB Boundaries
Prop Infected Flocks by Region
0.07%
1.6%
9.0%

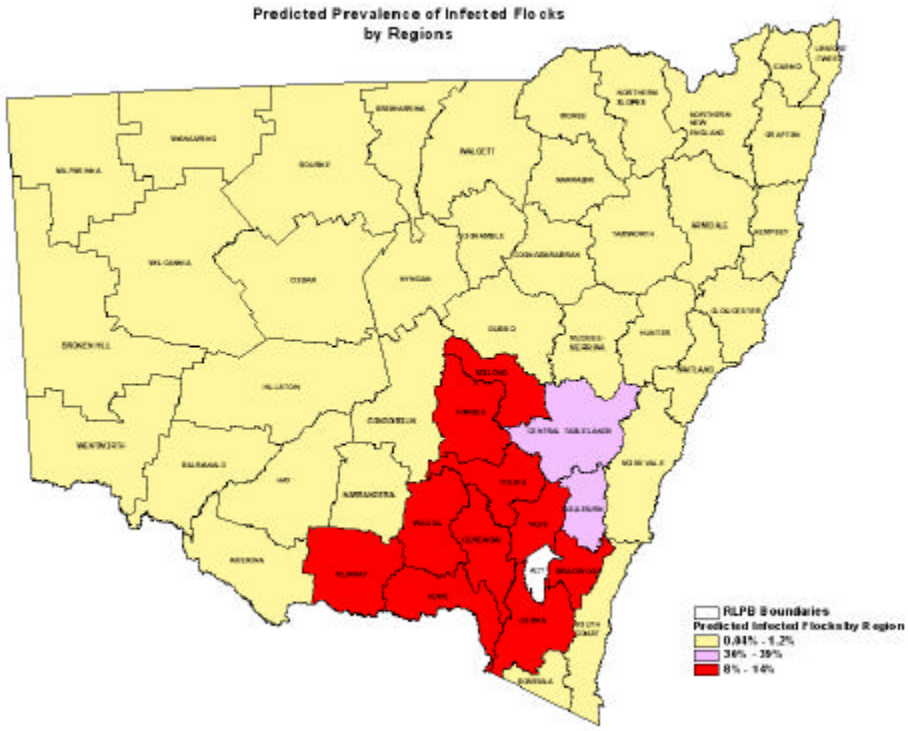
Map 3


Proportion of Abattoir Surveillance Lines Positive
by Rural Lands Protection Board
RLPB Boundaries
Prop Abattoir Surv by RLPB
0
0.1% - 1.0%
1.1% - 5.0%
5.1% - 10%
>10%

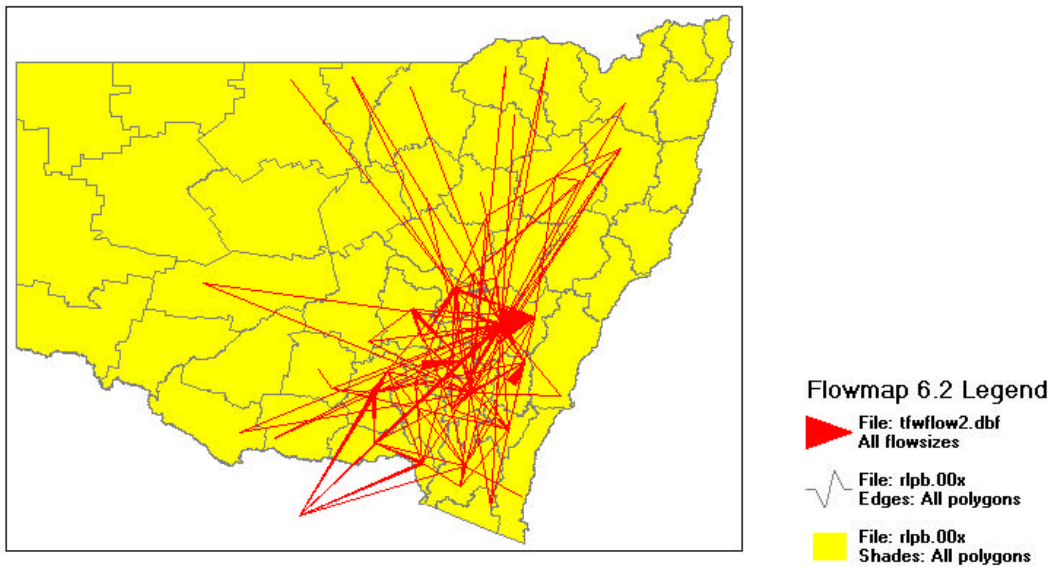
Map 4


Proportion of Abattoir Surveillance Lines Positive
by Regions
RLPB Boundaries
Prop Abattoir lines by Region
0.3%
7.2%
30%

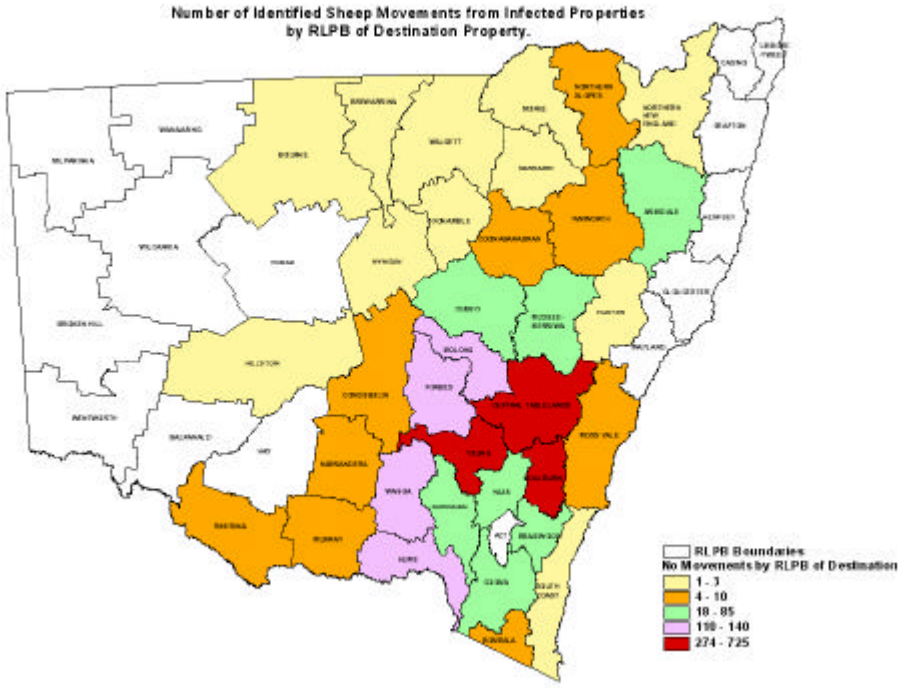
Map 5


Predicted Prevalence of Infected Flocks
by Regions
RLPB Boundaries
Predicted Infected Flocks by Region
0.04% - 1.2%
36% - 39%
8% - 14%

Map 6


Flowmap 6.2 Legend
File: tfwflow2.dbf
All flowsizes
File: rlpb.00x
Edges: All polygons
File: rlpb.00x
Shades: All polygons

Map 7


Number of Identified Sheep Movements from Infected Properties
by RLPB of Destination Property.
RLPB Boundaries
No Movements by RLPB of Destination
1 - 3
4 - 10
18 - 85
100 - 140
274 - 725

NATIONAL OVINE JOHNE'S DISEASE CONTROL AND EVALUATION PROGRAM
NATIONAL WORKSHOP ON CONTROL STRATEGIES
Canberra, April 17th-18th, 2001

PRINCIPLES FOR USE OF STRATEGIC VACCINATION TO CONTROL REGIONAL SPREAD OF OVINE JOHNE'S DISEASE

Prepared by NSW Agriculture – 4th April 2001

Summary

The prevalence of OJD flock infection in the current Residual Zone in NSW and within some foci of infection in the surrounding Control Zone has now reached the level where existing control strategies are inappropriate and unacceptable to many affected producers.

The majority of new flock infection with OJD in NSW now appears to be the result of lateral transmission from an adjoining infected property rather than forward movement by sheep trading. Lateral spread can occur indirectly by movement of contaminated material or directly by straying infected sheep.

Controlling the lateral spread of infection from an infected property to adjoining properties requires prevention or significant reduction of environmental contamination on the infected property if transmission is by environmental means such as water movement, and significant reduction in infection and shedding rates if transmission is by straying sheep. In high disease prevalence areas, destocking of individual properties to remove environmental contamination is not rational because the risk of reinfection from infected neighbours remains.

This paper proposes the wider use of vaccination as a critical element of effective disease control for OJD in NSW - as an addition (and not as an alternative) to current disease control strategies for reducing regional spread of this disease.

Vaccination is currently the only likely effective strategy to achieve widespread reduction of environmental contamination, and hence lateral spread, in the Residual Zone and in infected foci in the Control Zone.

To minimise disease spread from infected properties, vaccination should be undertaken in all infected flocks, immediately they are recognised as infected, to prevent a future rise in disease prevalence and land contamination. In many situations, the reduction of environmental contamination will require all sheep in the infected flock including adult sheep to be promptly vaccinated. Sheep subsequently introduced to these properties should also be vaccinated.

Where there is an identified high risk of lateral transmission, consideration also needs to be given to the potential benefit of pre-emptive (prophylactic) vaccination in flocks not currently identified as infected, especially on properties adjoining or downstream of a high prevalence infected flock.

Initially, the proposed strategy is to encourage vaccination by producers with infected flocks on a voluntary basis, with the possible option of tactical vaccination on a compulsory basis in situations where the risk of transmission to adjoining properties is high or the consequences are serious (eg infected neighbour of MAP flock). Progression to strategic compulsory vaccination over entire infected catchment areas is an option for future consideration.

To encourage vaccination and the voluntary submission of as yet unidentified infected flocks to diagnostic testing, trading of vaccinated sheep should be permitted between infected flocks.

It is proposed that trading of vaccinated sheep from infected properties in the Control Zone and the Proposed Protected Zone be permitted to suspect and infected properties in the Residual Zone and, with prior CVO approval, to other infected properties in the Control Zone, but not the Proposed Protected Zone. However, trading of vaccinated sheep between infected properties within the Proposed Protected Zone could be permitted with prior CVO approval, for example to permit the continued sale of rams from an infected stud in the Proposed Protected Zone to existing clients in the Proposed Protected Zone whose flocks are also infected.

Trading of vaccinated sheep from infected properties in the Residual Zone would be permitted to suspect and other infected properties in the Residual Zone and, with prior CVO approval, to infected properties in the Control Zone. Note that movement of vaccinated sheep to any infected property in the Control Zone would require prior CVO approval, based on assessment that the movement will not increase the risk of lateral spread at destination.

Trading of vaccinated sheep from any infected property in any zone to a suspect property in the Residual Zone would be restricted to vaccinated sheep from a demonstrated low disease prevalence mob on a low prevalence infected property.

Movement of vaccinated sheep from the Control Zone or Residual Zone into the Proposed Protected Zone would not be permitted in any circumstances.

Once controlled trading of vaccinates has been introduced, trading of sheep from infected flocks that have not been vaccinated as lambs would be limited to trading from demonstrated low prevalence infected flocks in which there has been a significant reason for delaying the introduction of vaccination, with such trading restricted to sales to infected and suspect flocks in the Residual Zone only.)

All vaccinated flocks will be subject to quarantine or undertakings in lieu of quarantine.

Any increased risk of disease spread as a result of permitting such trading from infected premises will be more than compensated by a reduction of illegal trading of infected sheep, increased detection of infected flocks and improved recognition of potentially infected sheep if they are moved outside the Residual Zone.

By permitting widespread vaccination and <u>controlled</u> trade in vaccinates, an overall increase in disease control is expected.

Introduction

This paper discusses options for use of vaccination against OJD in NSW. Consideration is given to the experience with vaccination in other countries, and the current OJD situation in NSW, particularly in terms of continued spread. Recommendations are made regarding future use of Gudair® vaccine in NSW to control the spread of OJD.

Principles

- Lateral spread of *Mycobacterium paratuberculosis* between adjoining properties by means other than intended sheep movement is now recognised as a significant source of new property infections in NSW. Controlling the spread of OJD in NSW cannot be achieved without controlling lateral spread of infection.

- The only practical way to reduce lateral spread from infected properties is to significantly reduce the contamination of land. This is the same basic principle underlying disease control by destocking OJD affected land.

- Based on overseas experience and the interim results of vaccine research in NSW, vaccination of infected flocks in both Residual and Control Zones of NSW would delay or suppress faecal shedding of mycobacteria and thereby control rising infection rates in these flocks and the resultant increase in land contamination. In this way spread to adjoining properties can be reduced. Whole of flock vaccination is likely to provide the most immediate and greatest benefit.

- Controlling local spread of OJD in areas with a high prevalence (>30%) of infected flocks such as the current Residual Zone will be difficult or impossible without widespread vaccination to suppress environmental contamination and flock infection rates.

- **Voluntary vaccination to control spread can be encouraged by facilitating local markets for trading in vaccinated sheep**

- Vaccination will not interfere with detection of OJD infected flocks so long as <u>all</u> vaccinates are permanently and clearly marked.

- Vaccination and effective identification of vaccinates will greatly assist disease control by identifying many potentially infected sheep, particularly if such potentially infected sheep are moved without permit to other districts.

- **All vaccinated flocks should be quarantined**

Background

Research in other countries has shown that vaccination of sheep and goats against *Mycobacterium paratuberculosis* in flocks infected with Johne's disease has the following effects:

- >90% reduction in the number of clinical cases of Johne's disease
- >90% reduction of faecal shedding of *M. ptb* organisms

Preliminary results from Australian trials also suggest that vaccination delays the onset and/or reduces the level of faecal shedding, although the impact of vaccination on clinical disease and mortality rates under Australian pastoral conditions remains uncertain.

M. ptb is not known to replicate outside the mammalian host. Therefore, any significant reduction in clinical disease and/or faecal shedding will result in a significant reduction of environmental contamination on the land on which infected flocks are run.

If it is accepted that vaccination reduces faecal shedding in infected flocks, and hence environmental contamination, it should be accepted that vaccination has a potentially important role to play in controlling the spread of infection between adjoining properties. This is supported by considerable field experience with JD vaccination in sheep and goats overseas.

Reduction of environmental contamination with *M. ptb* can reasonably be expected to reduce the rates of:

- local inter-property disease spread by environmental transfer (eg in run-off water);
- new infections of individual sheep in infected flocks (by reducing environmental challenge to uninfected animals on infected properties, thereby reducing, on an inter-generational basis, the infection rate in subsequent years), and therefore
- local inter-property disease spread by straying of small numbers of sheep.

Reducing the prevalence of infected sheep in infected flocks will reduce the rate of disease spread by sheep trading as well as localised spread, especially when trading involves small numbers of animals. The risk of introducing infection to a clean flock with sheep from an infected flock, assuming a 90% reduction in shedding, would reduce the probability of disease transmission from a vaccinated infected flock with a pre-vaccination infection rate of 10%, for a group of 10 sheep, from 70% to 10%. This could provide a significant reduction in the rate of inter-property disease transmission by small numbers of straying sheep.

Overseas, vaccination has been used successfully to control the spread of JD in small ruminants. Animal health authorities in these countries, particularly in Iceland, considered vaccination to be a sufficiently critical control strategy to make the vaccination of susceptible animals compulsory in JD control zones. (Reported outcomes from vaccination of sheep and goats in the field against JD are much more positive than the reported experience with vaccination of dairy cattle.)

When vaccination is introduced in a flock, in most circumstances all adult and juvenile sheep should be vaccinated as well as newborn lambs.

In many situations the prevalence of infection in a flock will be low when vaccination is introduced and hence most adult sheep can be vaccinated pre-exposure and develop some level of protective immunity. (Pre-exposure vaccination of adults is likely to be more effective than post-exposure vaccination.) This should greatly reduce the spread of infection through the flock and hence the risk of lateral spread. If adult sheep in an infected flock are not vaccinated, many may become infected when exposed at a later date, particularly where challenge is high. Therefore, if lambs only are vaccinated, infection and disease rates may increase over time amongst the unvaccinated adults in the flock, thereby increasing early pre-vaccination challenge for subsequent cohorts of lambs.

Overseas the vaccination of adults in heavily infected flocks has been reported to precipitate a spike in the mortality rate due to acceleration of the disease process in infected sheep in the late preclinical stage. This has not been observed in Australia to date.

The critical point for reduction of pasture contamination following introduction of vaccination occurs when there are no unvaccinated sheep left on the property, clinical cases have ceased and all lambs are being vaccinated prior to significant challenge. Potentially, this process of eliminating pasture contamination and hence challenge to subsequent cohorts of lambs can commence 4 or 5 years earlier if all sheep in the flock are vaccinated initially, not just lambs.

Vaccination alone however is unlikely to provide effective control of OJD spread immediately, because a proportion of vaccinated sheep continue to shed the mycobacteria. On a group basis, vaccinates remain infectious and contaminate properties to which they are moved, albeit at a lower rate than unvaccinated infected sheep. Effective movement controls for vaccinated sheep are therefore critical to effective disease control.

The identification of vaccinated sheep also provides a very significant indirect advantage for disease control. If vaccination is restricted to infected sheep or sheep from infected properties or infected areas, mandatory identification of all vaccinates will ensure these potentially infectious sheep are readily recognised if they are moved illegally to any other area.

The current national policy on vaccination against OJD is in principle inappropriate for the disease situation currently prevailing within the residual zone and in infected foci in the control zone. This policy is making the control of local disease spread very difficult, by prohibiting the introduction of vaccination until the disease prevalence in infected flocks and hence contamination on infected properties has risen to a level where local spread is more than likely.

Under the current NRA permit for the Gudair® vaccine, vaccine use is permitted to reduce unacceptable losses due to OJD, but is not permitted to facilitate strategic disease control.

Opposition to wider use of vaccination against OJD in NSW is based on two main arguments. These arguments are that:

- wider use of vaccination will make future control of OJD more difficult by interfering with diagnostic tests used to detect OJD infected sheep; and
- wider availability of vaccination to reduce economic losses from the disease will reduce the motivation of producers to eradicate or control the spread of disease in areas where it is present, thereby facilitating spread to other areas and creating ongoing control costs in such areas including future costs of vaccination.

The reality is that mandatory identification of vaccinates will actually assist the recognition of sheep with a potential infected status rather than interfere with diagnosis. Provided vaccinated sheep are effectively and permanently identified, vaccination will not interfere with other OJD control strategies.

The second opposing argument is also incorrect. Whatever economic disincentives for adoption of any alternative control strategy may be created by vaccination, this must be limited to flocks experiencing high mortality as these are the only flocks with an economic incentive for control by any strategy including any alternative strategy to vaccination. In other flocks, vaccination or any other strategy could not be justified on existing economic (mortality) grounds alone, although producers may justify vaccination or other strategies on a predicted risk of future high mortality. Conversely, in flocks with pre-existing high mortality, vaccination is already now permitted to reduce economic loss and the proposed policy for wider use of vaccination therefore does not affect these flocks.

In low prevalence infected flocks, the only reasons to undertake any disease control measure, vaccination or otherwise, are reduction of further pasture contamination and therefore future increasing mortality from OJD and hence a reduction of the risk of spread to neighbours. Controlling the normal rise in disease incidence by use of vaccine in these flocks also actually maintains the potential to utilise alternative disease control/elimination methods, when or if they become available in the future.

For the owners of infected flocks, vaccination can provide a short-term option for legal trading to other similar flocks whilst pursuing the long-term theoretical objective of eliminating the infection from the flocks and land by continued vaccination over many years.

If long-term vaccination is successful in eliminating the OJD mycobacteria from a significant proportion of infected flocks and properties, the benefit for regional disease control is clear. The prevalence of infected flocks in areas where destocking is not currently an economically rational approach could be reduced to a level where it is again rational.

Pre-emptive Strategic Vaccination

Secondary spread of infection from neighbouring properties adjacent to known infected properties may occur before any infection is detected on the neighbouring property itself. (This is demonstrated by tracebacks to neighbours of known infected properties). Accordingly, there may be a case for vaccination of high-risk neighbours, for example, neighbours where there is a history of straying sheep, significant downstream water flow or poor fencing. In such cases, vaccination and quarantine may be indicated to reduce further spread.

Accordingly, where there is:

- a high risk of inter-property disease transmission;
- significant consequences if such further transmission occurs; and
- no other practical or economic means to prevent such transmission

vaccination of the known infected flock and the flock at risk should be considered.

This raises three questions.

- When and where is it appropriate to vaccinate animals to reduce spread?
- Which animals should be vaccinated?
- What movement controls should be placed on vaccinated sheep?

In simplest terms, vaccination to reduce spread is indicated in all situations in which spread is likely to occur and no alternative strategy to prevent spread such as destocking is planned. In such situations, **all susceptible animals** (adults and lambs) should be vaccinated to minimise the spread of infection (unless the lambs are destined for slaughter before the age at which shedding may commence).

Within any infected flock, **all** susceptible animals should be vaccinated to prevent them being affected by the disease. In other words, the principle being applied here is that where there are sheep that are likely to be exposed to infection and that are likely to develop the disease, preventative vaccination is deemed appropriate.

Given the evidence of local environmental spread, in terms of disease control, it makes no difference which side of a boundary fence the susceptible sheep are located on. That is, it makes no difference whether they are on the infected property or an adjoining property. The only important point is that they are likely to be exposed to infection and transmit the infection to other sheep.

However, vaccination of sheep on an adjoining property which is not a known infected property immediately raises the issue of what is appropriate permitted trading for such sheep. The fact that such sheep have been vaccinated does indicate~~s~~ that there was some perceived risk of infection. Accordingly, it is appropriate that any vaccinated flock is subject to movement restrictions, even within the zone. In effect, vaccinated flocks should be subject to quarantine, whether classified as infected or suspect.

In high disease prevalence areas where the risk of infection from adjoining properties is high for producers who adopt any disease control procedure, producers must be encouraged to undertaken disease control on a group basis, preferably with the group based on a land catchment area. In high prevalence areas, to obtain support from all producers in an area for a local OJD program and to reduce the likelihood of re-infection of producers who choose to destock or undertake disease reduction plans aimed at long-term eradication, it will be important that all producers in the area have access to vaccination. Withholding vaccine from one producer in the area on the basis of lack of current evidence of infection could prevent the establishment of the group control program or compromise success if it is established.

In the Control Zone, it is proposed that vaccination of infected flocks will initially be voluntary, but should become compulsory when appropriate funding arrangements are in place. A staged progression to compulsory vaccination of infected flocks in the Residual Zone should also be considered, subject to appropriate funding arrangements. (Discussion of the appropriate funding arrangements is beyond the scope of this particular paper.)

Compulsion may be necessary to reduce the risk of lateral spread from infected properties, particularly where the consequences of such spread would be serious, for example if the adjoining property has an MAP flock. The justification for compulsion may be greater where the risk of pre-existing infection on adjoining properties is less, for example in the Control Zone in contrast to the Residual Zone.

Compulsory vaccination however may be difficult to justify unless it is undertaken at minimal cost to the affected producer. A progressive introduction of compulsory vaccination, initially restricted to high-risk situations, is therefore proposed after a period of wider availability of vaccination on a voluntary basis.

In particular, there is a need to vaccinate flocks with a high prevalence of infected sheep. Vaccination of adults in these flocks can be undertaken without compromising longer-term disease control objectives.

It is proposed that voluntary vaccination of suspect properties be permitted in the Residual Zone (but not the Control Zone). However, vaccination of suspect flocks should only be permitted where there are reasonable objective grounds for suspicion of infection. It is not proposed to permit a voluntary assumption of suspect status by a flock owner for the purpose of gaining access to vaccine for prophylactic reasons.

Movement of Vaccinates

Vaccination is not a stand-alone control strategy for preventing regional spread of this disease because a proportion of vaccinates that are subsequently exposed do become infected and some of these become faecal shedders. Movement controls are therefore necessary to prevent vaccinated sheep transmitting infection to uninfected flocks. **Experience overseas suggests that movement control *plus* vaccination will give a higher level of control over disease spread than either strategy alone.**

Since vaccination is restricted to animals that are infected or at a significant risk of infection, all vaccinated animals must be considered a significant risk to uninfected sheep, given that *some* infected vaccinates will continue to shed the JD mycobacteria.

Movement controls on vaccinated sheep must be designed with this potential threat from vaccinated animals to the control of disease spread in mind.

Movement of vaccinated sheep to areas or individual properties should not be permitted where such movement would increase the risk or prevalence of disease occurring at the destination. Accordingly, the presence of vaccinated sheep should not be permitted in a Protected Zone.

Use of vaccine in infected flocks should be permitted within Control (including Potential Protected) Zones and Residual Zones for both strategic disease control and alleviation of losses. Use of vaccine on infected properties within a Potential Protected Zone with CVO/Veterinary Committee approval is also appropriate to prevent spread to adjoining properties, given an understanding that under the current SD&Rs, vaccinated animals on infected properties will have to be destocked if the area wishes to progress to Protected Zone status.

Movement of vaccinated sheep can be safely permitted to properties or areas that already have an equivalent or higher risk or prevalence of infection to that of the source property or area - without compromising disease control. Accordingly, trade in vaccinated sheep between infected properties should be permitted. Regulated trade in vaccinated sheep should also be permitted from infected properties in the Residual Zone and Control Zone to higher-risk suspect properties within the Residual Zone.

Trade in unvaccinated sheep from infected or suspect properties should only be permitted where there is evidence the disease is present at low prevalence in the source flock and there are good reasons related to disease control for delaying the introduction of vaccination in the flock (eg where time is needed to clarify a suspect status and there is no immediate risk of lateral spread).

In some high-prevalence areas, all properties would be "high-risk". In these areas, vaccination should be encouraged in as many flocks as possible.

It is therefore proposed that movement of sheep from infected properties other than for slaughter be limited to sheep vaccinated as lambs in flocks undertaking Property Disease Reduction Plans, except where there is a good reason for delaying the introduction of vaccination in a flock that has a demonstrated low prevalence of infection.

Movements will only be permitted in accordance with the table below.

Proposed Permitted Movements of Vaccinated Sheep from Infected Properties in NSW

Origin	Destination		
	RZ	CZ	PPZ
Infected Property in RZ	Infected or Suspect property	Infected property (with CVO approval)	Not Permitted
Infected Property in CZ	Infected or Suspect property	Infected property (with CVO approval)	Not Permitted
Infected Property in PPZ	Infected or Suspect property	Infected property (with CVO approval)	Infected property (with CVO approval*)

*exceptional circumstances only

Where vaccination is permitted in a high-risk suspect flock, the same restrictions on trade from the suspect flock will apply as though the flock was a known infected flock.

It is proposed that vaccination be permitted only on properties undertaking an approved Property Disease Reduction Plan (PDRP). The PDRP will normally comprise management strategies as well as vaccination, but in some situations, vaccination may be the only appropriate strategy.

RECOMMENDATIONS:

1. **That vaccination be recognised nationally as a valid and potentially valuable adjunct strategy for controlling the regional spread of OJD, not just as a strategy for alleviating economic loss on the most heavily infected properties.**

2. **That vaccination be permitted in any known OJD infected flock for control of disease spread within and from the infected property on which the flock is run, from the time that infection is first detected in the flock and without regard to the existing level of infection or mortality in the flock.**

3. **That vaccination be permitted in any suspect flock where there is a significant risk that lateral spread will occur from that flock or where the consequences of such spread, if it occurred, would be serious.**

4. **That vaccination be permitted in any at-risk or suspect flock that is part of an approved Group (Catchment) OJD control scheme in a Residual Area or an infected focus in a Control Area, subject to all of the participating owners' cooperating with ongoing attempts by the local RLPB to clarify the true infection status of all flocks in the scheme.**

5. **That trading of vaccinated sheep be permitted from infected properties according to the following schedule:**

Origin	Destination		
	RZ	CZ	PPZ
Infected Property in RZ	Infected or Suspect property	Infected property (with CVO approval)	Not Permitted
Infected Property in CZ	Infected or Suspect property	Infected property (with CVO approval)	Not Permitted
Infected Property in PPZ	Infected or Suspect property	Infected property (with CVO approval)	Infected property (with CVO approval*)

*exceptional circumstances only

6. **Notwithstanding Point 5, that trading of vaccinated sheep from an infected property in any zone to a suspect property in the Residual Zone be permitted only from a known low prevalence infected mob in a known low prevalence infected flock that is undertaking a property disease reduction plan involving management strategies as well as vaccination.**

7. **That after the introduction of voluntary vaccination for all infected flocks, trading of unvaccinated sheep from infected flocks be permitted only from known low prevalence infected mobs in known low prevalence infected flocks that are undertaking a Property Disease Reduction Plan involving management strategies <u>and</u> where there has been a reasonable cause to delay the introduction of vaccination in the source flock, such trading of unvaccinated sheep to be permitted to infected flocks only in the Residual Zone.**

8. **That clear and permanent identification of all vaccinates remains mandatory.**

9. **That vaccination only be permitted in flocks that are quarantined and undertaking an approved Property Disease Reduction Plan.**

End

NATIONAL OVINE JOHNE'S DISEASE CONTROL AND EVALUATION PROGRAM
NATIONAL WORKSHOP ON CONTROL STRATEGIES
Canberra, April 17th-18th, 2001

OJD RISK MANAGEMENT STRATEGIES WHEN PURCHASING SHEEP OR GOATS

Prepared by NSW Agriculture – 4th April 2001

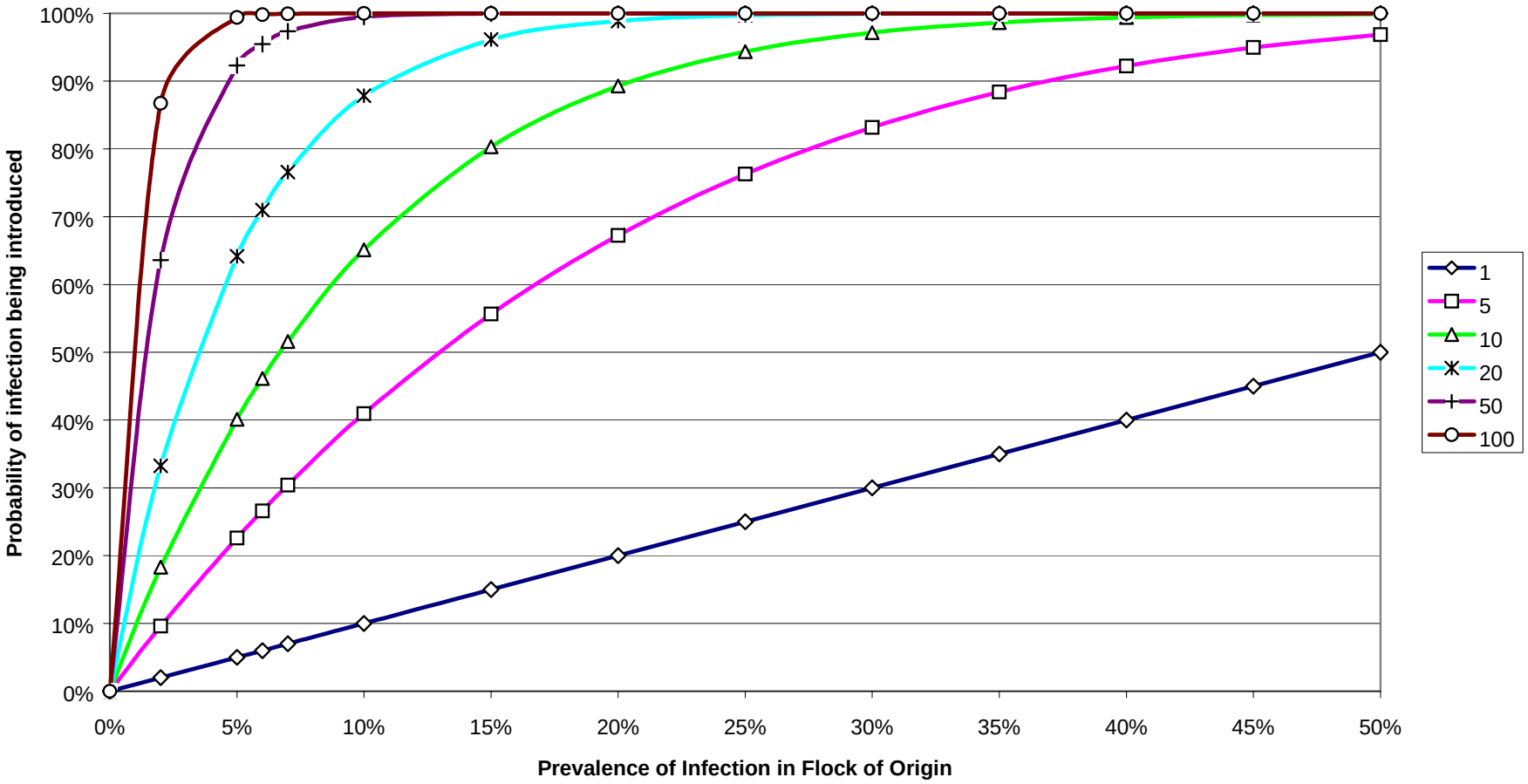
OJD Risk Management Strategies when Purchasing Sheep or Goats

The probability of introducing infection from an infected flock is dependent on the level of infection in the vendor flock, the number of animals introduced and whether there have been multiple introductions over a period of years (e.g. annual purchase of rams). Where disease is present at a high prevalence in a flock (e.g. 10% or more animals infected), the purchase of any number of animals, including small numbers of rams, presents a high risk of introducing disease. Where the prevalence of disease in a flock is very low (e.g. less than 2% of animals infected), the probability of introducing infection with the purchase of small numbers of animals (e.g. rams) is quite low. However the risk of infection from purchase of larger numbers (e.g. a mob of 100 wethers) is significant, i.e. there is a high probability that an infected animal is present in the purchased mob, *see Figure 1 for probability graph*.

Flocks which participate in assurance programs provide a source of low-risk sheep and goats for potential purchasers. Purchase from low-risk areas further reduces the risk. It is also essential to consider the implications on your enterprise and financial viability as well as potential effects on neighbours should OJD be introduced into your flock or goat herd.

End

Figure 1: Probability of introducing infection from flocks with varying prevalence and number of animals introduced (refer to legend key for 1, 5, 10, 20, 50 or 100 animals)



NATIONAL OVINE JOHNE'S DISEASE CONTROL AND EVALUATION PROGRAM
NATIONAL WORKSHOP ON CONTROL STRATEGIES
Canberra, April 17th-18th, 2001

NEW SOUTH WALES
KEY ISSUES AND PROPOSALS

Prepared by NSW Agriculture – 4th April 2001

Introduction

The need to implement control measures for ovine Johne's disease, over and above those currently available under the national program, is the primary focus of submissions from NSW to the National Ovine Johne's Disease Control Strategies Workshop. This paper summarises the problems, and the proposed solutions, from a NSW perspective.

This summary paper is supported by:

- **Epidemiological assessment of ovine Johne's disease in New South Wales, Evan Sergeant for NSW Agriculture, February 2001**
- **Lateral Transmission of Ovine Johne's Disease – a case study, NSW Agriculture and Rural Lands Protection Boards, April 2001**
- **Principles and Strategies for Control of Ovine Johne's Disease, NSW Agriculture, April 2001**
- **Principles for Strategic Vaccination to Control Ovine Johne's Disease in NSW, NSW Agriculture, April 2001**
- **Proposed Model for Control of Ovine Johne's Disease in NSW, NSW Agriculture, April 2000**

Key Issues to be addressed from a NSW perspective

1. Current lack of understanding of **epidemiology** - modes of spread of OJD in NSW and their relative importance with regard to disease control in NSW.

2. The significance of **lateral spread** of *Mycobacterium paratuberculosis* organisms by various vectors – infected stock, contaminated water, contaminated soil, wind, etc.

3. The requirement for a **re-evaluation of the control aspects** of the program in NSW in the light of the above.

4. The **requirements of the other states** in terms of short and long term exclusion/control of OJD.

5. The **risks to other states** presented by significant numbers of early infected and therefore unidentifiable (with current technology) animals associated with lateral spread in NSW – implications for the MAP.

6. The relationship between **on-farm control and regional control** in NSW.

7. The problem of **increasing environmental contamination** within NSW.

8. Requirement for availability **of effective control strategies in new foci of infection** in NSW which are well removed from the Residual Zone.

9. **Potential control strategies** – identified and evaluated – movement restrictions (quarantines and zoning), destocking, property disease reduction plans, strategic vaccination.

10. **Risks associated with the potential control strategies** – inability of many producers to comply with movement restrictions and remain solvent, current efficacy and practicality of destocking, efficacy of PDRPs with and without vaccination, efficacy of current zoning within NSW, risks associated with vaccination (efficacy, vaccination lesions, OH&S, imported vaccine).

Proposed Model for OJD Control within NSW

ZONING

Effectively divide NSW into three zones:
Residual Zone or high prevalence region (RZ),
Control Zone or buffer region (CZ),
Proposed Protected Zone or apparent low prevalence region (PPZ).

Basic principles are:

- minimum unit for implementation of zoning will be an RLPB division or equivalent,
- PPZ status should be instituted at least 12 months prior to the expected date of application for Protected Zone (PZ) status,
- a section of CZ (buffer) should normally separate any part of the PPZ from any part of the RZ,
- for the purpose of interstate movements from NSW the PPZ will continue to operate as part of the CZ,
- the RZ boundary needs to be continually reassessed in the light of current surveillance data and trading history,
- districts applying for PPZ status must demonstrate likely low prevalence of infection and producer support for eventual progression to Protected Zone (PZ) status, subject to revision of PZ criteria.

POLICY

Policy will be revised to provide a measured response according to known/apparent prevalence of infection, ie a separate policy for each zone.

Basic principles are:

- many aspects of the current policy will be appropriate for the CZ,
- surveillance, suspect flock investigations and implementation of disease control measures in the PPZ will be more stringent than under current policy,
- movement controls within the RZ will be significantly reduced,
- surveillance within the RZ will continue and those flocks looking to establish and/or maintain freedom from infection within the RZ will be encouraged, and subsidised, to utilise the MAP.

PROPERTY DISEASE REDUCTION PLANS (PDRP)

PDRPs will be strongly encouraged, supported by policy and ideally by assistance measures, within all three zones.

Basic principles are:

- some trading concessions contingent upon implementation of PDRP and trade from lower risk mobs or age groups,
- profiling of flock infection should be an integral part of any PDRP,
- potential for disease elimination without total destocking (as originally proposed by Morris Hussey) should be explored,
- specific strategies for infected MAP/stud flocks to assist genetic salvage and trading options.

TESTING

On the basis of current sensitivity and specificity assessments, pooled faecal culture (PFC) will be the preferred screening test for all surveillance and assurance testing in NSW.

Basic principles are:

- early detection and use of the most sensitive test available will be essential for implementation of effective control in all three zones,
- progression of status in NSW will be by PFC only, unless use of serology is approved, on a case by case basis, by the OJD coordinator or his delegate.

VACCINATION

Revision of current NRA permit and national Veterinary Committee rules is essential to allow vaccine to be used within the RZ and CZ for strategic control, and to permit regulated trade in vaccinated stock.

Basic principles are:

- use of vaccine in infected flocks within the RZ permitted for both strategic disease control and alleviation of losses with CVO approval,
- use of vaccine in infected flocks within the CZ permitted for both strategic disease control and alleviation of losses with CVO approval, after VetComm endorsement on a district or regional basis,

- use of vaccine in infected flocks within the PPZ permitted for both strategic disease control and alleviation of losses with CVO approval and VetComm endorsement on a case by case basis,
- trade, subject to regulations, in vaccinated stock permitted within and into the RZ and the CZ,
- trade of vaccinates between infected flocks in the PPZ may be permitted by the CVO on a case by case basis, where exceptional circumstances apply.

end

NATIONAL OVINE JOHNE'S DISEASE CONTROL AND EVALUATION PROGRAM

NATIONAL WORKSHOP ON CONTROL STRATEGIES FOR OVINE JOHNE'S DISEASE IN NEW SOUTH WALES

AMA House, Canberra, April 17th-18th 2001

RESOLUTIONS

(CARRIED BY CONSENSUS)

GENERAL:

1. The National Workshop agrees that giving effect to the principle of ongoing control of Ovine Johne's Disease (OJD) in keeping with the current national OJD program is critical.

2. The National Workshop agrees that, in light of new scientific knowledge and surveillance data, there is a need for significant change to OJD control strategies in NSW, as proposed in the model presented from NSW. The changes proposed at this workshop will enhance the national program but will only be effective with financial support for producers.

3. The National Workshop agrees that an alteration in the approach to regulation in the high prevalence areas should occur, consistent with the need to have OJD control strategies appropriate to the prevalence of disease in that area.

4. The National Workshop agrees that communication, education and industry ownership are extremely important and require greater emphasis during the national program.

5. The National Workshop agrees that greater support must be provided to affected producers whilst unaffected producer's flocks must be protected from OJD

6. The National Workshop notes that there is a relationship between the level of producer support for any regulatory disease control program and success of that program. The National Workshop agrees that the level of support from sheep producers that is necessary for successful containment of the spread of OJD infection in NSW is unlikely to be achieved without financial assistance for affected producers including producers in high prevalence areas.

7. The National Workshop agrees that whilst movements of infected sheep potentially result in transmission of infection over large distances, lateral spread of OJD between adjoining properties by mechanisms other than intentional movement of sheep is now recognised as an increasingly important factor in disease spread.

8. The National Workshop noted the epidemiology papers indicating that the distribution of OJD was still restricted, with large areas of NSW showing little or no evidence of infection. The workshop also noted the reports from NSW that indicate significant levels of mortality associated with OJD are increasingly being reported in NSW.

9. The National Workshop agrees that rapid implementation of the resolutions from this workshop should occur if producer support in New South Wales for the national control program is to be improved. The need for greater grass roots support for the program is well recognised.

10. The National Workshop notes that the control strategies for NSW endorsed by this workshop have the broad support of the NSW sheep industry through the NSW OJD Advisory Committee.

11. The National Workshop agrees that it is fundamentally important that the adoption of the strategies agreed upon at this workshop is supported financially. Funds should, as a matter of priority, be directed from national and state funding sources to the implementation of these strategies for OJD control in NSW including the specific on-farm strategies.

VACCINATION – THE NEED FOR VACCINATION

12. The National Workshop agrees that vaccination is now recognised as a potential key element in developing an effective OJD control program for NSW and, subject to proof of efficacy, an essential adjunct control strategy and alternative to property destocking for controlling the spread of OJD from infected properties to adjoining properties, not merely a strategy for alleviating economic loss on heavily infected properties.

13. The National Workshop notes that, despite the recommendations from this National Workshop for immediate wider use of vaccination for control of lateral spread of OJD in NSW, the current trials to assess the efficacy of an OJD vaccine under Australian conditions remain essential to provide objective data to support continued use of vaccination in the future to control OJD and to obtain future access to a registered vaccine product for OJD affected producers as soon as possible. The National Workshop notes that future use of the vaccine will need to be reviewed if the current research finds that the vaccine is not as effective under Australian conditions as is currently expected.

14. The National Workshop agrees that effective regional disease control for OJD is dependent upon effective control of disease spread within and from individual infected properties.

15. The National Workshop agrees that controlling the lateral spread of infection from OJD contaminated properties to adjoining properties will be difficult or impossible without effective strategies to limit the spread of infection and mycobacterial shedding within infected flocks and the resulting increase in land contamination on infected properties.

16. The National Workshop agrees, however, that vaccination must be used in conjunction with other disease management strategies and with strategies to ensure effective containment of vaccinated sheep (for example, security of fencing).

VACCINATION – PERMITTED VACCINE USES

17. The National Workshop agrees that discussions should be initiated with the National Registration Authority regarding revision of the current Permit for Gudair® vaccine to give effect to the resolutions on vaccine use from this National Workshop. The National Workshop also agrees that discussions should be initiated with the NRA to expedite the registration of Gudair® vaccine in Australia. The National Workshop also agrees that discussions should be initiated with Veterinary Committee regarding the national Standard Definitions and Rules for OJD to give effect to the resolutions on vaccine use from this National Workshop.

18. The National Workshop agrees that, subject to the approval of the National Registration Authority and the approval of the Chief Veterinary Officer of NSW, vaccination against OJD should be permitted in any known OJD infected flock in NSW for the control of disease spread within and from the infected property on which that flock is run, from the time that infection is first detected in the flock and without regard to the existing level of infection or mortality in the flock.

19. The National Workshop agrees that vaccination should be considered by the Chief Veterinary Officer for any flock in New South Wales that is suspected of being infected with OJD, if there is a significant risk that lateral spread will occur from that flock or where the consequences of such spread, if it occurred, would be serious. The National Workshop agrees however that this use of vaccine on suspect properties should have the prior approval of the Veterinary Committee and must be subject to the condition that all movements of sheep from any property on which such a vaccinated suspect flock is run are controlled and monitored.

20. The National Workshop agrees that vaccination should be permitted in any at-risk or suspect flock that is part of an approved Group (Catchment) OJD control scheme in a Residual Area or an infected focus in a Control Area, subject to the prior approval of the Chief Veterinary Officer.

21. The National Workshop agrees that there is an urgent need to develop nationally accepted procedures for determining the true disease status of any suspect flock in which vaccination has been permitted but which subsequently seeks to progress to a higher disease status.

22. The National Workshop agrees that flock vaccination should be considered by the Chief Veterinary Officer of NSW whenever there is an identified risk of lateral spread from an infected property in the proposed Control (Admin 2) Zone (C2Z) that does not promptly destock following detection of OJD. The National Workshop also agrees that vaccination of the C2Z infected flock should be accompanied by immediate and subsequent flock testing on adjoining properties assessed to be at risk of infection.

23. The National Workshop agrees that whole-of-flock vaccination and the vaccination of any adult sheep introduced onto properties with vaccinated flocks should be permitted in NSW, notwithstanding the lack of research evidence for the efficacy of adult vaccination against OJD under Australian pastoral conditions. This endorsement for vaccination of adult sheep is based on overseas research that has demonstrated efficacy of whole-of-flock vaccination, limited preliminary observations in ongoing Australian vaccination trials and the urgency of the need for a strategy to control lateral spread of infection.

VACCINATION – CONDITIONS OF USE

24. The National Workshop agrees that clear and permanent identification of all vaccinates must remain mandatory and that vaccination should only be permitted in flocks that are subject to official movement controls.

25. The National Workshop agrees that an approved and documented Property Disease Management Plan (PDMP) should be required as a precondition for permission to vaccinate any flock in the proposed C2Z area of the NSW Control Zone and should be strongly encouraged for any flock that is permitted to vaccinate in any other zone.

26. The National Workshop notes that the requirement for PDMP implementation as a condition for vaccine use has significant resource implications for NSW relating to the development and documentation of PDMPs.

27. The National Workshop agrees that where whole-of-flock vaccination is implemented, flock mortality should be monitored and the flock owner advised of the potential for a short-term increase in the mortality rate due to the vaccination of already infected adults in the flock and advised of the current lack of proof of efficacy of adult vaccination against OJD under Australian pastoral conditions.

28. The National Workshop agrees that owners of flocks that are vaccinated by contract vaccinators should nonetheless receive some formal training, be formally advised of the responsibilities of owners of vaccinated sheep and acknowledge having received this training and advice as a precondition of permission to have their flock vaccinated.

29. The National Workshop notes concern about potential liability associated with the use of a vaccine product that is not yet registered by the NRA for use in Australia and recommends action be taken to ensure all users of the vaccine and owners of vaccinated sheep are made aware of the implications for them of using an unregistered product, to limit this liability.

30. The National Workshop notes the importance of meat quality and product integrity issues related to vaccination against OJD and these should be continually monitored as vaccination is more widely adopted, with appropriate responses if necessary (e.g. improved training in proper vaccination techniques).

SHEEP IDENTIFICATION

31. The National Workshop agrees that the introduction of a national livestock identification scheme for sheep is critical for the effective future control of OJD in Australia.

PERMITTED MOVEMENTS

32. The National Workshop agrees that the trading of all potentially infected sheep for which trading is permitted, including vaccinated sheep and assessed low-risk sheep, must be regulated and carefully controlled in order that the risk of disease spread at the point of destination is minimised.

33. The National Workshop agrees that regulated trading of sheep assessed as low-risk (including vaccinated sheep) according to Appendix 8 of the Standard Definitions and Rules for OJD (under development), should be permitted from infected and suspect properties according to the following schedule:

Origin	Destination		
	RZ	C1Z	C2Z
IN Property in RZ	IN/SU property	IN property (with CVO approval)	Not Permitted
IN Property in C1Z	IN/SU property	IN property (with CVO approval)	Not Permitted
IN Property in C2Z	IN/SU property	IN property (with CVO approval)	IN property (with CVO approval*)
SU Property in RZ	IN/SU property	IN property (with CVO approval)	Not Permitted
SU Property in C1Z	IN/SU property	IN property (with CVO approval)	Not Permitted
SU Property in C2Z	IN/SU property	IN property (with CVO approval)	IN property (with CVO approval*)

*exceptional circumstances only

34. The National Workshop agrees that there will be a need to amend the SD&Rs for OJD to give effect to the recommendation from this workshop that controlled movement of sheep be permitted from infected properties to suspect properties in the Residual Zone.

PROPERTY DISEASE MANAGEMENT PLANS (PDMP)

35. The National Workshop endorses the concept of the PDMP which comprises appropriate measures aimed at control or reduction of disease on infected properties, elimination of infection from infected properties or exclusion of infection from neighbouring properties.

36. The National Workshop agrees that on-farm disease control is likely to be more effective if management strategies designed to reduce on-farm transmission of OJD are introduced at the same time as vaccination.

37. The National Workshop agrees that owners of properties in the proposed NSW Control (Admin 2) Zone (C2Z) that are known to be infected with OJD should be required to implement an approved PDMP. Owners of properties outside the C2Z that are known to be infected should be encouraged to implement an approved PDMP.

38. The National Workshop agrees that permission to sell or purchase sheep to or from an infected property should be conditional upon development and implementation of a PDMP.

39. The National Workshop agrees that profiling of infection within an infected flock may be a component of any PDMP.

40. The National Workshop agrees that OJD affected producers in any zone should receive technical and financial assistance for the development and implementation of a PDMP and sources of such assistance need to be identified.

41. The National Workshop notes that specific assistance strategies may be necessary for owners of sheep flocks who are experiencing exceptional losses due to restrictions on trading (e.g. some infected studs and some former MAP flocks), to assist these producers to develop PDMPs to maintain their trading options and salvage their genetics. This is critical to achieving the level of producer support necessary for effective disease control in NSW.

42. The National Workshop agrees that the potential for disease elimination and property decontamination under a PDMP without total destocking should be investigated, as recommended by the Hussey-Morris report.

ZONING

43. The National Workshop agrees that control of OJD in New South Wales should be administratively managed in three zones on the basis of

- known disease prevalence
- regional industry (producer) control objectives
- consistency with the overall state disease control plan

with control policy developed for each zone appropriate to the needs and control imperatives of each zone, in accordance with the proposed model for control of OJD in NSW as detailed in the National Workshop program papers.

44. The National Workshop agrees that the three zones in NSW will be designated:

- Residual
- Control (Admin 1) or C1Z
- Control (Admin 2) or C2Z

C1Z is that area of the current Control Zone in NSW adjoining the current Residual Zone and which has been identified as a moderate disease prevalence area for OJD. The C1Z is also that area of the NSW Control Zone which is unlikely to progress to Protected Zone status at the same time that the C2Z part of the Control Zone in NSW and the Control Zone areas of other states progress to Protected Zone status. [NOTE: In the National Workshop Program Papers, the C1Z area was referred to as the buffer Control Zone (CZ) and the C2Z area as the Proposed Protected Zone (PPZ).]

APPROVED TESTS

45. The National Workshop agrees that the Technical Advisory Group of Veterinary Committee should review the merits of all of the available tests for OJD with a view to considering whether:-

The Pooled Faecal Culture Test should be the only screening test approved on a national basis which, if negative and based on appropriate sampling, can result in status progression of an individual property for either surveillance purposes or market assurance.

INFECTED PROPERTY PROFILES

46. The National Workshop notes that there may be a need for Infected Flock Profiles (IFP) to be conducted on infected properties to support the following activities:

- Identifying relevant traces which need to be investigated (all traces are obtained and all involved producers and interstate authorities are notified as per current policy).
- Development of Property Disease Management Plans.
- Genetic salvage.
- Development of short and long-term trading options for low-risk (including vaccinated) sheep
- Testing over a period of time in some flocks to assess the potential for progression of status.

Funding should be provided for the investigation of the potential role of IFPs, and for IFP development, from the national surveillance program provided a demonstrated savings results, and from the research component of the national program.

47. The National Workshop agrees that research into both mortality and the sub clinical effects of OJD is important.

End

National Ovine Johne's Disease Control and Evaluation Program

NATIONAL WORKSHOP ON CONTROL STRATEGIES FOR OVINE JOHNE'S DISEASE

AMA House, Barton ACT, 17th – 18th April, 2001

Invited Core Participants

Vandegraaff, Dr Robin*	CHAIR OF WORKSHOP	CVO, SA; Chair OJD TSC
Hussey, Mr Dennis*	FACILITATOR OF WORKSHOP	
Abbott, Dr Kym*	Research Scientist	University of Sydney
Allworth, Dr Bruce*	National Coordinator	AHA
Andrewartha, Dr Rod	OJD Coordinator (CVO)	Dept of Agriculture, Tasmania
Booth, Dr Peter*	Wool Producer	NSW
Cathles, Mr Ian*	Wool Producer	Chair, NSW State OJD Committee
Denholm, Dr Laurence*	Workshop Convenor	NSW Agriculture
Eppleston, Dr Jeff*	OJD Field Officer	Central Tablelands RLPB
Evers, Ms Marilyn*	Chair, TSC Working Party	NSW Agriculture
Galvin, Dr John*	Animal Health Manager	DNRE, Victoria
Garner, Dr Graeme*	Research Scientist	AFFA
Gavey, Dr Lawrence*	State OJD Coordinator	Primary Industries, SA
Hides, Dr Sue	Field Veterinarian	DNRE, Victoria
Links, Dr Ian*	State OJD Coordinator	NSW Agriculture
Morecombe, Dr Peter	State OJD Coordinator	WA Department of Agriculture
Roberts, Dr John	State OJD Coordinator	QDPI
Roth, Mr Ian	Program Manager	NSW Agriculture
Sergeant, Mr Evan	Epidemiologist	Ausvet Animal Health Services Ltd
Whittaker, Mr Steve*	Field Veterinarian	Hume RLPB, NSW
Whittington, Dr Richard*	Research Scientist	NSW Agriculture

*funded by MLA at $1,560 per person under agreement with NOJDPAC (NOJDPAC 11 OOS 6)

Invited Non-Core Participants

Britten, Andrea	Veterinarian	CSL
Carling, Ms Trish	Research Officer	Senate RRA&T OJD Inquiry
Chudleigh, Prof. John	Chair	NOJDP Mid-Term Review
Churchill, Dr Robert	Veterinary Practitioner	Crookwell (AVA)
Feltmann, Mr Ian	Lamb Producer	Sheepmeat Council of Australia
Hansen, Dr Tom	Wool Producer	SA
Harding, Steve	Research Scientist	CSL
Henderson, Mr Kim	Stud Producer	NSW Stud Merino Breeders Assoc.
Kerin, Mr John	Chair	NOJDPAC
Miller, Dr George	Field Veterinarian	DNRE, Victoria
Nottle, Dr Frank	Field Veterinarian	RLPB AHC
Prowse, Dr Stephen	Research Scientist	CSIRO
Ramsay, Mr Simon	Wool Producer	Wool Council of Australia
Rolfe, Dr Peter	Veterinarian	MLA
Scanlan, Dr Bill	Veterinary Administration	AFFA
Skerman, Dr David	Research Administration	MLA
Turner, Mr Alix	Wool Producer	Wool Council of Australia

TOTAL 38: Chair (1), Facilitator (1), Core participants (19) and Non-core participants (17) (if all attend).