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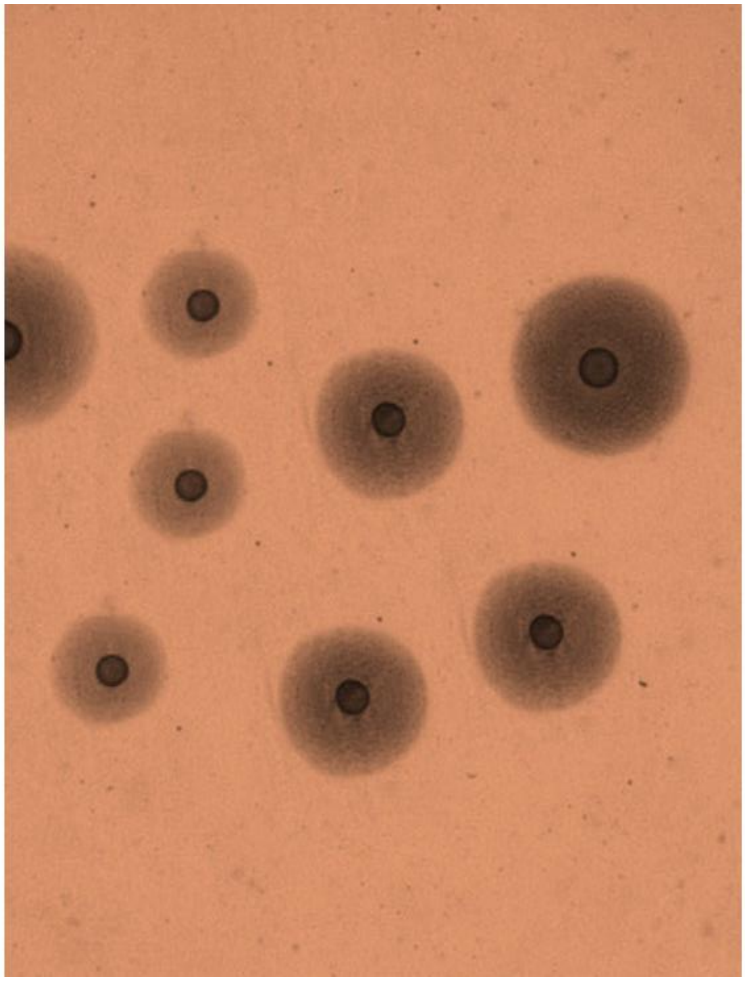
Mycoplasma bovis in New Zealand: A review of case and data management



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Commissioned by DairyNZ

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1 EXECUTIVE SUMMARY

New Zealand's dairy and beef industries are a mainstay of the country's agriculture sector.

On 21 July 2017, *Mycoplasma bovis* was diagnosed on a South Island dairy property. This bacterium had never previously been found in New Zealand. It was subsequently traced to other properties (including beef farms), leading to the announcement of an eradication program in May 2018.

The response has suffered from a number of deficiencies which were brought into the open by the buildup of unaddressed risk events in November 2018 to March 2019. These deficiencies related to structure, staffing, training, management and management tools and manifested as a case backlog of over 1,400 cases dating back (in some cases) about seven months.

The primary cause of the backlog was an accumulation of traces to and from infected properties which had not been followed up. While some program staff had begun to anticipate this as early as November-December 2018, it was not until April 2019 that the full extent of the backlog was realised.

The causes were many, and included:

- A silo-type structure which discouraged communication and collaboration across the response.
- The lack of a common data management platform across the response which lead to valuable data being kept in spreadsheets on individual computers and not shared. This was exacerbated by a lack of data management across the response which made data flow bottlenecks difficult to detect.
- A lack of operational decision-making at field level (due to a lack of veterinary specialists positioned in the field) which lead to a cumbersome, centralised decision-making process that was slow and not well-informed by local knowledge.
- Staff were often hastily recruited and sometimes lacked the skills, qualifications and experience to work efficiently in a disease response. Veterinarians were not adequately involved in steering the response at national and regional levels.
- The lack of a cohesive, well-trained emergency response force within MPI.
- Other factors included the lack of a single, updated contemporary farm database with unsatisfactory traceability compliance; a lack of strong and experienced management; frequent and confusing changes to response instructions and specifications and a lack of a single comprehensive and relatively static disease response manual.

While the backlog may not affect program timelines in the log run, there are concerns that a failure to lock down potentially infected properties may have contributed to disease spread.

No response is without its flaws and drawbacks. It is encouraging to note that when problems came to the attention of MPI that immediate steps were taken to deal with them. Much can also be said about the dedication and loyalty of the staff involved in the response, all of whom were constantly under severe pressure. The current situation need not be seen in a negative light – it in fact provides a good opportunity to take steps that will make New Zealand's biosecurity system stronger and more efficient.

This review makes a total of 32 recommendations aimed at improving structures, systems, decision-making, training, levels of expertise, management and response transparency and communication.

2 THE NEW ZEALAND DAIRY INDUSTRY

Agriculture is New Zealand's largest economic sector, accounting for 12% of GDP and 70% of export earnings. Lamb and dairy are the two largest industries in this sector.

The dairy industry is worth around $13bn annually. Each year the industry produces over 20bn litres of milk from a herd of about 5.25 million cattle on over 12,000 farms. Over 70% of dairy farms are found on North Island (many concentrated in the Waikato region) with the remainder on South Island.

3 *M. BOVIS* IN NEW ZEALAND

On 21 July 2017, samples taken from a South Canterbury dairy herd tested positive for *Mycoplasma bovis*. This bacterium had never previously been found in New Zealand.

Tracing at the time revealed several other infected properties, all linked to the first. Controls undertaken – and still in place – include infected properties being depopulated, then cleaned and disinfected. On 28 May 2018 the decision to proceed with an eradication campaign was announced; this is expected to run over an initial period of two years (for most of the work) but is expected to last a total of ten years as follow-up surveillance occurs.

Evidence of disease has been found on both North and South Islands; in June 2018 there were 42 infected properties and by April 2019 a total of 166 had been confirmed.

All cases thus far are attributed to a single strain.

A joint government-industry compensation scheme is in place, with over 600 claims with $62.5m paid out (as at April 2019).

DairyNZ has been working in partnership with the Ministry of Primary Industries (MPI) and Beef + Lamb NZ regarding the *M. bovis* incursion into New Zealand. The response campaign is jointly funded by government and industry.

4 THIS REVIEW

This review of some aspects of the response has been undertaken at the request of Dairy New Zealand (DairyNZ) with the agreement of MPI. It was occasioned by the realisation that a case backlog had begun to build; it became necessary to examine case management and data flows in order to make improvements to the current management system.

4.1 TERMS OF REFERENCE:

Overarching terms of reference for the review were determined as follows:

To independently review and confirm the below information;

1. The extent of a casing backlog which has developed within the current *Mycoplasma bovis* eradication effort in NZ and root cause analysis.

2. The likely impact of the backlog to the ongoing eradication effort/ comment on the status of eradication progress relative to the backlog.
3. End-end review of the disease management operations/processes and systems and recommendations/improvements to minimise likelihood of repeat of future backlogs/other risks.

4.2 Review Approach

Following discussions with key staff of DairyNZ and MPI, three areas of investigation were decided upon:

1. The Response Structure

The structure of the response with respect to chain of command/reporting lines, internal communication, role descriptions and training required examination. The command structure can either facilitate or impede information flow; optimizing management ensures a clear flow of instructions, feedback and case data.

2. Data flows

Data flows from the field to the control centres; it needs to be efficiently managed; it must be stored on a fit-for-purpose database; it must be quality controlled and properly analysed and used to direct the response. Understanding data flow is critical to ensuring smooth running of the program.

3. Strategies and Plans

In order to give best advice regarding program management, the aims and timelines of the response and the means of achieving them must be understood. A case backlog and any other inefficiencies in the system will affect timelines and may ultimately affect the overall strategy.

Information to inform the review was gathered by:

- A study of available government documents
- Obtaining relevant information/data in digital format from the MPI response team
- A series of face-to-face or telephone interviews with relevant response personnel

During the course of the review, 34 staff were interviewed (from National and Regional Control Centres, MPI, DairyNZ, Beef+Lamb NZ, AsureQuality and contractors). A total of 157 documents (mostly kindly provided by MPI) were consulted.

While the *M. bovis* response is now being termed a 'program,' it was obvious that all staff were still (due to force of circumstances) operating in response mode. The terms 'response' and 'program' are thus used interchangeably in this document.

5 The Response Structure and Related Issues

New Zealand's *Mycoplasma bovis* response is based on a command-and-control structure typical of many responses around the world, whether natural or man-made disasters, or biosecurity incidents.

New Zealand uses the Coordinated Incident Management System (CIMS) which is based on similar systems used in North America (NIMS) and Australia (AIIMS).

Such systems typically place a number of functions – typically Planning, Operations, Logistics and Communications – under the command of an Incident Controller who oversees and co-ordinates the efforts of these functions so that they work together in unison to deliver a specified outcome. In large emergencies, a number of control centres each using the above structure will be distributed regionally, with their work co-ordinated by a central unit.

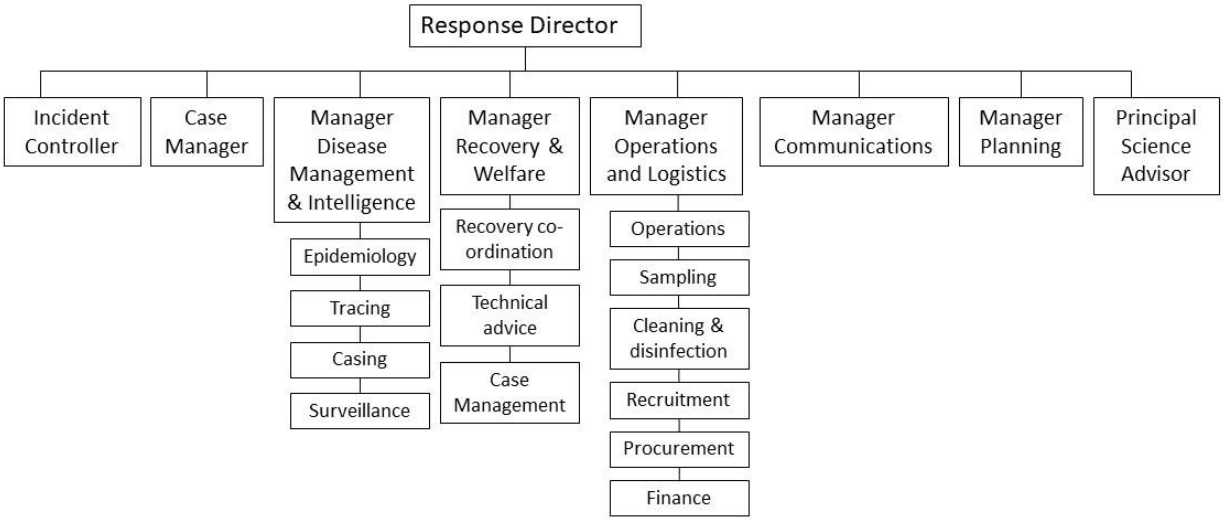

Fig. 1. Simplified structure at the Wellington National Control Centre showing some of the main functions

In the *M. bovis* response, a National Control Centre (NCC) (outline structure in Fig. 1) oversees the work at four Regional Control Centres located at Hamilton, Ashburton, Invercargill, Oamaru and Christchurch.

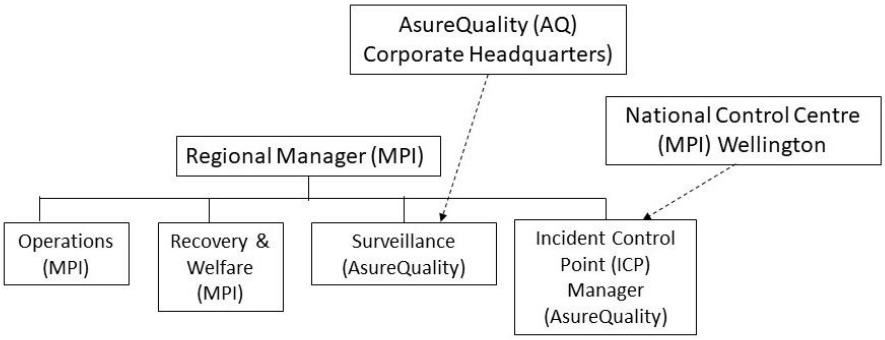

Fig. 2. Simplified structure of typical Regional Control Centre

Regional Control Centres (RCCs) are smaller than NCC with fewer functions; however, there are some reporting lines of note. Surveillance and property management are carried out by AsureQuality (AQ), which is a service provider contracted to MPI. The surveillance teams are tasked by AQ based on instructions supplied by NCC (although they do communicate informally with MPI colleagues with the RCC) and Incident Control Point (ICP) managers – who oversee most on-farm operations – are tasked directly by NCC.

The ICP Manager - an AQ employee - is the face of the program on the ground. All information directed to the farmer should be delivered through the ICP Manager.

Earlier in the response, regional centres were semi-autonomous and most decision-making was within their remit; however, as the response moved on and was transitioned to a program, most decision-making was centralised to NCC.

6 DATA FLOW AND MANAGEMENT

Upon the positive diagnosis of *M. bovis* on any given property, a list of traces to and from the property is generated. Normally these traces are derived from various sources – the National Animal Identification and Tracing system (NAIT), interviews with the farmer, and perusal of various farm purchase records. While as many possible types of trace are recorded (animals, milk, feed, etc.), it is generally movements of live animals and raw milk which constitute the highest risk for disease spread. The properties of origin or destination of these traces are then found and listed for investigation. This list is held with MPI National Control Centre; the properties on this list are discussed by NCC staff (telephonic contact with relevant farmers forms part of this). This process is known as 'casing'. The ICP manager sends a list of traces to the Surveillance Team at NCC who prepare it for discussion at a Notice of Direction (NOD) meeting at NCC (which involves staff from Surveillance, Tracing and Casing).

The NOD meeting decides – based on the information received from the field – on what actions are then to be pursued. This will likely include a NOD applied to the property to restrict movements, and a surveillance plan. It is important that these instructions are relayed to the ICP manager as soon as possible to ensure that potentially infected animals are locked down in good time.

After the casing process therefore, a list of risk events (usually traces) may be considerably whittled down and there will be clarity around initial actions to be taken on high risk farms.

The information legally required to impose a NOD (livestock owner, property address and boundaries) is obtained from one of the available property databases (FarmsOnline, Agribase or NAIT) and passed to the ICP for serving. A field surveillance team from AQ is deployed to draw samples from at-risk cattle (two sets of samples are taken 3 weeks apart). Results usually take five weeks to deliver.

The next steps will depend on the laboratory results and may include the imposition of a Restricted Place (RP) order, culling, cleaning and disinfection. Once the process is completed, an infected property is regarded as resolved. The owner may repopulate it and continue with business.

The flow of data and tasking involves pathways from the field (RCC) to the NCC; within the NCC and then once again between the NCC and the field.

Data relating to the various stages of the process are generally held in one of two places – either on the Animal Response Database (ARDB) originally built by AQ, or on Excel spreadsheets created for the purpose. While ARDB is widely accessible to most players in the response, the spreadsheets are held within each functional group and are not visible to anyone outside of the group. Information flow between and within the control centres is by email; the emails will contain tasks, requests or information files such as spreadsheets or MS Word documents.

Fig. 3. Summarised overview of workflow and casing

The information flows involve a mixture of MPI players and AQ players at regional level and at NCC. Surveillance teams on the ground are tasked by AQ based on instructions received from the RCC while the RCC directly tasks ICP managers – who are AQ employees.

Decisions on what instructions are to be given to ICP managers emanate from MPI officials within the NCC. While there may be informal contact within the RCC between local MPI and AQ staff, the AQ surveillance teams and ICP managers do not take instructions from local MPI staff.

7 STRATEGIC PLANS AND OVERSIGHT

The 'Biosecurity Response National Response Plan - Phased Eradication of *Mycoplasma bovis'* of July 2018 is the high-level guiding document for the current response. Its major objectives (summarised) are:

1. Eradicate *M. bovis* from New Zealand
2. Reduce the social, economic, environmental and farm impacts of *M. bovis*
3. Provide farmers and associated industries with tools, options, knowledge and motivation they need to protect their farms from *M. bovis* and to continue their farming business to the extent possible while subject to control measures.
4. Support directly affected farmers to re-establish viable and resilient farming businesses.

The goals stated in this document are:

• *M. bovis* is eradicated from New Zealand requiring no further response and any residual impacts are managed.

• The impacts on farmers, communities and wider NZ were mitigated to the extent possible.

• All stakeholders understood and were engaged in the response.

• All partners maintain confidence in their return on investment.

• The cattle sector proactively manages the biosecurity risks and is more resilient to future incursions.

• Confidence in New Zealand's biosecurity system is improved.

The progress of program implementation is overseen by the *Mycoplasma bovis* Governance Board, which is composed of senior officials from MPI, Beef+Lamb NZ, and DairyNZ, and has an independent chair.

In addition, the process receives its scientific advice from a Technical Advisory Group (TAG).

Within MPI, the program is managed by the *M. bovis* Program Director.

The strategy to achieve eradication is a national approach with a focus on tracing of movements from affected properties to new farms, and identification of additional infected properties through a National Surveillance Program. Disease spread is managed by movement controls on at-risk and infected properties. Movement controls stay in place until testing shows the herd is not infected, or infected properties are depopulated then cleaned and disinfected.

The success of this strategy therefore depends on (a) rapid and reliable tracing, (b) accurate pinpointing of infected herds and (c) a rapid lock-down of infected herds to prevent onward spread.

In a joint media release in May 2018, the New Zealand Prime Minister and Minister for Agriculture committed to the eradication program. It would take place over ten years, with most eradication activities expected to be complete within two years – i.e. by mid-2020.

8 THE PROCESSING BACKLOG: PROXIMAL CAUSES AND CONTRIBUTING FACTORS

There is no single identifiable cause for the backlog that was discovered in early 2019. It was a result of a confluence of events and circumstances. The proximal cause was a spike in workload; but there were a number of other process settings that made it almost inevitable.

The discussion that follows attempts to disentangle all of the factors that led to the development of the backlog.

The situation arose from what was characterised as a 'casing backlog.' It was not, in fact due to a lack of casing activity, but arose from a lack of information flow relating to risk events being fed into the casing stage of the process. This resulted in a backlog of unprocessed cases which resulted in an associated

temporary ‘drying up’ of actions being fed back into the field (the usual outcome from the casing process). It took some time for this backlog to be fully identified and revealed, by which time the number of unprocessed cases had grown into a considerable backlog.

The backlog can be ascribed to a number of factors – increased detection of risk events and increasing workload, exacerbated by management deficiencies and a lack of management tools. There were thus a number of proximal causes as well as a number of underlying or contributory causes.

8.1 PROXIMAL CAUSES

Prior to Christmas 2018, it became obvious to a number of field staff that more infected properties were being detected and that this would generate an increasing number of traces for follow-up. Apart from the ramping-up of detections due to normal operations, two other factors came into play. The first was the detection of properties by an *ad-hoc* bulk milk survey, and the second was follow-up work due to a detection of *M. bovis* in samples sent to an overseas diagnostic facility. A number of response personnel interviewed said that they fully expected the start of the New Year to be very busy.

Further complicating the situation was the fact staff numbers were decreasing due to expiring contracts, meaning less people were available to keep ongoing processing of cases at a high level. Recruitment to fill these vacancies began only two to three months later. In addition, little work was undertaken over the Christmas-New Year break, adding to the number of unprocessed cases. By early 2019 it was becoming increasingly obvious to staff that farms which had been identified months earlier as potential sources of risk remained un-investigated and unrestricted. There was a noticeable blockage to normal data flow processes, which meant that referrals of trace information for follow-up and action were not occurring. These concerns were reported from the field to NCC management.

It is estimated that most identified positive properties may generate up to 100–150 traces each. The spread of traces ranged from 1–145 per property in the lead-up to the backlog. Although the ‘spike’ in traces had been anticipated by many before Christmas, the true volume of work needing to be undertaken was only fully appreciated months later.

8.2 CONTRIBUTING FACTORS

There are a multitude of factors within the systems and processes of the response that contributed to the problems detected in March-April 2019. In fact, it is probably true to say that had most or all of these factors not been present, the tracing ‘spike’ would have been dealt with a lot earlier and much of the attendant disarray avoided.

8.2.1 Command and Control

The incident management system (CIM) is well-suited to short responses of only a few weeks or months. It is also well suited to simple responses where there is an uncomplicated task to perform (e.g. stamp out a bushfire, disseminate and retrieve insect traps in a fruit fly response, etc.) where simple and straightforward orders are passed down the line and feedback is relatively uncomplicated. However, in protracted and highly complex technical responses where a good deal of scientific knowledge is needed throughout the command structure and where transparent dissemination of information across the structure is essential, a military-type arrangement eventually ceases to be efficient.

The incident management system, over an extended period of time with the *M. bovis* response, led to the establishment of silos which became inflexible, solidified and difficult to cut across. Interviewing numerous responders showed that a turf protection mentality developed which to some degree hindered the free exchange of information, inhibited collaboration, and slowed processes.

8.2.2 The Lack of a Common Operating Picture

The lack of a shared data input and processing platform – critical for any emergency – was a pivotal factor. It was probably the single most important underlying cause of the unmanaged buildup of unprocessed properties. No individual manager had access to all that was happening across the various functional areas of the response and therefore no work backlogs were apparent to management.

Data were accumulated on numerous Excel spreadsheets held by individuals across the response with no possibility of generating a common operating picture for all managers (both centrally and regionally) to see and interpret. Due to an overwhelming workload, some of the spreadsheets were often temporarily 'overlooked', updating was haphazard, there was no version control, and crucially no sharing of these data between functions.

The Animal Response Database (ARDB) was to some extent in common usage and has some good functionality, but its abilities are limited, it is not intuitive and user-friendly and its reporting is limited in scope and usability. Due to the fact that its outputs are usually files of comma separated variables, it often served to support the spreadsheet culture that permeated the response.

None of the software packages in use were spatially enabled, so direct and interactive visualisation of, for example, geographic distribution of infected properties, livestock density, etc. was not possible. It was not possible to create a real-time view of current events in maps and tables for display in control centres as a common operating picture for use by managers. Managers were to an extent operating in the dark, with their vision of the response limited largely to their own silos of work.

This ultimately led to a situation where a suspicion of a processing backlog (emanating from field staff concerns) only slowly translated into an awareness of it at NCC level. Field staff realised by the end of 2018 that a backlog was beginning to build and that many properties of interest identified through traces were not being followed up. This intelligence was passed on to some NCC staff/management during February and March 2019, but serious questions were not raised until the beginning of April (by industry and MPI response staff). It was only by mid-April that the true extent of the backlog emerged, and even then, it seems that this was not necessarily fully understood by senior managers. Some staff recounted that it took some three weeks to piece together all of the available data to gain a comprehensive picture of the backlog situation.

8.2.3 Data management

There was no comprehensive data management process in operation, which exacerbated the situation caused by the lack of a common data management tool. Numerous interviewees noted that there was no data quality control strategy in place and no single person with oversight of all data flows and data repositories.

8.2.4 The National Animal Identification and Tracing system (NAIT)

New Zealand's national traceability system is well-designed and fit for purpose. However, issues relating to compliance and enforcement led to the discovery that many cattle movements on and off infected

properties were not recorded in the NAIT system. Many traces had to be generated manually, relying often on farmer and stock agent records, and on farmer memory. This was extremely labour-intensive, inaccurate and led to delays in following up individual properties and serving of legal notices.

8.2.5 Single farm database

There appear to be a number of databases where farmers are able to register their farm details for traceability purposes – FarmsOnline, Agribase and the NAIT database were all named by interviewees. The main problem here was the confusion in the farming community as to which database they should be using; added to that the fact that is no communication between these databases and no process in place for regular and obligatory updates of farm information. When a property was implicated in a trace, MPI staff had to search all of the databases to gain information on the property, and when they did find information, it was often years out of date. This led to more delays in processing properties through the response with further errors with decision-making, and the serving of legal notices.

8.2.6 Centralised decision-making

As there were few veterinarians on the ground, all decision-making regarding the fate of individual properties was shifted to veterinarians based within the national control centre with an insufficient understanding of the field situation.

This caused delays in processing of information with slow and muddled decision-making. At the start of the response, most important property-related decisions were made within regional centres. Some evidence was presented to this review of decisions that appeared to lack technical rigour. However, when this decision-making was centralised and concentrated in the hands of managers with no local knowledge, further examples were given of poor and greatly delayed decisions. A particular point of frustration were the meetings held in NCC Wellington where decisions regarding property status or property-based work were often delayed for weeks. Essentially the managers involved in these meetings were having to work blind while under extreme pressure – a situation which understandably led to further delays.

As a result of this muddled decision-making, cases were often handed over to AQ field teams (with NCC tasking ICP managers directly) with inadequate or even misleading background information. Notices were sometimes served on the wrong properties, or farmers would be subject to NODs without being able to obtain a good understanding of what had led to the NOD being imposed. Regional staff pointed out that not only did the process lack transparency, but it also damaged the reputation of MPI and the response as a whole.

Instances were also noted where field staff sent data to NCC to correct their erroneous information with NCC staff apparently not undertaking corrections and continuing to repeat the same errors.

8.2.7 Lack of Veterinarians

Critically, there was an absence of veterinarians at the highest levels of management in Wellington and an almost total absence of veterinarians at field level. The lack of veterinarians in what is essentially a veterinary response had a profound effect on the smooth running of the program. As noted above, veterinary decisions that should have been made by experienced veterinarians with local knowledge were “pushed up” to veterinarians in the NCC who lacked a direct say in the overall management of the program and its direction. They became embroiled in time-consuming operational processes while

simultaneously experiencing frustration at having no authoritative voice at the highest-level management to inform decision making.

Officers running the farm-based operations at regional centres sometimes found themselves unable to explain the program to farmers or to interpret and explain laboratory results to affected farmers due to their lack of veterinary knowledge. This resulted in frustration for field staff who were increasingly having to refer queries to the small number of NCC veterinarians and then having to wait for feedback.

Centrally-based staff often found themselves having to go onto farms to meet with disillusioned farmers to explain technical aspects of the program to them. This would have been far better handled by locally-based, experienced MPI-employed veterinarians and placed central staff under further pressure.

8.2.8 Staff training and experience

Most of the persons interviewed during the course of this review reported receiving inadequate or hastily-organised training. Many had little experience of emergency management and had no appropriate training. None had been involved in any prior simulation exercise.

Biosecurity responses are best serviced by teams of highly trained individuals who have trained and exercised together and are able to act effectively in concert. Such capability must be built up strongly and assiduously nurtured during 'peacetime' so that they can be rapidly stood up as soon as a response is initiated. It should be possible to set up, and move an initial pre-identified contingent of responders into, a control centre within a day – ideally within a few hours. This appeared problematic in the *M. bovis* response.

There appears to be no organised program to actively train government and other staff in emergency management. AsureQuality (AQ) did have a small corps of pre-trained staff to call upon, but as the response grew, they were not able to keep up with a supply of trained staff for field work. It became necessary to opt for an *ad-hoc* system of 'just in time' training to try to meet demand.

Within MPI, recruited staff were often lacking in appropriate training and experience prior to recruitment, and usually went through a standard induction to government when they started work, but received insufficient guidance thereafter. Several interviewees noted a lack of management, guidance and leadership.

Job descriptions were often vague; persons applying for jobs in the response often did not fully understand what they were being asked to do, and there were no clear 'role cards' to fully describe the content of their jobs.

In one instance that was investigated, the reviewer found a large disparity between the position description requirements in terms of qualifications and experience and the real training and abilities of the person actually appointed to a key position. This resulted in a 'square peg in a round hole' situation where the appointee was underqualified and underexperienced for the job. Interviewees testified that this state of affairs had been repeated for various positions across the response.

The review was presented with clear evidence that MPI has a high-quality recruiting process (MPI Capability Framework) in place where job candidates are subject to competence-based interviews which probe their experience and capabilities; however, it also became clear that the process was not always

followed. The outcomes of an interview panel are seen as paramount and no checks and balances are in place to ensure that the correct process was indeed followed in every case.

8.2.9 Level of staffing

In addition to a paucity of training, some interviewees pointed to an overall lack of personnel numbers to run the response well. Many told of working 11-12-hour days, and of working through weekends with no reasonable break. The general consensus was that the workload was overwhelming, many staff were constantly fatigued, and some had left the response for fear of burning out. One interviewee recounted getting into bed from work at 1.30 a.m. on the day that she was interviewed.

Quite apart from staff welfare implications, the apparent understaffing of the response will have repercussions for the speed at which scheduled work is handled, as well as the quality of the work done.

8.2.10 No single 'Point of Truth'

There was a strong feeling amongst response staff interviewed that information available in the control centres regarding the response was insufficient, inconsistent and frequently changing. Rather than there being a single comprehensive document containing all relevant information about *M. bovis* and detailed rules, guidelines and operating instructions for dealing with it, they were faced with a plethora of documents, some of which were constantly being amended. Some important documents were at one point changed on a weekly basis; staff found it extremely difficult to keep up to date with the latest versions of the operational instructions that they were meant to implement.

As a result of having a number of disparate but related documents to work from, some of which were subject to frequent alteration, other problems arose with consistency across these documents; technical terms often had different meanings in different documents; each set of instructions had its own glossary of terms which often did not match up with similar glossaries in other related documents.

Staff recounted being confused and often having to seek clarity from senior NCC personnel – which added to delays in program execution.

8.2.11 Producer involvement

Regional staff reported that there was no farmer involvement in the response. Farmer involvement at operational level (e.g. attending key regional response meetings) is essential for supplying local knowledge, a conduit into the farming community, adds transparency to a response and gives the affected community a stake in the process.

8.2.12 Effective technical communication

A shortcoming identified by the review was the lack of single scientifically qualified spokesperson for the program. Media and individual farmers would be contacting individuals within the response hierarchy to gain information, with all of the attendant risks of inconsistent messaging, science being incorrectly interpreted, confusion amongst response staff and farmers, and the accompanying danger of reputational damage.

9 THE PROCESSING BACKLOG

The data processing backlog occurred as a result of data remaining in silos and not being placed in the queue for immediate action.

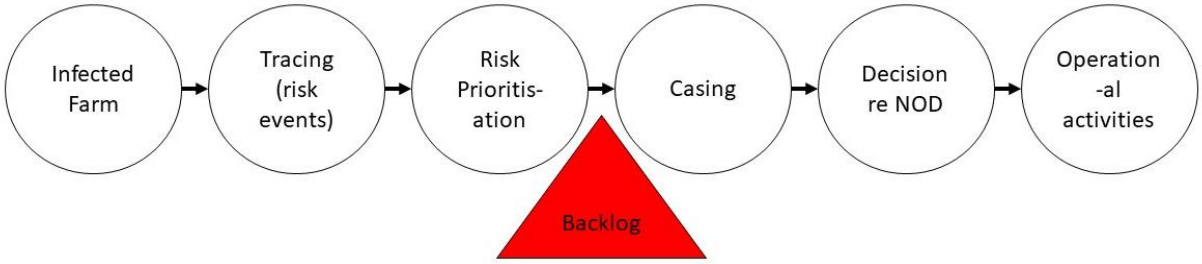

Fig. 4. Data bottleneck in NCC workflow

As shown in the above flow diagram, there was a lack of data feed-in to the casing team who were unable to pass information on individual properties downstream to other work processes.

An examination of the data shows that some 46 properties generated a backlog of 1,481 unprocessed traces; some of these dated back as far as October 2018. (There were a few that dated back nearly a year, but these traces were actually 'new' information on 'old' cases and were able to be ignored as having little relevance).

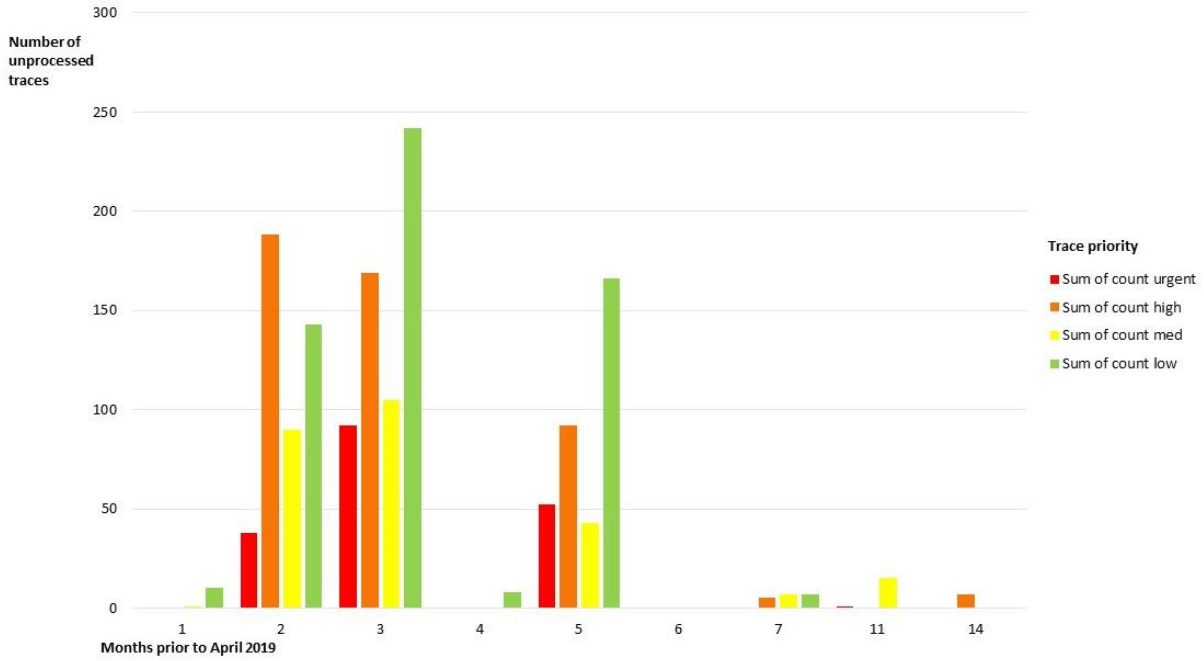

Fig. 5. Graph showing timeline (months) of backlog accumulation

The traces are prioritised (according to the risk attached to the trace based on the item that moved from one property to another) as 'urgent,' 'high,' 'medium' and 'low.' When presented in tabular form, it is easier to appreciate the workload that would be created by the trace processing backlog.

	Urgent	High	Medium	Low	Grand Total
Beef	41	343	120	464	
Dairy	142	77	125	63	
Dry	0	41	16	49	
Totals	183	461	261	576	**1481**

Table 1. Categorisation and count of unprocessed traces

Given that the events with the highest estimated risk are in the 'urgent' and 'high' categories, it follows that a total of 644 traces will need immediate attention. It was estimated that a team of four was able to work through about ten traces in a week – i.e. one person could handle 2.5 cases per week. For the 644 traces, a total of nearly 260 person weeks would be needed. It would take 20 people three months to attend to the most pressing cases.

The other traces would still require to be dealt with in order of priority, but feedback from staff is that these lower priority traces are unlikely to lead to many positive detections, if at all. It is also clear from looking at the figures that majority of the 'urgent' and 'high' priority traces are from the beef sector (384 out of 644) and that, given the lack of mobility of beef cattle as opposed to dairy, a low number of positive properties might be identified. (Were these traces related to dairy cattle, response staff feel that a large number of positive cases would be found, with serious implications downstream in the workflow).

10 Impacts and Ramifications

While key staff interviewed were keen to point out that the ultimate timelines estimated for the program may not be severely affected, but major impacts would be seen as follows:

10.1 Resourcing

Immediate backlog resolution will be staff-intensive. Resolving outstanding risk events is estimated to require over 260 person-weeks. This will require additional personnel input for a period of time. As noted, it would likely take a dedicated team of twenty about three months to resolve the risk events and initiate any necessary on-farm work. Given that it is believed that most eradication efforts should be complete by mid-2020, the backlog *per se* is unlikely to have a substantial and direct effect on this timeline provided that adequate resourcing is supplied.

10.2 Spread of Infection

Some risk events have not been cased for several months – so potentially a number of infected properties have been unattended and possibly spreading infection for an extended time period while awaiting casing. This will already have resulted in further spread and this risk will continue for as long as the cases remain unprocessed. The relative unreliability of the current diagnostic test used already carries with it the risk that a number of infected herds remain undetected; the backlog may push this figure higher. Mitigating this risk is the fact most of the properties involved are beef enterprises which are not likely to spread as much infection as dairy farms.

10.3 Downstream Workflow Effects

There will be downstream consequences as a glut of cases is released into the system; on-farm teams will be faced with a higher workload and some farms could be under restriction for extended periods as they await resolution – with farmer frustration, welfare and increased feed costs attendant.

11 MPI Action to Date

It must be pointed out that while a number of deficiencies have been identified in the response process, MPI did take decisive action to address those of which it became aware.

Among the steps taken were:

- Strengthening of regulations around NAIT to ensure higher levels of compliance and enable more comprehensive and rapid tracing.
- Beginning the development of a shared data platform (known as 'Tiaki') to enable the creation of a Common Operating Picture.
- Commitment of extra resources to the casing process.
- Planning for devolution of essential decision-making to regional control centres.
- Initiation of an external review to examine structure and process issues in more depth and recommend further changes.
- Structural changes to give epidemiological experts a greater role in steering the response.

These steps are noteworthy and the role of the Director-General and Chief Scientific Advisor in initiating them is acknowledged.

12 Findings and Recommendations

The response has suffered from a number of deficiencies which were brought into the open by the buildup of unaddressed risk events in November 2018 to March 2019. These deficiencies related to structure, staffing, training, management and management tools.

There is no doubt that the experience was unpleasant for all involved. However, it is true that no system is ever without its flaws, and it is to New Zealand's advantage that these flaws were uncovered during a response to a relatively mild disease rather than during a response to a crippling condition such as foot-and-mouth disease. It is in this light that recent events need to be seen; a unique opportunity has arisen to address some admittedly significant issues, but this will be of inestimable value in the longer term.

On the positive side of the ledger, the following are acknowledged:

- All of those interviewed during the review process were persons of high calibre. Some of them were stressed and fatigued, but all of them were determined to do a good job.
- The speed with which MPI moved to address problems once they were identified is to be appreciated.

- Current circumstances provide a milieu that is ripe for change; they provide an opportunity to rebuild New Zealand's animal health system to meet any future challenge. For example:
    - NAIT is a relatively young traceability system. Such systems take time to evolve and stabilise. Strengthening compliance and enforcement is wise, but there are further steps to be taken. New Zealand has a number of property databases, most of them poorly maintained and out of date – it is desirable that redundant systems be scrapped in favour of a single national database. It would also be advantageous to build NAIT on blockchain technology to improve its robustness and transparency. Traceability forms the central pillar of any response – it needs to be fast, reliable and also clearly linked not only to farms, but also to on-farm practices.
    - The response structure without doubt needs an overhaul with a far stronger veterinary presence, a streamlined HQ component and better regional bases with better resources and greater autonomy. However, this is not just for now, but needs to be so for the future. The opportunity has presented itself for New Zealand to put in place a stronger animal health system overall with a stronger regional presence and a closer interface with the farming community. Doing this will future proof the livestock sector against further biosecurity challenges.
    - A new common data management platform (Tiaki) is under development which will mean a good deal to the present response. A shared data input and processing platform is a critical baseline requirement for any emergency. It is, however, also an opportunity to think more widely and build a flexible and versatile system that will serve across the full variety of possible biosecurity responses. It is essential that the opportunity be grasped now to compare the emergent Tiaki with the more mature MAX system developed in Victoria, Australia. MAX has been designed for flexibility and has successfully been used in Exercise Diva (FMDv), anthrax, avian influenza, Pacific oyster mortality syndrome, Myrtle Rust, Chestnut blight, fruit fly incursions, and bushfires (where livestock have been involved). It may well be that some concepts used in MAX could profitably be transferred into Tiaki.
    - A new awareness in New Zealand's farming community with respect to on-farm biosecurity (including traceability) needs to be seized upon to build a national farm biosecurity system aimed at impeding pathogen transfer between properties and thus able to slow or prevent the spread, not only of *M. bovis*, but of other pathogens such as FMDv.

The eyes of trading partners are on New Zealand. The response will not be judged by whether or not *M. bovis* is truly eradicated, but by its efficiency and transparency. This is a unique opportunity for MPI to prove its mettle in the area of animal health.

12.1 Detailed Recommendations

12.1.1 Recommendations regarding Structure

1. It is recommended that the National Control Centre be downsized with a shift of resources and decision-making to Regional Control Centres (see Appendix 1 for the suggested structure).
2. It is recommended that the National Control Centre's functions be determined as co-ordination of and support to regional centres, the setting of standards and norms, strategic analysis, and support for decision-making when specific cases are referred by Regional Centres.

3. It is recommended that Regional Control Centre functions be determined as identification of infected premises, tracing, casing, imposition of legal restrictions, liaison with farmers, property decontamination, assistance with resumption of 'business as usual' for affected farmers, and provision of advice to NCC.
4. It is recommended that the direction of the response be guided by a management team with the high-level presence of experienced veterinary epidemiologists and livestock sector specialists in NCC and a Chief Operating Officer (COO).
5. It is recommended that a full review of program structure be undertaken on an annual basis to ensure that deployment of resources, allocation of functions and reporting lines evolve in tandem with progressive management of disease.

12.1.2 Recommendations regarding Data Management

1. It is recommended that development and implementation of the new Tiaki common platform proceed as soon as possible in order to ensure transparency and improved communication and collaboration across the program.
2. It is recommended that other similar emergency management software (such as MAX in Victoria, Australia) be compared with Tiaki in order to ascertain whether the addition of new functions/capabilities in Tiaki should be considered.
3. It is recommended that all response staff be thoroughly trained in the use of Tiaki from the outset in a programmed manner.
4. It is recommended that in the interim, all Excel spreadsheets in use be consolidated and placed on a widely accessible SharePoint site to ensure visibility to all.
5. It is recommended that the use of individual spreadsheets for holding data and response management be strongly discouraged.
6. It is recommended that a dedicated Data Manager be appointed to the program to design and implement procedures to manage data quality and data flow across the system.

12.1.3 Recommendations re Traceability and NAIT

1. It is recommended that awareness creation of traceability in the farming community continue in concert with compliance and enforcement actions.
2. It is recommended that a single property database be identified for use nationally and that other databases be discontinued.
3. It is recommended that regular updating (annually or biannually) of all property data in the national database be mandated.
4. It is recommended that the possibility of incorporating elements of 'Blockchain' technology in NAIT (to improve robustness and transparency) be investigated.

12.1.4 Recommendations re Technical Decision-making

1. It is recommended that MPI-employed[1] and suitably experienced veterinarians be placed in all Regional Control Centres to guide, and assist with the implementation of, all property-based disease management.
2. It is recommended that the position and authority of veterinary epidemiological expertise in the National Control Centre be elevated by placing suitably qualified and experienced individuals in key senior positions including the Incident Management Team.

12.1.5 Recommendations regarding Staffing Levels, Staff Training and Appointments

1. It is recommended that MPI consult with program managers after the proposed restructure has occurred to determine staffing levels required to efficiently run the program.

[1] Contracting private practice veterinarians is not recommended due to potential conflicts of interest occurring when they have to impose regulatory controls on their own clients.

2. It is recommended that all staff in the program be appropriately trained and experienced for the jobs to which they are appointed. This will comprise a combination of ensuring pre-employment qualifications and experience meet the required position description and high-quality on-the-job training and mentoring.
3. It is recommended that staff appointments be conducted in strict compliance with MPI's Capability Framework and that adherence to this framework is monitored.
4. It is recommended that emergency training for MPI staff be developed, standardised and that all such training courses and material are subject to accreditation standards. Training must be developed for all functions within a typical control centre (for a list of available resources, see Appendix 2).
5. It is recommended that all MPI personnel receiving emergency management training participate in mandatory simulation exercises annually. These exercises should centre on biosecurity emergencies and may be desktop exercises, field exercises or full functional exercises. As is customary, OIE should be notified of all exercises.
6. It is recommended that MPI be accepted as the lead agency in biosecurity emergencies and that all MPI staff be encouraged to participate in emergency responses and emergency management training whenever possible. This will create a 'battle ready' cadre of staff to act as first responders.
7. It is recommended that external efficiency audits be conducted regularly on all responses and be incorporated into work plans as a routine activity.

12.1.6 Recommendations regarding Response Information

1. It is recommended that a single comprehensive document or manual be created to detail control centre structure and management for animal biosecurity responses. This will include the various response functions, reporting lines, position descriptions and role cards completely describing the duties attached to each position in the response program.
2. It is recommended that a single comprehensive manual be created to cover all details of the *M. bovis* response, including an authoritative and balanced description of the disease, the response strategy and epidemiological principles and operational details pertinent to every aspect of the response. This document will serve as a single point of truth for the response and replace all current response documents. In order to avoid confusion, it will be updated infrequently.

12.1.7 Recommendations regarding the role of the Farmer in the Response

1. It is recommended that a local farmer be drawn into every Regional Control Centre as a direct and knowledgeable liaison with the local farming community.
2. It is recommended that such a farmer liaison attend incident management team meetings, control centre briefings and assist response partners with direct communication with farmers where necessary.
3. It is recommended that a number of suitable farmers be identified in each region for this role and that they be rotated through control centres on a weekly or fortnightly basis.

12.1.8 Recommendations regarding External Communications

1. It is recommended that a single senior scientist be identified as the spokesperson for the program to ensure that the program has one authoritative and trusted 'voice' and that all external enquiries re the program be directed to this person.
2. It is recommended that at Regional Control Centre level, technical communication to both farmer groups and individual farmers be entrusted to the Centre's veterinarian.

12.1.9 Recommendation regarding the future

The *M. bovis* response will inevitably evolve over time to maintain its efficiency and credibility as both internal and external circumstances change. Therefore:

1. It is recommended that the program be re-designed as a farmer-empowered, farm-based (but government-supported) program. It would be advantageous to begin planning for a new-look program as soon as possible involving industry/farming partners with a view to implementation once initial eradication activities are complete.

13 ACKNOWLEDGEMENTS

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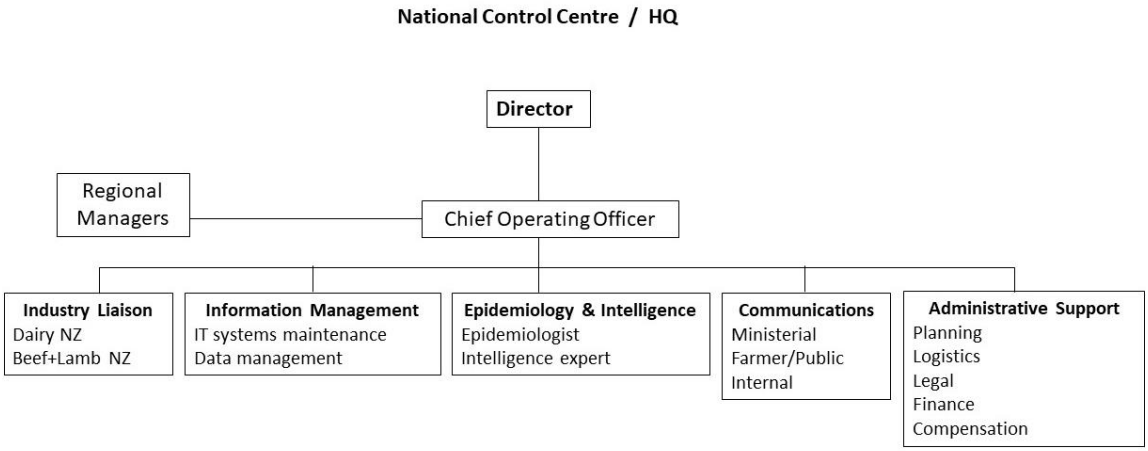
Roger Paskin
Mount Barker, SA
May, 2019

14 APPENDIX 1 – PROPOSED *M. BOVIS* PROGRAM STRUCTURE

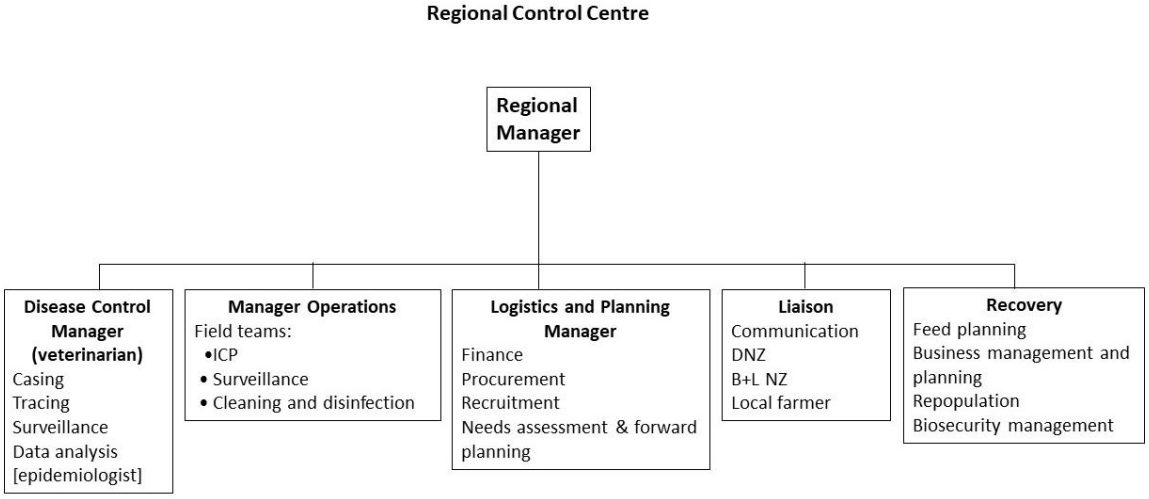
Headquarters/ NCC Wellington



Overall NCC functions: co-ordination of and support to regional centres, standards and norms, strategic analysis, decision-making (when necessary)

Position	Functions/Comments
Director	Overall management; reporting to the response Governance Board, MPI Executives and Minister
Chief Operating Officer	Reports to and supports Director; oversight of all response functions, support to all functions
Industry liaison	Provides industry oversight; manages all industry functions within the response, membership of IMT
Information management	Management of IT systems, software rollout, IT advice, data management
Epidemiology and Intelligence	Epidemiologist – veterinarian/s with epidemiology qualification and proven experience of operational management of diseases. Ongoing epidemiology analysis, technical steering of response, membership of IMT Intelligence – monitoring of information flows, integration of non-epidemiological information into decision making. An intelligence specialist with experience of holistic decision making
Communications	Management of information and crafting of messages to Minister, farmers/public and internally to response personnel. One or more communications experts with experience in multimedia communications and business support
Administrative support	Qualified individuals to oversee and perform the following functions: planning, logistics, legal, human resources, finance, contract management, compensation

Regional Control Centres – Hamilton, Ashburton, Invercargill, Oamaru and Christchurch



Overall Regional Centre Functions: Identification of infected premises, tracing, casing, imposition of legal restrictions, liaison with farmers, property decontamination, assistance with resumption of 'business as usual' for affected farmers, advice to NCC

Position	Functions/Comments
Regional Manager	Reports to Chief Operating Officer in NCC. Person with agriculture background and experience in managing emergencies/farm programs
Disease Control Manager	Must be a veterinarian with several years' experience in the livestock sector/running farm programs. Responsible for most of the decision-making in respect of disease surveillance, response and individual farm management, including risk event prioritisation, imposition of legal restrictions, technical advice to farmers and ICP managers. Drives the activities of the Operations Manager
Manager Operations	Person experienced in overseeing field operations in the agriculture sector; will have a good understanding of farming systems and will provide management oversight to all on-farm activities. Will receive technical inputs from Disease Control Manager and is responsible for tasking ICP management.
Logistics & Planning Manager	Will manage staff tasked with needs assessment, forward planning, recruitment, procurement, financial administration. Experienced in logistics and operational planning
Liaison	This function includes oversight of local communications, includes interaction with embedded DNZ and B+L NZ staff functions, and works closely with local farmers rotating through the response.
Recovery	A farming systems or extension expert with experience in management and interpersonal relations to oversee such activities as farm, feed and business planning, dealing with repopulation, planning and implementing farm biosecurity plans.

15 APPENDIX 2 – EMERGENCY MANAGEMENT TRAINING RESOURCES

Examples of Emergency Response Manuals and Related Documents

https://animalhealthaustralia.com.au/our-publications/ausvetplan-manuals-and-documents/

http://

Accredited Emergency Management Training (Australia)

https://animalhealthaustralia.com.au/emergency-animal-disease-training-program/

https://animalhealthaustralia.com.au/berta/

Master's Degree in Emergency Animal Disease Management (Melbourne University)

- For Control Centre Epidemiologists and Response Leaders

https://study.unimelb.edu.au/find/courses/graduate/master-of-veterinary-public-health/

16 APPENDIX 5 – GLOSSARY OF TERMS

Term/Acronym	Meaning
Agribase	A database where farmers register details of their farming enterprise/s
AIIMS	Australian Interagency Incident Management System
AsureQuality (AQ)	AsureQuality is a State-owned company contracted by MPI to carry out various biosecurity-related activities in agriculture and food safety
Beef+LambNZ	Beef and Lamb New Zealand - levy-funded industry management body for the sheep and beef sectors
Casing	The process of following up a property of interest identified through tracing
CIMS	Co-ordinated Incident Management System
DairyNZ	Dairy New Zealand - levy-funded industry management body for the dairy sector
FarmsOnline	A database where farmers register details of their farming enterprise/s
FMD	Foot-and-mouth disease
FMDv	Foot-and-mouth disease virus
GDP	Gross Domestic Product - an aggregated measure of the total value of national economic output
ICP	Incident Control Point
IMT	Incident Management Team - the senior managers of a control centre
IT	Information technology
MPI	Ministry of Primary Industries. The New Zealand government agency overseeing agriculture and biosecurity
NAIT	National Animal Identification and Tracing System
NCC	National Control Centre - *M. bovis* response headquarters located in Wellington
NIMS	National Incident Management System (USA)
NOD	Notice of Direction - a legal order directing a farmer to confine animals, present them for inspection or sampling, schedule them for culling etc
OIE	World Organisation for Animal Health (Office International des Epizooties)
RCC	Regional Control Centre - responsible for farm-level *M. bovis* management - there are five RCCs
RP	Restricted Place (a legal term for a property identified as infected with disease; it is subject to quarantine)
TAG	Technical Advisory Group
Tracing	The identification of the origin and destination of an animal or item whose movement may have transmitted infection