Report Cover Page

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AQIS Import Clearance Risk Framework
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Summary
This project outlines the implementation of tools for import inspection that were developed in ACERA project 0804. It scopes their application to high-volume, low-value items, universal loading devices and the external container inspection regime. The project delivers spreadsheet tools for routine application of the methods in operational environments and demonstrates how their use may lead to a movement away from blanket specifications to risk-weighted (risk-return) decision making in the allocation of resources to inspections.

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AQIS Import Clearance Risk Framework
0804a Final Report

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Disclaimer

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Executive summary

This report delivers follow-up material from the report Robinson et al. (2008), which provides background and contextual material for the analyses detailed herein.

1.1 Outcomes

The specific outcomes are:

1. Spreadsheet products that guide appropriate quarantine activity along with advice on operationalization for high-volume low-value (HVLV) imported goods (Deliverable 1, Chapter 3)
2. Spreadsheet products that guide appropriate quarantine activity along with advice on operationalization for external examination of universal loading devices (ULDs) (Deliverable 1, Chapter 4)
3. Spreadsheet products that guide appropriate quarantine activity along with advice on operationalization for the External Container Inspection Regime (ECIR) (Deliverable 2, Chapter 5)
4. A recommended design for an implementation trial of the risk management system and recommended activity levels developed in Deliverables 1 and 2 (Deliverable 3, Chapter 6)
5. An assessment of the data needs for a test of validity of current Self-Assessed Clearance (SAC) profiles. Briefly, the ICE methodology should be deployed upon SAC profiles. (Deliverable 4, Chapter 7)
6. Recommended structure for an internal AQIS Risk Team. (Deliverable 5, Chapter 8)
7. Recommendations for Further Work (Chapter 9):
   (a) AQIS should consider workshops to develop the necessary infrastructure and cooperation to implement the recommendations of Deliverables 1 and 2.
   (b) AQIS should consider further research projects including
      i. the resolution of multi-dimensional risk, such as is faced by Seaports,
      ii. how to measure effectiveness in a risk-based monitoring program,
      iii. how to best identify risky pathways from large and complex data sources (such as AIMS),
   (c) Develop and deploy approaches to estimating quarantine profile effectiveness from ICS,
   (d) Initiate information-sharing with organizations such as ACS, AUSTRAC, and Border Protection Command.

The risk tool developed distinguishes between different monitoring scenarios put forward by the program, but the program needs to consider the use of the tool and its output in the context of effectiveness, verification (of processes), validation (of systems), and reporting. AQIS acknowledges the need to consider biological consequences with regards to setting the risk tolerance.

1.2 Relevance to Beale review

The Beale report was released after this study had been commissioned (Beale et al., 2008). Among the many recommendations made by the Beale report, this study and its predecessor (Robinson et al., 2008) directly target five:

44 The balance and level of biosecurity resources across the continuum should be determined by a consistent analysis of risks and returns across programs. The level and allocation of resources should be comprehensively reviewed against risk-return profiles at least every five years.

- This report and its predecessor propose a risk-sensitive monitoring program that can be deployed for allocating resources (see, *e.g.*, Chapters 3–4).

50 The National Biosecurity Authority should establish an intelligence gathering and assessments group to monitor animal and plant pest and disease status internationally, with a particular focus on the region and on our trading partners.

- This report recommends the establishment of a risk team that will, among other tasks, gather and assess intelligence to monitor animal and plant pest and disease status internationally (Chapter 8). Such a team could contribute towards the intelligence gathering and assessments group envisaged by the Beale report.

52 The National Biosecurity Authority should undertake a continuing program of analysis of risk pathways using data collected from pre-border intelligence and border inspections at control points along the continuum. The results of this analysis should be used to update risk management strategies and measures.

- This report recommends the establishment of a risk team that will undertake analysis of risk pathways using data collected from pre-border intelligence and border inspections (Chapter 8).

53 The National Biosecurity Authority should develop and maintain, in consultation with the states and territories and business organizations, a comprehensive post-border monitoring and surveillance program for national priority exotic pests and diseases, which should include: ...

(b) existing and additional port surveillance activities.

- This report and its predecessor develop tools that could be used to implement a risk-sensitive monitoring program that can be deployed for port surveillance activities (see, *e.g.*, Chapters 3–4).

57 The National Biosecurity Authority should develop national research priorities, including for new technologies to better address biosecurity risk, and should work with research bodies to coordinate the research effort towards those priorities.

- This report proposes research projects that will develop science-based, statistically valid approaches to identifying high-risk pathways, and prescribing appropriate monitoring regimes for those pathways (Chapter 9).

2

Background

This report, ACERA project 0804a, extends the conclusions of ACERA project 0804 (Robinson et al., 2008). Briefly, the earlier report provided a summary of current AQIS Import Clearance (IC) processes, proposed a risk framework and analytical strategy for using historical data to identify high-risk import pathways and to prescribe candidate monitoring regimes based on the estimated risk, and demonstrated the application of the strategy using six case studies. The report also recommended the establishment of an internal risk team to continue development of these tools, as well as further opportunities for risk analyses.

2.1 Deliverables

The deliverables of ACERA project 0804a were as follows.

1. Spreadsheet products that guide appropriate quarantine activity levels to ensure an adequate level of protection for:

    - High-volume low-value (HVLV) imported goods (Chapter 3) .
    - Universal loading devices (ULDs) (Chapter 4) .

    This deliverable will include advice on operationalization of the recommended surveillance regimes.

2. Spreadsheet product(s) that guide appropriate quarantine activity levels to ensure an adequate level of protection for External Container Inspection Regime (ECIR), using data provided by AQIS (Chapter 5).

3. Design of an implementation trial of the risk management system and recommended activity levels developed in Deliverables 1 and 2 to run alongside current inspection procedures, to confirm validity of system and levels recommended. (This deliverable will also allow for the use of the risk management system to be applied to other, less complex inspection or intervention activities where adequate data are available) (Chapter 6).

4. Assessment of the data needs for a test of validity of current Self-Assessed Clearance (SAC) profiles. (If funding permits, then provide options for improvements) (Chapter 7).

5. Recommended structure for an internal AQIS Risk Team capable of:

    (a) implementing the trial proposed in Deliverable 3,
    (b) assessing the results of the trial and making recommendations for wider implementation,
    (c) fully operationalizing the risk management system following a successful trial, and

(d) developing further risk management tools and systems for AQIS moving forwards.

Deliverable 5 is reported in Chapter 8.

3

High-Volume, Low-Value (HVLV)

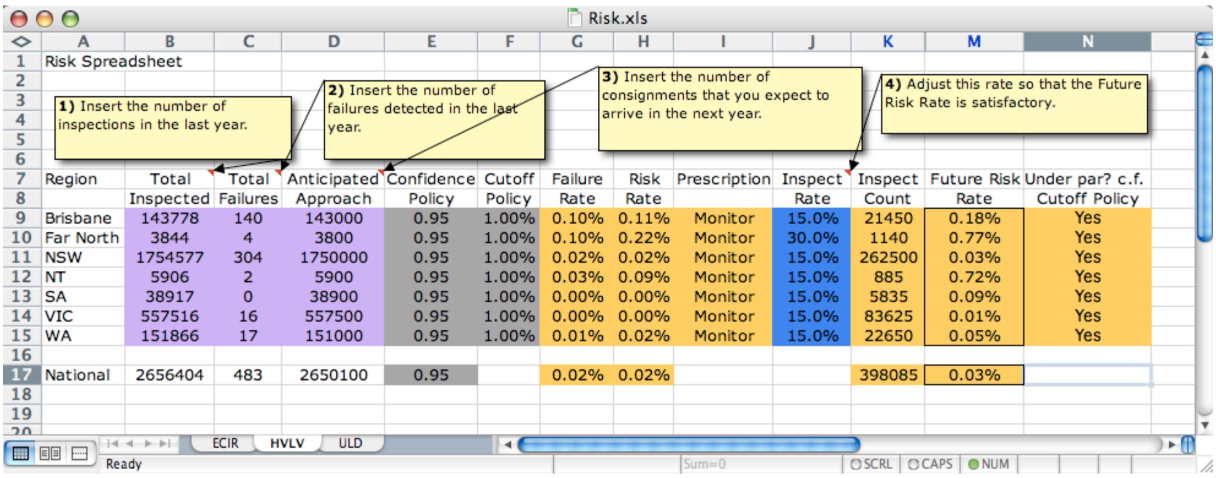
The spreadsheet risk tool has been delivered and presented to AQIS IC. The relevant analysis details that underpin the summary statistics can be found in Robinson et al. (2008).

We briefly review the principles of risk measurement as laid out in Robinson et al. (2008). The *observed non-conformity rate* for a commodity is the number of observed non-conformities (also called *failures*) divided by the number of inspections. The *non-conformity risk rate* is the non-conformity rate inflated increased to represent uncertainty about the system[1]. The *future non-conformity risk rate* is the non-conformity risk rate that is expected to be observed for future measurement periods.

Note that the activity levels reported below should be interpreted as a proof of concept rather than as a prescription. The activity levels to be applied should be determined by AQIS IC using the spreadsheet risk tool. Determining the levels of inspection to be used and timing of inspections is beyond the remit of this report. No comment or recommendation as to the appropriate or desirable activity levels should be inferred from the examples contained herein.

3.1 Spreadsheet

A screen capture of the spreadsheet is presented in Figure 3.1.



Region	Total Inspected	Total Failures	Anticipated Approach	Confidence Policy	Cutoff Policy	Failure Rate	Risk Rate	Prescription	Inspect Rate	Inspect Count	Future Risk Rate	Under par? c.f. Cutoff Policy
Brisbane	143778	140	143000	0.95	1.00%	0.10%	0.11%	Monitor	15.0%	21450	0.18%	Yes
Far North	3844	4	3800	0.95	1.00%	0.10%	0.22%	Monitor	30.0%	1140	0.77%	Yes
NSW	1754577	304	1750000	0.95	1.00%	0.02%	0.02%	Monitor	15.0%	262500	0.03%	Yes
NT	5906	2	5900	0.95	1.00%	0.03%	0.09%	Monitor	15.0%	885	0.72%	Yes
SA	38917	0	38900	0.95	1.00%	0.00%	0.00%	Monitor	15.0%	5835	0.09%	Yes
VIC	557516	16	557500	0.95	1.00%	0.00%	0.00%	Monitor	15.0%	83625	0.01%	Yes
WA	151866	17	151000	0.95	1.00%	0.01%	0.02%	Monitor	15.0%	22650	0.05%	Yes
National	2656404	483	2650100	0.95		0.02%	0.02%			398085	0.03%	

Figure 3.1: Screen capture of risk spreadsheet for HVLV.

Instructions for its use are as follows. The *mauve* cells are for general user input, the *grey* are for occasional policy input, the *blue* are for general policy input, and the *goldenrod* are output. Note that national figures are computed by aggregating the regional totals.

[1] Formally, the risk rate is the upper, one-tailed, Jeffrey 95% confidence interval for the population non-conformity rate.

Input by Users Mauve cells, to be set each time a prescription is required.

1. Record the total number of HVLV inspected by region for the last decision period (*e.g.*, year) in column B.
2. Record the total number of failures observed by region for the last decision period in column C.
3. Record the anticipated number of HVLV that will be expected by region for the next period in column D.

Input by Policy Grey cells, to be set rarely, possibly once only.

1. Columns E and F reflect policy and do not need to be changed as part of the allocation process. They are used to define the confidence policy and the risk cutoff. For example, at 0.95 and 1% respectively, the spreadsheet will guide the user to determine the necessary inspection rate such that *if the failure rate does not increase*, then the user can be 95% confident that the future risk will be below 1%.

Output 1 in columns G – I, which will change with the user input.

1. Column G reports the observed failure rate.
2. Column H reports the observed risk rate.
3. Column I reports the prescription: *monitor* the region, or *inspect all* HVLV in that region.

Planning Blue cells, to be set in response to the output cells.

1. The values in column J are the inspection rates that the user proposes. Changing these values has two effects: firstly, the number of HVLV to be inspected will change (Column K), and secondly, the predicted *future risk* will change (Column M).
   Regions that have "Inspect All" in column I are recommended to be assigned 100% in column J. However, the value is at the discretion of the user; see Section 3.2.

Output 2 in columns K – N, which will change with the user input.

1. Column K reports the number of HVLV to be inspected.
2. Column M reports the predicted future risk rate.
3. Column N reports whether or not the predicted future non-conformity risk rate is under the policy cutoff (Column F).

The goal is to find a compromise between sensible inspection rates and desirable future non-conformity risk rates. After entering the inspection data (Columns B, C, and D), the user should increase or decrease the inspection rates (Column J) until the future non-conformity risk rate (Column M) is at an acceptable level.

3.2 Implementation

It is best to consider operational constraints and opportunities when determining the inspection rate. Choosing an esoteric but low inspection rate might not be as useful, overall, as choosing a coarser and higher rate that is easy to implement. For example, if HVLV arrive 7 days per week, then multiples of 15%, corresponding to approximately 1 day per week, should be entertained.

In Figure 3.1, we adopt inspection rates of one random day per week in all regions except the Far North, for which two days per week are advocated. However, these activity levels do not include prescriptions for the timing of inspections. That is, a prescription of 15% could refer to inspecting, for example:

1. every seventh consignment,
2. a single random consignment out of every seven,
3. all consignments one day per week, for example, Monday, or
4. all consignments on one randomly-chosen day per week, or
5. all consignments on four randomly-chosen days per month.

This list is not intended to be exhaustive, and there may be alternatives that prove better suited to the circumstances at hand.

The different scenarios listed above have different implications for security and efficiency, and their suitability will depend on the rate at which consignments arrive, and the flexibility that AQIS IC has to allocate personnel resources to inspection. Specifically, a systematic pattern would be easier to implement, but a random pattern would be more secure. The implementation trial presented in Chapter 6 will provide insight as to the likely statistical differences.

The risk tool distinguishes between different monitoring scenarios put forward by the program, but the program needs to consider the use of the tool and its output in the context of effectiveness, verification (of processes), validation (of systems), and reporting.

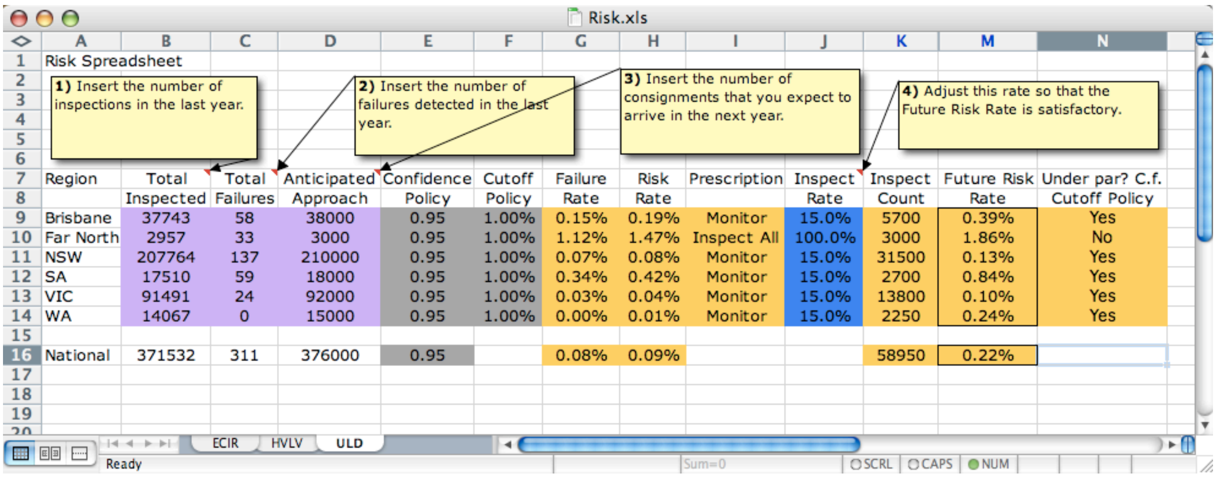
4

Universal Loading Devices (ULD)

This Chapter presents the spreadsheet risk tool for *external inspections* of ULD. Note that the activity levels reported below should be interpreted as a proof of concept rather than as a prescription. The activity levels to be applied should be determined by AQIS IC using the spreadsheet tools. Determining the levels to be used is beyond the remit of this report. No comment or recommendation as to the appropriate or desirable activity levels should be inferred from the examples contained herein.

4.1 Spreadsheet

A screen capture of the spreadsheet is presented in Figure 4.1.



Region	Total Inspected	Total Failures	Anticipated Approach	Confidence Policy	Cutoff Policy	Failure Rate	Risk Rate	Prescription	Inspect Rate	Inspect Count	Future Risk Rate	Under par? C.f. Cutoff Policy
Brisbane	37743	58	38000	0.95	1.00%	0.15%	0.19%	Monitor	15.0%	5700	0.39%	Yes
Far North	2957	33	3000	0.95	1.00%	1.12%	1.47%	Inspect All	100.0%	3000	1.86%	No
NSW	207764	137	210000	0.95	1.00%	0.07%	0.08%	Monitor	15.0%	31500	0.13%	Yes
SA	17510	59	18000	0.95	1.00%	0.34%	0.42%	Monitor	15.0%	2700	0.84%	Yes
VIC	91491	24	92000	0.95	1.00%	0.03%	0.04%	Monitor	15.0%	13800	0.10%	Yes
WA	14067	0	15000	0.95	1.00%	0.00%	0.01%	Monitor	15.0%	2250	0.24%	Yes
National	371532	311	376000	0.95		0.08%	0.09%			58950	0.22%	

Figure 4.1: Screen capture of risk spreadsheet for ULD.

Instructions for its use are identical to those reported in Section 3.1.

4.2 Implementation

As noted earlier, it is best to consider operational issues when thinking about the inspection rate. As an example, in Figure 4.1, we adopt inspection rates of one random day per week in all regions except the Far North, for which 100% inspection is advocated. The range of options noted in Section 3.2 might equally well apply in this scenario.

5

External Container Inspection Regime (ECIR)

In this chapter, we demonstrate the use of statistical risk analysis on a new case study, for ECIR, using data kindly supplied by AQIS. ECIR is the External Container Inspection Regime, under which almost all shipping containers are inspected as they leave the wharf[1]. Within this chapter, *contamination* refers to high-level contamination, for which the containers must be sent for washing before being released.

All analyses were performed using the open-source, free statistical environment R (R Development Core Team, 2008).

5.1 Summary

The contamination rate for ECIR for 2008 is 0.98%. The national contamination risk for external container inspection for 2008 is 0.99%. Note that the contamination risk is an estimated upper confidence interval for the average rate.

The total number of contaminations detected nationally from July 2002 until December 2008 is 171,179, from a total of 10,338,433 inspections, which is an average rate of 1.66%. The annual regional and national contamination rates from 2003 until the end of 2008 are presented in Figure 5.1. The regional and national predicted annual risks are presented in Table 5.1 and Figure 5.2. The highest regional contamination risk for external container inspection for the year of 2008 is 16%, in the FN QLD region.

The differences in the regional rates reflect a number of influences. There are differences in the containers' country of origin between the regions. Also the environment in which the containers are handled and the resultant possibility of local contamination varies among the regions.

We assume that the inspections are 100% effective. This assumption may make our prescriptions overly confident, and some care should be taken in their interpretation. This assumption is the same as was used in the analyses reported in Robinson et al. (2008)[2].

Note that the recommended sampling rates at the national and regional levels are not necessarily commensurate. That is, the national recommended rate cannot be calculated by simply averaging the regional recommended rates. We recommend that AQIS IC determine the regional levels separately, in which case the national inspection level would simply be the aggregate of the recommended regional levels. The alternative would be to set a national level and disburse those inspections amongst the regions, using the national level as a constraint.

[1]Containers that undergo inspections for giant African snails (GAS) in some regions are not subject to the ECIR.

[2]AQIS leakage survey records suggest that the rate at which inspections miss non-conformities is sufficiently low that this assumption can be asserted. See *e.g.* Table 16 of `http://www.daff.gov.au/__data/assets/pdf_file/0009/858132/04-ar0708-rop-b.pdf`, in which the quarantine risk effectiveness for ECIR is consistently over 95%.

Table 5.1: Estimated 95% contamination risk, average contamination rate, and tentative future sampling rate (TFSR) for ECIR, 2008, presented by region. The failed and inspected columns refer to the totals for each region in 2008. $\hat{f}_{0.95}$ (%) is the predicted risk, expressed as a percentage. $\hat{p}$ (%) is the average contamination rate. TFSR (%) is the tentative future sampling rate, expressed as a percentage, for a risk cutoff of 1%.

Region	Inspected	Failed	$\hat{p}$ (%)	$\hat{f}_{0.95}$ (%)	TFSR (%)
FN QLD	3855	578	14.99	15.96	100.0
NSW	603477	4688	0.78	0.80	3.3
NT	1612	0	0.00	0.12	33.4
SA	81239	753	0.93	0.98	100.0
SE QLD	370310	4010	1.08	1.11	100.0
TAS	10085	195	1.93	2.17	100.0
Victoria	669834	5863	0.88	0.89	9.8
WA	179570	2684	1.49	1.54	100.0
National	1919982	18771			

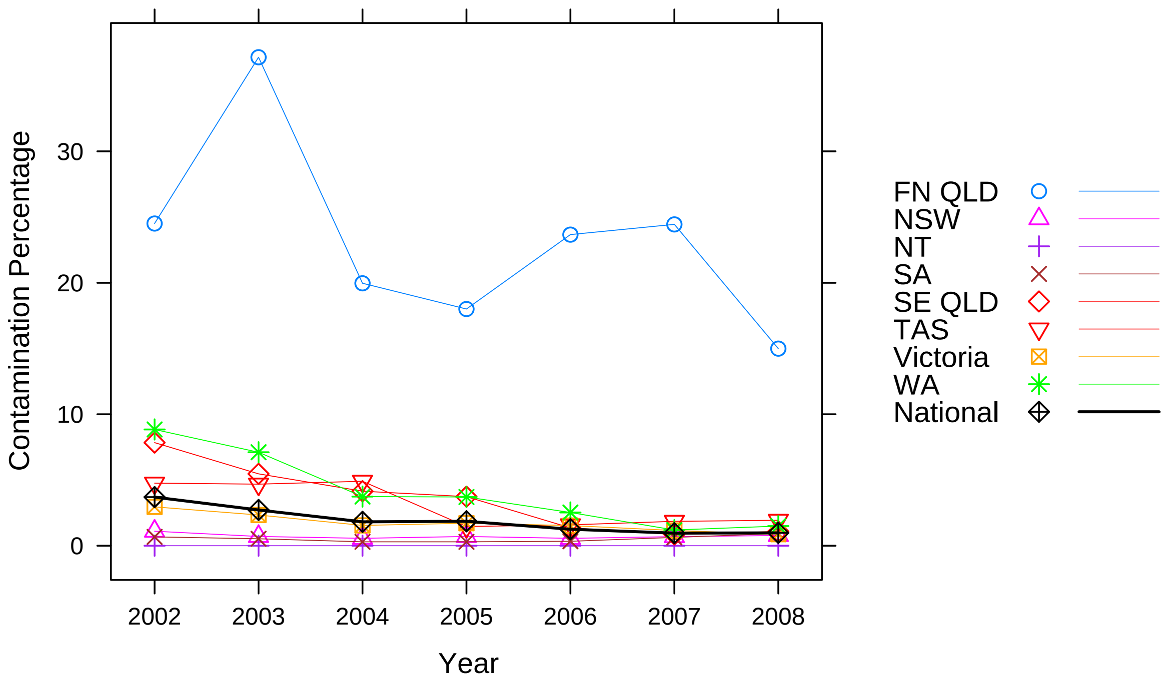


Figure 5.1: Annual contamination rate for ECIR, by region and nationally, expressed as a percentage. The thick black line is the national line. The negative trend reflects a decrease in the annual rate of contamination.

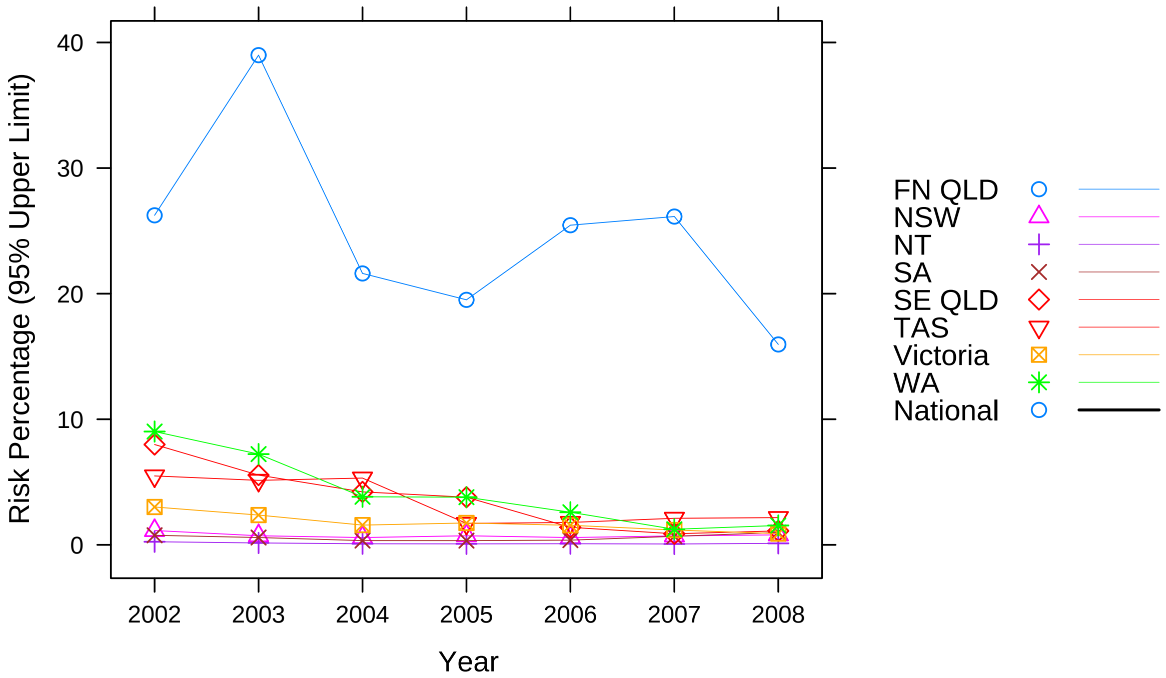
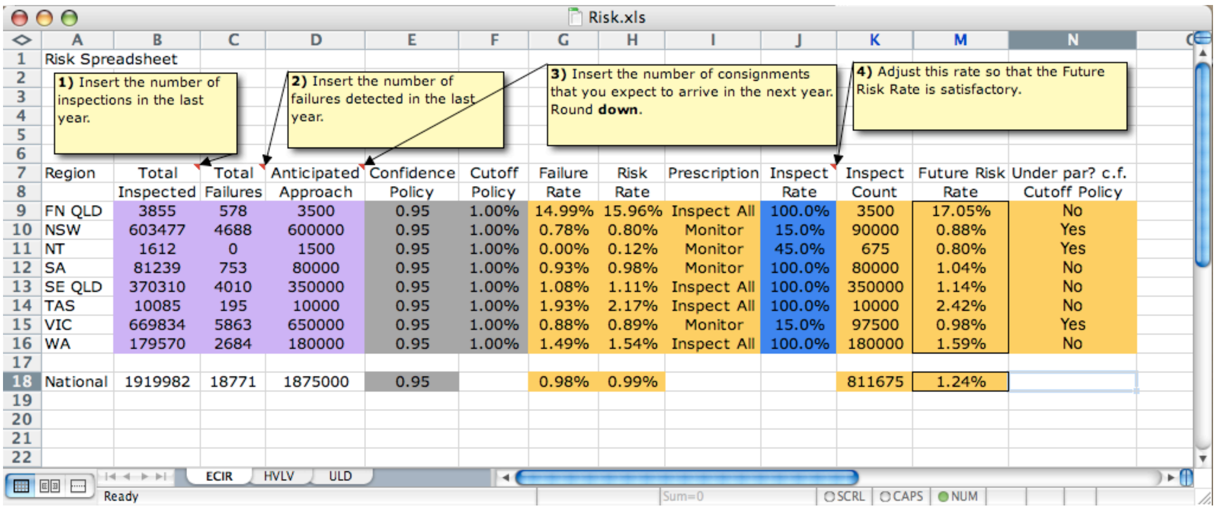


Figure 5.2: Estimated annual 95% contamination risk for external inspection of ECIR, by region and nationally, expressed as a percentage, for a risk cutoff of 1%. The negative trend reflects a decrease in the annual rate of contamination. See Table B.3 for data.



Region	Total Inspected	Total Failures	Anticipated Approach	Confidence Policy	Cutoff Policy	Failure Rate	Risk Rate	Prescription	Inspect Rate	Inspect Count	Future Risk Rate	Under par? c.f. Cutoff Policy
FN QLD	3855	578	3500	0.95	1.00%	14.99%	15.96%	Inspect All	100.0%	3500	17.05%	No
NSW	603477	4688	600000	0.95	1.00%	0.78%	0.80%	Monitor	15.0%	90000	0.88%	Yes
NT	1612	0	1500	0.95	1.00%	0.00%	0.12%	Monitor	45.0%	675	0.80%	Yes
SA	81239	753	80000	0.95	1.00%	0.93%	0.98%	Monitor	100.0%	80000	1.04%	No
SE QLD	370310	4010	350000	0.95	1.00%	1.08%	1.11%	Inspect All	100.0%	350000	1.14%	No
TAS	10085	195	10000	0.95	1.00%	1.93%	2.17%	Inspect All	100.0%	10000	2.42%	No
VIC	669834	5863	650000	0.95	1.00%	0.88%	0.89%	Monitor	15.0%	97500	0.98%	Yes
WA	179570	2684	180000	0.95	1.00%	1.49%	1.54%	Inspect All	100.0%	180000	1.59%	No
National	1919982	18771	1875000	0.95		0.98%	0.99%			811675	1.24%	

Figure 5.3: Screen capture of risk spreadsheet for ECIR.

5.2 Spreadsheet

Note that the activity levels reported below should be interpreted as a proof of concept rather than as a prescription. The activity levels to be applied should be determined by AQIS IC using the spreadsheet tools. Determining the levels to be used is beyond the remit of this report. No comment or recommendation as to the appropriate or desirable activity levels should be inferred from the examples contained herein.

A screen capture of the spreadsheet is presented in Figure 5.3. Instructions for its use are identical to those reported in Section 3.1.

5.3 Implementation

As noted earlier, it is best to consider operational constraints when thinking about implementing the recommended inspection rate. As an example, in Figure 5.3, we tentatively adopt inspection rates of one random day per week in NSW and VIC, three random days per week in NT, and 100% inspection for FN QLD, SA, SE QLD, TAS, and WA. However, the practicalities of maintaining staffing levels may affect the nominated inspection regime.

As noted earlier, these prescriptions specify inspection levels but not inspection timing. One outcome of the simulation trial that is proposed in Chapter 6 is a statistical comparison of different sample designs for monitoring, including the timing of the inspections.

A credible first phase of deployment, which should also be tested using the methodology proposed in Chapter 6, is a prescription of 50% monitoring across all regions.

5.4 Analysis

Current government policy specifies that all shipping containers will be inspected externally. In this context, a contamination corresponds to there being contamination on the outside of the container. Here we estimate the contamination risk, by region and nationally.

The container inspection data that we received from AQIS were monthly counts of inspections and contaminations, by region. To simplify the presentation we chose to construct summary statistics annually, both at the regional and national level. The national-level statistics are the unweighted aggregate of the regional statistics.

Our goal was to obtain a conservative indication of contamination risk. Therefore we report the upper limit of the one-tailed 95% confidence interval for the estimated contamination rate. We can interpret this figure as being a conservative upper limit for the true rate, ignoring leakage.

We converted the rates to percentages for our summary statistics and for Figure 5.2 for ease of interpretation.

The results of this analysis have two potential applications.

1. The reported risk can be used to support an assessment of the utility of 100% inspections. Our results suggest that 100% inspection of ECIR does not necessarily substantially reduce the risk relative to a lesser sampling rate, depending on the region.

2. The results can be used to identify those regions that have higher contamination risks. Table 5.1 identifies FN QLD (439 contaminations from 1796 inspections in 2007), Tasmania (152/8194), Victoria (7561/652311) and WA (2003/167601) as having higher contamination risks than the other regions. (See tables B.1 and B.2 for contamination and inspection counts by region and year.)

5.4.1 Further directions

Our goal is not to provide the definitive risk analysis for container inspection, but rather to use the container case study to demonstrate the tools that we suggest will be useful for risk analysis. Given better information there is no doubt that a better allocation could be constructed.

Dividing the shipments by port of entry allows the analysis to translate into an easily-implemented monitoring recommendation. It may make more sense to divide the shipments by source country and/or destination class (rural/metro), if that information were readily available at the port gate.

The documented analysis treats each year separately, which prevents any sharing of information from year to year. Arguably, the division of collection periods into years is artificial, and a better technique would permit aggregation of data from more than one year, which would simplify the identification of seasonal differences within the year. This approach can be easily implemented by accumulating the observed contamination and inspection counts across a number of years, possibly in a weighted fashion. The results of a version of this analysis are presented in Appendix B.

Information needs

1. AQIS already aggregates inspection data for ECIR by month and year, and by the region to which the container is delivered. This dataset was used for the analyses reported above.

2. A more precise profiling approach would be possible if more information about the individual ECIR were readily available. For example, contamination rates might vary by source country or ports en route, and profiles that were constructed with this knowledge would enable better-targeted surveillance.

6

Implementation trial

6.1 Introduction

The third Deliverable is a design of a trial of the risk-management system, and recommended activity levels arising from Deliverable 1, which recommends activity levels for ULD and HVLV inspection, and Deliverable 2, which recommends activity levels for ECIR case study. The intended goal is a trial that can be implemented by the specialist risk team that is proposed in Deliverable 5.

The trials that this Deliverable recommends have at least two purposes: to assess the effect of candidate inspection activity levels, and also to assess the effect of different potential inspection patterns.

Two types of trial are possible: physical, and simulated. Physical trials are expensive and cumbersome. Simulation trials are carried out in software, and are relatively easy and cheap to perform, but require detailed historical monitoring data.

If sufficient historical data are available, we recommend that a simulation trial be performed. If the simulation trial provides satisfactory evidence for or against a methodology, then a prescription can be chosen. If the simulation trial provides inadequate intelligence then a physical trial can be performed, and the results of the simulation trial can be used to guide the design of the the physical trial. Accordingly, we present design details for simulation studies for each of the three pathways.

The current requirements for ECIR, HVLV, and ULD is 100% inspection. Therefore a trial of the risk-management systems can be carried out within the existing infrastructure by simply ignoring those inspection outcomes that would not be performed under the system, for the purposes of monitoring. The outcomes of the current monitoring prescription and the risk management system can then be directly compared.

The data required for a simulation trial are as follows.

1. The trial would require historical monitoring data with wide temporal and geographical coverage. Gaps in the data source may or may not contaminate the results; in general, gaps are to be avoided if at all possible, and assessed for importance by subject-matter experts when they occur.
2. Ideally, the data would comprise inspection records that include a timestamp and the inspection outcome.
3. At worst case, having the number of inspections and the number of detections made in each day at a particular set of facilities would probably suffice.
4. Other inspection-level information might also be relevant to the outcome, for example, importing state, commodity tariff number, exporting country, etc.

6.2 Trial design

The trial design for each case should follow the steps laid out below. We recommend the use of Microsoft Excel for initial data manipulation, and R for subsequent manipulation, simulation, analysis, and reporting.

6.2.1 Data gathering

1. Collect, clean, and organize as much data as possible. For example, many regions have provided data for 2006 and 2007 for ULD and HVLV, and we assume that 2008 data would also be available.

2. The data should be set up as following: each pathway should be represented by a spreadsheet of five *columns*. The five columns should comprise: the date of measurement, the day of the week of the measurement, the region being reported, the number of inspections, and the number of non-conformities. There should be a row for every day spanned by the data for each region.

3. The annual and monthly inspection and non-conformity counts should be cross-referenced with published figures. Variations should be checked and verified.

6.2.2 Simulations

1. Compute the non-conformity rates for each pathway using all the available data.

2. Repeat the following steps as many times as possible for each candidate sampling regime, including but not necessarily limited to the recommendations of Robinson et al. (2008).

    (a) Choose a random start, and determine the days that correspond to the sampling regime under scrutiny.

    (b) Using only those days, compute the non-conformity rates for each pathway.

    (c) Record the non-conformity rate and the number of non-conformities in the records that were not included in the sample.

3. Summarize and report, comparing the estimated non-conformity rates with the true rates, and noting the average number of missed non-conformities.

The candidate designs can include adaptive designs, which would change the sampling intensity from year to year to mimic the recommended process, and constant designs, which would maintain a constant sampling intensity. Examples of candidate sample prescriptions are noted in Section 3.2.

6.3 Pathway data availability

Specific details about the data for each pathway follow.

6.3.1 ECIR

Regional monthly summary data are available for ECIR, and indeed these data form the basis of the report in Chapter 5. However, much finer-grained timing data would be necessary for a simulation study. In order to determine the temporal detail of ECIR data that is routinely recorded, we requested ECIR data templates from each regional office. To date, we have received templates from Far North Queensland, New South Wales, South-East Queensland, Victoria, and Western Australia (see Table 6.1). One year of data is readily available for numerous regions, and more could be obtained from the archives, with added time and cost.

6.3.2 HVLV

Fine-grained temporal data on HVLV interceptions are available for most of the regions, as far as we are aware (see Table 6.2).

6.3.3 ULD

Fine-grained temporal data on ULD interceptions are available for most of the regions, as far as we are aware (see Table 6.3).

Table 6.1: Summary of anticipated availability of historical ECIR data, by region.

Region	Timestep	Data Availability	Notes
FN QLD	$\leq$ Daily	1 year	
NSW	Daily	≥ 1 year	
NT		1 year	
SA	Daily	≥ 1 year	
SE QLD	Daily		
TAS			No data yet
VIC	$\leq$ Daily	≥ 1 year	
WA	Daily	≥ 1 year	

Table 6.2: Summary of availability of historical HVLV data, by region.

Region	Timestep	Data Availability	Notes
Brisbane	Daily	3 Years	
FN QLD	Daily	3 Years	
NSW	Daily	3 Years	
NT			No data yet
SA			No data yet
VIC	Daily	3 Years	
WA	Half-Daily	3 years	

Table 6.3: Summary of availability of historical ULD data, by region.

Region	Timestep	Data Availability	Notes
Brisbane	Daily	3 Years	
FN QLD	Daily	3 Years	
NSW	Daily	3 years	
SA			No data yet
VIC	Daily	3 years	
WA	Half-Daily	3 years	

6.4 Conclusion and recommendation

We recommend that in the first instance, AQIS IC pursue a simulation-based trial of the risk management system and recommended activity levels of Deliverables 1 and 2. The simulation trial should use the historical inspection data that have been provided for this study, and any other data resources that are available.

We note that these simulation studies will be using data that have substantially greater detail than those data that were available for the analysis documented in Robinson et al. (2008). For example, it will be possible to compute the rate of consignment arrival and the rate of non-conformity detection for each day of the week. We further recommend that the analysts undertaking the simulation trial consider using a generalized linear modelling approach, as detailed in Section 5.6 of Robinson et al. (2008), to determine whether a more fine-grained monitoring specification would be valuable.

7

Self-Assessed Clearance (SAC) profiling

The fourth Deliverable is an assessment of the data needs for a test of the validity of the current Self-Assessed Clearance (SAC) profiles.

7.1 Summary

We provide a brief summary of the use of SAC profiles. Our summary draws heavily on material kindly provided by Con Goletsos of AQIS NSW Regional Office.

SAC profiles are applied to non-commercial cargo with customs value under $1000. The profiles themselves are alphanumeric strings, including wildcards to allow for the possibility of spelling variations. Six types of profiles are used to refer SAC consignments to AQIS:

1. *Goods* profiles, based on the goods description field (places electronic hold, currently 2478 profiles),
2. *Entity* profiles, based on the identity of the consignee (hold, 436),
3. *Non-compliant name* profiles, which identify consignees or consignors that have a record of recent (within the last five consignments) undeclared items (hold, 145),
4. *HRM* profiles, which identify consignments of high risk transhipment or underbond (port-to-port) movement (alert profile, which informs officer but does not hold cargo, 172),
5. *CARNET* profiles, which identify temporary imports (alert profile), and
6. *ICE* profiles (under construction), a random sampling mechanism to monitor cargo that is not currently targeted by AQIS. Proposed to result in automatic referral.

Resolution of the consignment status relative to the profiles is called *screening*. During screening, the AQIS officer has access to a range of information relevant to the consignment, including a text description of the intent of each matching profile. The officer assesses the risk of the consignment based on the available information, and can choose to either *refer* (to AQIS) or *acquit* (release) the consignment.

Consignments can match more than one profile type, and more than one profile within types. When a consignment matches more than one profile, each match is displayed. If one of a number of matches is referred then the consignment is referred, and subsequent profiles are not evaluated. All matches must be acquitted for a consignment to be acquitted.

The ACS provides AQIS with a daily Profile Effectiveness Report (PER), which details how many profile referrals were acquitted, and how many were referred for further processing, for each profile number.

Two kinds of errors are of interest for the assessment of the validity of the SAC profiles: false negatives, and false positives. Anecdotal evidence suggests that the profiles are missing undeclared goods, and over-referring compliant consignments.

7.2 False negatives

A false negative is a failure to detect a non-conformity. AQIS wishes to estimate the false negative rate in order to assess the efficacy of current AQIS practices for this pathway.

Estimating the rate of false negatives is complicated by the fact that those consignments that do not match a profile are presently released without examination. The ICE project will bring surveillance to these otherwise-released consignments, which should result in satisfactory information about the false negative rate. ICE will not be formally online for some time yet.

In the interim, an informal ICE procedure was established in November 2008 and will be maintained until the full ICE has been deployed. Informal ICE involves officers inspecting all suspicious-looking consignments that are identified by the X-Ray. The informal ICE database includes the number of suspicious packages inspected as well as the number of items of quarantine concern, so the non-conformity rate *of suspicious packages* can be estimated. Up until December 23 2008, 188,655 packages had been x-rayed, of which 514 had subsequently been opened, and 135 of those opened packages contained material of quarantine interest.

If at all possible, a leakage survey should be implemented. Such a survey would include examination of randomly-selected non-suspicious consignments. The leakage survey would increase the value of the informal ICE process, because it would enable the estimation of the non-conformity rate of all packages for the profiles.

We feel that the informal/formal ICE process that has been adopted by AQIS is the most appropriate way to obtain information about false negatives in the SAC pathway.

A further possibility that had been raised was to compare the detected non-conformity rate for SAC with that for EMS, which is subject to 100% intervention. In order to make this a meaningful comparison, it would be necessary to

1. assume that the non-conformity rate of goods that enter through the EMS pathway are similar to those that arrive through SAC; and
2. determine whether or not the SAC profiles would match the EMS goods descriptions.

We have examined EMS surveillance data provided by AQIS. Unfortunately, goods descriptions are missing for most of the records, so checking for a match with the SAC profiles would be impossible for these records. Based on present practices, a comparison of SAC profile hit rates with MAPS seizure rates does not seem like a viable strategy to assess the quality of the former.

7.3 False positives

A false positive refers to a compliant consignment that matches a profile. Of those consignments that are referred, approximately 60% are released upon the examination of documentation.

AQIS is not ordinarily concerned with false positives. For any inspection or testing there is always the compromise between letting too many true positives through and investigating further too many true negatives. However, in the SAC process, false positives substantially increase the workload of field officers without bringing any direct benefit to the organization.

Estimating the rate of false positives is relatively easy because inspection data are available for each profile, and in fact the relevant data are provided daily to AQIS in the PER from ACS.

We suggest that the analysis could proceed along the following lines, using the readily-available PER data.

1. Aggregate the PER data across a reasonable time span, covering at least one year, for covering seasonal variation, and ideally covering two or more years.
2. Ignore the non-SAC records.
3. For each profile, compute the false and true positive rates.

4. For each profile, compute the *failure risk* according to the approach reported in Robinson et al. (2008), where failure is defined as a false positive.
5. Sort the profiles by failure risk, in decreasing order, so that we can assess the consequence of not looking at the least risky profiles.
6. Construct a graph with the cumulative number of inspections on the x-axis, and the cumulative number of true positives on the y-axis, in the order specified by Step 5. This graph summarizes the effort against the reward.

The SAC and PER data both contain the master airway bill (MAWB) and house airway bill (HAWB), which can be used to obtain more fine-grained details on the fate of the consignments.

8

Risk team

8.1 Background

This report and its predecessor (Robinson et al., 2008) have demonstrated that the application of statistical reasoning and tools to readily-available AQIS data can provide practical insights into the magnitude and nature of the risk associated with different import pathways. These insights can be used to guide the allocation of inspection resources to ensure the most efficient and robust deployment.

Robinson et al. (2008) also identified a number of opportunities for risk analyses comparable to the case studies that they reported, and recommended that AQIS establish a specialist risk team to provide such services to the organization. This chapter recommends a candidate structure and function of such a risk team.

It is natural and expected that the structure and function of such a team will evolve according to the changing needs and resources of the organization that it serves. New opportunities will become apparent as technology develops, and as the organization faces new challenges. We therefore recommend a small and flexible team that will be able to adapt to changing circumstances and opportunities.

Analytics is the collective term used to describe the use of statistics and data mining to provide organizational and business intelligence. We recommend that the structure of the risk team mirror that of analytics teams that have been established with comparable goals within similar organizations. There are numerous precedents for analytics teams in the Federal Government alone, for example, the Australian Taxation Office has a team of about 20 analysts, and AUSTRAC has a team of about six analysts. Medicare Australia, the Australian Institute of Sport, and the Australian Customs Service each has a team of two to three analysts.

The ATO, in concert with AUSTRAC, uses data mining to detect tax fraud and illegal monetary transactions[1]. Medicare Australia uses data mining techniques to identify anomalous behaviour amongst its providers. In association with subject matter experts, the behaviour is reviewed and if necessary, the data-mining output is used by compliance officers to intervene with the provider to modify their non-compliant billing or inappropriate behaviour. In some circumstances this may include recovery of monies owed to the Commonwealth. The impact of these activities may have flow on impact upon the provider's peers and broader billing behaviour.

We interviewed members of analytics teams and managers of analytics teams from numerous government departments, and also the private sector, to distill candidate approaches to establishing and nurturing a risk team, given that its structure and function would be similar to an analytics team. Our interviewees were from the Australian Customs Service, the Australian Defence Force Academy, the Australian Institute of Sport, the Australian Taxation Office, the AUSTRAC Intelligence Division, Medicare Australia, and Presciient Pty. Ltd. This chapter reflects the contents of those interviews.

[1]See, *e.g.*, `http://www.australianit.news.com.au/story/0,24897,23085585-24169,00.html` and `http://www.australianit.news.com.au/story/0,25197,24506075-15306,00.html`.

8.2 Specific recommendations

AQIS must create an environment in which analytics can flourish and best benefit the organization. This environment should include infrastructure, culture, and incentives.

The analytics team should be fostered and nurtured by a senior manager who understands and values its output. This person should be able to implement, champion, and maintain the solutions delivered by the team.

8.2.1 Environment

We recommend that in the first instance, the team be under the direct control of the Branch Manager for Cargo Management, within the Quarantine Operations Division.

The impetus and the opportunities for the risk team originated in the solutions outlined in this report for the Cargo Management Branch. The Branch is therefore familiar with the genesis of the ideas, the context in which the solutions can work, and the possibilities for further, efficient development and deployment of solutions.

However, the business intelligence issues that are faced by Cargo Management are also faced by the other branches. The supervision of developments by the Cargo Management Branch is intended merely to take advantage of the momentum developed in the existing work, and should be seen as a transitional arrangement that will ensure development remains focused on the needs of AQIS.

Therefore we recommend that the tenure of the team within Cargo Management be considered as a trial, and that ultimately, the team should be positioned to serve all branches within the Quarantine Operations Division, and report to the Executive Manager.

8.2.2 Structure

We recommend a small team, ideally about four people, that cover the following roles:

1. Team leader, to provide clear lines of authority and a point of communication with the team;
2. Business analyst (providing quarantine expertise);
3. Data miner;
4. Data analyst (responsible for extracting and cleaning data for analysis); and
5. Applied statistician (possibly shared with other areas, *e.g.* BA, PIAPH, or within AQIS.)

The team leader should ideally be at the 7 or 8 level, and should actively seek out opportunities for the risk team to deliver value to the organization, as well as ways of measuring and reporting the value of the team's output to the organization.

8.2.3 Function

Analytics should be seen as a core strategic function. The analytics team must actively grasp the real needs of the organization, and deliver solutions of clear value. That is, the team should be able to actively seek out opportunities to deliver value to the organization.

We can think of the function of a risk team as a portfolio of project types, among which the team's resources must be balanced.

1. Tactical projects.

   This set refers to identifying immediate needs and opportunities for analysis, performing the analyses, and making recommendations for monitoring and/or intervention.

   Examples include allocation of ICE resources, risk analysis for specific quarantine import pathways, reporting the effectiveness of inspections and other interventions, compared to a benchmarks for effectiveness calculated from current activities, and design of specialized short-term monitoring systems (e.g. efficiently monitoring certain pathways for seeds of invasive species). These are low-hanging fruit for which the value flows to the organization promptly. The case studies performed and recommended in Robinson et al. (2008) provide a blue-print for the kinds of projects that could be performed, and the kinds of outcomes that may be anticipated.

Results from these analyses should be made available to Biosecurity Australia to provide feedback for biosecurity recommendations, as recommended by Robinson et al. (2008).

2. Strategic projects.

   Robinson et al. (2008) argued that a statistical modelling approach to risk analysis could result in a sharing of strength in terms of the availability and value of monitoring information for different quarantine pathways. This set of projects refers to the construction, assessment, and possible deployment of candidate models to allow this sharing of information, and undertaking research, trials, and deployment of risk-based monitoring systems in collaboration with business units. Sources of information would include border surveillance data as well as information on animal and plant pest and disease status from international sources.

   An example is estimating and reporting the economic, social and environmental benefits of activities that successfully intercept potentially harmful pests, pathogens and diseases, in terms of $ saved from direct impacts and from what would otherwise be spent in post-border surveillance, eradication and containment activities.

3. Discovery.

   This set refers to the researching, testing, and deployment of analytics tools and strategies that have not yet been tried, and the search for information in historical AQIS data pools.

   Examples include network analysis, geographical analysis, text mining, and linkage analysis, any or all of which may provide advantageous new approaches for risk analysis for AQIS. Other examples of discovery projects include exploration of data matching and integration with external data sources such as immigration and travel data, economic data, and geographical data. Suitably-qualified[2] students might be recruited for certain Discovery projects.

The team should also be able to outsource smaller, well-defined projects. This requires that the following procedures should be as streamlined as possible, and ideally within the direct purview of the team itself: to negotiate and close straightforward contracts, to deploy reasonable budgets, and to share data appropriately. There will be little to be gained from outsourcing if the processes are less straightforward than the analyses themselves. Suitable providers might be analytics teams that are housed elsewhere in the APS (for example, the Bureau of Rural Sciences or ABARE), ACERA, and the private sector.

8.2.4 Evaluation

A mature performance management framework is absolutely essential, in order that the contributions of the team to the organization can be assessed and communicated.

In the first instance, we recommend that the team performance be assessed as follows:

- decreasing the cost of the data and information that are available to the organization, measured directly as reduced relative cost of data collection operations, for example by increasing the efficiency with which data are collected through better sample design,

[2] This might include graduate students in applied statistics (for example at the University of Melbourne, the Australian National University, and the University of Wollongong), and students who are studying advanced data mining classes held at the Australian National University.

- increasing the value of the data and information that are available to the organization, measured directly as equivalent relative cost of extra data collection operations (that is, how much would equivalent intelligence cost if it were collected as data), for example by statistical modelling, and
- decreasing the inspection load that is undertaken by the organization, measured directly as reduced or redeployed FTEs, for example by demonstrating the relatively low risk associated with some pathways.

As the operations of the risk team mature and diversify, different metrics of performance will need to be developed. We cannot stress enough the importance of closely monitoring the performance of the team using metrics that measure concrete benefits to Australia's biosecurity, even if those benefits are relative rather than absolute. To provide an example, the July 10 2006 Australian Financial Review reports that the ATO "has reaped a $118 million dividend from its first attempt at using data mining to score taxpayers who are late filing returns." Whilst we do not claim that this figure could be considered a benchmark for analytics, it does underscore the value of being able to measure performance using a metric that is meaningful to the organization.

8.2.5 Resources

The resources necessary for a risk team include a powerful and flexible computing environment, opportunities for training, and opportunities for networking within and outside the organization.

Data

The risk team will need ready access to relevant and reasonably complete data. The experiences of other developing teams suggests that data access is the most important, the most difficult, and the most time-consuming aspect of analytics.

Computing

The risk team will need powerful computing resources. To begin with greatest flexibility, we recommend the use of freely-available open-source software, such as R, as the team finds its feet and begins to develop its role within the organization. This software can be augmented by software that already exists within the organization, such as Microsoft Access. By the time that the team reaches the point at which its structure and function has stabilized, then investment into vendor-based software may be considered.

Analytics is not about software. However, the software tools that were mentioned during our interviews are listed below. This list is not exhaustive.

Operating Systems: GNU/Linux, Windows OS.

Data Bases: MySQL, PostgreSQL, Oracle.

Data Handling: R, Perl, Python, SAS, Octave, Matlab.

Statistics: R, SAS, SPSS.

Data Mining: R/RATTLE, SAS Enterprise Miner, SPSS Celementine Weka, K-Nime, Neuralware Professional 2, Cognos, Brio, ACL, Groovy.

Others: ESRI (Geographical analysis), Analyst Notebook (Network analysis), Modern Link Analysis (MLA).

The operating system and hardware are important. The choice depends on the government and department IT policies and systems, size of datasets that are routinely analyzed, and the needs of the team members. Some teams use Beowulf clusters of GNU/Linux machines, others use stand-alone Windows OS machines. There is a precedent for the use of dedicated, stand-alone machines in the case that existing infrastructure does not provide sufficient flexibility.

Training

We recommend that AQIS invest heavily in analytics training rather than in software. The Australian National University provides graduate-level courses in both Applied Statistics and Data Mining. These subjects could be used as initial or refresher courses for individuals within the team.

Networking

The team should be provided sufficient opportunities for networking both within and outside the organization.

Networking within the organization will provide sources of new opportunities for risk analysis. Many problems that are amenable to statistical resolution only come to light via informal meetings and discussions. Talking with the field officers provides insights into the problems that they face and inspiration for solutions.

Networking outside the organization will provide access to new ideas and methodologies that will add value to the team. The team should be able to attend conferences of data mining, analytics, and applied statistics professionals. The team should be encouraged to submit suitable articles to peer-reviewed journals. Finally, the team should be encouraged to join the local (ACT) analytics community and the Society for Risk Analysis, and attend and make presentations at their meetings.

8.2.6 Things to avoid

Starting a risk team from scratch is an ambitious project. It is essential that the organization keep the scope clearly defined. Our interviews also provided insights into some impediments for the successful establishment of analytics teams. We distill some of these ideas here.

1. Unless the databases that the team are using have a low-maintenance data application layer and sensible data architecture, much of the time spent by the team will be in the location, extraction, handling, and cleaning of data. Assessment of the team's progress must take account of the environment in which it is operating, and the amount of time it must devote to this kind of low-level maintenance.
2. Avoid vendor lock-in, that is, avoid requiring the team to use certain expensive tools.
3. Avoid diffusion, for example, allowing the team to lose focus from its core function by overwhelming it with simple analytics tasks that might be only slightly less efficiently performed by other units.
4. Avoid marginalizing the team, or allowing the team to marginalize itself, so that its prescriptions are ignored.
5. Avoid providing insufficient data handling support to the team, so that all of their time is invested into the extracting, organizing, cleaning, and warehousing of the data that they should be analyzing.

9

Future Opportunities

During the process of constructing this report, we have identified several further opportunities that AQIS should pursue.

9.1 Operational deployment

Chapter 5 develops a risk tool for ECIR and Chapter 6 describes the necessary steps for an implementation trial. However, operational deployment of this report's recommendations requires consensus among the stakeholders, including the AQIS national office, AQIS regional offices, and industry representatives. A workshop should be held to develop such a consensus.

9.2 Research priorities

Recommendation 57 of the Beale review recommended the setting of "... national research priorities, including for new technologies to better address biosecurity risk ...". Here we survey some candidate research initiatives that arise as a consequence of this report and 0804.

9.2.1 Shipping: multi-dimensional risk

The Seaports Program has identified substantial opportunities for the development of risk-based monitoring of vessels, persons, and cargo. A key element is that risk measurement for the former will require the resolution of at least two interacting sources of risk (*risk variables*): the vessel history, and the submitted paperwork (QPAR). The model-based risk-measurement strategy laid out in Section 5.6 of Robinson et al. (2008) provides a general framework that can be used to resolve this challenge, but key questions remain unanswered, specifically on the efficient use of the risk tool to set an appropriate level of monitoring when there is more than one risk variable in the model.

9.2.2 Measuring effectiveness

A measure of inspection effectiveness is essential for operational accountability. The risk-measurement strategy laid out in Robinson et al. (2008) provides a metric that could also potentially be used to measure effectiveness, but this metric may or may not be satisfactory for operational purposes. Further work should be done to determine the properties of this metric and to assess its appropriateness as a measure of effectiveness.

9.2.3 Identifying risky pathways

Robinson et al. (2008) recommended that a large-scale modeling exercise be undertaken of the AIMS database to try to identify high-risk import pathways. Such an exercise would require analytics personnel, data-managing personnel, computing facilities, and access to AIMS data. The following pieces of the puzzle are presently available.

1. Robinson has recruited a PhD student for research in the broad area of data mining for risk analysis. Robinson is also part of a team that obtained Australian Research Council funding for a top-up scholarship for that PhD student.
2. The Victorian Life Sciences Computation Initiative (VLSCI[1]) will deliver high-powered super-computing facilities to projects in the life sciences, at no cost to the research team. The facility will be based at the University of Melbourne. Overtures have been made to obtain computing support for a quarantine-based data mining project from this initiative.

We recommend that AQIS provide AIMS data, and analytical and programming support to this project.

9.2.4 Beale review

The Beale review (Beale et al., 2008) proposes a substantial reorganization of Australia's biosecurity infrastructure, and an increased focus upon science-based decision making. The recommendations made by the review suggest a number of opportunities for ongoing research in the broad areas of risk identification, risk monitoring, and risk mitigation. Extending the work performed in this study and ACERA 0804 to provide science-based, statistically valid and efficient measures of risk from the presently available data, and making recommendations about alternative data collection procedures, will deliver substantial benefits to Australia's biosecurity.

9.3 ICS monitoring

In response to the Beale review, AQIS has embarked upon an ICS profile survey, to provide information on the Quarantine profile effectiveness in relation to imported cargo. The data collection began in early February 2009 and will conclude about the end of April 2009. This survey will provide statistically valid data that will be useful for determining the false-negative rate of the existing AQIS profiles. Appropriate statistical analysis of these data will be essential.

9.4 Information sharing

9.4.1 ACS

The ACS has a small team of data-miners that has developed considerable familiarity with ICS data. It would be very valuable to establish some formal and informal links between the ACS data-mining team and an AQIS data-mining team, in order to accelerate the learning curve of the latter, and possibly obtain more straightforward access to valuable data. As has been noted earlier in this report, data preparation and handling can consume considerable resources, and any opportunities for collaboration in this area should be fostered.

9.4.2 AUSTRAC

AUSTRAC has memoranda of understanding with numerous other government departments. These memoranda of understanding allow AUSTRAC to share currency flow information with these departments. This information is subsequently used in data-mining operations, for example network analysis, which is used to determine connections between corporations and individuals. AQIS should give serious consideration to pursuing a memorandum of understanding to share data with AUSTRAC.

[1] http://www.vlsci.unimelb.edu.au/

9.4.3 Border Protection Command

The Border Protection Command is responsible for coordinating and controlling operations to protect Australia's national interests against the following maritime security threats:

- Illegal exploitation of natural resources
- Illegal activity in protected areas
- Unauthorised maritime arrivals
- Prohibited imports/exports
- Maritime Terrorism
- Piracy
- Compromise to Bio-security
- Marine pollution

It does this through combining the resources and expertise of the Australian Customs Service and the Department of Defence, and working with officers from the Australian Fisheries Management Authority, the Australian Quarantine and Inspection Service, and other Commonwealth, State and Territory agencies, Border Protection Command delivers a coordinated national approach to Australia's offshore maritime security.

The command has given an undertaking to share Information with AQIS. The shipping surveillance information would provide AQIS with the opportunity to review and assess information related to potential Quarantine risk, such as ships details, compliance record, loading port, destination port, and cargo details.

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Appendix A

Glossary of Acronyms

ACS	Australian Customs Service
AIMS	AQIS Import Management System. State databases are held locally, and each one is also accessible remotely.
AQIS	Australian Quarantine and Inspection Service
AUSTRAC	Australian Transaction Reports and Analysis Centre
BA	Biosecurity Australia
ECIR	External Container Inspection Regime
EMS	Express Mail Service
GAS	Giant African Snail
HVLV	High volume low value (*e.g.* documents through couriers)
ICE	Import Clearance Effectiveness
ICS	Integrated Cargo System, with database held centrally in Canberra
PER	Profile Effectiveness Report
PIAPH	Product Integrity, Animal and Plant Health
SAC	Self-Assessed Clearance, electronic lodging for consignments of declared value $<$ \$1000 (AU)

Appendix B

ECIR Analysis Details

Table B.1: Number of contaminations of ECIR, presented by region and nationally.

	2002	2003	2004	2005	2006	2007	2008	Total
FN QLD	426	709	333	334	377	439	578	2618
NSW	2319	3130	2779	3466	2935	3972	4688	18601
NT	0	0	0	0	0	0	0	0
SA	167	284	157	173	239	576	753	1596
SE QLD	7534	10395	9767	9759	3856	2885	4010	44196
TAS	123	298	384	107	195	152	195	1259
Victoria	6891	11190	8418	9732	9207	7561	5863	52999
WA	6156	9707	4800	4631	3842	2003	2684	31139
National	23616	35713	26638	28202	20651	17588	18771	152408

Table B.2: Number of external inspections of containers, presented by region and nationally.

	2002	2003	2004	2005	2006	2007	2008	Total
FN QLD	1738	1908	1668	1855	1593	1796	3855	10558
NSW	210216	444728	493313	493539	521651	574202	603477	2737649
NT	781	1278	2230	2481	2148	2795	1612	11713
SA	24903	53751	52729	58219	70887	90911	81239	351400
SE QLD	96051	190113	235420	261443	283673	337948	370310	1404648
TAS	2584	6362	7832	7322	12281	8194	10085	44575
Victoria	233154	479017	545007	568193	601127	652311	669834	3078809
WA	69611	136527	128422	124946	151992	167601	179570	779099
National	639038	1313684	1466621	1517998	1645352	1835758	1919982	8418451

Table B.3: Predicted 95% contamination risk for ECIR, presented by region and nationally, expressed as a percentage. These data are also presented in Figure 5.2.

	2002	2003	2004	2005	2006	2007	2008
FN QLD	26.24	38.99	21.61	19.51	25.45	26.14	15.96
NSW	1.14	0.72	0.58	0.72	0.58	0.71	0.80
NT	0.25	0.15	0.09	0.08	0.09	0.07	0.12
SA	0.76	0.58	0.34	0.34	0.37	0.68	0.98
SE QLD	7.99	5.55	4.22	3.79	1.40	0.88	1.11
TAS	5.49	5.14	5.32	1.71	1.78	2.11	2.17
Victoria	3.01	2.37	1.57	1.74	1.56	1.18	0.89
WA	9.02	7.23	3.83	3.80	2.59	1.24	1.54
National	3.73	2.74	1.83	1.88	1.27	0.97	0.99

Table B.4: Predicted *cumulative* 95% contamination risk for ECIR, presented by region and nationally, expressed as a percentage. The statistics for each year include the data for the preceding years.

	2002	2003	2004	2005	2006	2007	2008
FN QLD	26.24	32.40	28.64	25.99	25.63	25.49	22.75
NSW	1.14	0.85	0.73	0.72	0.69	0.69	0.70
NT	0.25	0.09	0.04	0.03	0.02	0.02	0.01
SA	0.76	0.62	0.49	0.44	0.41	0.47	0.56
SE QLD	7.99	6.34	5.36	4.82	3.90	3.17	2.74
TAS	5.49	5.09	5.08	3.99	3.19	2.96	2.78
Victoria	3.01	2.57	2.13	2.00	1.89	1.73	1.58
WA	9.02	7.79	6.24	5.56	4.81	4.03	3.56
National	3.73	3.06	2.53	2.32	2.06	1.82	1.66