AQIS Import Clearance Risk Return
ACERA 1001 Study F
Reportable Documents
Report 3

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December 12, 2010

Acknowledgments

This report is a product of the Australian Centre of Excellence for Risk Analysis (ACERA). In preparing this report, the authors acknowledge the financial and other support provided by the Department of Agriculture, Fisheries and Forestry (DAFF), the University of Melbourne, Australian Mathematical Sciences Institute (AMSI) and Australian Research Centre for Urban Ecology (ARCUE).

The authors thank the following people who have provided invaluable advice and input: Rafiul Alam, Adam Bennett, Ron Blair, Daryl Crapp, Gary Fogarty, Sonia Goldie, Matt Howard, Greg Messiter, Angelo Papadopoulos, Marisa Perri, Maninder Singh, and Greg Wilson.

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Executive summary

This report defines pathway risk management, and recommends a sequence of activities to be undertaken by various parties that will support the management of the pathway risk of reportable documents (RDs). This report follows Robinson et al. (2009c).

1.1 Recommendations

The Cargo Analysis and Review Program (CARP) should analyze RD inspection data provided by the regions no less frequently than quarterly, using the algorithms and spreadsheet tools that accompany this report, or similar.

The quarterly analysis of inspection data by CARP aims to produce statistical information that can be used to help managed the biosecurity risk of the pathway.

Inspection was mandated for all RDs under Increased Quarantine Intervention (IQI). Recent ACERA reports have recommended a reduction in the required inspection rate to 20% of RDs that arrive during 6 am–6 pm on weekdays (Robinson et al., 2009b,c). The present report provides a strategy that can be used to implement such a reduced inspection regime for RDs.

We emphasize that in order for such a reduction in inspection rates to be aligned with the principles of risk–return as documented in Beale et al. (2008), *a concomitant increase in inspection effort should be undertaken in pathways that are identified as being of higher risk*, such as the Cargo Air Assurance (CAA, also called freeline) or the internal inspection of ULDs (Robinson et al., 2010).

We recommend a 12-month review of pathway risk management as defined in this report, including the utility and appropriateness of the IRIS tool and the analytical strategies that are proposed in this report. This review should be undertaken before July 2011.

1.2 Risk–return context

In order to preferentially allocate resources to the activities that face the highest risk, the Cargo Branch is developing and implementing policies for the application of a risk-return approach on a number of activities.

Under Increased Quarantine Intervention (IQI), programs were required to intervene for 100% of volume, and obligated to achieve a minimum level of intervention. The prescribed minimum level varied across AQIS Programs. This historical approach provides, as a measure of performance, information on the level of activity that is to be undertaken and a numerical standard that is to be achieved.

Biosecurity risk management principles state that rather than focusing efforts on maintaining a prescribed level of activity or quantitative measure of performance, resources should be allocated on the basis of statistical intelligence and scientific assessment. Intervention levels should be responsive to changing risks, and performance should be measured against maintaining an acceptable level of risk.

Future risk management strategies will entail resourcing and guiding a level of intervention to maintain leakage at less than a determined level, where leakage is considered to be the (estimated) amount of undetected movement of goods or vessels of quarantine concern through an intervention process.

1.2.1 Alignment with Beale review

This report is the third in a sequence of three (previous reports are Robinson et al., 2009b,c). The study of which this report is a portion directly targets two of the recommendations made by the Beale report (Beale et al., 2008):

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 study provides an analysis of the risks and returns for the inspection of RDs.

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 study examines the quarantine risk associated with the RD pathway using border inspection data.

2

Introduction

2.1 Background

This project, ACERA project 1001f, extends the conclusions of ACERA projects 0804 (Robinson et al., 2008) and 0804a (Robinson et al., 2009a). Briefly, the earlier reports provided a summary of current AQIS Import Clearance (IC) processes, proposed a risk framework and an 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 unit load device (RD) case study initially used identical methodology to that presented in ACERA reports 0804 and 0804a in order to advise on the expected risk from the adoption of Phase 1 of the risk–return strategy for RDs. The results of that study are reported in Robinson et al. (2009b).

Phase 1 of the Air Cargo risk–return strategy involved the releasing, without inspection, of RDs that arrive during the night shift or on weekends, for each of the three most active regional facilities: Sydney, Melbourne, and Brisbane.

Phase 2 of the Air Cargo risk–return strategy involves the releasing, without inspection, of

- all RDs that arrive during the night shift or on weekends, and
- no more than 80% of RDs that arrive during the weekday shifts,

excepting those night and weekend shifts that are randomly nominated for inspection, and those RDs that arrive on flights that are identified by the CARP as *high-risk flights*[1]. For the purposes of the risk–return study, the day shift is defined as comprising all flights that arrive after 6 am and before 6 pm.

This report describes the implementation and operationalization of Phase 2, including the concomitant data collection, handling, and analysis that are needed for pathway risk management.

2.2 Definitions

Pathway risk management involves the estimation of the pathway contamination risk, and taking such actions as are deemed necessary to ensure that the contamination rate stays below a nominated level, with specified statistical confidence.

[1] No such flights have been identified to date; all flights are presently low-risk flights.

A component of pathway risk management is the allocation of inspection resources. Inspection plays three important roles: interception of contaminated items, estimation of leakage, and deterrence. Given an estimate of pathway risk,

- If the estimated risk of the pathway is above the program risk cutoff specified by the program then the pathway should be inspected at a sufficient rate that the estimated pathway leakage will be below the cutoff. Fully inspecting the pathway is an option.
- If the estimated risk is below the program risk cutoff, then the pathway should be monitored by random sampling, at a rate advised by the CARP, based on statistical analysis of previous inspection data, for example using the IRIS tool.

2.3 Deliverables

The deliverables of ACERA project 1001f are as follows:

1. a report that reviews the risk associated with the adoption of Phase 1 of the RD risk–return strategy (delivered: Robinson et al., 2009b),
2. a report that details statistical models and examples of use for more fine-grained risk profiling, with a spreadsheet, an algorithm, and/or business rules to identify high-risk pathways and documentation suitable to implement same (delivered: Robinson et al., 2009c), and
3. a training workshop (delivered in November 2009) and guidelines for operational deployment (this report).

The balance of this report is structured as follows. Chapter 3 provides a summary of the recommended workflow of the use of the IRIS tool to support pathway risk management, as performed by the Air Cargo program with support from CARP. Chapter 4 details the recommended inspection regime to be carried out within each region. Chapter 5 describes the data template to be used by the regions to capture the inspection data and to report the data to the pathway manager. Finally, Chapter 6 describes the quarterly operations that should be undertaken by CARP to provide the Air Cargo program with guidance about the level of quarantine risk that is reflected in the inspection data.

3

Workflow

The purpose of the quarterly analysis of inspection data by CARP is to produce statistical information that can be used to assist in managing the biosecurity risk of the pathway. Pathway risk managers will use the statistical information as one component of the pathway risk management decision-making process.

The workflow is as follows.

1. The regional offices will perform inspections on RDs using a protocol that is based on risk–return principles, and communicated to them by the pathway manager (Chapter 4).
2. The outcomes of the inspections will be recorded on templates that are provided by the pathway manager, which are to be returned to the pathway manager each quarter (Chapter 5). The pathway manager provides these templates to the CARP.
3. The CARP analyzes the data on the templates and:

   (a) estimates the risk of the pathway and any sub-pathways, and

   (b) identifies any sub-pathways that show evidence of particularly high risk (e.g., risky flights).

   The CARP reports the analysis to the pathway manager, providing estimates of risk, interpretation, and context (Chapter 6).
4. The pathway manager decides whether the level of risk in the pathway and sub-pathways is acceptable, and may solicit further guidance from the CARP as to appropriate remedial actions. Examples of such guidance would be a recommendation for increased inspections, or the identification of sub-pathways that should be inspected at a higher rate.
5. The pathway manager advises the regions of any changes to the inspection protocol that are necessary.

4

Inspection Strategy

We recommend the following inspection regime for RDs for all regions. Inspection rates refer to the rates of inspection of flights, not RDs.

- a minimum 20% inspection rate of flights arriving between 6 am and 6 pm on weekdays, selected randomly except as noted below;
- Targeted inspection — flights that are suspected of being high-risk should be targeted in addition to the 20%. Here we refer to *high-risk* as meaning either (i) that there is an unusually high probability of contamination, determined using inspection records, or (ii) that the consequences associated with contamination are of particular concern.
- Night inspection — once per calendar month for any regions with flights arriving between 6pm and 6am, inspect at least 20% of those flights, selected randomly except as noted above.
- Weekend inspection — one weekend day per calendar month for any regions with flights arriving on weekend days, inspect at least 20% of those flights, selected randomly except as noted above.
- Leakage inspections will proceed as per previous protocols. That is, 10% of the x-rayed RDs will be reinspected by x-ray, and 10% of the reinspected RDs will be opened by hand.
- Inspection results will be provided quarterly to CARP for analysis and risk–return update.

The inspection rate should average or exceed 20% of week-day flights across a year. The inspection rate may exceed 20% due to random fluctuations and/or targeted inspections. The inspection level of one weekend day per month is chosen based on striking an informal balance between convenience and data collection. It should not be interpreted as a hard–and–fast prescription by the managing program. However, some hard–and–fast prescription should be made to provide guidance for the regional offices.

4.1 Random selections

The best approach for random selection of flights will be specific to individual regions. Regional offices should be encouraged to suggest alterations for operational clarity and convenience.

The designs laid out below should be run as a trial for at least four quarters, as a burn-in period. At that point the CARP should review the estimated risk and provide guidance as necessary for changes to inspection rates or protocols, based on the statistical analysis of the historical inspection data.

The number of RDs on flights that are not inspected does not need to be recorded. This information will be obtained by the CARP from Customs if necessary.

Note that the sample designs that are described below for each of the regions are only recommendations, arrived at after discussions with each region. They should be considered as guidelines, not hard–and–fast prescriptions.

4.1.1 Adelaide

On average, five RD–bearing flights arrive per day at Adelaide International airport between 6 am and 6 pm. All RD movements pass through Australian Air Express, so all inspections can take place there. The region will inspect all the RDs that arrive on a single specific flight each week day, rotating the flight/day combination so that all flights are approximately equally covered.

One random weekend shift will also be inspected each month.

4.1.2 Brisbane

Up to 40 flight numbers arrive each month between 6 am and 6 pm. Some flights arrive daily, others are sparse. Any given day can see up to 12 flight numbers. Five daily flights arrive regularly holding RDs. The RDs are unloaded and delivered to one of two express couriers: DHL and TNT.

Every flight is inspected once per week except those that arrive on Saturday or Sunday; the latter will inspected once per month. Flights that arrive after 6 pm will be held over until the next day. Inspections will be performed by officers who will be on-site at the CTO for SAC inspection and surveillance duties.

This design represents a compromise between effort and complexity. It will result in over-sampling of the flights that arrive less frequently than daily, but that is perfectly acceptable from the statistical point of view.

4.1.3 Melbourne

Approximately 18 RD–bearing flights arrive each day between 6 am and 6 pm. The RDs are delivered to one of four CTOs: TNT, DHL, UPS, and Fedex.

During each weekday, the region will inspect all the flights that arrive at one of the four CTOs. Each CTO will therefore have all the arriving ULDs inspected on at least one day per week; on the fifth day the region will inspect all the flights at a CTO for a second time. Thus all ULDs arriving at each CTO will be inspected on five days every four weeks. The CTO will be given at least 24 hours notice to permit the RD to be banked up and inspected in a continuous stream.

Apart from DHL, flights that arrive later than 2 pm routinely have RD held over until the next morning. One random evening shift per month will be included, which comprises the inspection of RDs from all flights arriving outside 6am to 6 pm.

One random weekend shift will also be inspected each month.

4.1.4 Perth

Approximately 22 flights per week deliver RD to Perth, which are then dispersed among 5–6 express couriers (EC). Each EC will be visited one different day per week; all RDs arriving at that courier between 6 am and 6 pm will be inspected. The EC day will be rotated approximately monthly.

One weekday per month will be selected by the region; on that day, all RDs that arrive after 6 pm will also be inspected.

One random weekend shift will also be inspected each month.

4.1.5 Sydney

Sydney is the major hub for RDs. Approximately 70 RD–bearing flights arrive each day between 6 am and 6 pm. Most of the RD arrive at DHL (30 flights), TNT (20 flights), Fedex (12 flights), and UPS (12 flights); the balance are spread amongst smaller CTOs.

A point of concern with random sampling from 6 am until 6 pm for the Sydney operation is that the distribution of RD per flight is very skewed; that is, there are a few freighter flights that carry the bulk of RDs, and many flights that carry few RDs. The proposed design will lead to undesirably high variability of sampling rates.

Therefore, the Sydney operation will target freighters as much as possible. Furthermore, the operation will inspect all RDs that arrive in each express courier during a different time period each day per week, rotating the time slot across the bonds not more frequently than monthly.

One random weekend shift will also be inspected each month.

4.2 Targeted selections

Currently, no flights are identified as high-risk flights in any region for this pathway.

4.3 Inspection Effectiveness

Leakage surveys must be performed to provide timely statistical information about pathway-level effectiveness. Leakage surveys also satisfy subsidiary roles of motivation and interception. Leakage surveys for RDs will proceed as per previous operations.

4.4 Purposive Sampling

At any time, AQIS may gain intelligence about the expected contamination of any of the pathways described in this report. The intelligence might suggest, for example, that a particular flight or courier or carrier should be targeted with extra inspections, in addition to the 20% prescribed herein. The pathway manager should act on this intelligence without concern about the statistical ramifications of unbalanced pathway monitoring.

5

Data Template

The template to be used by regional offices for recording RD inspection data will be constructed as follows. It will be a spreadsheet that contains at least two worksheets:

1. **Reportable Docs** will report the inspection effort, and
2. **Intercepts** will report the details of contaminated RDs.

Other worksheets may be added by the program to ease data handling.

5.1 Reportable Docs

The Reportable Docs sheet will report the inspection effort. It will comprise ten columns (Figure 5.1):

1. **Date** of inspection, in dd/mm/yy format,
2. **Flight** flight number,
3. **Port of Origin**,
4. **Courier**,
5. **MAWB** — the Master Airway Bill number,
6. **Number of Bags** inspected, where available,
7. **Number of Pieces** inspected, where available,
8. **X-Ray Validation** recording the number that are re-inspected,
9. **Inspection Validation** recording the number that are opened,
10. **Officer**'s Name, and
11. **Comments**

	A	B	C	D	E	F	G	H	I	J	K
1	Date	Flight	Port of origin	Courier	MAWB	Number of Bags	Number of Pieces	X-Ray Validation	Inspection Validation	Officer	Comments
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
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16											
17											
18											
19											
20											
21											
22											
23											

Figure 5.1: Screen capture of the worksheet that captures the inspection effort.

5.2 Interceptions

The Intercepts sheet will report the details of contaminated RDs. It will comprise 16 columns, labeled as follows (Figure 5.2).

1. **Date** of inspection, in dd/mm/yy format,
2. **Flight** flight number,
3. **Port of Origin**,
4. **Courier**,
5. **Declared as**,
6. **Actual contents**,
7. **Type of Risk**,
8. **Method of Detection** (Inspection, X-ray validation, or Inspection validation,
9. **AIMS**,
10. **AIMS Result**,
11. **MAWB** — the Master Airway Bill number,
12. **HAWB** — the House Airway Bill number,
13. **Officer**'s Name,
14. **ICS Referring Officer**,
15. **Letter Written** by Air Cargo Manager,
16. **Additional Comments**,
17. **Auditor's Comments**, and
18. **Audited By**.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1	Date	Flight	Port of Origin	Courier	Declared As	Actual Contents	Type of Risk	Method of Detection	AIMS	AIMS RESULT	MAWB	HAWB	Officer	ICS Referring Officer	Comment - Letter written (sent to be added by Air Cargo manager)	Additional Comments	Auditor's Comments	Audited By
2																		
3																		
4																		
5																		
6																		
7																		
8																		
9																		
10																		
11																		
12																		
13																		
14																		
15																		
16																		
17																		
18																		

Figure 5.2: Screen capture of the worksheet that captures the interception results (split into two pieces for easy reading).

6

Analysis

The purpose of the quarterly analysis of inspection data by CARP is to produce statistical information that can be used to assist in managing the biosecurity risk of the pathway. Pathway risk managers will use the statistical information as one component of the pathway risk management decision-making process.

This chapter describes the process by which the quarterly inspection data are used to determine whether or not the pathway should be fully inspected, and if not, at what rate the random inspections should proceed.

6.1 Background: Managing the Biosecurity Risk

Management of the pathway biosecurity risk proceeds as follows. The pathway program nominates a cutoff, a level below which the leakage rate of actionable biosecurity risk material is to be reliably kept. This cutoff is possibly chosen with input from other stakeholders, and may vary for different components of the pathway. The cutoff is determined in the context of the definition of BRM that is considered *actionable*. In addition, the pathway program nominates a confidence, which can be interpreted as the level of confidence with which the program wishes to state that the BRM leakage rate is below the risk cutoff.

For example, the program might use the figures of a risk cutoff of 1% with statistical confidence 95%. Then,

- the risk of the pathway is estimated using the algorithms encoded in the ACERA IRIS (Inspection Risk and Inspection Surveillance, see Section 6.2) spreadsheet tool or similar;
- if the estimated risk of the pathway is above the cutoff specified by the program then the pathway should be either inspected at 100% or inspected at a sufficient rate that the estimated pathway leakage will be below the program risk cutoff; and
- if the estimated risk is below the program risk cutoff, then the pathway should be monitored by random sampling, as specified in Chapter 4.

The purpose of increasing the inspection rate of a pathway is to decrease the pathway leakage. Alternative measures to reduce the risk of the pathway may be worth considering. For example,

- the pathway manager could decrease the pathway leakage by rigorously following up on interceptions, and determining whether or not the interceptions represented a genuine biosecurity risk; and

- effective use of profiling could be used to alter the balance of inspections on sub-pathways. If risk on sub-pathways can be demonstrated to vary then inspection resources can be preferentially and profitably directed towards the high-risk sub-pathways. An example of such a collection of sub-pathways in the context of RDs might be couriers, airlines, flights, or load ports.

6.2 Quarterly Risk Calculations

6.2.1 Introduction

In order to facilitate this management, the CARP will produce statistical estimates of risk at the pathway level, and sub-pathway levels as appropriate. The following instructions provide one possible strategy for preparation and analysis of the data. Alternatives that are more convenient may be developed by the CARP and the program that manages the pathway.

6.2.2 Preparation

The first nine columns of the inspection record spreadsheet (Figure 6.1) are to be copied directly from the inspection tab of the regional monthly RD inspection template (see Figure 5.1). Each row in these spreadsheets represents the inspection of all the RDs of a single flight.

The next column computes the number of RD pieces inspected. If the number of pieces is recorded, then that number is used. If the number of pieces is not recorded, *then the average number of RD pieces per bag is assumed to be nine*, so the number of pieces is estimated as the number of bags multiplied by 9.

The next column represents the number of detections of actionable contamination in RDs for each flight. These values are manually transcribed from the interceptions tab of the regional template (see Figure 5.2). That is, the counts of contamination by flight and date are summarized from the regional template and entered into the inspection record spreadsheet.

The final column is used to determine which rows are included in the pivot table to the right, which computes the relevant statistics.

Ordinarily the rows corresponding to the previous year's worth of inspections will be included. When the data have been entered and the rows selected (using the Scope column), then refresh the pivot table (select the table with the mouse, right-click, and select Refresh Data).

The results from the pivot table should then be discussed with the pathway manager. Briefly, the results are interpreted as follows. Each row corresponds to all of the inspections that have been performed for a particular flight number. The first column (Flights) reports the number of times that flight was inspected. This number can be used to see whether the correct number of inspections per flight is being approximately achieved. The second column (RDs) reports the total number of RDs that have been inspected per flight and overall. The third column reports the rate (from 0 to 1) of actionable contamination by flight, and should be used to identify risky flights, either formally or informally.

6.2.3 Calculation

A screen capture of the IRIS tool is presented in Figure 6.2. Four key statistics must be entered in order to prescribe an inspection strategy. Each of the four key characteristics is identified

Date	Flight	Port of origin	Courier	MAWB	HAWB	Number of Bags	Number of Pieces	X-Ray Validation	Inspection Validation	Piece Count	Actionable Intercepts	In Scope
1/04/2010	QF082	London				0	0	0	0	0	0	1
6/04/2010	NZ221	Auckland				0	0	0	0	0	0	1
7/04/2010	SQ269	Singapore	DHL			6	54	9	2	54	0	1
8/04/2010	CX105	Kuala Lumpur	DHL			3	27	9	2	27	0	1
9/04/2010	SQ269	Singapore	DHL			3	27	9	2	27	0	1
12/04/2010	QF082	London	DHL			0	0	0	0	0	0	1
13/04/2010	SQ269	Singapore	DHL			3	27	9	2	27	0	1
14/04/2010	CX105	Hong Kong	DHL			5	45	9	2	45	0	1
15/04/2010	MH139	Kuala Lumpur	DHL			3	27	9	2	27	0	1
16/04/2010	NZ221	Auckland				0	0	0	0	0	0	1
19/04/2010	SQ269	Singapore	DHL			3	27	9	2	27	0	1
20/04/2010	MH139	Kuala Lumpur	DHL			3	27	9	2	27	0	1
21/04/2010	CX105	Hong Kong	DHL			2	18	9	1	18	0	1
22/04/2010	QF082	Singapore	DHL			4	36	9	2	36	0	1
23/04/2010	NZ221	Auckland	DHL			0	0	0	0	0	0	1
27/04/2010	CX105	Hong Kong	DHL			4	36	9	1	36	0	1

In Scop 1

	Data			
Flight	Flights	RDs	AI Rate	AI Sum
CX105	13	427	0	0
MH139	9	171	0	0
NZ221	11	0	0	0
QF082	10	108	0	0
SQ269	13	558	0	0
SQ279	3	117	0	0
Grand T	59	1381	0	0

Figure 6.1: Screen capture of inspection spreadsheet holding South Australia RD inspection data. See Section 6.2.2 for description of usage.

below along with the column for entry in the IRIS algorithm spreadsheet.

1. The total number of RDs actually inspected during the quarter (Column B),
2. The total number of RDs for which actionable BRM was detected during the quarter (Column C),
3. The total number of RDs expected to arrive in the next quarter (Column D), and
4. An estimate of the inspection leakage rate, that is, the rate at which inspections miss existing actionable BRM. This quantity is also referred to as the inspection effectiveness (Column G).

The IRIS spreadsheet then combines these four statistics with the pre-determined cutoff (Column H), and the confidence with which the program wishes to state that the rate is below the cutoff (Column I). The spreadsheet is more completely detailed in Tables 6.1 and 6.2.

When the data noted above have been entered, the goldenrod cells can be *interpreted*. Specifically,

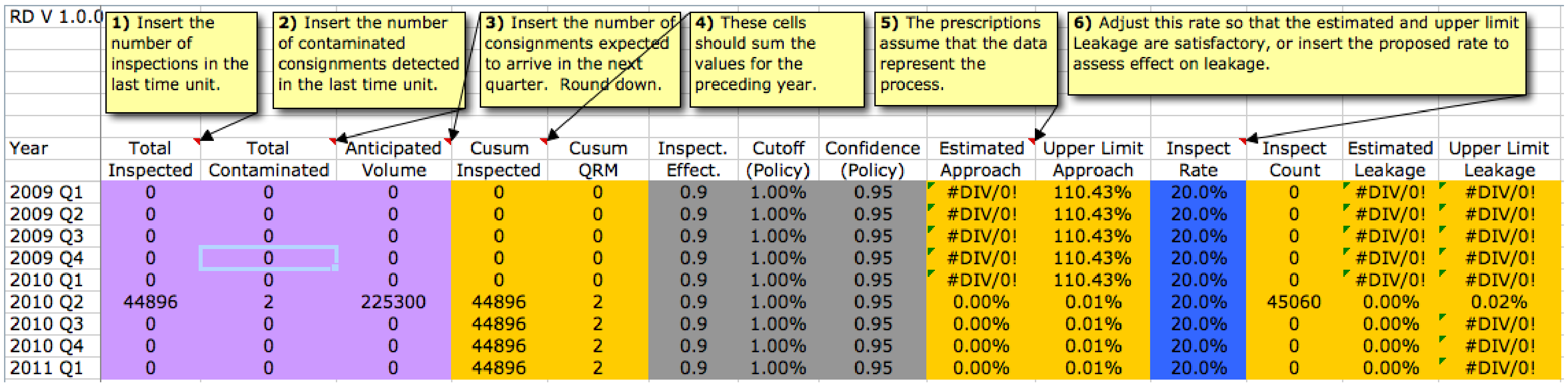
- The estimated approach (Column J) reports an estimate of the inherent rate at which BRM approaches on the pathway.
- The upper limit approach (Column K) reports an estimate of the inherent risk of the pathway, following the definition of risk recommended by Robinson et al. (2008), which is the estimate of the rate inflated to reflect ignorance about the rate. The level of the limit is determined by the confidence level (Column I).
- The nominal inspection rate is inserted in Column L.
- The nominal inspection rate is converted by IRIS into a proposed inspection count using Column D.
- The future leakage is predicted by IRIS in Column O. This prediction of the leakage takes account of the estimated approach rate (Column J), the proposed inspection rate (Column L), and the inspection effectiveness (Column G).
- A conservative prediction of the future leakage is presented by IRIS in Column P. This prediction takes account of the same factors as does the prediction of the future leakage in Column O, but produces an upper limit instead of a best guess. The level of the limit is determined by the confidence level (Column I).

If the results of IRIS suggest that the pathway risk is higher than desirable, then the blue cells can be *changed* to reflect alternative inspection regimes. Increasing the inspection rate will decrease the expected and upper-limit leakage.

6.3 Limitations

The IRIS tool is designed to produce statistical information about the risk of contamination on a pathway, and to guide decision-making about the amount of future inspection effort to invest in a pathway. IRIS will not provide guidance as to the severity of the contamination.

The IRIS tool is not designed to produce statistical information about temporal trend or spatial patterns of contamination. However, the user interface of IRIS is generic, and its algorithms can be updated as deemed necessary or useful in time.



Year	Total Inspected	Total Contaminated	Anticipated Volume	Cusum Inspected	Cusum QRM	Inspect. Effect.	Cutoff (Policy)	Confidence (Policy)	Estimated Approach	Upper Limit Approach	Inspect Rate	Inspect Count	Estimated Leakage	Upper Limit Leakage
2009 Q1	0	0	0	0	0	0.9	1.00%	0.95	#DIV/0!	110.43%	20.0%	0	#DIV/0!	#DIV/0!
2009 Q2	0	0	0	0	0	0.9	1.00%	0.95	#DIV/0!	110.43%	20.0%	0	#DIV/0!	#DIV/0!
2009 Q3	0	0	0	0	0	0.9	1.00%	0.95	#DIV/0!	110.43%	20.0%	0	#DIV/0!	#DIV/0!
2009 Q4	0	0	0	0	0	0.9	1.00%	0.95	#DIV/0!	110.43%	20.0%	0	#DIV/0!	#DIV/0!
2010 Q1	0	0	0	0	0	0.9	1.00%	0.95	#DIV/0!	110.43%	20.0%	0	#DIV/0!	#DIV/0!
2010 Q2	44896	2	225300	44896	2	0.9	1.00%	0.95	0.00%	0.01%	20.0%	45060	0.00%	0.02%
2010 Q3	0	0	0	44896	2	0.9	1.00%	0.95	0.00%	0.01%	20.0%	0	0.00%	#DIV/0!
2010 Q4	0	0	0	44896	2	0.9	1.00%	0.95	0.00%	0.01%	20.0%	0	0.00%	#DIV/0!
2011 Q1	0	0	0	44896	2	0.9	1.00%	0.95	0.00%	0.01%	20.0%	0	0.00%	#DIV/0!

Figure 6.2: Screen capture of IRIS algorithm spreadsheet with national inspection data for RDs, for the purposes of demonstration. See Section 6.2.3 for description of usage.

Table 6.1: IRIS — ACERA cargo risk model guidance colour key.

Colour	Key
Orchid	Data inserted by CARP, quarterly, from Pathway Manager.
Goldenrod	ACERA Cargo Risk Model outputs.
Gray	Data and policy levels inserted by CARP, reviewed regularly (e.g., annually) with Pathway Manager.
ProcessBlue	Inspection rate can be adjusted by CARP to affect projected leakage rate.

6.4 Sub-pathway analysis

Analysis of components of the pathway should be performed by the CARP quarterly. The analysis of sub-pathways, such as flights, involves two phases.

1. The CARP should assess how many times each flight has been inspected, and therefore the rate of inspection for the flights. Counting the number of times each flight is inspected will help to identify whether any flights seem to be over- or under-inspected. As noted above, at least 20% of all week-day flights for each region should have all RDs inspected. For some regions, this level of intervention will be readily verified, for others, it may be necessary to construct some summary statistics to be confident that the inspection level is reasonable for each flight.

   This step is provided by the pivot table included in the inspection record spreadsheet.

2. The CARP should estimate the risk of each flight. This could be performed either by simply dividing the BRM interceptions against the number of inspections for the flight, or even using a risk tool similar in scope to the IRIS algorithm, as captured by the reported spreadsheet tool. Reporting the estimated risk of each flight will help to identify whether any flights seem to be of substantially higher risk than the others. If so, then the pathway-level risk may be reduced by using a profile to increase inspection efforts on the high-risk flights.

   This step is provided by the pivot table included in the inspection record spreadsheet.

The spreadsheets are designed to be applied quarterly, but at each quarter to use the previous 12 months data when they are available.

Table 6.2: IRIS — Inspection Risk and Inspection Surveillance ACERA cargo risk model guidance notes. See Table 6.1 for colour key.

Col	Column Name	Notes
A	Year / Quarter	Year and financial quarter
B	Total Inspected	Total number of inspections per quarter. E.g. For ECIR pathway, total number of sea containers inspected. Insert the number of inspections in the last quarter.
C	Total Contaminated	Total number of contaminated items found. Insert the number of contaminated items detected in the last quarter.
D	Anticipated Volume	Insert the number of items expected to arrive in the next quarter. Round down.
E	Cusum Inspected	Cumulative sum of the inspected items. These cells sum the values of the preceding year.
F	Cusum BRM	Cumulative sum of the items that contained BRM. These cells sum the values of the preceding year.
G	Inspection Effectiveness	If there is BRM present in or on the item, what is the probability that it is found? This rate is estimated using previous effectiveness surveys conducted by AQIS.
H	Cutoff (Policy)	The cutoff rate is set by the pathway manager, and differs for each pathway. [The cutoff rate is a policy decision yet to be decided. Current modeling is based on 1%]
I	Confidence (Policy)	Represents the confidence we need to have that the leakage rate is below cutoff. [The confidence rate is a policy decision yet to be decided. Current modeling is based on 95%.]
J	Estimated Approach	An estimate of the actual rate at which BRM comes along the pathway. (N.B. The quality of this and the following estimates depends on how well the data represent the actual process).
K	Upper Limit Approach	Estimated upper limit for actual approach rate. The estimated number that we are 95% confident that the actual, unknown rate is below. (Upper limit of a reasonable range).
L	Inspect Rate	Inspection Rate. The inspection rate can be adjusted so that the estimated and upper limit leakage is satisfactory, or to reflect a level nominated by the Pathway Manager.
M	Inspect Count	Inspection Count. Number of items to be inspected according to the Inspect Rate.
N	(No Label)	(Hidden column)
O	Estimated Leakage	Estimated future leakage.
P	Upper Limit Leakage	Estimated upper limit for future leakage. The number that we are 95% confident that the future, unknown leakage will be below. (Upper limit of a reasonable range).

Bibliography

Beale, R., Fairbrother, J., Inglis, A., and Trebeck, D. (2008). *One Biosecurity: a Working Partnership*. Commonwealth of Australia.

Robinson, A., Burgman, M., Atkinson, W., Cannon, R., Miller, C., and Immonen, H. (2008). AQIS Import Clearance Data Framework. Technical Report 0804, Australian Centre of Excellence for Risk Analysis.

Robinson, A., Burgman, M., Langlands, R., Cannon, R., and Clarke, F. (2009a). AQIS Import Clearance Risk Framework. Technical Report 0804a, Australian Centre of Excellence for Risk Analysis.

Robinson, A., Karri, R., Clarke, F., Theakston, M., and Scott, M. (2010). AQIS Import Clearance Risk Return: ULD Report 3. Technical Report 1001e 3, Australian Centre of Excellence for Risk Analysis.

Robinson, A., Karri, R., and Luckman, G. (2009b). AQIS import clearance risk return: HVLV/Reportable Documents report 1. Technical Report 1001f 1, Australian Centre of Excellence for Risk Analysis.

Robinson, A., Karri, R., and Luckman, G. (2009c). AQIS Import Clearance Risk Return: HVLV/Reportable Documents Report 2. Technical Report 1001f 2, Australian Centre of Excellence for Risk Analysis.

Robinson, A., Karri, R., and Luckman, G. (2009d). AQIS Import Clearance Risk Return: ULD Report 1. Technical Report 1001e 1, Australian Centre of Excellence for Risk Analysis.

Appendix A

Definitions / Acronyms

ACERA	Australian Centre of Excellence for Risk Analysis
AQIS	Australian Quarantine Inspection Service
BRM	Biosecurity Risk Material
CARP	Cargo Analysis and Review Program
CPM	Cargo Positioning Manifest, which shows the position and type of RD in the aircraft. Used by the leading hand to co-ordinate the loading and unloading of the aircraft.
CTO	Cargo Terminal Operator, which controls the area of the airport or wharf in which cargo is loaded and unloaded from aircraft or ships. This role also encompasses cargo handlers such as stevedores, who load international sea cargo.
Cusum	Cumulative Sum
ECIR	External Container Inspection Regime. External inspection of containers at the wharf. Relates to sea cargo only.
HRM	High-Risk Movement
IC	Import Clearance
IQI	Increased Quarantine Intervention
IRIS	Inspection Risk and Inspection Surveillance; IRIS is an algorithm that is presented in a spreadsheet tool developed by ACERA to calculate pathway risk using inspection and contamination data
Items	The material, unit, vessel or object undergoing inspection for BRM.
Leakage Rate	The rate of items crossing the border that still contain BRM.
Pathway manager	The AQIS manager responsible for resourcing, monitoring and reporting for the pathway. E.g. Ferne Clarke
ULD	Unit Load Device (air can). Air container used for transporting goods on aircraft.

Appendix B

Change Log

12-12-2010 Final draft with references to "surveillance inspections" renamed.

25-11-2010 Updated description of Brisbane workflow after conversation with Rafi Alam and Melbourne workflow after discussion with Adam Bennett and Marisa Perri.

10-11-2010 Information about bag multiplier added (assumes 9 RD pieces per bag).

30-10-2010 Initial draft.