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21 December 2009

Office of the Chief Executive
Biosecurity Australia
GPO Box 858
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To whom it may concern,

Draft import risk analysis report for fresh apple fruit from the United States of America Pacific Northwest states.

Please find attached the DPIPWE's comments on the *Draft import risk analysis report for fresh apple fruit from the United States of America Pacific Northwest states*. The comments have been prepared by a DPIPWE Biosecurity Technical Group (BTG) Working Group comprising representatives from government and local industry. If you have any questions, please contact me on (03) 6421 7634 or Andrew.Bishop@dpipwe.tas.gov.au.

Also note that Alex Schaap, General Manager, Biosecurity and Product Integrity Division, DPIPWE, and Chair of BTG has written to Dr Colin Grant on the matter of recognition of regional difference in the conduct of IRAs, copy attached for your information.

Yours sincerely

Andrew Bishop
Manager
BIOSECURITY & PLANT HEALTH BRANCH

Draft import risk analysis report for fresh apple fruit from the United States of America Pacific Northwest States.

DEPARTMENT OF PRIMARY INDUSTRIES, PARKS, WATER, & ENVIRONMENT (TASMANIA) SUBMISSION

Prepared by the Biosecurity Technical Group Apple Fruit Working Group, December 2009

CONTEXT OF WORKING GROUP COMMENT

These comments are submitted because apple fruit from the USA Pacific North West (PNW) potentially pose a direct biosecurity threat to Tasmania's pome fruit industry, and to other plant industries in this State that might also be affected by pests associated with the import proposal. However, the Tasmanian Government believes the potential ramifications of new pests on apple fruit from the PNW entering and establishing in Tasmania, go beyond this.

Our favourable biosecurity status is integral to, and at the heart of, the Tasmanian brand, and hence our ability to maintain and position ourselves as a unique source of a broad range of quality, natural produce and products for discerning national and international markets. Accordingly, a biosecurity threat to any single industry, such as pome fruit, is also a threat to how the whole Tasmanian brand is maintained, perceived and valued in the market.

Further, Tasmania's small size and proportionately high reliance on primary industries means that even a modest impact on one industry can have relatively greater impacts on the State's economy and people, than is the case for larger, more diverse mainland economies.

These characteristics of the Tasmanian situation inform the following comment on the *Draft import risk analysis report for fresh apple fruit from the United States of America Pacific Northwest States*.

COMMENTS FOR SELECTED SECTIONS OF THE DRAFT IRA REPORT:

1. Section 2 - Method for Pest Risk Analysis

General observations
This section of the draft IRA and Appendix D explain elements of the method used to assess pest risk, including the approach to use of qualitative likelihoods, and recognition of regional difference. These responses are acknowledged, and the DPIPWE requests and looks forward to an opportunity to participate in future reviews of the pest risk assessment method, and the informal consultations proposed by BA.

However, we reiterate other methodological concerns raised in our submission to the Issues Paper which do not appear to have been addressed in the draft IRA. These are:

- Alternative host distribution patterns in Australia are not sufficiently specified in the consideration of consequences, especially where pome fruit growing and an array of other agricultural enterprises (other orchards, vineyards, other agriculture) are clustered;

- Trade impact estimates are insufficiently justified. Certain types of cost are identified (eg. loss of markets, increased treatment costs for exports) however there is little attempt to quantify the range within which these losses could be expected to fall, or the current value of the trade potentially at risk, nor is there comment on the relative impacts in areas which have proportionately high reliance on potentially affected trade;

- Domestic trade impacts of incursions associated with the proposed import may manifest country-wide since fruit markets operate on a national scale. It remains difficult to see why domestic trade impacts are mostly assessed as significant at local and district levels;

- Low scores are generally assigned to potential environmental impact but these appear to be based largely on absence of evidence. It is difficult to predict environmental impacts of pests known primarily for their effects in production systems but we maintain it is important, at least for transparency, to distinguish whether the estimate is a based on assumption or evidence;

- While the IRA refers to existing policy (apples from Japan, New Zealand etc.) in pest risk assessments for PNW apples, we maintain that there is still little clarity about whether or how potential cumulative risk resulting when additional market access for the same host product from different countries, is considered;

- While detection on arrival of trash with PNW apples would trigger quarantine actions in Australia and excluding trash from the analysis is consistent with previous policy, it nonetheless seems imprudent not to consider potential trash and other contamination issues, particularly for serious pests (eg. Fire blight, see comment below) for which trash and contaminated conveyances are plausible vectors.

Accordingly, the DPIPWE recommends that the draft IRA report should:

(1) *Better characterise alternative host distributions and consider whether this influences likelihood and consequence estimates; and*

(2) *More explicitly describe potential international and domestic trade impacts, including in relation to potential economic costs. and how the nationally integrated nature of domestic fruit and other host product trade affects consequence estimates; and*

(3) *Clearly articulate that low scores for environmental impact are based on assumption, unless potential for impact in the environment has been tested and the evidence suggests consequences are likely to be insignificant; and*

(4) *Clarify how existing policy that allows import of apples from other countries is taken into account from the perspective of cumulative risk; and*

(5) *Consider likelihood of entry associated with apple leaf, stem and other trash, and contaminated apple conveyances, in particular in relation to pests with potentially significant impacts.*

Treatment of uncertainty in pest risk assessments

The need to *document the areas of uncertainty and the degree of uncertainty in the assessment, and to indicate where expert judgement has been used* as specified in the International Standard for Pest Management 11: *Pest Risk Analysis for Quarantine Pests Including Analysis of Environmental Risks and Living Modified Organisms* (ISPM 11) is a significant methodological issue.

ISPM 11 emphasises that clear treatment of uncertainty is important. However, the draft IRA does not in general adequately document the nature or extent of uncertainty in each pest risk assessment. New Zealand's biosecurity authority incorporates a statement of uncertainty into its import risk analyses, providing an example of how this can be done (MAF 2008) to improve transparency.

In addition, where uncertainty exists either because information was unavailable or the data are open to interpretation, the draft IRA report tends to assert a position rather than consider plausible alternative explanations. We note that the WTO Appellate Body has commented explicitly on this matter and considers that:

'*The risk assessment could set out both the prevailing view representing the mainstream of scientific opinion, as well as the opinions of scientists taking a divergent view'* (WTO 2009).

While these comments applies to national IRAs generally, being more explicit about uncertainty is particularly important in evaluating risk posed by pests which may have serious impacts from which recovery is unlikely or difficult. In this draft IRA, the uncertainty surrounding likelihood of introduction and economic consequences of fire blight, are a case in point, to which we return below.

The DPIPWE recommends that:

(6) The draft IRA report should be amended to clearly articulate the nature and extent of uncertainty in the analysis, to identify and discuss plausible alternative explanations, and to explain how uncertainty was factored into likelihood and consequence estimates.

2. Section 4 - Pest Risk Assessments for Quarantine Pests

Pest categorisation and verification of Pest Free Status

In its submission to the Issues Paper for this proposal, Tasmania requested that the pest free status of the PNW from pests of concern to Australia should be verified according to relevant international standards (ie. ISPM Nos 4, 6, 8, 10, 17 and 26).

Three Tephritid fruit fly species are indentified in the pest categorisation. These species were not further assessed because they are occasional incursions in California that are eradicated. The species are:

Anastrepha ludens (Mexican fruit fly);
Bactrocera dorsalis (Oriental fruit fly); and
Ceratitis capitata (Mediterranean fruit fly).

Consistent with the relevant international standards, surveillance is needed to establish and maintain part or all of the PNW as a Pest Free Area for Fruit Flies. Given that these species are significant pests, and are detected intermittently in California, general surveillance is insufficient. Rather, specific surveys are necessary to demonstrate fruit fly freedom. This would also mean that the requirements Australia imposes internationally align more closely with domestic arrangements for fruit fly surveillance.

The DPIPWE recommends that:

(7) The Draft IRA report should verify that data supporting area freedom for Anastrepha ludens, Bactrocera dorsalis and Ceratitis capitata meet ISPM 26, and that specific surveys are in place to ensure pest free status is maintained.

(8) The pest categorisation for quarantine pests that are not recorded in the PNW but present elsewhere in the USA, should be revised to include species for which official control measures intended to prevent entry to the PNW are in place. The nature and likely effectiveness of those official control measures should be confirmed prior to excluding these pests from further assessment.

Rhagoletis pomonella (Apple maggot)

Rhagoletis pomonella (apple maggot) is regarded as the most serious potential tephritid pest for many apple producing temperate areas (CABI 2007). It has spread from its original range in eastern North America to western states of the USA over the last thirty years (Foote *et al*. 1993). The draft IRA assesses the likelihood of entry, establishment and spread of *R. pomonella* as LOW. However, the estimates of the likelihood of distribution and spread in the draft IRA are likely to be underestimates for the following reasons.

Likelihood of entry - *R. pomonella* is widespread in North America with populations from Mexico to Canada, and throughout the USA. Infected fruit imported into Australia is likely to be widely distributed and therefore fruit will almost certainly be imported into a climate suitable for the pest to emerge from infected fruit. As the draft IRA notes, infected fruit are likely to be disposed in suitable habitats for pupation, and potential hosts of the pest are common. Therefore the likelihood of distribution and transfer to a suitable host is more appropriately estimated as HIGH.

Likelihood of spread: *R. pomonella* has broad climatic tolerances, with populations spanning most of North America. Therefore it is likely that large areas of Australia would have a suitable climate for establishment and spread. The availability of hosts of *R. pomonella* is also unlikely to be a limiting factor to spread because the hosts are common in Australia.

The draft IRA notes that *Rhagoletis* species are generally not known to fly more than short distances, and that this supports a likelihood of spread estimate of MODERATE. However, the rate of spread of this pest in America contradicts the notion that spread is limited by natural dispersal ability. Additionally, the assertion in the draft IRA that the pest is unable to fly large distances is based on a literature review by Fletcher (1989) who noted that the study of fruit fly dispersal remains 'conjectural' due to the limitations of the methods used to estimate dispersal. These limitations apply to the experiments that were relied upon to estimate the likelihood of spread of *R. pomonella* in the draft IRA. Given this, the risk of spread is more appropriately estimated as HIGH.

Magnitude of impact: Consequence of establishment of *R. pomonella* is assessed as HIGH and the impact on domestic and international trade is assessed as "significant at the district level" in the draft IRA. If this pest was introduced into Tasmania, significant State-wide impacts (ie. at the regional level) would occur because it would result in the loss of Tasmania's whole-of-state fruit fly freedom status which facilitates access to markets not available to other Australian producers. Loss of Tasmania's unique market access would also have national implications because product that otherwise would have been exported overseas (eg. cherries to Taiwan), would need to be sold interstate, leading to supply increase in the domestic market. Given this the consequence estimate for international and domestic trade should be "significant at the regional level".

The DPIPWE recommends that:

(9) The draft IRA report should be amended such that the risk assessment for Rhagoletis pomonella estimates likelihood of distribution and likelihood of spread as HIGH, and impact on international and domestic trade as 'significant at the regional level'

Fire Blight (*Erwinia amylovora*)

The pest risk assessment for fire blight in the draft IRA report contends that the unrestricted risk of *E. amylovora* associated with apple fruit from the PNW falls in the same range as risk associated with apple fruit from New Zealand, previously assessed as 'LOW' (BA 2006). Hence, aspects of the New Zealand apple IRA report relating to fire blight are discussed in this submission. The comment below and publications since then indicate it is questionable to substantially rely on that previous analysis for the purpose of the PNW import proposal.

Spread of fire blight in relation to trade in apples

A study of genetic variability amongst *E. amylovora* strains collected from Europe is interpreted by Biosecurity Australia in the NZ IRA report (BA 2006 pages 64 and 94) as indicating the importation and spread of fire blight through trade in apples is highly unlikely. Moreover and though it is not clear in the 2006 BA report, it is understood this study also underpinned BA's conclusion that the likelihood of the bacterium transferring from infected imported apples to susceptible Australian hosts, was one in a million at most.

The study in question (Jock *et al.*, 2002) involved use of pulsed-field gel electrophoresis (PFGE) to identify four major pattern types within which around 120 European strains of *E. amylovora* were grouped. Jock *et al*. (2002) assert that the relatively discrete geographic distributions of the four pattern types can be used to map disease spread from Great Britain and Egypt to various European countries. Jock *et al. (*2002) seem to suggest these generally well separated and unmixed distributions were established initially by long distance movement of infected propagating material, after which ordered spread from infected areas to non-infected areas occurred over shorter distances, mediated by insects, birds and aerosols. They conclude "*despite barely controlled trade with fire blight host plants and associated plant products within Europe, the PFGE patterns of the E. amylovora isolates were ordered, indicating sequential spread*."

It should be noted that Jock *et al.* (2002) make their conclusions in regard to unrestricted trade of *host plants and associated plant products*, which is appropriate since they provide no evidence that controls over host plant movements in the study area are any greater than controls over apple movement. In a later study, Jock *et al*. (2005) refer to the 2002 work as supporting an hypothesis that mature infected apples pose minimal risk as an agent of long distance dispersal of fire blight, since if they were more important, mixed PFGE pattern types would occur. This is the interpretation BA also makes of the 2002 study.

However, if discrete distributions occur despite minimally controlled trade in host plants *and* apples, it cannot be argued that only one of these commodities (apples) represent a low risk pathway. It would be erroneous to suggest that host plants provide a low risk pathway since it is well established that fire blight can spread via movement contaminated stock. Indeed, as Jock *et al.* (2002) suggest, this could have caused the appearance of a particular pattern type in northern Italy and central Spain. Hence, there must be other explanations for the distributions identified by Jock *et al*. 2002. Accordingly, and because there appears to be nothing to rule it out, we contend that using the results of Jock *et al.* (2002) to support a case for very low likelihood of importation of fire blight via apple fruit is questionable.

Further, there are plausible alternate explanations for the PFGE patterns. The patterns could have formed if certain strains had a selective advantage in certain geographic regions that favoured their dominance (environmental selection). Subsequent incursions of *E. amylovora* to areas dominated by one of the four major strains may have been in such low numbers that the newcomers did not substantially affect the genetic composition of the established population because the particular niche was filled. Notably, Jock *et al*. (2002) did find some variants within each of the four groupings, which could support this hypothesis. In addition, importation of infected material from the same area over time may result in repeated introductions of a particular strain of the bacterium, leading to the observed pattern types. This scenario is possible because trade patterns can be stable over time.

The meaningfulness of the patterns identified by Jock *et al.* (2002) is also debateable. Jock *et al*. (2002) did not test whether the pattern types are statistically significant, and may be regarded with reasonable confidence. Rather, they conducted a survey of broad genetic patterns in western, central and southern Europe. The degree of genetic variability used to categorise these patterns appears to be very small and is potentially attributable to many sources. For example, samples were collected from various hosts, which itself may have influenced which strains were present. It is less than prudent to base conclusions about fire blight transmission and spread on the Jock *et al.* (2002) study without transparently considering sampling and statistical issues.

Further, the BA NZ IRA report does not consider the Jock et al. 2002 study in alongside other studies about the degree of genetic diversity amongst *E. amylovora*. Momol and Aldwinckle 2000 reviewed the literature and make the general observation that *E. amylovora* is a genetically homogenous species compared with other bacteria. Brennan *et al.* (2002) examined intra-specific variability and found genetic homogeneity in 44 of 65 Irish *E. amylovora* isolates. Isolates from Greece, Bulgaria and the Czech Republic were similar to the 44 homogenous Irish isolates meaning that the Irish isolates did not cluster on the basis of their geographic origin. These findings are consistent with those of Momol *et al.* (1997) who could not distinguish between isolates from Canada, America, Germany, England, France and Japan. The isolates from America, where fire blight is though to have originated, could generally not be distinguished from those present in other countries. Geider (1997) and McManus and Jones (1995) suggest that *E. amylovora* populations in New Zealand may have been introduced via two incursion events from Europe and USA.

Given the apparently high degree of homogeneity among isolates from different parts of the world, it is difficult to draw reliable conclusions about the likelihood of spread of *E. amylovora* with apple fruit on the basis of genetics.

The lack of direct evidence that fire blight has ever been introduced via the trade of apple fruit has also been used to support a case for low likelihood of introduction through this commodity. However of the 48 countries where the disease is recorded, consensus about the mode of introduction has only been achieved for nine. For most of the nine, there is no conclusive evidence - rather the most likely scenario is accepted (see Bonn and van der Zwet 2000 for review). It is also noteworthy that fire blight moved from the North Island to the South Island of New Zealand, despite strict quarantine arrangements for bees and plant material from infected areas (Bonn and van der Zwet 2000). Therefore, even though birds or wind may have facilitated spread in this case, there is nothing to suggest apple fruit should be discounted as a pathway.

The absence of fire blight in South America despite unrestricted trade in apples between North and South America has also been interpreted to indicate that fire blight is not introduced and spread through apple fruit. Such an interpretation should be made with caution as the CABI database records fire blight in Brazil and Venezuela (CABI 2006), and there are conflicting reports about Brazil's phytosanitary measures.

Even leaving aside the CABI listings, information about absence of fire blight from areas that have imported apples without phytosanitary restrictions does not necessarily provide evidence that it cannot spread via apples. There are a number of alternative, equally plausible explanations such as random outcomes of low risk events, environmental tolerances, timing and quantity of imports, and available hosts and vectors. It is important to note that the bacteria may be present without hosts showing symptoms of infection. Without an analysis of these factors, the conclusion that the absence of fire blight from these areas demonstrates that *E. amylovora* cannot be spread on apple fruit is speculative.

Recent scientific developments

Two relatively recent sets of findings are pertinent to the interpretation of the BA NZ apples IRA report. One relates to studies on the viable but non-culturable (VBNC) phenomenon in *E. amylovora* and the other relates to newer PCR detection methods that demonstrate previous methods may have resulted in a high level of false negatives for the bacteria. The implications for the conclusions of the BA NZ IRA report are outlined below.

Viable but non-culturable state

The recent demonstration by Ordax *et al.* (2009) (mentioned in the draft PNW IRA report but not discussed) that *E. amylovora* can survive in a VBNC state in mature apple fruit calyces for at least 35 days, *and* subsequently regain culturability and pathogenicity, is significant. This finding is consistent with previous work on the VBNC phenomenon.

Ordax *et al.* (2006) determined that *E. amylovora* can enter a VBNC state as a survival strategy against copper and have suggested that this may be part of its life cycle. Other studies have shown that the bacterium can survive in this state for at least 101 days in pear calyces (Ceroni et al. 2004). VBNC may also be induced in response to nutrient starvation and other environmental factors (Biosca *et al.* 2004).

Collectively, this work has three implications for fire blight pest risk assessment. Firstly it suggests that much of the literature used to assess the presence of *E. amylovora* may have under-estimated pathogen numbers if culture methods were relied upon. Secondly, the VBNC phenomenon could mean orchards thought to be free of fire blight due to absence of symptoms, may contain the bacteria. Thirdly VBNC bacteria have thicker cell walls compared with normal cells, and may be present in the calyx. Hence VBNC cells may be resistant to risk mitigation measures for removing epiphytic fire blight from apples.

The BA NZ IRA report notes the significance of the VBNC phenomena in relation to bacterial survival is yet to be established but concludes it may be an irreversible physiological condition prior to cell death. However Ordax *et al.* (2009) have now demonstrated that *E. amylovora* can revert to a culturable, pathogenic state under favourable environmental conditions.

While we recognise the importance of policy consistency, this should not subordinate the need to update and review pest risk assessments as additional information comes to light. We contend implications of the VBCN work in relation to potential for *E. amylovora* to be introduced into Australia with pome fruit warrants further consideration, not only in the context of the PNW proposal, but all other existing pome fruit import policy applied to areas where fire blight is present.

Development of highly sensitive nested-PCR Techniques

Advances in DNA techniques also cast doubt over the reliability of previous work that has not detected *E. amylovora* (Llop *et al.* 2000; Taylor *et al.* 2001; Stöger *et al.* 2006). Llop *et al.* (2000) developed a two-nested-PCR procedure to detect *E. amylovora* in plant material with a very high level of sensitivity, some 100-1000 times more sensitive than older PCR systems. The authors conclude it could be used for detecting endophytic and epiphytic populations of *E. amylovora* in epidemiological studies and for the routine use in quarantine surveys (Llop *et al.* 2000).

Thus and in addition to potential under-estimation of fire blight due to VBNC, PCR techniques previously used to detect fire blight are also likely to have under-estimated it due to false negatives. This has relevance to BA NZ IRA report as the information used for the @RISK model is likely to have under-estimated the presence of fire blight, particularly in symptomless fruit. This is not consistent with the assertion in the BA report that “there is no justification or evidence to show that the bacterial numbers reported in the scientific papers cited above were systematically underestimated because of a lack of sensitivity” in response to stakeholder comments (Biosecurity Australia 2006).

The DPIPWE recommends that:

(10) The draft IRA report should be amended such that the risk assessment for Erwinia amylovora better reflects the uncertainty that exists in relation to spread and trade in apples, and adequately takes into account research concerning the viable but non-culturable state, and advances in DNA detection technologies.

Vectors not considered in the fire blight pest risk assessment

Fire blight associated with apple trash

Erwinia amylovora could be present in apple trash (leaves and small twigs) associated with apples. The NZ IRA report suggests that trash does not represent any greater biosecurity risk than that addressed by apple fruit. However, trash represents a separate and plausible vector that should be included in this analysis.

Fire blight associated with storage bins and packing containers

The NZ IRA report reviewed the literature that relates to the likelihood that fire blight can survive on packing containers. The bacteria can survive on both wooden and plastic containers and retail sale trays (Ceroni *et al.* 2004). Survival ranged from 27 days to 11 months and was dependant on whether the container was outdoors or in cold storage (Biosecurity Australia 2006). It has also been suggested that fire blight was introduced into England on wooden packing crates (Lelliot 1959; Billing and Berrie 2002).

Fire blight on insects associated with apples

Fire blight is known to be spread by insects, particularly pollinating species that travel between infected and uninfected flowers. Hildebrand *et al.* (2000) detected the pathogen on 4.3% of insects caught in an experimental orchard. The insects collected belonged to four different orders and at least eight different families.

It should be noted that this study used an older PCR technique that has been demonstrated to potentially lead to false negatives (Llop *et al.* 2000). The proportion of infected insects and the time that species remained contaminated is likely to have been under-estimated in this experiment.

Immature Fruit and Fruit Showing Symptoms

There is potential for infected immature fruit, or fruit showing symptoms that were not picked up in quarantine inspections, developing ooze which would contain a high bacterial inoculum. Once discarded this infected fruit could then be visited by insects and transported to a suitable host, or transferred by wind or rain to susceptible hosts. An example of this potential is illustrated by AQIS interceptions of oozing pears suspected of carrying fire blight (P. Merriman and B. Rodoni pers comm cited in Jock *et al.* 2005).

The DPIPWE recommends that the draft IRA report should be amended such that the risk assessment for *Erwinia amylovora* includes an assessment of:

(1I) the likelihood of fire blight being introduced in apple trash; and

(12) the likelihood of fire blight being introduced in storage bins and packing containers; and

(13) the likelihood of fire blight being introduced on insects associated with apples; and

(14) the likelihood of fire blight being introduced on infected immature fruit or fruit showing symptoms.

3. Section 5- Pest Risk Management

The draft IRA Report identifies potential management options to reduce the likelihood of introduction of those pests assessed as posing risk that exceeds Australia's ALOP. According to ISPM 11:

[T]he result of the pest risk management procedure will be either that no measures are identified which are considered appropriate or the selection of one or more management options that have been ***found to lower the risk associated with the pest(s) to an acceptable level*** (ISPM 11 Section 3.6 emphasis added).

However, the draft IRA report does always characterise the efficacy of proposed options, including that the measures would reduce risk to at least 'VERY LOW'. Without an explicit description how and the extent to which the proposed measures influence unrestricted risk, the report is not consistent with ISPM 11.

Also, and while the Import Risk Analysis Handbook 2007 (BA 2009) does not purport to lay out IRA methods, the approach used in the draft IRA would also seem to deviate from the handbook which states that, in cases where the risks exceed Australia's ALOP a draft IRA will:

- identify potential risk mitigation measures and determine whether application of the measures could reduce the risks to achieve Australia's ALOP and
- include a preliminary view of the preferred options for risk management.

The DPIPWE recommends that:

> *(15) The draft IRA report should be amended to explicitly assess whether the proposed risk mitigation measures reduce unrestricted risk to 'VERY LOW' and where multiple measures are found to do so, include an explanation of the preferred option/s.*

Pest Risk Management: Apple maggot (*Rhagoletis pomonella)*

The draft IRA report identifies two risk management options for *R. pomonella*. The options are pest free area, or pest free place of production or production site (Option 1); and treatment of all lots (Option 2). The feasibility of Option 1 is doubtful. This is due to the widespread distribution of the pest, its characteristics and existing management practices in the PNW. The reasons that area, place of production and production site freedom are questionable options are outlined below.

R. pomonella was introduced into California, Oregon, Washington, Idaho, Utah, and Colorado in the early to mid 1980s (Reissig 2006). It is now widespread in Oregon, is recorded in Washington and is known to occur in Idaho (CABI 2007, Reissig 2006). Clearly the entire PNW could not be declared a pest free area, although there may be some areas within the three states which APHIS may seek to declare pest free areas. However there are issues with parts of this area being declared a pest free.

In accordance with ISPM 26, to establish a Fruit Fly Pest Free Area (FF-PFA) surveillance activities should be undertaken for at least 12 consecutive months to demonstrate that the pest is not present (FAO 2006). During this period there should be no populations detected. The draft IRA report indicates that survey data would need to be submitted to DAFF before access could be considered on this basis. Existing survey data, if available, should form part of the analysis so that the likely validity of the proposed risk mitigation measure can be determined in the draft IRA.

The effect of the current management practices in the PNW on surveillance should also be considered prior to establishing a pest free area or place of production or production site. ISPM 26 highlights the potential for the regular application of insecticides to negatively impact on surveillance by resulting in false negative records. The current management activities in the PNW may lead to false negatives in surveillance activity for apple maggot. For example any captures of *R. pomonella* on isolated hawthorn or feral apple trees in central Washington triggers the spraying of trees to prevent the spread of the pest (Klaus *et al*. 2007 cited in Yee 2007). The application of chemical insecticides, on feral, domestic or commercial plantings in the PNW area could reduce the efficacy of surveillance activities.

In addition, the characteristics of *R. pomonella* are incompatible with the general requirements for the establishment of pest free places of production or production sites, listed in the relevant International Standard. ISPM 10 lists the characteristics of pests that are suitable for declared pest free places of production or production sites (FAO 1999). These characteristics include:

- the natural spread of the pest (or its vectors, if appropriate) is slow and over short distances;

– the possibilities for artificial spread of the pest are limited;

– the pest has a limited host range;

– the pest has a relatively low probability of survival from previous seasons;

– the pest has a moderate or low rate of reproduction; and

– as far as possible, factors in the biology of the pest (eg latency) and in the management of the place of production do not interfere with detection.

R. pomonella does not demonstrate these characteristics. For example, it has demonstrated an ability to spread (whether naturally or human mediated) through range expansion in North America over the last 30 years. It infests many common species and existing management measures may interfere with surveillance programs. It is also known that a proportion of pupae may over winter in the soil for two winters which may influence ability to detect and manage.

As *R. pomonella also* has a broad host range, it seems likely that alternate hosts will be present in the places of production or production sites, and in buffer zones. Therefore the general requirements for the place of production or production sites are also unlikely to be met.

Given this, the feasibility of establishing a pest free area, or pest free place of production or production site for *R. Pomonella* is doubtful.

As noted, there is not enough detail in the draft IRA report to determine whether Option 2 would reduce the level of risk to an acceptable level. Evidence to demonstrate the efficacy of the two proposed management options should be part of the draft IRA.

The DPIPWE recommends that the draft IRA report should:

(16) explicitly consider factors relevant to the establishment of pest free areas, pest free places of production or production sites, for each pest for which these measures are recommended as suitable for mitigating risk. In particular, factors relevant to recommending this option for R. pomonella, should be explicitly reviewed since feasibility of effective implementation appears questionable; and

(17) include evidence to support the efficacy of proposed risk mitigation options for each pest. In particular, evidence in relation to treatment efficacies for R. pomonella should be presented.

Pest Risk Management: Fire Blight (*Erwinia amylovora*)

The BA NZ apple IRA report concludes a combination of orchard inspection for symptoms of fire blight and subsequent treatment (chlorine or any suitable disinfection agent that is at least as effective as chlorine) during processing would adequately mitigate risks associated with apples such that Australia’s ALOP would be met. Concerns over the efficacy of the chlorine treatment are outlined below.

Chlorine treatment

The BA NZ IRA report proposes treatment of apple fruit with 100 ppm chlorine for 1 minute, or any other treatment shown to be at least as effective, to reduce surface contamination that would not have been detected during orchard inspection or which could result from cross contamination during picking or processing. The chlorine treatment is not intended to eliminate bacteria from the calyx or internal tissues. It is a measure that aims to further reduce the level of bacteria on fruit which is already likely to be low because that fruit originates from symptomless orchards.

However, it is worth noting there appears to be no evidence in published literature to suggest that treating contaminated apple fruit with 100 ppm chlorine for 1 minute will eradicate *E. amylovora* from the surface of mature apple fruit. The results of Sholberg *et al*. (1988) summarised below, illustrate a situation where the effect of a 100 ppm chlorine dip treatment for 10 minutes was equivalent to a water control on the survival of *E. amylovora* on naturally contaminated Newtown apples.

Prior to dip treatment, Newtown apples sampled at harvest from orchards from British Columbia were contaminated with *E. amylovora*. The acetic acid treatment is included to demonstrate the results of an effective but non-user friendly treatment. Five months storage of contaminated apples at 2^{o}C also reduced the number of bacteria to levels below detection.

Chemical treatment and temperature (^{o}C)	Bacteria[1, 3] (CFU/ml)
Chlorine100 micrograms/mL[2]	
10	2.83 a
20	1.76 e
30	2.00 d
Control (water)	
10	2.19 c
20	1.93 de
30	2.57 b
Acetic acid (1 M)	
10	0.00 f
20	0.00 f
30	0.00 f

While the cells of *E. amylovora* suspended in 100 ppm chlorine for 1 minute are likely to be killed, the dose of chlorine and exposure time required to kill the majority of *E. amylovora* cells attached to exposed surfaces of mature apple fruit is unknown. The results of the study by Sholberg *et al*. (1988) suggest that 100 ppm chlorine applied for as long as 10 minutes is an ineffective treatment. It is well known that microorganisms attached to surfaces are generally less susceptible to disinfectants or sanitisers than microorganisms suspended in water (for example, refer to Gibson *et al*. 1995). Recent work by the State of Victoria on managing washing water for vegetables supports this concept (Mebalds *et al*. 2002).

Psallidas and Tsiantos (2000) detail treatments for disinfestation of apple and pear fruits that suggest that a rate of chlorine greater than 100 ppm or completely different active materials are required for surface eradication of *E. amylovora*. Furthermore, the current Eurepgap risk management measure for fruit contamination due to the presence of microbes or other contaminants in water is to maintain chlorine levels in the wash water at 500 ppm, when chlorine is used as the sanitiser (Pink Lady Australia, EurepGAP Interpretive Manual). Again, while 100 ppm chlorine may be lethal to *E. amylovora* as a cell suspension (*in vitro*), the ability of the proposed treatment to eradicate *E. amylovora* from the surface of mature apple fruit is questionable. Based on the results of Sholberg *et al.* (1988) there is also doubt that the 100 ppm chlorine treatment is even partially effective in certain situations.

Another issue is that the chlorine dip treatment may do more harm than good. When 'Rome Beauty' apples were collected from or near fire blight cankers in West Virginia and stored under refrigeration for 1-4 months, visible blight symptoms developed on 10-15% of fruit surface-sterilised for 3 min. with 0.65% of sodium hypochlorite, but only on 0-4% of non-surface sterilised fruit (van der Zwet *et al.*, 1990). To quote Hayward on page 119 of the WTO 'Report of the Panel" (Japan – Measures affecting the importation of apples, July 2003) "…any treatment involving immersion in an aqueous medium could serve to mobilise or leach inoculum from within protected sites such as stomates, lenticels, etc. The result is that the previously clean majority might be contaminated by the diseased minority. There is also the greater likelihood of injury to the fruit during post-harvest handling and these injuries allowing entry of other pests.

These observations indicate uncertainty about the efficacy of the chlorine treatment condition proposed in the BA NZ IRA report, and hence have implications for the confidence we can place in the adequacy of the same measures for the PNW import proposal.

> The DPIPWE recommends that:
>
> *(18) The draft IRA report should be amended such that the risk mitigation assessment for Erwinia amylovora reflects uncertainty about the efficacy of chlorine in eliminating the pest from the exposed surface of apples.*

References:

BA (2009) Import Risk Analysis Handbook 2007 (updated 2009). Department of Agriculture, Fisheries and Forestry, Canberra

Beers, E.H., Klaus, M.W., Gebhard, A., Cockfield, S., Zack, R. and O'Brien, C.W. (2003). Weevils attacking fruit trees in Washington. Proceedings of the 77th Annual Western Orchard pest & Disease Management Conference. Portland 15-17 January 2003. Published by Washington State University, Pullman

Billing, E. and Berrie, A.M. 2002 A re-examination of fire blight epidemiology in England. *Acta Horticulturae* 590:61-67.

Biosca, E.G., Marco-Noales, E., Ordax, M., and Lopez, M.M. 2004 Long-term starvation-survival of *Erwinia amylovora* in sterile irrigation water. *Proceedings of the 10th International Workshop on Fire Blight, Bologna, Italy, 5th-9th July 2004*. pp27-28

Biosecurity Australia 2006, Final Import Risk Analysis Report for Apples from New Zealand, Department of Agriculture, Fisheries and Forestry, Canberra, www.affa.gov.au/content/publications

Brennan, J.M., Doohan, F.M., Egan, D., Scanlan, H., and Hayes, D. 2002 Characterisation and Differentiation of Irish *Erwinia amylovora* Isolates. Journal of Phytopathology 150: 414-422

CABI (2006, 2007) CAB International, Crop Protection Compendium, 2006 and 2007 Editions. Wallingford, UK: CAB International. www.cabicompendium.org/cpc

Ceroni, P., Minardi, P., Babini, V., Traversa, F., and Mazzucchi, U. (2004) Survival of *Erwinia amylovora* on pears and on fruit containers in cold storage and outdoors. Bull OEPP/EPPO Bull 34:109-115

Constable, F. E.; Joyce, P. A. and Rodoni, B.C. 2007 A survey of key Australian pome fruit growing districts for exotic and endemic pathogens. *Australasian Plant Pathology* 36 (2): 165-172

EPPO 2004 Diagnostic Protocols for Regulated Pests. European and Mediterranean Plant Protection Organization. (www.eppo.org) Accessed 2 April 2007

FAO (1999) International Standard for Phytosanitary Measures (ISPM) No. 10 Requirements for the Establishment of Pest Free Places of Production and Pest Free Production Sites. Secretariat of the International Plant Protection Convention, Food and Agriculture Organization of the United Nations, Rome

FAO (2006) International Standard for Phytosanitary Measures (ISPM) No. 26 Establishment of Pest Free Areas for Fruit Flies (TEPHRITIDAE). Secretariat of the International Plant Protection Convention, Food and Agriculture Organization of the United Nations, Rome

Fletcher, B. S. (1989) Movements of Tephritid. IN Robinson, A. S., Hooper, G. (Ed.) Fruit Flies - Their Biology, Natural Enemies and Control. Amsterdam, Elsevier

Foote RH, Blanc FL, Norrbom AL, 1993. Handbook of the Fruit Flies (Diptera: Tephritidae) of America North of Mexico. Ithaca, USA: Comstock

Geider, K. 2000 Exopolysaccharides of *Erwinia amylovora*: Structure, biosynthesis, regulation, role in pathogenicity of amylovoran and levan. In: Vanneste, J.L. (Ed) *Fire Blight the Disease and its Causative Agent, Erwinia amylovora*. CABI Publishing, CABI International, Wallingford, UK. pp117-140

Jock, S., Donat, V., Lopex, M.M., Bazzi, C., and Geider, K. 2002 Following the spread of fire blight in Western, Central and Southern Europe by molecular differentiation of *Erwinia amylovora* strains with PFGE analysis. Environmental Microbiology 4(2) 106 -114

Jock, S., Langlotz, C. and Geider, K. 2005 Survival and possible spread of *Erwinia amylovora* and related plant-pathogenic bacteria exposed to environmental stress conditions. *Journal of Phytopathology* 153(2):87-93.

Lelliott, RA 1959. Fire blight of pears in England. *Agriculture* 65:564-568.

Llop, P., Bonaterra, A., Penalver, J., Lopez, M.M. 2000 Development of highly sensitive nested PCR procedure using a single closed tube for detection of *Erwinia amylovora* in asymptomatic plant material. *Applied and Environmental Microbiology* 66(5) 2071-2078

MAF (2008) Import Risk Analysis: Fresh Litchi Fruit (*Litchi chinesis*) from Australia. Draft Approval for Public Consultation. Wellington, New Zealand, Ministry Of Agriculture and Forestry

McManus, P.S., and Jones, A.L. 1995 Genetic fingerprinting of *Erwinia amylovora* strains isolated from tree-fruit crops and *Rubus spp.* Phytopathology85: 1547-1553

Mebalds M, Hamilton A, Holmes R, Harrup P. (2002) Managing clean and safe water for washing vegetables. Field Day Notes. Department of Natural Resources and Environment, Victoria

Momol, M.T., Momol, E.A., Lamboy, W.F., Norell, J.L., Beer, S.V., and Aldwinkle, H.S. 1997 Characterisation of *Erwinia amylovora* strains using random amplified polymorphic DNA fragments (RAPDs). Applied Microbiology 82:389 - 398

Ordax, M., Biosca, E.G., Wimalajeewa, S.C., Lopez, M.M., and Marco-Noales, E. (2009) Survival of *Erwinia amylovora* in mature apple fruit calyces through the viable but no-culturable (VBNC) state. Journal of Applied Microbiology 107:106-116

Psallidas PG, Tsiantos J (2000) *Chemical control of fire blight*. In: Fire Blight: The Disease and its Causative Agent, *Erwinia amylovora*. Vanneste JL (Ed.) pp. 199-234

Reissig, W.H. (2006) Diagnostic Factsheet: Apple maggot (*Rhagoletis pomonella*). Michigan State University. www.pestid.msu.edu/InsectsArthropods/ApplemaggotRhagoletispomonella/tabid/274/Default.aspx. Accessed 25 November 2009

Rodoni, B., Kinsella, M., Gardner, R., Merriman, P., Gilings, M. and Geider, K. 1999 Detection of *Erwinia amylovora* the causative agent of fire blight in the Royal Botanic Gardens, Melbourne, Australia. *Acta Horticulturae* 489: 169-170

Sholberg PL, Gaunce AP, Owen GR (1988) Occurrence of *Erwinia amylovora* of pome fruit in British Columbia in 1985 and its elimination from the apple surface. *Canadian Journal of Plant Pathology* **10**, 178-182

Stöger, A., Schaffer, J., and Ruppitsch, W. 2006 A rapid and sensitive method for direct detection of *Erwinia amylovora* in symptomatic and asymtomatic plant tissues by Polymerase Chain Reaction. *Journal of Phytopathology* 154: 469-473

Taylor, R.K. and Hale, C.N. 2003 Cold storage affects survival and growth of *Erwinia amylovora* on the calyx of apple. *Letters in Applied Microbiology* 37(4)340-343

Taylor, R.K., Guilford, P.J., Clark, R.G., Hale, C.N., and Forster, R.L.S. 2001 Detection of *Erwinia amylovora* in plant material using novel polymerase chain reaction (PCR) primers. *New Zealand Journal of Crop and Horticultural Science* 29:35-43

Van der Zwet T 1990 *Plant Disease* **74,** 711-716

Van der Zwet, T and Bonn, W.G. 1995 Recent Spread and Current Distribution of Fire Blight. ISHS Acta Horticulturae 489: VII International Workshop on Fire Blight

World Trade Organisation 2009 *WTO Analytical Index: Guide to WTO Law and Practice. Agreement on Sanitary and Phytosanitary Measures.* http:www.wto.org/English/res_e/booksp_e/analytic_index_e/sps_02_e.htm accessed 26June 2009