CONSULTATION: LABELLING REVIEW RECOMMENDATION 34: MANDATORY LABELLING OF IRRADIATED FOOD

SUBMISSION

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About the Submitter

From 1974 to 2001 I was a senior scientist and manager at the Institute of Nuclear Sciences (DSIR) and the CRI, Geological and Nuclear Sciences. My role was to advise on and research into the biological uses and risks of ionising radiation. In 1983 I was asked to be the focal person for activities related to food irradiation and to be the New Zealand delegate to the International Consultative Group on Food Irradiation (ICGFI) from 1985 until it disbanded in 2003. In this role I was expected to communicate international activities in food irradiation back to New Zealand and to carry New Zealand views into the international arena. This involved regular liaison with the former Ministries of Health, Agriculture and Fisheries, Consumer Affairs, Environment and Foreign Affairs and Trade. I was a member of the Working Party and Steering Group on Food Irradiation and Industrial Radiation Processing (1987-88).

In 2001 I became a private consultant. Until 2007 I worked mainly with the International Atomic Energy Agency in areas other than food. However, I have remained the National Coordinator for food irradiation projects conducted in the Asia-Pacific region and have been used frequently as an expert advisor, trainer and lecturer for IAEA food irradiation meetings and courses. I have also been used as an occasional science consultant by Steritech, the contract irradiation facility currently expanding its range of services from sterilization of medical and health care products to phytosanitary treatment of fresh produce. In 2011 I drafted Application A1069 to amend Standard 1.5.3 to allow the irradiation treatment of tomatoes and capsicums.

About the Submission

Part A presents Finding and Conclusions.

Part B provides detail in support of the findings and recommendations. Extra information related to matters raised in the consultation document are also provided. Much of Part B is supported by literature references. Some is based on personal opinion. I have tried to signal the difference. The opinions were gained from my international meetings and contacts and from many talks and meetings with stakeholders in New Zealand and Australia such as growers, other food producers, food technologists and with consumer and other interest groups.

Part C provides the references and Part D responds to the FSANZ questionnaire.

PART A: FINDINGS AND RECOMMENDATIONS

Review of Mandatory Labelling

Mandatory labelling of irradiated food and ingredients should be removed because –

- Food irradiation is no longer a new technology but its benefits have not been fully realised because it cannot compete on a level playing field with alternative technologies that are not labelled and about which the consumer is largely unaware;
- Food producers and retailers tend to avoid proper consideration of irradiation because they can fall back on alternatives which have no labelling requirement and, therefore, less potential for rejection or controversy;
- Labelling is unable to inform consumers about the benefits of irradiation and how it compares to alternative technologies in terms of risk and consumer values;
- Labelling is a barrier to fuller adoption of irradiation technology and the food trade and consumers may be disadvantaged in future if irradiation is needed to expand export trade or to reduce the risks of foodborne bacterial pathogens;
- The advantage of mandatory labelling accrues to the significant minority of consumers who wish to avoid irradiated food;
- There is now strong evidence that there is a market for irradiated food if it is offered for sale. The current labelling requirements result in disadvantages to the majority of consumers. The disadvantages include potential loss of product choice and competition in the marketplace, inferior product quality and exposure to chemical residues. Consumers may also place a negative value on alternatives to irradiation that are associated with insecticide/pesticide use or ozone depletion;
- Insufficient weighting has been given to the disadvantages and risks of labelling to the majority of consumers and to the food industry;
- Most consumers express a wish to have new technologies labelled if asked but, as shown for GM food in the EU, relatively few actually utilize the label or avoid buying GM food. A similar situation is likely for irradiated food.

FSANZ is given the specific objective of providing adequate information for consumers to make informed choices (FSANZ 2016). However, its regulatory measures must also have regard to –

- The need for standards to be based on risk analysis using the best available scientific evidence.
- The promotion of consistency between domestic and international food standards.
- The desirability of an efficient and internationally competitive food industry.
- The promotion of fair trading in food.

There is a poor overall ‘fit’ of the mandatory labelling requirement with the FZANZ objective and required conditions outlined above.

The mandatory labelling requirement and the lack of labelling and information for alternative treatments means that consumers are not given adequate information to make a fully informed

choice. An evaluation of the science literature on irradiation and other processes that are applied to food today suggests there is no reason for a unique requirement to label irradiated food. No comparative risk analysis has been conducted of the disadvantages and advantages of labelling to consumer groups who are either willing or unwilling to purchase irradiated food.

The unique mandatory requirement for a technology that has been in commercial use for 40 years places it in an unfair position when competing with alternative treatments. The slow development of the technology may eventually have a negative impact on the food trade and consumers (see above).

Mandatory labelling is consistent with the relevant Codex Alimentarius standards, but it should be noted that the Codex labelling requirement was initiated when food irradiation could fairly be regarded as a new technology.

Irradiated Ingredients and the Restaurant/Catering trade

If labelling policy is not revised for irradiated whole foods, then the policy for irradiated ingredients should be changed. The present policy calls for labelling of any food that contains an irradiated ingredient without any lower concentration limit below which the food need not be labelled. This is unjustifiable scientifically or logically for minor concentrations of a safe ingredient in a multi-ingredient food.

The requirement for mandatory labelling of irradiated food in the restaurant or catering trades should be removed since it is discriminatory when the consumer is offered a choice of many foods that are handled and processed under conditions that are highly variable and unknown to the consumer. The option exists for food traders to make a claim that food is non-irradiated as is the practice for GM-food, gluten-free food and organic food.

Alternative Approaches to Communicating Food Irradiation Benefits

Ample informational materials about the benefits of food irradiation are available. There is little evidence such information has been effective at reaching consumers in general. There is clear evidence that in a controlled environment (e.g., a focus group or respondents to a survey) fuller information about irradiation increased consumers' willingness to purchase irradiated food or to consider its purchase based on the quality and price of the product presented at retail.

However, there are likely to be difficulties with an organised public campaign such as -

- who will be responsible and carry the cost for the campaign;
- a public campaign about the benefits of irradiation will generate a backlash of counter-criticism from opponents of the process that may confuse the consumer;
- consumers expect FSANZ to allow only the sale of safe food, so they may wonder why an information campaign is necessary ("if it's safe, why do I need labels or to know details?");
- In addition there is, again, the unpalatable fact that a true evaluation of irradiation requires a comparison with existing methods which the food trade may find uncomfortable.

If these difficulties can be overcome then an information campaign led by, say, FSANZ, could be helpful.

Fundamental Problems for FSANZ to Address

There are at least two key issues in a review of labelling irradiated food.

- Alternatives to irradiation are not subject to the same scrutiny, and the consumer is not informed about their use or their potential detrimental effects (see above);
- FSANZ seeks to regulate via measures that are evidence and science based. However, the mandatory labelling of irradiated food is values-driven. It exists solely to inform the consumer that a specific process has been applied to the food. There is no health or safety reason. It is difficult to reconcile the science and values based approaches to labelling.

In the FSANZ Food Labelling Hierarchy a new technology is one requiring pre-approval safety assessment and time-limited labelling. There is no intention to review the need for this assessment though it is worth noting that the Codex General Standard for Irradiated Foods sets technical dose limits but these may be applied to all foods. This implies that Codex accepts that any irradiated food poses no toxicological hazard and no special nutritional or microbiological risks.

Consumers in New Zealand may not yet be familiar with food irradiation, a fact at least partly due to mandatory labelling. However, recognizing the overseas experience with food irradiation, its safety and the disadvantages of mandatory labelling, food irradiation should no longer be classed as a 'new technology'. The need for labelling irradiated food is driven by some consumers' values and it should be treated as a Consumer Value Issue in the Food Labelling Hierarchy. This would no longer require labelling to be mandatory.

Recommendations

1. The mandatory labelling of all irradiated whole foods should be discontinued and those in the food trade, restaurants or catering who wish to do so should be allowed to make a verifiable claim that a food has not been irradiated.
2. If FSANZ decides to continue mandatory labelling, it is recommended that food be labelled only if irradiation causes a significant material change in the food such as a change in organoleptic properties, shelf-life or function.
3. The replacement of the terms 'irradiated' or 'treated with ionising radiation' with terms such as 'picowaved' or 'electronic pasteurisation' on labels or informational materials should not be permitted.
4. If the mandatory labelling of whole food is continued, then –
    a. The requirement to label irradiated ingredients should be modified to require labelling only when the ingredient is more than 10% of the whole food by weight;
    b. The requirement to label irradiated food in restaurants and catering premises should be removed and premises wishing to specify that they sell only non-irradiated food should be allowed to advertise the fact, if verifiable.

PART B: EVIDENCE AND ADDITIONAL INFORMATION

Evidence to support the submissions findings is provided in this section. It also responds to the FSANZ request for any further information related to the topics raised in its consultation document.

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Adequate Information and Informed Choice

The present labelling requirement does not meet FSANZ's objective of providing adequate information for consumers to make informed choices (FSANZ 2016) satisfactorily because labelling cannot provide sufficient context or indication of relative risk.

Labelling is a straightforward way to allow consumers who would prefer not to buy irradiated food to avoid doing so. One of the technical advantages of irradiation is that it leaves the food looking and tasting "natural". Some types of food process are immediately obvious to the consumer (canning, drying, freezing) but many are not and are not labelled. The latter include the non-irradiation methods for phytosanitary treatment of produce.

In the absence of irradiation fresh imports/exports are subject to another mandatory treatment that could be heat, long-term cold storage, chemical treatment or fumigation. These treatments have potential effects on the quality, shelf-life and nutritional content of the food at least as great, or greater, than that of irradiation (e.g., Drake 1998; Heather and Hallman 2008; Hallman 2011). Pesticide/insecticide residues in food are controlled and their actual risk is small. But consumer concern remains high, a concern that surveys show is greater than concern about irradiation (Resurreccion *et al* 1995; Gamble, Harker and Gunson, 2002; TKP 2012). The principal fumigation method requires an ozone depleting gas (methyl bromide) but pre-shipment treatment of produce is presently exempted from the ban on other uses such as soil fumigation (UNEP 2009).

A label is a totally inadequate means to fully inform the consumer about a new technology. In part this is because a technology may have many benefits (Molins 2001; Arvanitoyannis 2010). More important is the difficulty that a label can provide no sense of context or relative risk. This is put into sharp focus for irradiation as a phytosanitary treatment, where there are several competing options about which the consumer remains uninformed, which have not undergone a rigorous pre-assessment process, and which potentially may have the deleterious effects mentioned.

An accurate statement of the purpose of irradiation is allowed on labels in several countries including Australia and New Zealand. The label on imported irradiated mangoes usually states "irradiated to protect the New Zealand environment' though a more relevant and accurate statement would be "to protect New Zealand's agriculture and economy". Neither will be perceived as of direct benefit to a consumer.

The above are complex issues and choices and cannot be resolved through a label. Further, the alternative treatments are "not under consideration as part of this work" (FSANZ 2016). If informed and asked about the alternatives, consumers could well decide they wish to be informed further and for food so treated to be labelled. Certainly such knowledge would alter perceptions of irradiation.

A consumer that is not informed more effectively about irradiation technology and the issues for alternative technologies is not <u>fully</u> informed about phytosanitary irradiation and cannot make truly meaningful choices. This results in a disadvantage to the development of phytosanitary irradiation. The argument can also be extended to other uses of food irradiation such as decontamination.

Value of Labelling

The purpose of mandatory labelling of irradiated food is simply to inform the consumer that a food has undergone a specified process. Despite assurances that labelling is not required for a health or safety reason, it is likely that some consumers may regard a label as a warning. If a significant percentage took a label to be a warning despite official assurances of safety, then the technology

would be disadvantaged. FSANZ quotes a local study suggesting 5.5% may regard labelling as a warning. A US study by He, Fletcher and Rimal (2005) suggests it could be over 30%.

How much labelling of a process rather than facts about nutrition and health is valued by most consumers is difficult to assess. There is still little basis on which to make a proper assessment. There is clearly a significant minority of consumers that want the process brought to their attention.

There is evidence that even though a majority of consumers say they oppose a new technology, and also support its labelling, most shoppers do not actively avoid it (Gauthier 2009; Gupta, Fischer and Frewer 2011a, 2011b; Roberts and Henon 2015). A study of the response of consumers in several EU countries to labelling of GM food is pertinent (EC 2008). Despite a high percentage believing labelling of GM food was desirable, few actually read the labels and few actively avoided GM food where it was available for purchase. The EU study set out to determine whether European consumers bought GM-foods. Despite considerable variation between the ten Member States of the study the answer broadly was "yes – when they have the opportunity". Irradiation may be in a parallel situation.

Most people express opinions in favour of being given more information in principle and it hardly surprising that a TomatoesNZ question elicited an 85% response in favour (quoted in FSANZ 2016). However, the number of grocery shoppers who regularly read labels will be much lower. Consumer responses to what they wish to see on labels varies with the way the question is framed (Hallman, Cuite and Morin 2013).

Other International Food Irradiation Labelling Approaches

FSANZ noted that the US regulation requires labelling of irradiated whole foods with the Radura logo and text but irradiated ingredients do not have to be identified on the label (USFDA 2015a). However, in 2007 the USFDA proposed a new rule for labelling irradiated food. This is still under discussion but the approach it takes remains the USFDA preferred position (USFDA 2007; USFDA 2015b). Under the proposal, an irradiated food would only be required to display a label if there had been a "material change" in the food.

A "material change" is a change to the organoleptic, nutritional or functional properties of the food. I interpret this to mean that, for example, strawberries irradiated at 400Gy for a phytosanitary purpose would not be labelled. However, strawberries treated at 2.5kGy for the purpose of extending shelf-life would be labelled.

The 2007 USDA proposal for a labelling change also included an intention to allow a company to petition for permission to use a term other than "irradiated".

As noted by FSANZ, Malaysia and Canada only require labelling of ingredients when the added ingredient is more than 5 or 10% of the whole food respectively (MOHM 2011; CFIS 2014).

Over 80,000 tonnes of spices and herbs are irradiated annually in the US alone. Globally the amount must exceed 100,000 tonnes (Kume and Todoriki 2013). Irradiated condiments are probably used principally as ingredients. I am unaware of any food containing herbs or spices as an ingredient that states that the herbs or spices have been irradiated. In practice it seems that many countries either do not require or do not enforce labelling of minor ingredients.

Consumer Attitudes to Food Irradiation

FSANZ (2016) discussed consumer attitudes as revealed by some surveys of opinion which are usually conducted in the absence of any opportunity to purchase irradiated food. Eustice and Bruhn (2013) have also provided a review of surveyed opinion. Another and more relevant way to gauge

consumer reaction is through their purchase behaviour when irradiated food is available on retail shelves. Purchase behaviour shows there is a market for irradiated food.

Purchase behaviour

Globally, small but significant volumes of labelled irradiated food have been purchased and re-purchased over many years where they are regularly available. Examples include ground beef and chicken (8,000 t/a) as well as imported fresh produce (20,000t/a) in the USA, spicy chicken feet and wings in China (120,000 t/a), fermented sausage in Thailand (several hundred t/a) and frog legs (4,400 t/a) in Europe (Kume and Todoriki 2013; EC 2015; Roberts and Henon 2015; Werawit 2015).

In New Zealand, despite an initially flurry of concern reported in the media and on some consumer websites, irradiated mangoes have been purchased in steadily increasing amounts since 2004 reaching approximately 1000 tonnes in recent years (Lynch 2015). The mangoes sell despite competition from cheaper South American mangoes. Despite the two major supermarket chains not offering irradiated tomatoes and significant opposition from local tomato growers, independent grocers have offered irradiated tomatoes for sale successfully since they became available in 2013.

There are no reports of any irradiated food, once it has been made available legally, being taken off the market due to consumer reaction. It would appear that there is a market for irradiated food once the consumer has the opportunity to appraise it at retail level. As with any food product, willingness to purchase by 100% of consumers is not required for it to be viable.

Consumer purchase behaviour when irradiated foods are actually offered to them suggest that simple surveys of consumer attitudes are over-simplistic and may underestimate the potential market for irradiated food (Pszczola 1990; Satin 1996; Eustice and Bruhn 2013; Roberts and Henon 2015), a situation similar to that found in Europe for GM food (EC 2008).

Surveys

FSANZ discussed some of the many overseas surveys of consumer attitudes to irradiation of food. A further review can be found in Eustice and Bruhn (2013). Two surveys conducted in Australia and New Zealand prior to irradiated mangoes becoming available and one in 2007 were also discussed (Gamble, Harker and Gunson 2002; NFO 2003; TNS 2008). Almost all surveys show clearly that the percentage of consumers willing to purchase irradiated food increases when information is provided (Nayga 2005; Bhumiratana, Belden and Bruhn 2007; Eustice and Bruhn 2013).

In 2012 AUSVEG engaged a market research consultancy to survey Australian consumer attitudes to phytosanitary treatments including irradiation (TKP 2012). This was triggered by the restrictions that had been signalled by the Australian Pesticides and Veterinary Medicines Authority on the use of dimethoate and fenthion as phytosanitary treatments. The aim of the survey was to better understand customer perceptions, attitudes, barriers and concerns around the different treatment methods.

The survey was in two stages. One involved 3 focus groups in Melbourne, Adelaide and Hobart with in depth interviews. The other was a broader survey of 917 respondents who were the grocery buyers for their household but did not regularly purchase organic food. The survey found there is a universal acceptance of need to control fruit fly, but awareness of pest issues and control methods generally is low.

Four post-harvest treatment methods were compared; chemical sprays, fumigation, irradiation, and cold treatments. Heat treatments were not discussed. When asked, after a short presentation of

each method, to pick one preferred method and which other methods would be acceptable, cold disinfestation was preferred by 63% and accepted by 88%. The preferred/accepted percentages for irradiation, chemical dips/ sprays and fumigation were 11/42, 10/39 and 6/37 respectively. The strong preference for cold treatment was probably because refrigeration is a familiar concept.

The survey investigated a wide variety of reasons for consumers' preferences. Again cold treatment was always seen in the most positive light to such an extent that the scores for the other treatments were not statistically different though irradiation usually scored better. As found in other overseas and New Zealand studies, irradiation was generally preferred to chemical and fumigation treatments. Specifically on irradiation, the survey's authors concluded -

- The overarching response to irradiation was lack of understanding.
- Sentiment was very mixed, from "not sure what to think", to positive, to negative.
- For irradiation to be successful, it would require significant investment in public education.
- The name was a concern, but no more than the (names of) chemical options.
- Being used overseas for many years was generally a positive, as it spoke to track-record of safe use.
- The elimination/eradication of microorganisms and bacteria was a positive to some, with the benefit that produce lasts longer on the shelf.

Interestingly, the authors concluded that education can cause discomfort for all treatment methods. The methods require significant explanation over and above the names/short descriptions. As the only method requiring labelling, irradiation would be the subject of most suspicion.

Personal overview of consumer attitudes

My personal overview of the literature on consumer attitudes is that –

- The majority of consumers have either not heard about irradiation or have only a very limited knowledge of it;
- If asked, without providing any further information, a majority express concern about the concept and indicate they would be unlikely to purchase irradiated food;
- When provided with information about irradiation, the percentage in favour always increases and often becomes a majority of consumers;
- A significant minority will always be opposed to any use of irradiation of food;
- Irradiation is a preferred treatment over chemical and fumigation treatments;
- If asked, consumers will express a preference for a label but the evidence is slight that consumers generally take notice of available labels unless they have a specific reason.

I believe a small percentage of consumers is either strongly opposed or strongly in favour of irradiated food. The majority of consumers, given that the option often appears largely theoretical, can be persuaded either way. They trust that the food supply is kept safe by authorities and by the need for the food trade to maintain a good reputation. These consumers are likely to base decisions on the quality and cost of what they see on retail shelves (IFIC 1998; Bruhn 2008).

Overall, the results of surveys and of purchase behaviour when irradiated food is available indicate that simple assertions that consumers do not want irradiated food or will not purchase it are wrong.

Food Producer Attitudes to Irradiated Food

In my experience, growers and grower organisations generally accept the safety and technical benefits of food irradiation. Most discussion is around variations of the following inter-connected questions. Will consumers purchase it, especially if it's labelled? Why does it have to be labelled when other treatments are not? If labelling is required can we give the process a different name?

Growers (and the food trade generally) may have concerns about the direct and indirect costs of labelling of the type summarised by FSANZ (2016). If the labelling requirement is removed for Australia and New Zealand, labels will still be required for exports to countries that require it. However, in my view the more fundamental difficulty growers see with labelling is that it will bring to the fore and reinforce the underlying fears the public in general have with radiation and radioactivity and provide an opportunity for a few highly motivated opponents of irradiation to generate opposition. It reinforces fears in the food trade that they could move to a technology that will be controversial and may be rejected by the consumer despite evidence to the contrary. Thus labelling becomes a barrier to switching to irradiation and the concern about market failure becomes a self-fulling prophecy. Growers understandably try to maintain access to conventional methods such as spraying.

Growers in Queensland became particularly interested in irradiation when the Australian Veterinary and Agricultural Medicines Authority (APVMA) signalled that use of the insecticides dimethoate and fenthion would be restricted (APVMA 2015 a, b). Growers noted the success of the mango trade to New Zealand. Application A1069 to irradiate tomatoes and capsicums was the result. However, irradiated tomatoes have had only limited penetration into New Zealand (see later). Growers have noted that New Zealand growers opposed import of Australian tomatoes. This was probably to be expected. However, it has been also been noted that the partly successful opposition has been based around the labelling issue (Hort 2012; Chapman 2016).

Market access decisions often create different viewpoints between producers involved in exports and those who produce and sell locally. Interestingly, New Zealand tomato growers also export tomatoes to Australia (Stats 2012) which are liable for methyl bromide treatment to gain access to Australia (BA 2009; MPI 2014). There appears to be no wish to inform consumers about this.

Retailer Attitudes to Irradiated Food

The attitude of the major supermarkets in New Zealand is puzzling. They have continued to sell irradiated mangoes in increasing volumes while declining to offer irradiated tomatoes. Whatever the reason for their reluctance to offer irradiated tomatoes it cannot be a belief that irradiated food should not be sold on principle, nor that consumers will refuse to purchase it. In Australia a similar pattern may be emerging in which irradiated produce is sold initially in independent markets and not the major supermarkets.

Retail organisations worldwide have been reluctant to engage in any discussion of irradiated food with international organisations such as the International Consultative Group on Food Irradiation, irradiation companies or research organisations and scientists. I am aware of many meetings to which retailer representatives have been invited but have not attended or, occasionally, sent an

observer. Although I have often been invited to speak to growers and their organisations, I have never been invited to speak to a retail group. Sue Kedgley quotes the then head of Woolworths Australia in 2012 as saying irradiated food is "an extremely emotional product……..and retailers were not going to try to convince consumers there is nothing wrong with irradiation" (Kedgley 2015)

In Europe, where political opposition to food irradiation has been strong for 15 years, some UK supermarkets have clearly stated that they will not stock irradiated foods (TFC 2003). Consumer opposition is often cited for this stance. The situation in New Zealand and Australia is less clear. The view has been expressed that the major barrier to increasing the application of irradiation of food comes not from consumers but from retailers perceiving a consumer barrier (Pszczola 1990; Bruhn 1995; Satin 1996; Roberts and Henon 2015).

Irradiated Mangoes and Tomatoes in New Zealand

Irradiated mangoes have been sold in increasing volumes by the major New Zealand supermarkets since 2004 but since irradiated tomatoes became available in 2013 only independent grocers have sold them (Lynch 2015; Roberts and Henon 2015; FSANZ 2016). Mangoes are not produced within New Zealand whereas tomatoes are locally produced even in winter when supplies from Australia have traditionally been sought to increase supply.

FSANZ have suggested that local availability may be an influence on consumer decisions. However, this seems unlikely to be a major factor since New Zealand consumers purchased much larger quantities of Australian tomatoes up to 2011 (Stats 2012) when they were imported after insecticide treatment. This treatment was suspended late in 2011.

A more likely factor for the reluctance to stock irradiated tomatoes may be the reaction to the importation of competing product from local growers. HortNZ, the representative organisation for TomatoesNZ, have steadily expressed concern, including in the media, that labelling of irradiated tomatoes needed to be strengthened and may be inadequately enforced (Hort 2012; Chapman 2016). Their campaign about labelling has been linked with a long-standing campaign to obtain Country of Origin labelling for imported produce.

Price is affected by the availability of Australian tomatoes in the New Zealand winter. Local tomatoes fetched a high price when there were no competing imports. When imports recommenced in 2013, their price was several $/kg cheaper than the local produce. This competition is good for New Zealand consumers. Purchase of Australian mangoes appears to be quality-driven but Australian tomatoes are price-driven.

I understand that restaurants and the catering trade wish to use irradiated tomatoes during the winter but find the labelling provisions too onerous (FSANZ 2016). Only 300-400 tonnes per year of Australian tomatoes have been irradiated for export to New Zealand (Murray Lynch, *pers. comm.* 3 February 2016) compared to 2000-3000 tonnes per year when insecticide treatments were available (Stats 2012). The situation regarding irradiated tomatoes at retail and in restaurants and catering is another indication that labelling can be a barrier to the competitive development of the technology.

Labelling and New Technologies

Pasteurization was the high profile 'new technology' of the late 19th century. The objections to it from some consumers were remarkably similar to those raised against food irradiation and it was

more than 70 years before the technology was firmly established (Satin 1996). Irradiation is not the only 'new' technology that can take many years to become established.

There can be little argument that over the years new technologies have made for a safer, more secure food supply and contributed to improved consumer health and national economies. Yet suspicion of new technology continues today for various reasons and is probably increasing especially if the consumer feels the technology offers little direct benefit. There is extensive literature on consumers and new technologies which either uses food irradiation as an example or seems directly applicable to it (Cardello, Schutz and Lesher 2007; Lyndhurst 2009; Frewer et al 2011; Rollin, Kennedy and Wills 2011; Sapp et al 2013; Eustice and Bruhn 2013)

The evidence shows that irradiation is poorly understood even by consumers who are aware of the term "food irradiation" and many are inherently suspicious of it. A label may re-inforce these suspicions; a US study found over 30% of consumers could regard the labelling as a warning (He, Fletcher and Rimal, 2005). Consumers may reason "if it's safe, why label it?"

Communicating new technology to consumers is recognized as complex (Rollin, Kennedy and Wills 2011). As discussed above, labels are not a way to fully inform consumers about the benefits of a new technology. By labelling only new technology it may be inferred by the consumer that it has an inherent risk whereas conventional technologies are safe even though they have usually not been subject to the same pre-market assessment or scientific scrutiny. Given current suspicion, labelling of new technology tends to disadvantage the technology when it competes with "conventional" technology and inhibits its adoption. The label is at the heart of a 'feedback loop' of concerns between consumers, producers and retailers.

Mandatory labelling of only a new technology such as irradiation does not produce a level playing field when the food trade makes market judgments about whether to adopt irradiation or to continue with existing technologies that do not require labelling.

Labelling and the Unwilling and Willing Consumer; an analysis and perspective on relative risks and advantages.

There is evidence from consumer purchase behaviour and from surveys for the co-existence of consumers who are unwilling and consumers who are willing to purchase irradiated food.

Unwilling consumers

The advantage of mandatory labelling to unwilling consumers is straightforward; they can more easily avoid the food. There are no direct risks to them, though it could be argued that they remain exposed to, and largely unaware of, the potential risks from phytosanitary treatments that will be used instead of irradiation.

Willing consumers

The disadvantage to willing consumers is that development of the market in irradiated food is being inhibited by labelling. This may mean reduced access to some imported fresh produce, reduced competition and increased prices in the marketplace and poorer quality of some imported produce. In the absence of the irradiation option, they also face the risks associated with the chemical residues and fumigants that may in practice be small, but which are of considerable concern to them (Resurreccion *et al* 1995; Gamble, Harker and Gunson 2002; TKP 2013).

Undecided consumers

The balance of evidence indicates that relatively few consumers are entrenched as unwilling or willing consumers. Most are undecided; they may be persuaded either way. At this time they are probably in the majority and will purchase produce based on the quality and price of the food they see on retail shelves. This group will face the same disadvantages and risks as the willing consumers.

Who carries the most risk

It is my view that the willing and undecided consumers outnumber the unwilling consumers. The disadvantages and risks may be unknown to them, but they are real and substantive and must be given more weight than hitherto when considering the advantage of labelling to the small but significant number of unwilling consumers.

Future Trade Issues

Any decision on mandatory labelling of irradiated food should take into consideration the possible future uses of this versatile technology and ensure that any decision does not stifle its development and disadvantage New Zealand economically. Export/import of fresh produce has dominated the use of irradiation in Australia and New Zealand. Elsewhere the decontamination of spices and fresh and processed meats has been the major use.

In the last 5 years irradiation has become increasingly favoured as a phytosanitary treatment. Chemical treatments have been subject to increasing scrutiny including bans or restrictions on their use on health and safety grounds, for example ethylene dibromide (Gilbert 2014), ethylene oxide (EC 1989; FSANZ 2002) and the insecticides dimethoate and fenthion (APVMA 2015a, b). Although methyl bromide is still permitted for phytosanitary use under the Montreal Protocol (UNEP 2009) signatory states are required to seek alternative treatments.

To help reduce their dependence on methyl bromide fumigation, the US now imports irradiated produce from Mexico, India, Vietnam, Thailand, Pakistan, South Africa and Australia as well as from the US state of Hawaii in amounts totalling over 20,000 tonnes per annum (Jeffers 2015; Bustos-Griffin, Hallman and Griffin 2012; Follett 2014; ABC 2016). Smaller amounts of irradiated Australian produce have been sent to Malaysia and Indonesia while Vietnam has begun exports to Australia (VNS 2015). Bilateral negotiations on import requirements for irradiated produce trade are on-going between several countries.

We will take just one example to stress the importance of other possible future developments of the technology. Considerable efforts are being made to reduce food-borne bacterial pathogens to insignificant numbers in key food such as chicken, seafood and food eaten raw (MIN 2015). These efforts concentrate first on continuous improvements in manufacturing practice within the food supply system. However, should further reductions be required then irradiation is ideal as a final stage treatment. The pathogens that irradiation can control easily include campylobacter, salmonella, listeria, and *E col* including *E coli* 0157:H7 but not norovirus (Farkas 1998).

It is estimated (AE 2010) that every year in New Zealand food-borne pathogens cause a few deaths, many thousands of illnesses requiring hospital stays and over 200,000 cases of lesser illnesses which tend to be under-reported. The economic cost is thought to be above NZ$162M. The economic cost to Australia is thought to be A$1.3B (AE 2006). Norovirus contamination is only slightly reduced by

usable irradiation doses. A US estimate of the health-cost savings of applying irradiation treatment was 25% although application of irradiation to all at risk food is not credible. Treatment of foods destined for the vulnerable such as the elderly, very young or immune-suppressed could be valuable.

Approximately 8,000 tonnes of ground beef is irradiated annually in the US to reduce food-borne pathogens (Kume and Todoriki 2013) with a major target *E coli* 0157H7 which is a zero-tolerated pathogen under US law (USDA/FSIS 2002). It is feasible that if domestic US ground beef eventually becomes *E coli* free, then our exports to the US could be required to meet a similar standard.

Irradiated Ingredients

If FSANZ decides that mandatory labelling of irradiated food should continue, then the labelling of irradiated ingredients and irradiated food in restaurants and catering must be considered. Under the present Standard and its interpretation irradiated ingredients in a compound food must be labelled. There is no threshold below which labelling is not required. The food may contain multiple ingredients present at vastly greater concentrations that have not be assessed for risk and which may well have undergone some other process. Such a position is unscientific, illogical, discriminatory and probably unenforceable.

Requiring labelling down to a theoretical single irradiated molecule violates the scientific truism that it is impossible to prove a negative, in this case that food has not been irradiated. It would not be possible to prove, if challenged, that an unlabelled multi-ingredient food does not contain an irradiated ingredient at trace amounts.

Herbs and spices are often blended from many sources to provide the desired properties. Any heat treatment of the ingredient or the food containing it would render the best detection methods for herbs and spices ineffective. This could make verification of the fact of irradiation difficult. Dependence on a paper trail to show whether an ingredient has or has not been irradiated may be problematic.

Under the FSANZ regulation, a pizza comprising a base and complex topping which contains a few shavings of salami that contains a small percentage of safe, irradiated paprika must be labelled. The labelling of such minor irradiated ingredients in complex food carries the concept of the consumers' right-to-know to extreme lengths.

The USA does not require labelling of an irradiated food once it is used as an ingredient in another food. Canada does not require labelling of an ingredient below 10% of the packaged food Canada (CFIS 2014) and Malaysia does not require it below 5% (MOHM 2011). The FSANZ position on ingredient labelling is also held by the EU (EC 1999) though possibly not by individual EU member countries who retain their own regulations until the EU completes its unified approved list of irradiated foods.

Irradiated Food and Ingredients in Restaurants/Catering

FSANZ has adopted the same approach as the EU in requiring labelling of irradiated food or food containing an irradiated ingredient in restaurants and catering. The Codex General Standard on the Labelling of Pre-packaged Food (CAC 1985) does not specifically mention labelling in restaurants or catering. Most countries have regulations that are silent on the topic.

Customers in restaurants and catering establishments have a right-to-know if a food could affect their health. Labelling of irradiated food in that environment would likely be seen as a warning by customers. FSANZ does not require food produced using another new technology (GM food) to be labelled in restaurants or catering (FSANZ 2016).

Singling out irradiated food for mandatory labelling appears discriminatory. From a scientific viewpoint it is hard to see irradiation as a unique process that requires labelling in restaurants and catering. The restaurant/catering customer is faced with a choice of multi-ingredient food and food produced, processed and handled under conditions that are highly variable and unknown to the consumer. Restaurants commonly declare food sold as "organic" "gluten-free" or sometimes "GM-free". They would be free to claim the food offered as "non-irradiated" in the same way.

Detection of Irradiated Food

There is no single test to show that food has been irradiated but a barrage of several tests has been verified internationally and developed into standard methods by the EU (CEN 2012) and adopted as Codex standard methods (CAC 2003). These can be used to detect most uses of irradiation on various food classes. Unfortunately for the present situation in Australia and New Zealand they all perform best at doses above 1 kGy, the maximum dose permitted for phytosanitary treatments.

The most likely test to detect the irradiation of fresh produce at doses well under 1 kGy is a variation of the standardized method of Photostimulated Luminescence EN 13751: 2002 (CEN 2012), developed initially by David Sanderson (Sanderson, Carmichael and Naylor 1996). This is usually calibrated to be useful at the high dose levels used to treat herbs and spices (Sanderson, Carmichael and Fisk 2003). However, it is probable that the test could be re-calibrated to be sensitive enough to detect phytosanitary doses (D. Sanderson, *pers.comm.,* 9 August 2013). However this has not been subject to the international verification needed to make it a standard method.

In summary, irradiation above 1 kGy can usually be scientifically verified. However, at phytosanitary doses only a 'paper trail' would be available to tell whether fresh produce had been irradiated. A method to provide physical evidence capable of being used in court proceedings does not exist at present.

Alternative Means to Communicate the Benefits of Irradiation

Labels

Labels cannot communicate or compare the benefits of any technology adequately.

Surveys of consumers routinely show they want labelling information, but it is much less certain how much they value and use them. The study of GM food in EU countries showed that most consumers wanted GM food labelled, but few read the labels and most purchase the food where it was available (EC 2008). A high response in favour of labelling will usually be obtained if they are asked 'should a [name of technology] be labelled". However, if asked to think about what they would like to see on a label, the numbers naming that technology will be low; in other words, the risks of the technology are not in the forefront of consumer thinking (Hallman, Cuite and Morin 2013) and answers depend on how the question is phrased.

Radura symbol

The Radura symbol is often prescribed in labelling regulations, in the US for example (USFDA 2015). It was first used in the 1960s; it is unclear whether it was first used in The Netherlands or South Africa. It was not an attempt to trade on 'green values' as sometimes claimed as such values were hardly extant at that time.

A widely held belief among organisations involved in the development of food irradiation throughout the 1980-2000 period was that the Radura symbol would eventually become the sole means of demonstrating that a food had been irradiated. This would be after a period in which the food was labelled via Radura plus text and there was an information campaign which explained irradiation. I am unaware of any such campaign having occurred anywhere. It was suggested that Radura would become a symbol of a quality, for example for "safer" chicken.

Information campaigns

FSANZ and MPI in New Zealand and overseas agencies such as the USFDA, Health Canada, the European Commission and many more have factual information on food irradiation on their websites and/or available as brochures. The International Atomic Energy Agency has Fact Sheets and videos available. Most of the research establishments responsible for food irradiation world-wide have produced brochures, fact sheets and, sometimes, videos about irradiation. There is little evidence they have been used or useful in communicating the benefits of irradiation except in controlled situations such as focus groups or survey respondents (Nayga, Aiew and Nichols 2005; Bhumiratana, Belden and Bruhn 2007; Eustice and Bruhn 2013).

There is no shortage of informational material. The question is how to apply it. As many commentators have pointed out, communicating risk and benefit, particularly in an emotional area such as food, is complex (Rollin, Kennedy and Wills 2011).

One point of contact with the consumer is at point of sale. A few grocery stores in New Zealand have displayed a fact sheet near the boxes of irradiated tomatoes that was produced by MG marketing. MPI also circulated a brochure to grocery owners that explained irradiation and their labelling responsibilities but this was not made available to consumers. However, point of sale information has drawbacks.

- It requires the cooperation of store owners, preferably all shop owners.
- It is doubtful that a busy shopper will read a detailed brochure.
- If the shopper has further questions, who will be *immediately* available to respond?

Media campaigns also beg the questions of who will be responsible and who should cover the costs?

- A government agency may have sufficient consumer trust, but government does not generally promote a specific technology. This is especially so when there are competing technical options;
- The food trade generally feels it doesn't have the technical competence to lead a campaign even it were felt to be appropriate;

- The irradiation industry is seen by consumers as having too much self-interest as might the food trade.

The reality is that any pro-campaign will provoke a counter-campaign from dedicated opponents of irradiation. The result is for the consumer to perceive “experts shouting at each other” and to tune out. Also, consumers may feel that if a technology needs a label or any ‘campaign’, then it must be suspect.

There is one final issue with any information campaign. A new technology succeeds in the market when it can demonstrate that it is sufficiently better than existing technologies providing there are no distorting issues (as is the case with irradiation). This means that any information programme will, at some stage, be forced to compare the advantages of the new technology over older technologies. This can be awkward in the food trade specifically in the areas of phytosanitary treatments or pathogen reduction.

PART C: REFERENCES

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PART D: QUESTIONS FOR STAKEHOLDERS

All submitters

1. What information (for example, studies, data or consumer feedback) can you provide on consumer awareness, understanding and behaviour, in response to labelling about food irradiation?
   See Australian study (TKP 2012) and Part C: Studies of Consumer Attitudes to Food Irradiation.

2. Do you purchase, or would you consider purchasing, irradiated food?
   Yes: it's safe and safer for the consumer than some alternative phytosanitary treatments. I would prefer my herbs, spices and condiments to be decontaminated by irradiation. As I get older and become more vulnerable to foodborne illnesses, I might like to have an option of obtaining irradiated chicken.

3. Does the current labelling requirement for irradiated food (see box below) provide enough information for you to make an informed choice about the food you buy?

   Labelling requirement: If the food, ingredient or component of a food has been irradiated, a statement to the effect that the food, ingredient or component has been treated with ionising radiation is required

   It wouldn't if I did not have sufficient knowledge already. See text section Part B Adequate Information and Informed Choice, and Value of Labelling.

4. What are your views about the wording of the statement not being prescribed?

   See answer to Q6; but if mandatory labelling is retained, then the terms 'irradiated' or 'treated with radiation' are suitable. In fact they should not be substituted by terms lightly disguised to hide the fact of irradiation.

5. What are your views about the voluntary use of the Radura symbol?
   If consumers are informed in advance that it indicates irradiated food, then it would be a helpful signal to consumers and eventually more effective than text.

6. Do you think the current labelling requirement for all foods permitted to be irradiated should be removed?
   Yes.

7. If labelling was to continue for irradiated whole foods, do you think restaurant meals containing irradiated ingredients should still be labelled?
   No. Even GM-foods are not labelled. See Part B Irradiated Ingredients and Irradiated Food in Restaurants/Catering.

8. If labelling was to continue for packaged foods containing irradiated ingredients, do you think the irradiated ingredients should still be labelled?

   Only if the ingredient is more than 10% of the whole food. See Part B. Irradiated Ingredients.

Produce growers

9. Does the mandatory labelling requirement prevent you from using irradiation as a treatment for your produce? Please provide reasons for your answer.

N/A

Food manufacturers

Section N/A

10. Do you use irradiated ingredients in your products? (For example, tomato paste, herbs & spices).
11. Does the fact that irradiated foods have to be labelled impact on your decision to use them?
12. How important is the labelling factor alongside other factors? (For example, price, availability of ingredients, quality of produce, reputation of supplier).
13. If the mandatory labelling requirement was removed for irradiated ingredients used in processed foods, would your company be more likely to use irradiated ingredients?

Food service providers

Section N/A

14. Do you use irradiated whole foods in your products? (For example, irradiated tomatoes in sandwiches).
15. If the mandatory labelling requirement was removed for irradiated whole foods, would you still ask suppliers to label the food?

All industry submitters

Section N/A

16. Have you conducted any consumer research or received consumer enquiries about irradiated food? If so, are you able to provide the research to FSANZ?
17. Do you think the current mandatory labelling requirement is an impediment to developing existing / new markets? What reasons do you have for this?
18. What do you perceive to be the costs associated with the mandatory labelling requirement? (For example, costs of segregating irradiated produce from non-irradiated produce, specific packaging and/or labelling costs, traceability costs).
19. What do you perceive the costs associated with the **removal** of mandatory labelling to be? (For example, potential for loss of consumer confidence in your products, amending product segregation, handling and display processes).
20. What are the opportunity costs for your business associated with the mandatory labelling requirement? (That is, does the requirement to label irradiated produce cause you to compromise in your business practices? For example, does the time delay involved in labelling your produce prevent you from accessing certain market opportunities?).
21. What are the relative costs and benefits of irradiation and other treatments in terms of cost, efficacy, post-treatment product quality, convenience and timeliness?

All submitters

22. What are your views about information on the safety and benefits of food irradiation being on food labels?
    Labels are inadequate for providing adequate information and act as a barrier to the development of a new technology and a truly competitive market. See submission.

23. What other practical approaches other than labelling can be used to communicate the safety and benefits of food irradiation? (Please describe).

    Alternative communication materials are easy to obtain but there many practical difficulties to applying them effectively. See Part B Alternative Communication Methods.

24. Do you have any information on the effectiveness of any of these approaches? (If so, please provide).
    They work well in small groups, but they have been little used in a concerted public campaign. The literature rather points to the difficulties in communicating safety and benefits (see Rollin, Kennedy and Wills 2011 and references therein).