PSGR

Physicians and Scientists for Global Responsibility

New Zealand Charitable Trust

Formerly Physicians and Scientists for Responsible Genetics New Zealand

PO Box 9446
TAURANGA 3112

+64 7 544 5515
[redacted]
www.psgr.org.nz

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Food Standards Australia New Zealand
PO Box 5423
KINGSTON ACT 2604
AUSTRALIA

Food Standards Australia New Zealand
PO Box 10559
WELLINGTON 6143
NEW ZEALAND

Submission on Application A1115
To irradiate blueberries and raspberries for phytosanitary purposes

We urge Food Standards Austria New Zealand (FSANZ) to reject Application A1115. The food regulation review process of FSANZ has a legislated mandate to protect public health and safety. In approving this Application, FSANZ would not be meeting this duty of care.

Irradiation kills most bacteria, including beneficial bacteria that naturally control the growth of harmful bacteria. It also potentially adversely affects the nutritional value of a significant proportion of a fresh fruit, vegetable or grain, when these go on to be used in dried, canned and/or frozen processed foods. Studies suggest irradiated foods may lose 5-80 percent of many vitamins, particularly vitamin A, thiamin, B2, B3, B6, B12, folic acid, C, E, and K. The content of Amino acids and essential polyunsaturated fatty acids may also be affected.[1] [2] The amount of loss depends on the dose of irradiation and the length of storage time.

Foods not irradiated, i.e. fresh foods, contain high levels of phytonutrients and digestive enzymes necessary for good health. They are powerhouses to help fight disease. Among others claimed are:[2]

- Berries can help prevent heart disease; and
- Dark leafy greens help prevent serious health conditions, boost immune function, and help prevent other infections.[2]
- Broccoli and celery have been shown to prevent cancer, black raspberries to reverse oral cancer, pomegranates to halt prostate cancer and green tea to halt breast cancer;
- Beet greens are a liver cleanser;
- Cilantro can remove heavy metals;

In recognition that irradiation alters the nature of food, irradiation is regulated as a food additive in the US and irradiated food is labelled accordingly[3]; i.e. it is no longer a fresh food.

[1] Loaharanu, Paisan (1990). "Food irradiation: Facts or fiction?". IAEA Bulletin (32.2): 44–48. Retrieved March 3, 2014.
[2] http://www.organicconsumers.org/Irrad/irradfact.cfm
[3] http://foodirradiationwatch.org/index.php/fsanz-seeking-to-approve-the-irradiation-of-blueberries-and-raspberries/

A study looked at the viability of broccoli seeds and functional properties - such as ascorbic acid, carotenoid, chlorophyll, and total phenol contents - of broccoli sprouts grown from seed irradiated using electron beam and gamma ray at doses up to 8 kGy. The yield ratio and sprout length decreased as the irradiation dose increased. The resulting underdeveloped sprouts had decreased ascorbic acid, carotenoid, and chlorophyll contents.[4] In another study, looking at irradiation to disinfest wheat, the researchers found, "... irradiation significantly reduced seed germination and seedling vigour."[5] Irradiation caused adverse effects in both studies.

Fresh fruits and vegetables are important sources of Vitamin C, important for healthy gums, teeth, bones, and muscles, for healing wounds and fighting infection and many experts say it contributes to a reduced risk of heart disease, cancer, and cataracts. Vitamin C levels have been shown to be reduced in foods exposed to commercial levels of irradiation. At low doses (0.3 to 0.75 kGy) irradiation has been found to destroy up to 11 percent of Vitamin C in fruit before storage, and up to 79 percent of Vitamin C after three weeks of storage.[6]

While the extent to which vitamin loss occurs will vary based on a number of factors, including the type of food, irradiation levels, and availability of oxygen, vitamin loss almost always increases with increasing doses of radiation and the destruction of vitamins continues beyond the time of irradiation.[7] Irradiated food that is stored, experiences greater vitamin loss than food not irradiated. At the limit of its shelf life of 270 days, irradiated mango pulp contained 57 percent less Vitamin C than non-irradiated mango pulp at the limit of its shelf life of 60 days.[8]

Vitamin E is the most sensitive fat-soluble vitamin with losses of 50 percent when irradiated with oxygen present and Vitamin B1 (Thiamine) has been shown to be the most water soluble vitamin vulnerable to radiation.[9] Many plants have phytochemicals that are thiaminases (ryegrass is a prime example) and it is suggested that thiamine could have a role in autism due to its role in neural function, and low levels have a well-known pathology.

Officially we may maintain that the average New Zealand diet is adequate, yet there are people who eat less than two servings of fruits/vegetables per day and may not receive sufficient Vitamin C. For example, the elderly, children, alcoholics, men living alone who develop 'widower' or 'bachelor' scurvy, people with medical conditions that may prevent the intake and/or absorption of nutrients, dialysis patients, and people with inflammatory bowel disease (Crohns Disease), malabsorption disorders or severe dyspepsia.[10] [11]

In communities where nutrient intake is marginal, up to 15 percent of the population may be scorbutic (<0.2mg/100ml serum) without a further reduction in dietary input by eating irradiated foods. A scorbutic condition can lead to an increased risk of bacterial endotoxin toxicity: for example, in many of the impoverished and nutrient-deficient South Auckland populations.

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[4] 'Seed viability and functional properties of broccoli sprouts during germination and postharvest storage as affected by irradiation of seeds', Waje et al, J Food Sci. 2009 June;74(5):C370-4. doi: 10.1111/j.1750-3841.2009.01161.x. http://www.ncbi.nlm.nih.gov/pubmed/19646029

[5] 'Electron beam irradiation effects on wheat quality, seed vigor, and viability and pathogenicity of teliospores of Tilletia controversa and T. Tritici', BORSA et al, Journal Plant disease 1995, vol. 79, no6, pp. 586-589 (23 ref.) http://cat.inist.fr/?aModele=afficheN&cpsidt=3590579

[6] 'Effect of low dose irradiation on composition of tropical fruits and vegetables', Mitchell et al, J Food Comp Anal 5: 291-311 1992

[7] 'Combined effects of irradiation, storage and cooking on the vitamin E and B1 levels of foods', Diehl, Food Irra. 10;2-7 4-1467.

[8] 'Combined effect of steaming and gamma irradiation on the quality of mango pulp stored at refrigerated temperature', Youssef et al, Food Research International 35: 1-13 2002.

[9] www.ift.org/knowledge-center/read-ift-publications/science-reports/scientific-status-summaries/irradiation-and-food-safety.aspx

[10] http://dermnetnz.org/systemic/scurvy.html

[11] Vitamin C: Evidence, application and commentary, Ge et al https://www.rnzcgp.org.nz/assets/documents/Publications/Archive-NZFP/Oct-2008-NZFP-Vol-35-No-5/GeOctober08.pdf

The latent scorbutic state can then be converted into frank scurvy by infections and under such conditions haemorrhagic phenomena are frequent. All of the patho-physiological features of haemorrhagic and thrombotic conditions found in bacterial meningitis, for example, are seen in ascorbic acid deficiency states.[12]

While irradiation (or pasteurization) may kill 99.9 percent of the pathogens present, and may decrease outbreaks of food-borne illnesses, as consumption of a greater range of irradiated food products increases, there may be unintended consequence of increasing the number of people who get sick from other infections and chronic diseases due to the fact that the 'natural' advantages in fresh food plants have been at least diminished in the irradiation process. The long-term health consequences of eating irradiated food are still unknown and untested, an inexcusible situation.[13]

Multiple studies support the premise that an increased rate of pathogen growth may occur when irradiated food is cross-contaminated with a pathogen, as the competing spoilage organisms are no longer present. For example, spores from the toxigenic organism Aspergillus ochraceus NRRL-3174 were exposed to specific levels of gamma irradiation and then allowed to germinate, and increases in ochratoxin A production by irradiated, compared to non-irradiated, spores were observed after inoculation of spores onto cracked red wheat.[14]

As FSANZ will know, irradiation creates a complex series of reactions that alter the molecular structure of food and creates known carcinogens. Irradiation damages food by breaking up molecules and creating free radicals. Free radicals kill some bacteria, but can also damage vitamins and enzymes, and can combine with existing chemicals, such as pesticides, in a food to form new chemicals known as unique radiolytic products (URPs).

Researchers in a 2002 study pointed to information on the toxicological potential of 2-alkylcyclobutanones (2-ACBs), radiolytic derivatives of triglycerides found exclusively in irradiated food, being scarce. In the study, Wistar rats received daily a solution of highly pure 2-tetradecylcyclobutanone (2-tDCB) or 2-(tetradec-5-enyl)-cyclobutanone (2-tDeCB) at a concentration of 0.005% in 1% ethanol as drinking fluid, while control animals received 1% ethanol. All animals received a single intraperitoneal injection of the chemical carcinogen azoxymethane (AOM) at Weeks 3 and 4. At three months after AOM injection, no significant changes were observed in the total number of preneoplastic lesions in the colon of AOM controls and 2-ACB-treated animals. However, after six months the total number of tumours in the colon was threefold higher in the 2-ACB-treated animals than in the AOM controls. This is the first demonstration that a compound found exclusively in irradiated dietary fats may promote colon carcinogenesis in animals treated with a chemical carcinogen.[15]

The European Food Safety Authority (EFSA) acknowledges that, "As ionising radiation passes through food, it creates a trail of chemical transformations by primary and secondary radiolysis effects. The main reported radiolytic products are certain hydrocarbons and 2-alkylcyclobutanones produced from the major fatty acids in food, and some cholesterol oxides and furans." Available "data indicate that at least some 2-alkylcyclobutanones may induce DNA damage in vitro yet no in vivo genotoxicity studies are available."

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[12] Do the NZ Ministry of Health and IMAC ("Immunisation Advisory Centre") Provide Accurate Information about the Risks of Vaccines? December 2003 http://www.naturalmedicine.net.nz/vaccination/do-the-nz-ministry-of-health-and-imac-%E2%80%9Cimmunisation-advisory-centre%E2%80%9D-provide-accurate-information-about-the-risks-of-vaccines/.

[13] http://www.sustainabletable.org/728/food-irradiation

[14] 'Production of ochratoxin A by Aspergillus ochraceus NRRL-3174 before and after exposures to 60Co irradiation', Applegate and Chipley, Appl Environ Microbiol. Mar 1976; 31(3): 349–353.
PMCID: PMC169778 http://www.ncbi.nlm.nih.gov/pmc/articles/PMC169778/

[15] 'Food-borne radiolytic compounds (2-alkylcyclobutanones)may promote experimental colon carcinogenesis'. Raul et al, Nutr Cancer. 2002;44(2):189-91. http://www.ncbi.nlm.nih.gov/pubmed/12734067

"Concerning other radiolytic products no new relevant toxicological studies have been reported." This is unacceptable in terms of safety issues for human consumers. EFSA goes on to say that, "evidence was indicated in publications on leukoencephalomyelopathy in cats which have been fed mainly or exclusively with highly irradiated feed" and "the relevance of the cats' studies for human health should be clarified."[16]

FSANZ will know that an Australian company had to recall cat food products involving irradiation[17] and 40 cats were euthanized after severe paralysis following ingestion of one product marketed by the company.[18] Scientists concluded the cat deaths were caused by Vitamin A depletion, saying irradiation treatment is known to deplete Vitamin A. Of the cats studied, histopathological damage to the white matter of the spinal cord and brain was observed.

As long ago as 1977, the US Army[19] discovered that of 65 chemical compounds found in irradiated beef, 35 did not naturally occur in that particular food, five did not naturally occur in any food, and 15 increased in concentration due to the irradiation processing, including benzene, a known carcinogen. The researchers also noted that with irradiated food "the possible presence of undetected substances can never be excluded." Other URPs are known toxins, such as quinones, formaldehyde and lipid peroxides, and many are unique to irradiated foods. Studies have still not adequately covered the long-term effect of these new chemicals in the human diet and we cannot simply assume they are safe.[1]

However small each factor is, the cumulative effects of continuous ingestion of irradiated foods have not been studied or proven safe. Of particular concern is the fact that there are no studies on the effects of feeding babies or children diets containing irradiated foods, except for a very small study in India which found four of five children fed irradiated wheat developed polyploidy, a chromosomal abnormality that is known to be an indication for the increased chance of cancer development further on in life.[20]

Studies on animals fed irradiated foods continue to show an increase in tumours, reproductive failures and kidney damage among other effects. The causes may include irradiation-induced vitamin deficiencies, inactivity of enzymes in the food, DNA damage, and/or toxic radiolytic products in the food.[3]

When the US FDA approved irradiation for poultry, the approval was based on 5 of 441 animal-feeding studies. Toxicologist, Dr Marcia van Gemert, who chaired the committee that approved irradiation, later said: "These studies reviewed in the 1982 literature from the FDA were not adequate by 1982 standards, and are even less accurate by 1993 standards to evaluate the safety of any product, especially a food product such as irradiated food."

The standards of studies quoted as validating the safety of irradiation need critical analysis by independent scientists, not those who will benefit financially from approvals. The five studies mentioned above showed adverse health effects on the animals in the tests, and/or were conducted using irradiation at lower energies than those the FDA eventually approved.

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[16] EFSA Panel on Food Contact Materials, Enzymes, Flavourings and Processing Aids (CEF), EFSA Journal 2011;9(4):1930 [57 pp.]. doi:10.2903/j.efsa.2011.1930, European Commission Question number: EFSA-Q-2006-034 Adopted: 25 November 2010 Published: 06 April 2011 Affiliation: European Food Safety Authority (EFSA), http://www.efsa.europa.eu/en/efsajournal/pub/1930.htm

[17] Food Magazine. News. November 24, 2008. *Petfood recall prompted by cat deaths*.. Retrieved April 29, 2013.

[18] Burke, Kelly (November 28, 2008). "Cat food firm blames death on quarantine controls". *The Sydney Morning Herald*. Retrieved April 29, 2013.

[19] Federation of American Societies for Experimental Biology, Evaluation of The Health Aspects of Certain Compounds Found in Irradiated Beef. Report to the US Army Medical Research and Development Command, Bethesda, MD, August 1977. U.S. Food and Drug Administration. Recommendations for Evaluating the Safety of Irradiated Food. Final Report of FDA's Irradiated Food Committee. Washington, D.C., July 1980.

[20] Bhaskaram and Sadasivan. 'Effects of feeding irradiated wheat to malnourished children.' Amer J Clin Nutr , 28:130-135, 1975

The Department of Preventative Medicine and Community Health of the New Jersey Medical School found two of the five studies were methodologically flawed. In a third study, animals eating a diet of irradiated food experienced weight loss and miscarriage, almost certainly due to irradiation-induced Vitamin E dietary deficiency.

The remaining two studies investigated the effects of diets consisting of foods irradiated at doses below the FDA-approved general level of 100,000 rads. That fact alone eliminates them in justifying food irradiation at the FDA approved levels.[21]

Twelve studies carried out by Raltech Scientific Services Inc. under contract to the US government, examined the effect of feeding irradiated chicken to several different animal species. The studies revealed the possibility of chromosome damage, immunotoxicity, greater incidence of kidney disease, cardiac thrombus, and fibroplasia. Studies of rats fed irradiated food also indicate possible kidney and testicular damage and a statistically significant increase in testicular tumours.[5]

Irradiation also stimulates aflatoxin production, which occurs naturally in humid areas and tropical countries in fungus spores and on grains and vegetables. The World Health Organization considers aflatoxin to be a significant public health risk and a major contributor to liver cancer in the South.

Irradiation will also potentially have a mutagenic effect on bacteria and viruses that survive exposure becoming radiation-resistant.[5] Radiation-resistent strains of salmonella have already been developed under laboratory conditions. Scientists at Louisiana State University found bacteria in spoiled meat and animal faeces that survived a radiation dose five times the FDA suggests for beef. Scientists exposed bacteria (D. radiourans) to between 10 and 15 kGy of radiation for several hours - enough radiation to kill a human subject many thousand times over. The bacteria, which scientists speculate evolved to survive extreme conditions of dehydration, survived the radiation exposure.[5]

The FDA is reported to have based its approval of irradiation for fruits and vegetables on a theoretical calculation of the amount of URPs in the diet from one 7.5 oz serving per day of an irradiated food. Considering the varieties of foods that could potentially be approved for irradiation, and the wide variations in varieties and quanties consumed in human diets, this quantity was obviously inadequate and provided misleading results.

The European Food Safety Authority Panel on Biological Hazards (BIOHAZ)[22] considered the efficacy of food irradiation and concluded “food irradiation should be based on risk assessment and on the desired risk reduction rather than on predefined food classes/commodities and doses as proposed in the past. . . . Irradiation should be considered as one of several approaches to reducing pathogens in food and thus helping to ensure protection of consumers’ health.”

The EFSA also recommended food irradiation should only be used in conjunction with an integrated food safety management programme. Of concern is the fact that, as with genetically engineered foods, there is no regulatory body monitoring the effects of ingesting irradiated foods in any quantity for any period of time, thus epidemiologists cannot determine what are those effects.

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[21] ‘A model testing study for the transfer of radioactivity to fruit’m Ould-Dadaa et al, DOI: 10.1016/S0265-931X(03)00105-X Journal of Environ Radioactivity http://www.sciencedirect.com/science/article/pii/S0265931X0300105X

[22] Opinion of the Scientific Committee/Scientific Panel On request from: European Commission Question number: EFSA-Q-2008-462 Adopted: 22 September 2010 Pub 6 April 2011 Affiliation: European Food Safety Authority (EFSA), Parma, Italy. Scientific Opinion on the efficacy and microbiological safety of irradiation of food, EFSA Journal 2011;9(4):2103 [88 pp.]. doi:10.2903/j.efsa.2011.2103. http://www.efsa.europa.eu/en/efsajournal/pub/2103.htm

It may take decades to demonstrate a statistically significant increase in cancer and/or other diseases or adverse effects due to mutagens and other factors introduced by food irradiation. The current absence of independently approved acceptable testing methods for irradiated foods also leaves consumers with inadequate protection. The foods in this Application, if irradiated, could further disadvantage the following significant percentages of New Zealand children and adults involved in establishing government health statistics:[23]

- 33.7% of adults do not eat at least three servings of vegetables per day
- 31% of women and 36% of men do not eat at least three servings of vegetables per day
- 53% of Pacific adults do not eat at least three servings of vegetables per day
- 58% of adults living in the most deprived areas were less likely to eat at least three servings of vegetables per day.

- Three out of five children do not eat the recommended two serves of fruit per day
- Two out of five children do not eat three or more vegetables per day

- 41.8% of adults do not eat two or more servings of fruit per day
- 64% of adults living in the least deprived areas were less likely to eat at least two servings of fruit per day

FSANZ must be open to alternative, safer methods of decontamination, other than irradiation.

Polls in the US – where irradiated foods are most freely available - have shown people do not want irradiated foods and seek non-irradiated food in stores. Some stores reportedly will not stock irriadated foods in order to support consumer choice.[24]

New Zealand growers that export fruits and vegetables as listed in this Application may be exposed to greater competition or market exclusion for foods that have been irradiated. It can reflect on New Zealand's 'clean green' image for tourism as has been found with genetically engineered foods.

We urge FSANZ to:

- Not to approve irradiation of fresh produce;
- Where it does, to establish full, accurate irradiated food labelling that is plainly visible in a legible font size on any product that has been irradiated; and for supermarkets and food markets to be mandated to display large informative signs for the benefit of the buying public. Many do not.
- Maintain a labelling system that also includes the source of the irradiation; Gamma rays as emitted by the radionuclides cobalt-60 (Co-60) or caesium-137 (Cs-137); Electrons (electron beams, E-beams) or X-rays.

Irradiating food is merely an inadequate 'sticking plaster' for the much larger problem of poor sanitation in processing plants. Bacteria creation must be stopped at source with better regulatory sanitary conditions. "Food should not be processed by irradiation as a substituted procedure for good manufacturing practices."[25]

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[23] http://www.health.govt.nz/nz-health-statistics
[24] http://www.mercola.com/article/irradiated/nuclear_lunch.htm
[25] https://www.legislation.gov.au/Details/F2009C00895

We urge FSANZ to decline approval of this Application which adds to a too long list of the basic, daily fresh foods essential for sound human health turning them into processed foods of less nutritional worth. FSANZ should refuse any further applications and cancel previously approved applications for irradiation to meet its duty of care to the New Zealand and Australian public.

Jean Anderson
On behalf of Physicians and Scientists for Global Responsibility New Zealand Charitable Trust

The Trustees and Members of Physicians and Scientists for Global Responsibility Charitable Trust

Paul G Butler, BSc, MSc, MB, ChB, Dip.Obst., FRNZCGP, General Practitioner, AUCKLAND

Jon Carapiet, BA(Hons), MPhil., Senior Market Researcher, AUCKLAND

Bernard J Conlon, MB, BCh, BAO, DCH, DRCOG, DGM, MRCGP (UK), FRNZCGP
General Practitioner, ROTORUA

Elvira Dommisse BSc (Hons), PhD, Mus.B, LTCL, AIRMTNZ, Scientist, Crop & Food Research Institute (1985-1993), working on GE onion programme, CHRISTCHURCH

Michael E Godfrey, MBBS, FACAM, FACNEM, Director, Bay of Plenty Environmental Health Clinic, TAURANGA

Elizabeth Harris, MBChB, Dip Obs, CNZSM., CPCH, CNZFP; DMM, FRNZCGP, General Practitioner, Dunedin

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Peter R Wills, BSc, PhD, Associate Professor, University of Auckland, AUCKLAND

Damian Wojcik, BSc, MBChB, Dip.Rel.Studies, Dip.Obst., DCH, FRNZCGP, FIBCMT (USA), FACNEM, M Forensic Medicine (Monash), FFCFM (RCPA), General Practitioner, Northland Environmental Health Clinic, WHANGAREI

Jean Anderson, Businesswoman retired, TAURANGA.

Ends