PSGR

Physicians and Scientists for Global Responsibility

Charitable Trust

Formerly Physicians and Scientists for Responsible Genetics New Zealand

PO Box 8188
TAURANGA 3145

[redacted]

7 November 2012

Food Standards Australia New Zealand
Po Box 10 559
WELLINGTON 6143
New Zealand

and

Food Standards Australia New Zealand
PO Box 7186
Canberra BC ACT 2610
Australia

Application A1069 – Irradiation of Tomatoes and Capsicums

To permit irradiation of fresh tomato (Lycopersicon esculentum) and fresh capsicum (Capsicum annuun) for a phytosanitary (quarantine) purpose

PSGR recommends Food Standards Austria New Zealand (FSANZ) reject Application A1069. 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.

The safety and nutritional integrity of the proposed irradiated foods is not determined. Irradiation of tomatoes and capsicums could potentially adversely affect the nutritional value and safety of a significant proportion of fresh foods and processed food supplies in New Zealand and Australia as these products are widely used in dried, canned and frozen processed foods.

Current indadequate labelling and the absence of acceptable testing methods for irradiated foods leave consumers with inadequate protection. FSANZ must ensure that full, accurate irradiated food labelling is visible on any product that has been irradiated until such time as all irradiation is stopped.

FSANZ has not taken into account the alternative methods to irradiation.

Local growers exporting tomatoes and capsicums may be exposed to greater competition or market exclusion for foods that have been irradiated. It may also reflect on New Zealand's "clean green" image for tourism as has been found with genetically engineered foods.

PSGR urges FSANZ to decline approval of this Application, refuse any further applications and cancel previously approved applications for irradiation.

Irradiated Foods and Safety

Documents released by the US Food and Drug Administration refer to "wholesomeness" of food, meaning a determination that the food is "microbiologically, nutritionally and toxicologically safe". Further, "FDA responsibility in the evaluation of the process (of irradiation) is limited to the determination of the *safety of the process* under specific conditions of use" (our italics). Safety of the process is a seemingly ambiguous statement. It does not suggest responsibility for the potential effects of the irradiation process on foods to be consumed by the human population. Additionally, the "FDA has no proper role as a promoter … the primary responsibility for such activities remains with industry." Thus vested interests are largely free to promote or ignore scientific findings.[i]

Food irradiation exposes food to ionizing radiation under controlled conditions aiming to kill fungi, mould, bacteria, and insects. The types of ionizing radiation used are:

1. Electron irradiation. E-beams are particulate radiation and do not penetrate the product beyond a few centimetres.
2. Gamma radiation is derived from nuclear materials. It is radiation of photons in the gamma part of the electromagnetic spectrum. The radiation is emitted by the radionuclides cobalt-60 obtained through the use of radioisotopes, and occasionally by caesium-137 recovered during the processing of spent nuclear fuel. Cobalt-60 provides deeper penetration enabling treatment to pallet loads, varying in time from several minutes to hours.
3. X-ray irradiation, also derived from nuclear materials. X-rays are photon radiation of a wide energy spectrum. X-ray irradiators have deep penetration comparable to Co-60.

It is understood, doses of radiation are currently assigned to general food classes and specific food commodities, a system that reportedly does not consider the physical state of the food; e.g., fresh or frozen food of the same type; water activity. Composition and diversity of food products would affect results.

The Food and Drug Administration's Irradiated Food Committee warned that safety testing should be based on concentrated extracts of irradiated foods, rather than on whole foods. It was perceived this would maximize the concentration of radiolytic products[ii] and would enable development of sufficient reliability and sensitivity for routine safety testing to be established. In an editorial comment on an article in *Science*[iii], the FDA was quoted as admitting "it is nearly impossible to detect and test radiolytic products with current techniques".[iv]

"None of a particular existing detection method can be used to authenticate all irradiated food products. Ionizing radiation generates hydroxyl radicals in aqueous or oil emulsion systems and these radicals break acyloxygen bond in food components and form aldehydes, Cn-1 alkanes, short-chain hydrocarbons, CO, free fatty acids, and alcohols."[v]

It is well known that even low dose ionizing radiation can cause negative effects via DNA damage.[vi]

Once a fruit or vegetable is picked, death and decay begin to take over. Vested interests propose slowing the decay process and extending shelf life by irradiation. It ignores the fact that irradiation does not differentiate between desirable and undesirable bacteria. Bacteria which are the natural indicators of *un*wholesomeness in a food – e.g. staleness, disagreeable smell or unpleasant taste - can be killed by irradiation. Irradiation kills bacteria most sensitive to it, but does not remove toxins already deposited in the food.[vii]

Neither does irradiation remove pesticide or herbicide residue, toxic nonliving material, or necessarily all bacteria, yeasts or moulds. The chemical interaction of pre-harvest pesticides with irradiation is currently unknown. Irradiation can increase the production of some extremely toxic aflatoxins by certain fungi, aflatoxins known to be carcinogens, and their ability to continue production following irradiation has not been addressed.[vii]

A Report for the Council for Agricultural Science and Technology claims each kilogray of ionizing radiation breaks only six chemical bonds out of 10 million in food. The International Institute of Concern for Public Health shows that, "In 100 millilitres (or 0.1 litre) of water there are 5-gram moles, that is 1025 molecules. At the low-dose of one kilogray, 6 times 1018 chemical bonds are broken creating the hydroxyl radical, one of the most reactive entities known in biochemistry. Water makes up some 80% of most foods. Food irradiation will be permitted to an average dose of 10 kilograys." [vii]

There is an urgent need for independent scientific studies contracted by FSANZ on the wholesomeness or not of irradiated foods so as not to perpetuate inadequate decisions made by overseas regulators, and for examination of the political and economic climate under which the technology is being promoted. Vested interests for food irradiation fail to fully acknowledge the dangers of this technology, claiming food irradiation safety is based on sound science.

PSGR refutes this last statement.

Studies on animals fed irradiated foods have shown increased tumours, reproductive failures and kidney damage. Some of the possible causes are irradiation-induced vitamin deficiencies, inactivation of enzymes in the food following irradiation, damage to DNA, and toxic radiolytic products in the food.

Other studies on animals fed irradiated foods have revealed chromosomal damage, immune and reproductive problems, kidney damage, tumours, internal bleeding, low birth weight, and nutritional muscular dystrophy and more. There appear to be no substantive studies to show the effects of feeding babies or children diets containing irradiated foods, excepting a small study initiated by the National Institute of Nutrition in India (see page 5).

Irradiation breaks up the molecular structure of food, forming positively and negatively charged particles. The by-products react with food to create new chemical substances known as "unique radiolytic products" (URPs).

The irradiation process produces products such as formaldehyde, benzene and formic acid, and quinones, a class of organic compounds derived from compounds such as benzene or naphthalene. All of these are known to be harmful to human health. Some URPs are chemicals which have not previously been identified and therefore have not been tested for toxicity or potential effects.

Treatment of foods containing fatty acids with ionizing radiation can create chemicals called 2-alkylcyclobutanones (2-ACBs) unique to irradiated foods. The major 2-ACB formed in irradiated meat is 2 dodecylcyclobutanone (2-DCB). The FDA "recommends that indirect food additives consumed in quantities greater than 1.5 ug per day be tested for safety. On average, approximately 6.0 ug of 2-DCB is present in an irradiated, and then cooked, 125 g ground beef patty, which exceeds the 1.5 ug/day limit.[viii]

"Whether irradiated by linear accelerators or pelletized radioactive isotopes, the resulting ionizing radiation produces highly reactive free radicals and peroxides from unsaturated fats. US Army analyses revealed major differences between volatile chemicals formed during irradiation or cooking meat. Levels of the carcinogen benzene in irradiated beef were found to be some tenfold higher than cooked beef." (Raised levels are also found in canned beef.) This analysis also found high concentrations of six URPs "implicated as carcinogens or carcinogenic under certain conditions".[ix]

Benzene is a recognized cause of bone marrow failure. Substantial quantities of epidemiologic, clinical, and laboratory data link benzene to aplastic anaemia, acute leukaemia, and bone marrow abnormalities.[x] The specific hematologic malignancies that benzene is associated with include: acute myeloid leukaemia (AML), aplastic anaemia, myleodysplastic syndrome (MDS), acute lymphoblastic leukaemia (ALL), and chronic myeloid leukaemia (CML).[xi] Benzene targets liver, kidney, lung, heart and the brain and can cause DNA strand breaks and chromosomal damage.[xii]

Benzene exposure has been linked directly to the neural birth defects spina bifida and anencephaly.[xiii] Men exposed to high levels of benzene are more likely to have an abnormal amount of chromosomes in their sperm, which impacts fertility and foetal development.[xiv]

Certainly, traces of benzene appear naturally in fresh foods, air and water. Benzene is also found in soft drinks, some alcoholic drinks, dyes, detergents and pesticides. A large contributor of benzene intake is cigarette smoke by inhalation or 'passive' smoking.[xv]

PSGR claims irradiating food would effectively add to the cumulative intake of benzene and other undesirable products entering the human food chain. However small that intake may be, it is unwarranted, unnecessary, and fails in a duty of care for public health.

Irradiation does not kill all bacteria in foods

It is claimed irradiation kills 95% of bacteria on a given food; by inference 5% survive. Some bacteria eliminated or greatly reduced by irradiation are beneficial. Dangerous bacteria can still be found on food after irradiation.

Laboratory studies have shown that irradiating micro-organisms may give rise to radiation-resistant bacteria. These bacteria will multiply. In time, they will no longer be killed by currently approved doses of irradiation. One study revealed bacteria can survive a radiation dose five times the dose allowed by the FDA for beef. Researchers exposed bacteria to 10 – 15 kGrays of radiation for several hours. This would kill a human being. The bacteria survived.

As long ago as 1953: "*Escherichia coli*, strains G and B/r, was grown during continuous irradiation of up to 10,000 Roentgens per hour. Growth, visable count and turbidity, was observed to occur at a rate equal to nonirradiated controls and the maxium crop of cellular material was also equal. Only the period before the inception of growth (lag) increased as a function of a dose. Under these conditions the mutation frequency increased as a function of total radiation dose, regardless of how much growth (if any) had occurred during irradiation. Nucleic acid content of radiation grown cultures was indistinguisable from controls."[xvi]

Irradiation can cause bacteria to mutate forming, for example, new forms of salmonella, E-coli and other harmful bacteria.

Bacteria readily develop resistance to antibiotics through rapid mutation and natural selection. Radiation is a way to stimulate such mutations.

Irradiation is known to destroy essential nutrients

Scientists claim hyper oxides produced by the irradiation process reduce the concentrations of fatty acids and fat-soluble vitamins which may in turn influence absorption and utilisation of the food. Irradiation is known to destroy essential vitamins and nutrients, including vitamin A, thiamine, vitamins B2, B3, B6, B12, folic acid, vitamins C, E and K, amino acids and polyunsaturated fatty acids. Losses range up to 80 % for any of these. There may also be a fatal vitamin E deficiency brought about by eating some irradiated foods.[vii]

Donald R Louria PhD, Chairman of the Department of Preventive Medicine and Community Health for the University of Medicine and Dentistry of New Jersey, said: "The supporters of food irradiation treat the potential damage to the nutrient value of food as if it were unimportant or nonexistent. That is a major mistake. If the nutrient value of food is reduced, then the argument for food irradiation prolonging shelf life is undercut. Surely, it would not make sense to prolong shelf life if the foods are nutritionally defective."

Irradiated foods and health

Dr S G Srikantia, BSc, BBS, DSc, Professor of Food and Nutrition at the University of Mysore, India, co-authored a paper on studies initiated by India's National Institute of Nutrition in 1973. The study found feeding freshly irradiated wheat to monkeys, rats, mice and to a group of malnourished children induced gross chromosomal abnormalities in blood or bone marrow cells, and mutational damage in rodents.[xvii] The study participants were repeatedly fed freshly irradiated wheat. It found:

- Rats and mice showed increased levels of polyploid cells, i.e. cells with chromosome abnormalities, in their bone marrow.
- Normal monkeys and the undernourished children showed elevated levels of polyploid, i.e. abnormal cells in circulating lymphocytes (white blood cells). The levels of polyploidy took several months after the irradiated wheat was withdrawn to return to normal.
- Mice showed evidence of dominant lethal mutation as indicated by increased numbers of intrauterine (prenatal) deaths. The dominant lethal mutation indicated undesirable changes in reproductive performance.

The study concluded that the explanation for the increased polyploidy and the dominant lethal mutation was the effect of a mutagen formed in wheat during the process of irradiation.

Irradiated wheat was stored for twelve weeks then fed to study participants. The fact that these effects were not repeated when stored irradiated wheat was fed participants, suggested the mutagen is a relatively unstable substance.

Obviously, storing fresh food for twelve weeks to avoid the adverse effects of irradiation is impractical and undesirable.

A warning was printed in the Journal of Nutrition (http://jn.nutrition.org/): "An increase in concentration of a mutagen in food by irradiation will increase the incidence of cancer. It will take four to six decades to demonstrate a statistically significant increase in cancer due to mutagens introduced into food by irradiation. When food irradiation is finally prohibited, several decades worth of people with increased cancer incidence will be in the pipeline."

Irradiation can cause chromosomal damage to human cells; e.g. irradiated sucrose solutions were toxic to human white blood cells. White blood cell cultures from four different healthy human males underwent a considerable inhibition of mitosis and chromosome fragmentation. In studies on animals, researchers have found reproductive problems and adverse effects such as a decrease of 20.7% in surviving weaned rats, a 32.3% decrease in surviving progeny of dogs which also weighed 11.3% less than animals on the control, and carcinomas of the pituitary gland - a particularly disturbing finding since this is an extremely rare type of malignant tumour.[xviii]

Irradiated food has caused innumerable health problems in laboratory animals.[xviii] Studies on rats fed irradiated foods, showed kidney and testicular damage and a statistically significant increase in testicular cancer. In others, animals eating irradiated food experienced weight loss and miscarriage, this being almost certainly due to vitamin E deficiency caused by irradiation.[xviii]

Decisions have been made by regulatory authorities on questionable research claiming to demonstrate the safety of food irradiation. One early study was carried out by Industry Bio-Test (IBT). In 1983, IBT were convicted of conducting fraudulent research for the US government and industry. In the interests of public safety, FSANZ should conduct its own studies using an independent source.[xviii]

PSGR claims:

The assumption that irradiated products will not harm the human population and can thus be fed to New Zealanders and Australians is flawed and possibly wholly untrue, and leaves industry to dictate what is acceptable. It is a failure in FSANZ's duty of care. The risks to human well-being involved with food irradiation far outweigh the perceived/presumed "benefits".

Irradiation of food products largely grew from the Nuclear Industry's wish to promote itself positively. The push for food irradiation fails to acknowledge its intricate connections to the nuclear industry, its inherent dangers, and the failure to the US FDA and other regulatory bodies to prove safety.

Independent research shows that food irradiation has not been adequately tested on humans, and the negative implications are apparent and ignored.

Given safer, cheaper, and more effective alternatives to ensure food safety, large-scale food irradiation should not proceed. Notably, New Zealand has the capacity to produce sufficient tomatoes and capsicums without the need to import irradiated food.

PSGR urges that this Application be refused.

Yours faithfully

Jean Anderson
for the Trustees and Members of Physicians and Scientists for Global Responsibility

Paul G Butler, BSc, MB, ChB, Dip.Obst. (Auckland), 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, KUROW

Frank Rowson BVetMed
Veterinarian, MATAMATA

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

Damian Wojcik, BSc, MBChB, Dip.Theology, Dip.Obst., DCH, FRNZCGP, FIBCMT (USA)
Director and founder of the Northland Environmental Health Clinic, WHANGAREI

Jean Anderson
Businesswoman retired, TAURANGA.

[i] www.fda.gov/downloads/food/foodingredientspackaging/irradiatedfoodpackaging/ucm054571.pdf
[ii] Recommendations for Evaluating the Safety of Irradiated Food. Final Report of FDA's Irradiated Food Committee, July 1980.
[iii] Epstein, S S, and Gofman, J W, Irradiation of food, Science 223:1354, 1984.
[iv] Sun, M. Science 223:1354, 1984.
[v] http://onlinelibrary.wiley.com/doi/10.1111/j.1750-3841.2012.02936.x/full
Journal of Food Science, Volume 77, Issue 9, pages iv–v, September 2012, DOI: 10.1111/j.1750-3841.2012.02936.x © 2012 Institute of Food Technologists®
[vi] http://rsbl.royalsocietypublishing.org/content/early/2012/04/05/rsbl.2012.0150.full
[vii] International Institute of Concern for Public Health, originally published 1988, revised January 2003 for IICPH. http://iicph.org/food_irradiation
[viii] Safety testing of 2-alkylcyclobutanones – URPs, Sommers, Christopher, pub. 13 December 2005, last modified May 2012, http://www.ars.usda.gov/research/publications/publications.htm?seq_no_115=187521
[ix] 'Preventing Pathogenic Food Poisoning: Sanitation Not Irradiation', Samuel S. Epstein and Wenonah Hauter, International Journal of Health Services, Volume 31, Number 1, Pages 187-192, 2001, http://www.preventcancer.com/consumers/food/irradiation_ijhs.htm
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.
[x] Harrison's Principles of Internal Medicine, 16th ed., p. 618.
Merck Manual, Home Edition, "Overview of Leukaemia".
[xi] Smith, Martyn T. (2010). "Advances in understanding benzene health effects and susceptibility", Ann Rev Pub Health 31: 133–48. doi:10.1146/annurev.publhealth.012809.103646.
[xii] Huff J (2007). 'Benzene-induced cancers: abridged history and occupational health impact'. Int J Occup Environ Health 13 (2): 213–21. PMID 17718179.
Rana S V; Verma Y (2005). 'Biochemical toxicity of benzene', J Environ Biol 26 (2): 157–68. PMID 16161967.
[xiii] Breathe carefully: air emissions of benzene may cause birth defects. — Environmental Health News. Environmentalhealthnews.org (2010-10-26). Retrieved on 2011-04-17.
[xiv] Benzene exposure linked to sperm abnormalities that cause birth defects. — Environmental Health News. Environmentalhealthnews.org (2010-02-16). Retrieved on 2011-04-17.
[xv] http://www.nvaging.net/grants/IIIC/Aluminum%20and%20Benzene%20in%20Foods.pdf
[xvi] Growth and mutation of bactrial during continuous irradiation, B A Rubin, 24 September 1953.
Billen D, Stapleton G E and Hollander A, 1953, The effect of X radiation on the respiration of *Escherichia coli*, J. Bact, 65, 131-135. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC357234/pdf/jbacter00552-0123.pdf
[xvii] Vijayalaxmi, and Srikantia, S.G. A review of the studies on the wholesomeness of irradiated wheat conducted at the National Institute of Nutrition, India. Radiat. Phys. Chem. 34(6):941-952, 1989.
http://www.ccnr.org/food_irradiation.html
[xviii] http://www.preventcancer.com/consumers/food/irradiation.htm
http://www.ncbi.nlm.nih.gov/pubmed/7883460
http://www.mercola.com/article/irradiated/irradiated_research.htm
www.jstor.org/discover/10.2307/3572764?uid=3738776&uid=2&uid=4&sid=21101251542093
http://www.jstor.org/discover/10.2307/3580559?searchUrl=%2Faction%2FdoBasicSearch%3Ffilter%3Djid%253A10.2307%252Fj100337%26Query%3Dhuman%2Bwhite%2Bblood%2Bc%26Search.x%3D10%26Search.y%3D7%26wc%3Don&Search=yes&uid=3738776&uid=2134&uid=2&uid=70&uid=4&sid=21101251542093
http://www.ncbi.nlm.nih.gov/pubmed/4908553
Bull World Health Organ. 1969; 41(6):873-904.
Mutagenicity and cytotoxicity of irradiated foods and food components, Schubert J.
'Food irradiation: a complex conundrum' Food Cosmet Toxicol. 1969 Mar; 7(2):171-4.
Vopr Pitan (1973)
'Biochemical effects of irradiated sucrose solutions in the rat', De AK, Aiyar AS, Sreenivasan A. Radiat Res. 1969 Jan;37(1):202-15.