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Re: Food Additive Petition 9M4697, Use of ionizing radiation for pre-processed meat and poultry; both raw and pre-processed vegetables, fruits and other agricultural products of plant origin; and certain multi-ingredient food products; Food Additive Petition 1M4727, Use of ionizing radiation for control of foodborne pathogens in crustaceans and processed crustaceans; Food Additive Petition 9M4682, Ionizing radiation for the control of *Vibrio* and other foodborne pathogens in fresh or frozen molluscan shellfish; Food Additive Petition 9M4695, Use of ionizing radiation to treat unrefrigerated (as well as refrigerated) uncooked meat, meat products, and certain meat food products; and Food Additive Petition 9M4696, Increase the maximum dose of ionizing radiation permitted in the treatment of poultry products

Greetings,

The FDA is considering the five above-referenced food additive petitions to irradiate a much greater portion of the food supply, including the huge category of “ready-to-eat foods” (FAP 9M4697) comprising an estimated 37 percent of the average American diet. On May 16 and October 31, 2001, our organizations filed comments opposing these petitions on grounds of serious safety issues stemming from scientific studies indicating that certain irradiated foods may cause mutagenic and cytotoxic effects in lab animals as well as in humans. We have also filed comments dated November 19, 2001, enclosing our new report on food irradiation hazards entitled *Hidden Harm* and comments dated May 15, 2002, emphasizing the determination by the

Codex Alimentarius Contaminants and Food Additives Committee rejecting the proposed liberalization of food irradiation standards as had been proposed, due to the remaining toxicity issues.

We submit this further comment in **opposition** to the above-referenced petitions, including the voluminous attached tabbed information, which is incorporated herein by reference. This new toxicity information is determinative that FDA must exercise its discretion to **deny** the five pending food additive petitions and that FDA should **reconsider** the safety of all of its past approvals of food irradiation. Both new and old information strongly suggest that food irradiation poses a health risk and that broad consumption of large amounts of irradiated food could cause a modern equivalent of the “thalidomide tragedy.” As you surely know, the thalidomide tragedy actually was largely averted in this country through the determined effort of a very small number of FDA officials. We call on each of you personally to exert a similar influence here.

We must initially dispel the idea that all studies have shown that food irradiation is safe, a patent falsehood that has achieved some credibility nationally and internationally through repetition alone. We attach for you as **Tab 1** a brief report by Public Citizen entitled, *The Health Problems of Irradiated Foods: What the Research Shows*. This excerpts **40 different studies**, both *in vitro* and *in vivo*, mostly published in peer-reviewed journals, that document health risks to animals and humans. One of those excerpts, dating from 1969, states (emphasis added):

Irradiating can bring about chemical transformations in food and food components resulting in the formation of potential mutagens, particularly hydrogen peroxide and various organic peroxides....It is now realized especially since the thalidomide episode that [older testing] protocols do not detect the more subtle population hazards such as mutagens and teratogens... In view of the serious consequences to the human population which could arise from a high level of induced mutations, it is desirable that protocols for irradiated food should include in vivo tests on mammals for possible mutagenicity.¹

Since this was written several *in vivo* tests for mutagenicity in mammals have been done. As our May 16, 2001, comment on the mutagenicity issue documented, more than one-third of those studies (10 of 27 *in vivo*) that were published in peer-reviewed journals actually were **positive**, finding an array of reproduction-related abnormalities and potential genetic damage.² One of these positive studies was conducted on children in India. In this study, ten malnourished

¹ Schubert, J. 1969. Mutagenicity and cytotoxicity of irradiated foods and food components. *Bulletin of the World Health Organization* 41:873-904.

² Also, 5 of 13 *in vitro* mutagenicity studies were positive; again, this is more than one-third of the published studies.

children (aged 2 to 5) fed freshly irradiated wheat for six weeks developed polyploidy and certain abnormal cells in increasing amounts throughout the feeding period. This condition persisted up to two months after the feeding ended. (This condition was not detected in children fed irradiated wheat stored for 12 weeks.)³ It is shocking that FDA has allowed more irradiated foods into the human food supply nonetheless.

The European Union approach.

The European Union has been proactive in this area and in 1999 commissioned a detailed initial assessment of the toxicity of several “unique radiolytic products” (URPs) that have been found to be toxic in various contexts. Our earlier comments disclosed some of these toxicity concerns for 2-alkylcyclobutanones (2-ACBs), and we are pleased to be able to present FDA with the English translation of the 100-plus page report on 2-ACBs prepared by a consortium of German and French scientists from recognized institutions over the last four years (**Tab 2**).⁴ Entitled “Toxicological Study to Assess the Risks Associated with the Consumption of Irradiated, Fat-containing Foods,” the report by Burnouf et al. contains major new findings. For example, below is a quote from the English Summary on a new topic, tumor promotion, that has never been assessed in any other irradiated food animal or human feeding studies. **This represents a new area of toxicity that FDA has never examined.** It cannot be dismissed as already covered.

In an experiment with rats treated with a specific colon carcinogen, it was shown that 2-tDCB and 2-tDeCB have a promoter effect on the development of colon tumors. In this experiment, we found a larger number of aberrant crypts and development of more and larger tumors in the animals that received 2-ACBs in

³ Bhaskaram, C., and G. Sadasivan. 1975. Effects of feeding irradiated wheat to malnourished children. *American J. of Clinical Nutrition* 28:130-135.

⁴ Translation was done by William Freese Translations of Mt. Rainier, MD. Mr. Freese has a degree in chemistry and more than 13 years experience translating medical and scientific texts. The untranslated report is online at: www.bfa-ernaehrung.de/Bfe-Deutsch/Information/bfeber91.htm (2nd 2002 paper). The full citation is: D. Burnouf, H. Delincée, A. Hartwig, E. Marchioni, M. Miesch, F. Raul, D. Werner (2001), Etude toxicologique transfrontalière destinée à évaluer le risque encouru lors de la consommation d'aliments gras ionisés - Toxikologische Untersuchung zur Risikobewertung beim Verzehr von bestrahlten fetthaltigen Lebensmitteln – Eine französisch-deutsche Studie im Grenzraum Oberrhein, Rapport final d'étude Interreg II, projet N° 3.171. BFE-R--02-02, Federal Research Centre for Nutrition, Karlsruhe, Germany.

combination with the carcinogen azoxymethane (AOM). Although we did not observe initiation of tumor development by 2-ACBs alone, both the in vitro tests and the in vivo experiments with laboratory animals demonstrate that 2-ACBs have potential toxicity. In other feeding studies, it was shown that a very small amount of 2-ACBs can be recovered from fatty tissue, while a similar small amount is excreted in feces. These results indicate that 2-ACBs are largely metabolized or possibly stored in other parts of the body. Therefore, further studies are absolutely necessary in order to elucidate the metabolism of 2-ACBs.

The authors emphasized that further 2-ACB metabolite studies are “**absolutely necessary**” in order to determine the fate of these substances, in order to at least elucidate the extent to which they act as tumor promoters in the human body. The authors conclude:

[S]ince our results point to toxic, genotoxic and even tumor-promoting activity of several 2-ACBs, we consider it necessary that further research, including confirmation of our results by other laboratories, be conducted to permit an assessment of the possible risks associated with consumption of irradiated, fat-containing foods.

After a somewhat dismissive and inaccurate review of their report by the EU Scientific Committee on Food in July 2002, the report’s authors, Burnouf et al., made a statement to clarify the significance of their work (**Tab 3**).

[O]ur new data which will be published in peer-reviewed journals, raise some doubts or at least suggest that caution should be exercised before any risk to consumers by exposure to these compounds is denied. At present, knowledge about the potential toxicity of the 2-ACBs (including possible metabolites) and their toxic potency is very limited. Since these compounds are uniquely formed by irradiation and are not inherent in food, in our opinion, complementary studies are needed to make a qualified risk assessment. It needs to be shown that despite the presence of potentially cyto- and genotoxic radiation-induced agents, the consumption of irradiated fat-containing food is safe for consumers.

As the leading researchers to have done any irradiation toxicity assessment in recent decades - and with representation from the well-known food irradiation research program of the Federal Research Center for Nutrition in Karlsruhe, Germany - it is extraordinarily significant that they say that current knowledge is inadequate to show the food is “safe for consumers” and that, pending further research, “risk to consumers” should not be “denied.”

At the same time, as a result of an unfortunate rider amendment in the Farm Bill of 2002, the United States is poised to initiate a new program of feeding irradiated ground beef (which

contains 2-ACBs) **to schoolchildren en masse!** That is the height of recklessness, which we appeal to you personally to effectively stop now by publicly ordering a review of the safety of your past irradiation approvals, including for ground beef. Also, ground beef is potentially covered by the pending food additive petitions 9M4697 and 9M4695. The European studies provide clear justification for denying these petitions. The matrix below, based on the report, illustrates the problems in a nutshell with the particular 2-ACBs detected in irradiated ground beef. These matters must be investigated and resolved to determine whether Americans, especially children, would be hurt from consuming it in large quantities.

Chapter in Burnouf et al. report	Particular 2-ACB				
	2-DCB	2-dDCB	2-tDCB	2-dDeCB	2-tDeCB
2.5 – found in ground beef	X	X	X*	X	X
2.6.1 – cyto- and genotoxic to human cells		X	X		X
2.6.2 – cytotoxic/oxidative damage to DNA in human cells	X	X	X		X
2.6.3 – cytotoxic to bacteria	X	X	X		
2.6.4 – colon tumor promoter in rats			X		X
2.7 – stored in adipose tissue and present in feces of rats			X		X

* - Note the authors' comment in chap. 2.5 that 2-tDCB in ground beef was found at "high levels."

We urge you to review Tab 2 carefully and to obtain the published versions from the scientific literature (the authors have indicated several papers are in press) and fully assess their significance. All of the pending food additive petitions involve foods that contain fats and fatty acids that will form various 2-ACBs upon irradiation. But, none of these foods have been subject to quantitative toxicological analysis along the lines urged by Burnouf et al. **Dismissing this information lightly would be regulatory malpractice.**

Putting the brakes on irradiation now - as we urge - would be consistent with a recent decision by the European Parliament (**Tab 4**). This past December, a majority of Parliament Members voted for a provision that the EU's list of foods authorised for irradiation should not be expanded. The current list, which includes only dried aromatic herbs, spices and vegetable seasonings, is to be considered complete until such time as further scientific knowledge may indicate that irradiation is safe and efficacious. The background report from the European Parliament's Committee on the Environment, Public Health and Consumer Policy circulated in support of the adopted motion prior to the vote includes these strong but sensible precautions (**Tab 5**), which we urge you to take into account.⁵

I. whereas irradiation depletes some nutrients and produces radiolytic products in

⁵ Online at: www2.europarl.eu.int/omk/sipade2?PROG=REPORT&L=EN&PUBREF=//EP//NONGML+REPORT+A5-2002-0384+0+DOC+PDF+V0//EN .

some foods, some of which may pose health risks; whereas data on long-term health effects of eating a diet based largely on irradiated foods are lacking and research into the potential health risks should be conducted as soon as possible.

[The European Parliament....]

.....

12. Insists that research into the long-term health effects of eating a diet largely comprised of irradiated foods be conducted and that no additional foods shall be added to the list if any evidence of long-term health risks emerges;

13. Stresses that the short- and long-term effects of eating a diet largely comprised of irradiated foods on children's health should be used as a reference for human health risk assessments, given the enhanced sensitivity of children to chemical exposure and depletion of nutrients in food.

Further, a Working Group of the Codex Alimentarius Commission's Contaminants and Food Additives Committee (CCFAC) in November, 2002, recommended *against* approval of a Codex proposal to remove the present 10 kiloGray radiation dose cap, which would allow any foods to be irradiated at any dose - regardless of how high.⁶ This decision was largely due to concerns raised by several countries about the potential health hazards of the proposal.⁷

If the risks are significant enough to warrant precautionary actions by the European Parliament and the Codex CCFAC, they are significant for Americans also, with an emphasis on our children. If you, as the key FDA officials, proceed to approve or allow further irradiation and the continuing European studies do fully document human toxicity risks in the next few years, then a potentially devastating scandal will land in your laps.

- **Tab 6. Biology of Food Irradiation book.**⁸ The attachment is a chapter from the important

⁶ E-mail communication from Alicia O. Lustre, CCFAC, to David Byron, Food Standards Officer, Food and Agricultural Organization of the United Nations, Nov. 18, 2002.

⁷ We also note that long-standing Codex standards prohibit the irradiation of, and the inclusion of irradiated ingredients in, infant formula, canned baby food, and processed cereal-based foods for infants and children, respectively: CODEX STAN 72-1981, CODEX STAN 73-1981 and CODEX STAN 74-1981. Plainly, irradiation is considered to pose potential risks to young children.

⁸ Murray, D.R. 1990. Biology of Food Irradiation. Research Studies Press Ltd. Staunton,

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1990 synthesis of the irradiation toxicity studies, by D.R. Murray. The chapter, “Deleterious Consequences of Eating Irradiated Foods,” includes well-documented sections on mutagenicity and carcinogenicity. It provides detailed support for the several positive mutagenicity results from the Indian National Institute for Nutrition studies in the 1970s, including increased polyploidy in malnourished children, results that FDA has minimized or ignored in past statements. Further, Murray conducts a lengthy undermining of the validity of past toxicity studies in which negative health impacts of irradiated diets were counteracted through vitamin supplementation. In essence he accuses some researchers of “masking” what actually would have been damning findings for irradiated diets through excessive nutritional supplementation. FDA should carefully review and respond to Murray’s critique, because he makes a strong scientific case, even before the 2-ACB studies, against what FDA has approved.

Affidavit of Dr. William Au.

In support of our Oct. 31, 2001, comment we included an affidavit (and attached his CV) providing the opinion of William Au, Ph.D., a Professor in the Division of Environmental Toxicology at the University of Texas. Dr. Au is an internationally recognized expert on the toxicological mechanisms for the induction of human disease. Since then Dr. Au has studied food irradiation issues further on a contract with us, including the 2-ACB research; thus, we are submitting a new comment from him (**Tab 7**). He explains the general hazards of tumor promoters such as were found in irradiated fat-containing foods by Burnouf et al., cited above, and warns that “consumption of irradiated food among individuals who have risk factors for colon cancer will cause increased risk for the disease.” (Again, no animal feeding studies upon which FDA has relied in its past approvals have examined the colon tumor promotion question.)

Dr. Au cites eleven studies that “indicate that consumption of large amounts of irradiated foods can increase health risk in the population.” He criticizes the past official assurances of safety from the World Health Organization and others as scientifically flawed and warns FDA to take a much closer look, especially at risks to undernourished children. He reviews new laboratory test results on the volatile organic chemical components found in irradiated ground beef and states “hazards from exposure to such a mixture of chemicals are virtually unknown.”

This precautionary opinion from a noted expert again is one that FDA would ignore at its professional peril. FDA must seek outside review from independent toxicologists not aligned with past irradiation approvals and must demand new state-of-the-art toxicological testing for all classes of irradiated foods, whether already approved or proposed for future approval.

In closing, Kesavan and Swaminathan’s irradiation review paper, which contains a number of

UK. Unfortunately, the appended copy includes some underlining, but the book is out of print and this is the best version available.

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early observations on the toxicity of irradiated foods, contains a still-relevant quote from a letter written in 1968 by Dr. G. Lofroth, an experienced irradiation researcher, to the Department of Health, Education and Welfare in Washington, DC.⁹

In my studies of the literature, I have often found a credibility gap between observed parameters and the recurring conclusions that there is no apparent toxic hazard involved in the ingestion of irradiated food.

Thirty-five years later the same government department is still faced with cutting through the rhetoric that irradiated food is safe and looking carefully at the actual results of the numerous studies cited in this and our previous comments that show it presents serious potential hazards if eaten in large quantities. If you fail to close the still extant “credibility gap” and proceed to approve the five pending petitions, you will in effect vastly increase the percentage of irradiated food in the diets of more than 200 million Americans, including tens of millions of children, and millions of pregnant women. Even slight increases in toxicity, mutagenicity, or tumor promotion when multiplied across those numbers, given the varying sensitivities in the population to the URPs, could have devastating long-term consequences in the form of increased disease, stillbirths of fetuses, birth defects, and deaths in the American population.

Thank you for your consideration of this comment in opposition to the above-referenced food additive petitions. We also request to meet with you personally on this matter. To arrange a meeting please contact Peter T. Jenkins, Policy Analyst, of the Center for Food Safety (tel: 202.547.9359 x13; email: peterjenkins@icta.org).

Sincerely,

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Attachments (7 tabs)

cc: FDA Food Additive Petition Docket No.s: 99F-5522; 01F-0047; 99F-4372; 99F-5321; 99F-5322 (with attachments)

⁹ Kesavan and Swaminathan, cited above, at p. 266, citing Lofroth letter dated Sept. 12, 1968. See several cites to Lofroth’s toxicity research therein.