



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF
PREVENTION, PESTICIDES AND
TOXIC SUBSTANCES

Response to Public Comments Concerning the Use of Sulfuryl Fluoride In Food Handling Facilities

July 14, 2005

The Agency has received a pesticide petition (3F6573) from Dow AgroSciences LLC, 9330 Zionsville Road, Indianapolis, IN 46268 proposing, pursuant to section 408(d) of the FFDCA, 21 U.S.C. 346a(d), to amend 40 CFR part 180 by establishing tolerances for residues of sulfuryl fluoride and fluoride anion in or on processed food commodities. The Agency published the Notice of Filing and Dow's risk assessment in the Federal Register (70 FR 10621, March 4, 2005) as required by the Food Quality Protection Act.

The Agency received 19 sets of written comments, usually in the form of questions, on the Notice of Filing. In general, the substantive comments related to questions and consequences surrounding fluoride exposures and issues regarding fluoride toxicology. The substantive questions and comments are grouped into basic areas of concern and each section below contains a summary of the commenter's concerns grouped by general topic and/or particular argument.

1 Previous Objections to the Use of Fluoride:

Comments: Fluoride has been identified as a toxicological endpoint of concern for exposure to sulfuryl fluoride. The issue of approving fluoride tolerances is considered to be significant because fluoride bio-accumulates in the human body, wildlife, and fish, and it persists in soil. The fluoride tolerances EPA approved on January 23, 2004, are the highest that have ever been allowed. Objections and a request for a hearing was submitted by Fluoride Action Network (FAN) and Beyond Pesticides on March 24, 2004 (Docket No. OPP-2003-0373) to the first time use of sulfuryl fluoride as a food fumigant. (Objections available at: <http://www.fluoridealert.org/epa-sf.htm>). Among the many substantive issues that FAN and Beyond Pesticides raised was the decision by EPA to allow an acceptable dosage of fluoride for infants (0.571 mg/kg body weight/day) which is five times higher than for adults (0.114 mg/kg/day). FAN asserts that this decision runs counter to EPA's mandate under the Food Quality Protection Act (FQPA) to set standards that are more protective of children. To date, EPA has not made an official response to these objections and to the request for a hearing.

It was further noted by the commenter that the information provided in the Notice of Filing by Dow AgroSciences LLC with their petition for additional tolerances for sulfuryl fluoride did not offer responses to FAN's objections. EPA has been asked to explain its rationale for allowing the use of sulfuryl fluoride as a food fumigant prior to releasing a formal response to FAN's afore-mentioned objections and request for a hearing. EPA was also asked if appropriate alternatives were investigated.

Agency Response: On June 2, 2004, EPA issued a preliminary response to FAN's objections and hearing request concerning the tolerance approved in January 2004. That preliminary response identified certain issues raised by FAN that did not appear to meet the requirements for granting of hearing, requested the submission of certain information from FAN, and attempted to answer the questions posed in the hearing request. EPA has approved the tolerances for sulfuryl fluoride and fluoride in Dow's latest petition prior to the completion of the administrative process on FAN's objections and hearing request because EPA concluded that the requested tolerances meet FFDCA section 408's safety standard. As to FAN's contention that the prior tolerance action was not protective of infants and children, EPA has attempted in this action to better explain why aggregate exposure to fluoride is safe. EPA believes that use of the MCL to calculate a RfD-type value as was done previously overstates the risk of fluoride because it does not take into account the long-term exposure necessary to cause the endpoint of concern, crippling skeletal fluorosis. In its latest action, EPA has also considered whether exposure over at least a 10-year interval exceeds the level determined by the MCL decision as well as the Institute of Medicine to be safe.

2 Existing Food Uses for Sulfuryl Fluoride

2(A) States Where Sulfuryl Fluoride is Registered for Food Use

Comments: On January 23, 2004, EPA issued a Final Rule that granted tolerances for sulfuryl fluoride and fluoride anion in or on certain grain, dried fruit, and tree nut commodities as a result of post-harvest fumigation with sulfuryl fluoride. Since that time, certain states have approved the use of sulfuryl fluoride as a food fumigant. Since there is no centralized list available to the public to list the states which have approved the use of sulfuryl fluoride on food commodities, the name of each state that approved its use as a food fumigant was requested as well as the identity of food commodities that it has been used on in both 2004 and 2005. In addition, the Agency was asked to identify the food commodities that are for export markets.

Agency Response: Sulfuryl Fluoride has been registered for use in the post-harvest fumigation of certain grain, dried fruit, and tree nut commodities in every state except Alaska and New York. Although EPA assumes that sulfuryl fluoride is used on an estimated percentage of all of these registered commodities for human health risk assessment purposes, the Agency does not request, collect, or otherwise have access to data regarding which of these commodities have received actual fumigations or the specific commodities that have been fumigated in any specific treatment.

2(B) Adverse Incidents with the Use of Sulfuryl Fluoride as a Food Fumigant

Comments: Information regarding whether or not any reported adverse reactions to the workers involved in using sulfuryl fluoride have been reported in any of the states that have registered sulfuryl fluoride as a food fumigant. In addition, information regarding whether or not any other reported adverse incidents have been reported in the use of sulfuryl fluoride as a fumigant on food. Details of the reports were requested for any that EPA has received.

Agency Response: EPA has not received any reports of adverse reactions to the workers involved in using sulfuryl fluoride as a food fumigant in these states. Likewise, EPA has not received reports of any other adverse incidents in the use of sulfuryl fluoride as a fumigant on food.

2(C) Fluoride Exposure to Workers Using Sulfuryl Fluoride as a Food Fumigant

Comments: Information regarding whether or not any testing for fluoride levels in workers using sulfuryl fluoride as a food fumigant been performed, and, if so, details for any relevant information was requested. In addition, the level of fluoride in these workers' blood and/or urine that would trigger EPA's concern was requested. Further, information was requested that would identify the makeup of the workforce using sulfuryl fluoride on food commodities (i.e., percentage of migrant farm workers, percentage of workers with health insurance, percentage of workers belonging to a union, etc.).

Agency Response: EPA would be concerned about fluoride levels in blood and/or urine that result from occupational exposure to sulfuryl fluoride that are in excess of that which would be equivalent to oral exposures greater than the reference dose (RfD) for sulfuryl fluoride and/or the maximum contaminant level (MCL) or Institute of Medicine recommended NOAEL for fluoride. Risk estimates from OPP are based on a coupling of exposure estimates to hazard estimates. Those exposure estimates are typically in terms of environmental concentrations (i.e., how much pesticide is in food, water, air, etc.). While concentrations of fluoride in blood and/or urine serve as measures of internal dose, EPA does not have data on blood or urine levels of fluoride in workers and has not examined how internal levels of fluoride can be used to characterize the risk posed by fluoride.

EPA does not have information regarding the makeup of the workforce using sulfuryl fluoride on food commodities.

3 Proposed New Food Uses for Sulfuryl Fluoride

3(A) Proposed Tolerance Level and Fluoride Residues in Powdered Eggs

3(A)(i) Proposed Tolerance Level for Fluoride on Eggs

Comments: The Notice of Filing dated March 4, 2005 proposing to establish tolerances

for residues of sulfuryl fluoride and fluoride anion in or on processed food commodities included a proposed tolerance level for fluoride on egg at 850 part per million (ppm). This tolerance is approximately seven times higher than any previously approved or proposed fluoride tolerance. Within the Notice of Filing, the highest fluoride levels reported were 754 ppm in powdered eggs. Questions were submitted regarding why Dow AgroSciences LLC would request the increase in the tolerance for egg from 754 ppm to 850 ppm.

Agency Response: A tolerance is meant to serve, among other things, as an indicator of misuse (i.e., uses that are not made in compliance with the labeled use pattern). Therefore, so long as the tolerance will be safe, the tolerances should be set within bounds that protect legal uses of a pesticide (lower bound) and that capture potential misapplication (upper bound). Given the variability in the residue data, EPA presumes that the tolerance proposed by Dow is designed to fall within those bounds.

3(A)(ii) Intended Use and Exposure to Treated Eggs

Comments: EPA has been asked to identify with as much specificity as possible, the intended uses of eggs fumigated with sulfuryl fluoride (for example, baby food, processed food, bakeries, restaurants, animal feed, inert ingredients, food to foreign countries, non-food products, etc.) and the population subsets that will be most exposed to these eggs (for example, prisons, schools, military bases, organic consumers, export market, etc.). In addition, the amount of fluoride in milligrams that would be consumed through the consumption of 1 powdered egg was requested.

Agency Response: The primary use associated with this tolerance is for treatment of areas and equipment within food processing facilities. Typically, powdered eggs serve as a recipe component in processed food products such as cakes and brownies (either in their final form or as a box mix). For efficient treatment, it is necessary to empty, to the extent possible, hoppers, bins, and other containers of processed foods and recipe components prior to fumigation. EPA has not approved the direct fumigation of processed foods. Thus, only a small quantity of ingredients in the processing facility will be exposed to sulfuryl fluoride. Further, any commodities that are treated are likely to be mixed with other untreated commodities as part of the food processing operations. To the extent that dried eggs are treated as a result of treatment of areas or equipment in a food processing facility, EPA expects that will generally only occur in food processing facilities preparing finished foods and the dried eggs would be present in such a facility only as a component of the finished food.

Regarding powdered eggs that may also be reconstituted and used for making egg-based foods such as scrambled eggs or omelets, EPA does not have information regarding what subset of the population might be most exposed to fumigated ingredients beyond that included in our dietary exposure model (Dietary Exposure Evaluation Model; DEEM, version 2.03). The dietary model breaks the general U.S. population in to subgroups based on age and gender, and does not address the specific groups mentioned in the comment. Exposure estimates for the subgroups addressed by the model will be included in EPA's forthcoming human health risk assessment for

Petition 3F6573. However, assuming a worst-case, tolerance-level residue of fluoride of 900 ppm, the dietary exposure can be estimated based on the reconstitution factor for powdered eggs (2 teaspoons/egg), the bulk density of powdered egg (0.35 g/mL), and the number of teaspoons per mL (0.20288):

$$0.35 \text{ g/mL} \times 2 \text{ tsp} \div 0.20288 \text{ tsp/mL} \times 900 \text{ } \mu\text{g/g} \approx 3100 \text{ } \mu\text{g} = 3.1 \text{ mg.}$$

For the reasons mentioned above, EPA expects that (1) dried eggs will only infrequently have fluoride residues from sulfuryl fluoride treatment; (2) for those small amounts of dried eggs that do have residues, generally such residues will be well below the tolerance level, and (3) exposure to dried eggs containing fluoride from sulfuryl fluoride, to the extent it occurs, would generally be as a result of consuming a finished food that had dried eggs as a component. Thus, EPA considers it extremely unlikely for a person to be exposed in a single day to an amount of dried egg containing tolerance-level residues of fluoride that is equivalent to a single whole egg. Even more unlikely would be for such an exposure to occur on a repeated basis which would be necessary to raise any concerns regarding skeletal fluorosis, the effect of concern for fluoride.

3(B) Packaging of Processed Foods to be Treated with Sulfuryl Fluoride

3(B)(i) Fluoride Exposures and Residue Levels on Packaging

Comments: It was noted that, in the Notice of Filing, Dow made the assertion that fluoride residues in commodities fumigated under packaged versus open fumigation conditions indicated that the packaging tends to function as a barrier that prevents or reduces sulfuryl fluoride exposures to the contents of the package. On that basis, the question was raised of whether or not the packaging materials themselves have been tested for fluoride levels. Along similar lines, the question was raised of whether or not the discarded fumigated packaging materials would need to be treated as hazardous waste. Finally, scenarios were described in which certain retail packing materials may be reused (i.e., to store food, for children to play with, etc.). To assess these types of scenarios, EPA has been questioned on what fluoride levels a young child might receive in hand-to-mouth exposures after handling a food package fumigated with sulfuryl fluoride.

Agency Response: Data are not available reflecting the levels of either sulfuryl fluoride or fluoride in packaging materials. Food residue studies with sulfuryl fluoride indicate that substances with high fat content are the most likely to retain residues of sulfuryl fluoride following post-fumigation aeration and that substances with high protein content are more likely to have higher fluoride concentrations. EPA believes that the packaging materials that might be present during fumigation are most probably polymer film and/or cardboard products. Since these have neither a high fat nor a high protein content, it is probable that there would be very little retention of either sulfuryl fluoride or fluoride ion. Given that, EPA has not done a hand-to-mouth exposure analysis and believes that any such exposures would be very small, especially in light of the other sources of fluoride exposure. Similarly, there would be no need to treat discarded fumigated packaging materials as hazardous waste.

3(B)(ii) Estimated Quantity of Fumigated Packaging

Comments: EPA has been asked to provide the estimated quantity of the packaging to be fumigated with sulfuranyl fluoride on a yearly basis.

Agency Response: Sulfuryl fluoride is intended to be used as a methyl bromide alternative that is used to target pests in food processing facilities. Based on information received by applications for methyl bromide critical uses exemptions, discussions with the manufacturer of sulfuranyl fluoride, food processors, and university researchers, EPA has estimated that approximately 1 percent of processed foods could be fumigated with methyl bromide per year. Therefore, EPA believes that 1 percent of processed foods is the upper bound of what could be fumigated with sulfuranyl fluoride. This is estimated using the following assumptions:

- Most food processing plants strive to operate continuously (year round, 24 hours per day, seven days a week). Some production down-time occurs because of equipment maintenance and repair and fumigations, so we assume that 300 days of production occurs annually.
- An average of 2.5 fumigations occurs in each facility during the year. These fumigations are usually timed to take place over holiday weekends.
- If we assume 3 fumigations occur for every 300 days of production, we estimate that 1 percent of the annual production will be fumigated.

This estimate includes food exposed while in the food processing facility as well as packaged food products stored within the same facility.

3(B)(iii) Disposal of Fumigated Packing Materials

Comments: Several questions were raised regarding the amounts and treatment of disposed packing materials that would have been fumigated with sulfuranyl fluoride. The principal expected route of disposal (i.e., recycling, shipment to landfills, incineration, etc.) was requested. EPA has also been asked to provide the percentage of fumigated packaging that may be incinerated, and was questioned on whether the yearly levels has been calculated or if the fate of the fluoride emissions when disposed by incineration has been determined. Similarly, it was noted that certain states allow open burning of garbage, and an estimate was requested for the levels of fluoride emissions that may result from this route of disposal.

EPA Response: The commenters are referred to EPA's Office of Solid Waste for information on the components within various industrials and household wastestreams and their ultimate destinations. Although EPA has no knowledge of the actual amount of fumigated food packing that is incinerated every year, EPA believes that it would not exceed 1%, since a maximum of about 1% of packaging would be possibly fumigated. Regarding exposures to

fluoride through emissions when disposed of by incineration or burning, EPA reiterates that the packaging materials that might be present during fumigation are expected to exhibit very little retention of either sulfuryl fluoride or fluoride, and it is believed that any such exposures would be very small, especially in light of the other sources of fluoride exposure.

3(C) Repeated Fumigation Applications

Comments: Information regarding circumstances when food commodities may be fumigated more than once with sulfuryl fluoride has been requested.

Agency Response: A second fumigation may take place due to a pest infestation at a regional distribution warehouse. EPA has estimated above that approximately 1 percent of processed foods could be fumigated once, based on information from applications for methyl bromide critical uses exemptions, discussions with the manufacturer of sulfuryl fluoride, food processors, and university researchers. This estimate includes food exposed while in the food processing facility as well as packaged food products. In addition, EPA estimates that 0.0005% of processed foods in packages could be fumigated twice (about 5% of 1% fumigated products could be fumigated twice or 0.0005% of foods). In the case of a distribution warehouse, only the suspected products would be removed to a trailer for targeted fumigation. Other chemicals may be used for these fumigations.

Cocoa beans imported into the United States are usually fumigated twice, once before shipment and a second time in the port of entry warehouses before being sent to the customer.

3(D) Addition of Signal Odor Agents to Sulfuryl Fluoride Formulation(s)

Comments: The Agency was questioned on whether or not chloropicrin was to be added to sulfuryl fluoride when it is used as a food fumigant.

Agency Response: Although Dow AgroSciences LLC may at some time in the future petition to add chloropicrin to the sulfuryl fluoride formulation, or petition to amend the product labeling to require the addition of chloropicrin by the user at the time of fumigation, the Agency has no knowledge of intentions to add chloropicrin to sulfuryl fluoride when it is used as a food fumigant at this time.

4 Toxicology of Sulfuryl Fluoride and Fluoride Anion

4(A) Acute Toxicity of Sulfuryl Fluoride

Comments: Clarifications were requested regarding acute toxicity data that is available for sulfuryl fluoride. More specifically, clarification regarding whether the acute LC50 of 642 ppm 1,088 milligram/kilogram body weight (mg/kg/bwt) for sulfuryl fluoride in CD-1 mice exposed for four hours was for oral or inhalation exposure. In addition, the Agency was questioned whether or not this was the most sensitive acute toxicity data available, and whether

or not the mouse was the most sensitive species for acute toxicity data.

Agency Response: The LC₅₀ reflects an inhalation exposure. Acute inhalation toxicity data are available from mice and rats. Of these, the mouse appears to be the more sensitive species. Data from other species are not available; therefore, the mouse is the most sensitive species based on the available data.

4(B)(i) Effects of Fluoride on the Pineal Gland as Evidence of Endocrine Disruption

Comments: FAN has challenged Dow's assertion that there is no evidence from any studies to suggest that sulfuryl fluoride or fluoride are endocrine disruptors. FAN asserts that a dissertation submitted to the School of Biological Sciences, University of Surrey, by Jennifer Luke in fulfillment of the requirements for the Degree of Doctor of Philosophy contains relevant information regarding fluoride effects on the pineal gland. FAN states that Luke's studies indicate that the accumulation of fluoride in the pineal gland can reduce the gland's synthesis of melatonin, a hormone that helps regulate the onset of puberty, and that fluoride-treated animals were found to have reduced levels of circulating melatonin and an earlier onset of puberty than untreated animals. Additional detail regarding Luke's experiment and the rationale behind her conclusions may be found in the comments submitted to EPA by FAN (OPP-2005-0067-0019).

Agency Response: The Agency has previously determined that the data referred to are too limited in scope for EPA to use the information to serve as the basis of any regulatory decision(s). EPA reiterates that the effects of fluoride on the pineal gland have been reported only by one author in one study. The author states that the interpretation that depressed melatonin levels in the blood may hasten the onset of puberty is considered "conjectural". Because animal data on the effects of fluoride and the pineal gland comes from a single study with limited number of animals with only two dose levels, these findings should be confirmed by other laboratory studies.

4(B)(ii) Effects of Fluoride on the Male Reproductive System

Comments: A collection of published papers was cited that detail fluoride's adverse effects on the male reproductive system. The predominant effect reported is fluoride's potential to affect male fertility. A 2004 submission to the National Research Council on a list of studies that document reproductive effects at <http://www.fluoridealert.org/pesticides/nrc.male.repro.april.2004.htm> was referred to.

Agency Response: A very large body of information regarding the toxicology of fluoride, including reproductive effects, is available in open literature. A complete review or re-presentation of that information is beyond the scope of EPA's current assessment for sulfuryl fluoride. However, for a comprehensive review of the toxicology of fluoride, EPA refers to publications by the World Health Organization (2002), the Department of Health and Human Services (2001), the National Research Council (1993), the Medical Research Council (2002), and NHS CRD (2000). After review of these resources, EPA believes that the use of skeletal

fluorosis as the toxicological endpoint in conducting the human health risk assessment for fluoride is the most protective for the U.S. population.

5 Definition of “Processed Food”

Comments: It has been noted that Dow AgroSciences has petitioned for tolerances for a commodity referred to as “Processed Food”. EPA has been asked to provide a definition of “Processed Food” and to provide examples so that the public will know more definitively what this term covers.

Agency Response: According to the Federal Food, Drug, and Cosmetic Act, which is the statute under which tolerances are set, processed foods are “...any food other than a raw agricultural commodity and includes any raw agricultural commodity that has been subject to processing, such as canning, cooking, freezing, dehydration, or milling.” For conventional agricultural pesticide tolerances, this typically means a raw agricultural commodity that is processed into another form of that commodity (e.g., apples to apple juice, wheat to flour, mint to mint oil, etc.). As relates to Dow’s current petition, EPA has taken the term to mean any commodity that is the output from a food processing facility (e.g., chips, cookies, cake mixes, etc.). A processed food tolerance was therefore proposed because it would be impractical to establish individual tolerances on the myriad of such finished foods.

6 Extension to Comment Period

Comments: On April 1, 2005, the Federal Register published an extension to the comment period allowed by the Notice of Filing regarding Dow’s petition to establish new tolerances for sulfur dioxide. The extension was stated to have been issued as a result of a request from “stakeholders.” EPA has been asked to identify who the stakeholders were that made this request, and the reasons they provided for the comment period extension.

Agency Response: In this case, the “stakeholder” that requested the extension to the comment period was a representative of a national trade association representing pet food industry and affiliated suppliers. The reason given to substantiate the request was that more time was needed by the association to review relevant fluoride data in order to adequately determine.

7 Ozone Depletion

Comments: EPA has been asked to explain why sulfur dioxide will not be an ozone depleter. In addition, a request was made for EPA to make accessible the atmospheric test protocol for sulfur dioxide.

Agency Response: For the determination of ozone depleting potential, the following EPA websites may be referred to. For a list of ozone depleting substances, please refer to <http://www.epa.gov/docs/ozone/ods.html>. For more information about ozone depletion, please

refer to <http://www.epa.gov/docs/ozone/index.html>.

8 Clarification of Food Commodities with Approved and Petitioned Fluoride Tolerances that Can Be Used as List 4 Inerts

Comments: EPA's List 4 Inerts contain a long list of chemicals and food commodities that are used as "other ingredients" in pesticide formulations. The List 4 Inerts are also allowed for use in organic agriculture in the US Department of Agriculture's National Organic Program. For example, both "sodium fluoride" and "cheese" are included as List 4B Inerts. EPA has been asked to identify each of the food commodities that have fluoride tolerances, and those petitioned by Dow on March 4, 2005, which can be used as List 4 Inerts.

Agency Response: List 4 Inerts are those inert ingredients that are considered to be minimal risk inert ingredients and are therefore of minimal concern. Unless specifically excluded, commonly consumed food commodities, whether a raw agricultural commodity or a processed food, that are commonly consumed for their nutrient properties and are in the form that the commodity is sold or distributed to the public for consumption are considered to be List 4 Inerts. Most of the food commodities that have previously established fluoride tolerances and fluoride tolerances petitioned by Dow AgroSciences LLC on March 4, 2005 can be used as List 4 Inerts. The exclusions are generally those foods that may cause allergic reactions in some individuals, and include peanuts, tree nuts, milk, soybeans, eggs, and wheat. For a more comprehensive description commonly consumed food commodities that qualify as List 4 Inerts and its exclusions, please refer to the Code of Federal Regulations, Chapter 40 Part 180.950.