

Issue Brief: Aluminum-Containing Food Additives

Aluminum - the most abundant metallic element in Earth's crust - occurs naturally in the environment as silicates, oxides and hydroxides, and as complexes with organic matter. Natural occurrence in foods may result from uptake from soils or water. Aluminum (Al) - containing compounds are used in foods and beverages - either as direct food additive or in the manufacturing of food-contact substance to hold or package food items. Aluminum-containing ingredients are approved by the U.S. Food and Drug Administration (FDA) as food additives (mainly as preservatives, coloring agents, leavening agents, or anticaking agents), and others are authorized for use as generally recognized as safe (GRAS) or are prior-sanctioned ingredients. It has been reported that high levels of aluminum may be toxic to the central nervous system and one consumer group has alleged high levels may increase the risk of Alzheimer's disease. However, studies on the role of aluminum in Alzheimer's disease have mixed results and FDA has not taken any regulatory action limiting the use of aluminum-containing food additives.

Legal Framework

Under section 201 of the Federal Food, Drug, and Cosmetic Act (FFDCA), any substance that is reasonably expected to become a component of food is a "food additive" that is subject to premarket approval by FDA, unless the substance is GRAS or meets one of the other exclusions from the food additive definition. ^{1/} FDA has approved various aluminum-containing food additives. Specifically, according to FDA's online database "Everything Added to Food in the United States (EAFUS)," ^{2/} food additive regulations clearing the use of aluminum-containing food additives include 21 CFR § 172.310 ("Aluminum nicotinate"), 21 CFR § 172.863 ("Salts of fatty acids"), 21 CFR § 172.892 ("Food starch-modified"), and 21 CFR § 173.340 ("Defoaming agents").

Congress specifically exempted GRAS ingredients from the food additive definition. ^{3/} An ingredient can be GRAS through one of two means: (1) common use in food prior to 1958; or (2) a showing through scientific procedures that the substance is safe under the conditions of its intended use. ^{4/} According to EAFUS, the following aluminum-containing ingredients are GRAS: 21 CFR §182.1125

^{1/} 21 U.S.C. § 321(s). The FFDCA defines "food additives" broadly as any substance "the intended use of which results or may reasonably be expected to result, directly or indirectly, in its becoming a component or otherwise affecting the characteristics of any food (including any substance intended for use in producing, manufacturing, packing, processing, preparing, treating, packaging, transporting, or holding food; and including any source of radiation intended for any such use)"

^{2/} The EAFUS Database can be accessed at:

<http://www.accessdata.fda.gov/scripts/cfn/fcnavigation.cfm?filter=aluminum&sortColumn=&rpt=eafuslisting>

^{3/} See *supra* note 1.

^{4/} *Id.*

("Aluminum sulfate"), 21 CFR §182.1127 ("Aluminum ammonium sulfate"), 21 CFR §182.1129 ("Aluminum potassium sulfate"), 21 CFR §182.1131 ("Aluminum sodium sulfate"), 21 CFR §182.1781 ("Sodium aluminum phosphate"), 21 CFR §182.2122 ("Aluminum calcium silicate"), 21 CFR §182.2727 ("Sodium aluminosilicate.") Companies can also take self-determined GRAS positions for aluminum-containing ingredients and do not have to notify FDA of their determination. ^{5/}

FDA may rescind the GRAS status of a substance based on safety data. ^{6/} In 1971 FDA began a systematic review of previously listed GRAS ingredients, including aluminum-containing food ingredients, to assess whether the data continue to support their safety. In doing so, FDA contracted with the Life Sciences Research Office (LSRO) of the Federation of American Societies for Experimental Biology (FASEB), which convened a Select Committee on GRAS Substances (SCOGS) that conducted a full safety review for aluminum salts. SCOGS noted that the intake from aluminum compounds added to food may average about 20 mg per day, and concluded that there are "no reasonable grounds to suspect a hazard to the public when they are used at levels that are now current or that might reasonably be expected in the future." ^{7/} FDA has not conducted a systematic GRAS review of aluminum-containing compounds since the 1970s.

Aluminum-containing compounds are also approved by the FDA as indirect food additives under 21 CFR Parts 175, 176, 177, and 178. Indirect food additives are used in food-contact articles and include adhesives and coatings (Part 175), paper and paperboard (Part 176), polymers (Part 177), and adjuvants and production aids (Part 178). Aluminum-containing compounds are also subject to effective Food Contact Notifications (FCNs) 24, 177, 202, 248, 302, 433, 476, 575, 576, 577, 633, 988, 1026, and 1171. Their uses are unlikely to raise any special safety concerns due to the *de-minimis* aluminum levels that might end up in the finished food. Finally, aluminum mono-, di-, and tristearate are listed in 21 CFR § 181.29 ("Stabilizers") as prior-sanctioned food ingredients.

Due to its excellent heat conductivity, aluminum is also widely used to make cookware. FDA typically has not required food additive petitions for cookware used exclusively in the home or in restaurants, unless there is evidence of a potential health hazard. ^{8/} It was reported in 1973 that aluminum migrated from cookware might lead to increased risk of Alzheimer's disease. ^{9/} In 1986, FDA reviewed existing data and concluded that it "has no information at this time that the normal dietary intake of aluminum, whether from naturally-occurring levels in food, the use of aluminum cookware, or from aluminum food additives or drugs, is harmful." ^{10/}

^{5/} We also searched FDA's GRAS Notice Inventory but did not locate any GRAS notification for aluminum-containing substance.

^{6/} See 21 CFR § 170.38 ("Determination of food additive status").

^{7/} *SCOGS Opinion: Aluminum ammonium sulfate* (1975), <http://www.fda.gov/Food/IngredientsPackagingLabeling/GRAS/SCOGS/ucm260848.htm>

^{8/} Since 1958, FDA, on occasion, has stated that the components of dinnerware, eating utensils, and other kitchenware used to prepare or serve food by individual consumers fall under the so-called "housewares exemption" to the FFDCa and are exempt from the FDA requirements for premarket clearance.

^{9/} Crapper, D. R., S. S. Krishnan, and A. J. Dalton. "Brain aluminum distribution in Alzheimer's disease and experimental neurofibrillary degeneration." *Science* 180.4085 (1973): 511-513.

^{10/} FDA's original statement is no longer available online, one of the multiple sources that cite this statement is available at: http://www.msue.msu.edu/objects/content_revision/download.cfm/revision_id.499708/workspace_id.-4/01500616.html/

More recently, in September 2008, the Agency for Toxic Substances and Disease Registry (ASTR) also noted in its assessment of aluminum that exposures to the levels of aluminum that are naturally present in food and water and the forms of aluminum that are present in dirt and aluminum pots and pans are not considered to be harmful. 11/

Recent Developments

- In November 2011, responding to concerns from the public that aluminum in vaccines may pose a risk to infants, FDA scientists developed an up-to-date analysis of the safety of aluminum adjuvants used in vaccines. 12/ The study concluded that aluminum for infant dietary and vaccine exposures is significantly less than the corresponding safe body burden of aluminum using the regulatory minimal risk levels (MRLs) established by ASTR. 13/
- In October 2005, responding to a letter entitled "Explore high-risk factors behind Alzheimer's disease" published on USA Today on January 31, 2005, the Alzheimer's Association, a non-profit organization, stated on its website that the link between aluminum and Alzheimer's disease has never been conclusively proven. 14/ The association further commented that the research community is generally convinced that aluminum is not a key risk factor in developing Alzheimer's disease. 15/
- In September 2005, the Department of the Planet Earth, a non-profit citizen group, submitted a petition asking FDA to rescind the GRAS status for aluminum-containing food ingredients on the basis that the intake of aluminum elevates the risk of Alzheimer's disease. 16/ FDA has yet to act on this petition.

Issues to Watch

- Some studies show that people exposed to high levels of aluminum may have an increased risk of developing Alzheimer's disease, but other studies have not found this to be true. Given aluminum's ubiquitous application in foods, we expect there will be renewed public safety concerns whenever the link between aluminum and Alzheimer's disease resurface in the public media.
- In a November 8, 2013 *Federal Register* notice, FDA issued a tentative determination that partially hydrogenated oils (PHOs) are no longer GRAS due to

^{11/} ASTR, *Public Health Statement for Aluminum* (September 2008), <http://www.atsdr.cdc.gov/phs/phs.asp?id=1076&tid=34>

^{12/} FDA, *Summary Reports Aluminum in Vaccines Poses Extremely Low Risk to Infants* (2012), <http://www.fda.gov/biologicsbloodvaccines/scienceresearch/ucm284520.htm>

^{13/} Mitkus, Robert J., et al. "Updated aluminum pharmacokinetics following infant exposures through diet and vaccination." *Vaccine* 29.51 (2011): 9538-9543.

^{14/} The Alzheimer's Association, *Association responds to USA TODAY letter to the editor* (Feb 02, 2005), http://www.alz.org/news_and_events_alzheimer_news_02-02-2005.asp

^{15/} *See id.*

^{16/} Department of the Planet Earth, *Petition to Rescind the "Generally Recognized as Safe" for GRAS Status for Aluminum Based Food Additives* (September 14, 2005), <http://www.fda.gov/ohrms/dockets/dockets/05p0377/05p-0377-cp00001-01-vol1.pdf>

scientific evidence documenting an increased risk of coronary heart disease. FDA's action was in response to a 2004 citizen petition submitted by the Center for Science in the Public Interest (CSPI). AFFI coordinated the industry response in opposition to the agency position on PHOs asserting the underlying science and law do not support the agency's tentative determination. AFFI will continue to monitor the agency's handling of PHOs and remains concerned it could set a dangerous precedent, in the event FDA reaches a conclusion that PHOs are not GRAS. The precedent would provide FDA with the ability to withdraw the food additive regulations or GRAS status of other food ingredients, such as aluminum-containing substances, when data indicate a link with an increased risk of developing disease.

International Perspective

- European Union (EU): Aluminium-containing food additives are regulated under Regulation (EC) No 1333/2008 on food additives (the "EU Food Additives Regulation"), ^{17/} as amended by EU Commission Regulation (EU) No 380/2012 taking into account the European Food Safety Authority (EFSA) 2008 recommendations. In its May 22, 2008 opinion, EFSA recommended to lower the tolerable weekly intake (TWI) for aluminium to 1 mg/kg body weight/week. ^{18/} Cereals and cereal products, vegetables, beverages and certain infant formulae were identified as the main contributors to the dietary aluminium exposure that exceeded the TWI for highly exposed consumers. European Commission Regulation 380/2012 restricts the use of aluminium silicates (commonly used as anti-caking agents), the use of aluminium lakes and sodium aluminium phosphate acidic E541 (SALP) as a raising agent to one product only – namely sponge cakes produced from contrasting coloured segments, held together by jam or spreading jelly, encased in a flavoured sugar paste (i.e. Battenberg style cakes), at a level of 0.4 g/kg in the sponge parts only.
- Canada: Although Health Canada did not determine unacceptable risk from current uses of aluminum-containing food additives in the Canadian food supply, as a consequence of the Joint FAO/WHO Expert Committee on Food Additives (JECFA) assessment Health Canada requested information from industry on the use of aluminum-containing food additives. ^{19/}
- Australia: Recently, Food Standards Australia New Zealand (FSANZ) investigated concentrations of aluminium in foods and beverages as a part of the first phase of their 24th Australian Total Diet Study (ATDS). ^{20/} Most foods contained detectable levels of aluminium, with the highest

^{17/} http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2008R1333:20131014:EN:PDF;https://www.fsai.ie/uploadedFiles/Reg380_2012.pdf

^{18/} Scientific Opinion of the Panel on Food Additives, Flavourings, Processing Aids and Food Contact Materials (AFC) on Safety of aluminium from dietary intake, The EFSA Journal (2008) 754, p. 1. (<http://www.efsa.europa.eu/en/efsajournal/doc/754.pdf>)

^{19/} Health Canada Requests Information from Industry on the Use of Aluminum-Containing Food Additives - http://www.hc-sc.gc.ca/fn-an/securit/addit/aluminum_stake-eng.php.

^{20/} Exposure of Australian consumers to aluminium in foods and beverages. <http://www.foodstandards.gov.au/consumer/chemicals/Pages/Aluminium-and-Food.aspx>

concentrations generally found in cakes, pikelets and pancakes. Estimated dietary exposures of Australian consumers to aluminium were within internationally recognized safe levels for most of the population. Although there was a slight exceedance of the health-based guidance value for aluminium for 2–5 year old high consumers, this was not considered to be a major public health and safety issue. Nevertheless, FSANZ is investigating whether the current permissions for aluminium-containing food additives are still appropriate.

- Codex: In 2011, after several re-evaluations, the 74th Joint FAO/WHO Expert Committee on Food Additives (JECFA) set the Provisional Tolerable Weekly Intake (PTWI) of aluminum from all sources - including food additives - at 2 mg/kg body weight per week. 21/ JECFA identified cereals and cereal-based products as major contributors to dietary aluminium exposure. To ascertain dietary exposure to aluminum is well below the PTWI, JECFA recommended that the Codex Committee on Food Additives (CCFA) revise existing aluminum-containing food additive provisions in the Codex General Standard for Food Additives (GSFA) (Codex Standard 192-1995). 22/ The 45th CCFA undertook the above exercise and significantly reduced or eliminated uses from the GSFA. At the 45th CCFA plenary, the JECFA Secretariat clarified that bioavailability studies for sodium aluminium phosphate acidic (INS 541i) and aluminosilicate salts (INS 554, 556, 559) were lacking making it challenging conclude that Aluminium (Al) speciation from these compounds were less bioavailable than other aluminium-containing food additives. Thus, JECFA concluded that all Al-containing food additives had a similar toxicokinetic profile in their exposure assessment.

AFFI Action Items

- AFFI will continue to monitor FDA developments regarding aluminum-containing food ingredients.
- AFFI will also continue to monitor the status of the pending citizen petition from the Department of the Planet Earth and, if necessary, coordinate with other industry associations to provide comments, should FDA take regulatory action regarding aluminum containing ingredients.

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^{21/} JOINT FAO/WHO EXPERT COMMITTEE ON FOOD ADDITIVES, Seventy-fourth meeting. Rome, 14–23 June 2011.

ftp://ftp.fao.org/ag/agn/jecfa/JECFA_74_Summary_Report_4July2011.pdf

^{22/} http://www.codexalimentarius.net/gsfaonline/docs/CXS_192e.pdf