GRAS 31 Flavo

The 31st publication by the Expert Panel of the Flavor and Extr progress in the consideration of flavor ingredients generally

by
I.M.C.M. Rietjens,
S. M. Cohen,
G. Eisenbrand,
S. Fukushima,
N. J. Gooderham,
F. P. Guengerich,
S. S. Hecht,
T. J. Rosol,
J. M. Davidsen,
C. Harman,
D. Ramanan,
and S. V. Taylor

THE FEMA GRAS PROGRAM HAS OPERATED TO assess the safety of flavor ingredients for their intended use in human food for more than 60 years. The GRAS provision of the 1958 Food Additives Amendment to the Federal Food, Drug, and Cosmetic Act defines a food additive as: *"… any substance … which … may … [become] a component or… [affect] the characteristics of any food … if such substance is not generally recognized, among experts qualified by scientific training and experience to evaluate its safety, as having been adequately shown through scientific procedures … to be safe under the conditions of its intended use…"* The FEMA GRAS program operates within the confines of the 1958 Food Additives Amendment using defined scientific procedures as published in Smith et al. 2005a and b and Cohen et al. 2018a to assess the safety of flavor ingredients under their conditions of intended use.

The FEMA Expert Panel has long operated under well-defined and thorough procedures to protect against potential conflicts of interest and bias in their assessments of GRAS status for flavor ingredients. The Expert Panel's procedures are published (Marnett et al. 2013) and are publicly available on the FEMA website (www.femaflavor.org/gras#conflict).

This publication includes the results of the Expert Panel's review of 49 new flavorings under their conditions of intended use (Tables 1 and 2). In addition, the Expert Panel determined that new use levels and/or use

ring Substances

act Manufacturers Association provides an update on recent recognized as safe under the Food Additives Amendment.

in new food categories for 25 flavor ingredients are consistent with their current FEMA GRAS status (Table 3). The Expert Panel removed the FEMA GRAS status for the uses of two substances.

Progress in the Reevaluation of Natural Flavor Complexes

Flavoring substances are often described as chemically defined substances (CDS) (e.g., isoamyl acetate) or natural flavor complexes (NFCs) (e.g., orange oil). Chemically defined substances are typically single chemical substances. In contrast, the NFCs are essential oils, absolutes, concretes, oleoresins, and/or extracts typically derived from the seeds, fruit, fruit peels, leaves, flowers, exudates, bark, twigs, and/or roots of plants and are complex mixtures. During the 63 years of the FEMA GRAS program, the FEMA Expert Panel has completed two reevaluations of the chemically defined flavor ingredients, and in 2015 the Expert Panel expanded its reevaluation program to include FEMA GRAS NFCs, focusing on NFCs listed in GRAS 3 (Hall and Oser 1965).

Since 2015, the FEMA Expert Panel has conducted updated safety evaluations of more than 200 NFCs and has published their results in a series of articles in *Food and Chemical Toxicology* (FCT). These publications are listed on page 46, and two additional publications are in preparation. Each of these publications* focuses on a group of NFCs related by their similar composition

*Open access articles are available on the *FCT* website and are also linked on the FEMA Flavor website https://www.femaflavor.org/safety-assessments.

FEMA Expert Panel NFC Safety Evaluation Publications

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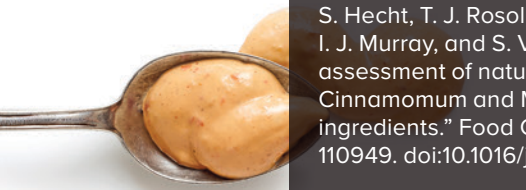
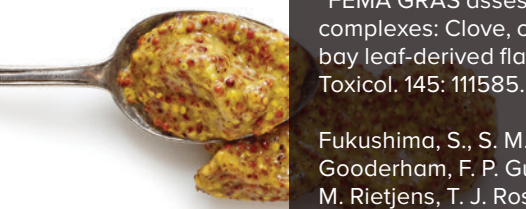
Cohen, S. M., G. Eisenbrand, S. Fukushima, N. J. Gooderham, F. P. Guengerich, S. S. Hecht, I. M. C. M. Rietjens, M. Bastaki, J. M. Davidsen, C. L. Harman, M. M. McGowen, and S. V. Taylor. 2020. "FEMA GRAS assessment of natural flavor complexes: Mint, buchu, dill and caraway-derived flavor ingredients." Food Chem Toxicol. 135: 110870. doi:10.1016/j.fct.2019.110870.



Rietjens, I. M. C. M., S. M. Cohen, G. Eisenbrand, S. Fukushima, N. J. Gooderham, F. P. Guengerich, S. S. Hecht, T. J. Rosol, J. M. Davidsen, C. L. Harman, I. J. Murray, and S. V. Taylor. 2020. "FEMA GRAS assessment of natural flavor complexes: Cinnamomum and Myroxylon-derived flavor ingredients." Food Chem Toxicol. 135: 110949–110949. doi:10.1016/j.fct.2019.110949.



Gooderham, N. J., S. M. Cohen, G. Eisenbrand, S. Fukushima, F. P. Guengerich, S. S. Hecht, I. M. C. M. Rietjens, T. J. Rosol, J. M. Davidsen, C. L. Harman, I. J. Murray, and S. V. Taylor. 2020. "FEMA GRAS assessment of natural flavor complexes: Clove, cinnamon leaf and West Indian bay leaf-derived flavor ingredients." Food Chem Toxicol. 145: 111585. doi:10.1016/j.fct.2020.111585.

Fukushima, S., S. M. Cohen, G. Eisenbrand, N. J. Gooderham, F. P. Guengerich, S. S. Hecht, I. M. C. M. Rietjens, T. J. Rosol, J. M. Davidsen, C. L. Harman, V. Lu, and S. V. Taylor. 2020. "FEMA GRAS assessment of natural flavor complexes: Lavender, Guaiac Coriander-derived and related flavor ingredients." Food Chem Toxicol. 111584. doi:10.1016/j.fct.2020.111584.

Eisenbrand, G., S. M. Cohen, S. Fukushima, N. J. Gooderham, F. P. Guengerich, S. S. Hecht, I. M. C. M. Rietjens, T. J. Rosol, J. M. Davidsen, C. L. Harman, and S. V. Taylor. 2021. "FEMA GRAS assessment of natural flavor complexes: Eucalyptus oil and other cyclic ether-containing flavor ingredients." Food Chem Toxicol. 112357. doi:10.1016/j.fct.2021.112357.

Cohen, S. M., G. Eisenbrand, S. Fukushima, N. J. Gooderham,. F. P. Guengerich, S. S. Hecht, I. M. C. M. Rietjens, T. J. Rosol, J. M. Davidsen, C. L. Harman, V. Lu, and S. V. Taylor. 2021. "FEMA GRAS assessment of natural flavor complexes: Origanum oil, thyme oil and related phenol derivative-containing flavor ingredients." Food Chem Toxicol. 112378. doi:10.1016/j.fct.2021.112378.

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Rietjens, I. M .C. M., S. M. Cohen, G. Eisenbrand, S. Fukushima, N. J. Gooderham, F. P. Guengerich, S. S. Hecht, T. J. Rosol, J. M. Davidsen, C. L. Harman, and S. V. Taylor. 2023. "FEMA GRAS assessment of natural flavor complexes: Allspice, anise, fennel-derived and related flavor ingredients." Food Chem Toxicol. 174: 113643. doi:10.1016/j.fct.2023.113643.

Davidsen, J. M., S. M. Cohen, G. Eisenbrand, S. Fukushima, N. J. Gooderham, F. P. Guengerich, S. S. Hecht, I. M. C. M. Rietjens, T. J. Rosol, C. L. Harman, and S. V. Taylor. 2023b. "FEMA GRAS assessment of derivatives of basil, nutmeg, parsley, tarragon and related allylalkoxybenzene-containing natural flavor complexes." Food Chem Toxicol. 113646. doi:10.1016/j.fct.2023.113646.

Rosol, T. J., S. M. Cohen, G. Eisenbrand, S. Fukushima, N. J. Gooderham, F. P. Guengerich, S. S. Hecht, I. M. C. M. Rietjens, J. M. Davidsen, C. L. Harman, S. Kelly, D. Ramanan, and S. V. Taylor, S.V. "FEMA GRAS assessment of natural flavor complexes: Lemongrass oil, chamomile oils, citronella oil and related flavor ingredients." Food Chem Toxicol. 113697. doi:10.1016/j.fct.2023.113697.

Gooderham, N. J., S. M. Cohen, G. Eisenbrand, S. Fukushima, F. P. Guengerich, S. S. Hecht, I. M. C. M. Rietjens, T. J. Rosol, J. M. Davidsen, C. L. Harman, S. E. Kelly, and S. V. Taylor. 2023. "FEMA GRAS assessment of natural flavor complexes: Sage oil, Orris Root Extract and Tagetes Oil and related flavor ingredients." Food Chem Toxicol. 113940. doi:10.1016/j.fct.2023.113940.

and/or taxonomical properties and describes the safety evaluation of each NFC as well as information on their history of use, current usage, and manufacturing method(s). Since the constituents of many NFCs are secondary metabolite products of common plant biochemical pathways, they can be organized into a limited number of congeneric groups that share similar structural, metabolic, and toxicological properties. For the safety evaluation, the Panel applies the constituent-based, stepwise procedure it developed in the early 2000s, which was then updated prior to the beginning of the reevaluation program (Cohen et al. 2018a, Smith et al. 2005a).

Evaluation of Natural Flavor Complexes Containing Allylalkoxybenzene Constituents

An important issue considered by the FEMA Expert Panel in the safety evaluation of NFCs is the assessment of the risk posed by a relatively small number of common plant metabolites, such as safrole, methyl eugenol, estragole, myristicin, and parsley apiole. All these have the allylalkoxybenzene structural motif that exhibits genotoxic and/or carcinogenic properties and thus raises safety concerns. These common secondary metabolites often function within plants to attract pollinators or provide a defense against pathogens and/or insect herbivores predators and are present in over 450 different plant species including culinary herbs and spices such as nutmeg, mace, basil, parsley, and tarragon (Tan and Nishida 2012).

While standard genotoxicity assays for allylalkoxybenzenes generally return negative results (Rietjens et al. 2014), incorporation of appropriate metabolic activating systems produce positive genotoxicity results (Herrmann et al. 2012, 2014, 2016). Evidence of carcinogenicity in the rodent liver has been reported for methyl eugenol, safrole, and estragole, and these compounds as well as those with a similar structural motif have been shown to undergo bioactivation to a reactive metabolite which may form DNA adducts (Miller et al. 1983, NTP 2000, Rietjens et al. 2014). Because the essential oils, oleoresins, and extracts derived from these plants unavoidably contain allylalkoxybenzene constituents, the FEMA Expert Panel carefully evaluated potential safety concerns and detailed exposure analyses, as described in a recent publication (Davidsen et al. 2023b).

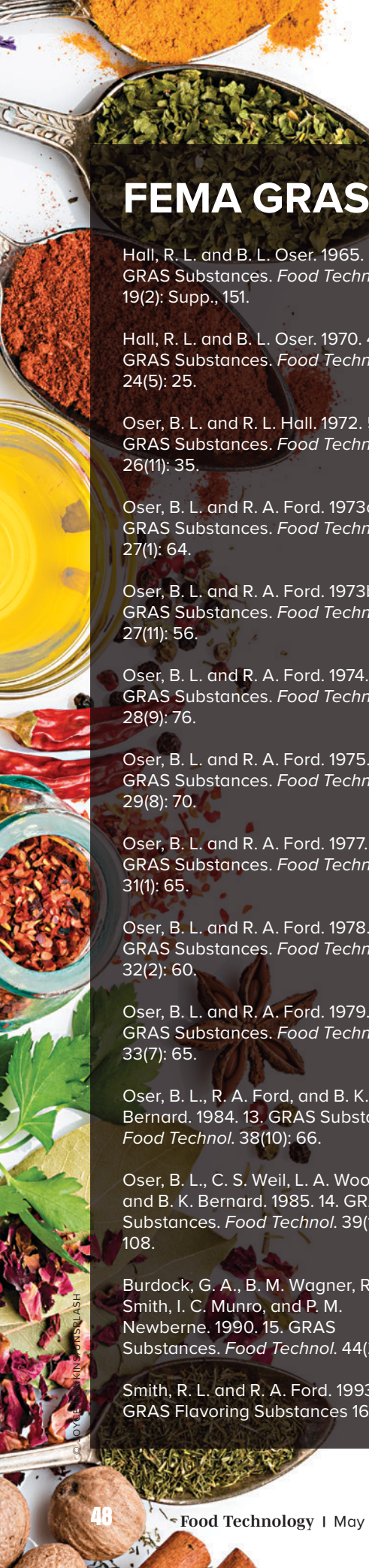
These FEMA GRAS NFCs reevaluated in Davidsen et al. included Basil Oil (FEMA 2119), Basil Oleoresin (FEMA 2120), Estragon Oil (FEMA 2412), Mace Oil (FEMA 2653), Mace Oleoresin (FEMA 2654), Nutmeg Oil (FEMA 2793), Nutmeg Oleoresin (FEMA 5028), Parsley Oil (FEMA 2836), Parsley Oleoresin (FEMA 2837), and Snakeroot Canadian Oil (FEMA 3023). As part of their safety evaluation, the estimated current intake of each allylalkoxybenzene constituent from the use of the NFC as a flavor ingredient was compared to the Threshold of Toxicological Concern (TTC) of 0.15 µg/person/day for potential DNA-reactive mutagens and/or carcinogens (Boobis et al. 2017, EFSA Scientific Committee et al. 2019, Kroes et al. 2004). For many of the NFCs evaluated, the estimated daily intake of the allylalkoxybenzene constituent present in the NFC was below 0.15 µg/person/day and therefore not considered to raise a safety concern. When the estimated daily intake was greater than the TTC, the Panel conducted a further evaluation, as described in GRAS 29 (Cohen et al. 2020), by comparing the estimated daily intake of the allylalkoxybenzene constituent from the NFC to the $BMDL_{10}$ values, defined as the lower confidence limit of the benchmark dose resulting in a 10% extra incidence in the number of animals developing liver adenomas and/or carcinomas compared to untreated animals.

For safrole, estragole, and methyl eugenol, rodent carcinogenicity studies were available. The adverse effects observed in the liver were analyzed using Benchmark Dose modeling with Bayesian model averaging using the U.S. Environmental Protection Agency BMDS software version 3.2 to determine the $BMDL_{10}$. For myristicin, elemicin, and parsley apiole, for which carcinogenicity data were not available for benchmark dose modeling, $BMDL_{10}$ values for these substances were estimated by read-across, using relative potency factors to methyl eugenol calculated by comparing *in vivo* and *in vitro* DNA adduct formation and/or physiologically based kinetic modeling studies of myristicin, elemicin, parsley apiole to methyl eugenol (Davidsen et al. 2023b). The FEMA Expert Panel used an MOE (margin of exposure) value of 10,000 to determine if consumption of the allylalkoxybenzene constituent from the use of the NFC raised a safety concern; this threshold for evaluating a risk by the MOE approach is similar to the value used by other scientific and regulatory bodies (EFSA 2005, EFSA Scientific Committee 2012, Health Canada 2021, JECFA 2005, JECFA 2016).

With the exception of Estragon Oil (FEMA 2412), for all the NFCs evaluated within Davidsen et al., the MOEs for the estimated intake of the respective

Basis for Safety Evaluation Decisions for GRAS 31

Key findings of the FEMA Expert Panel GRAS determinations, including identity statements for natural flavoring complexes, are available on femaflavor.org.



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Smith, R. L., J. Doull, V. J. Feron, J. I. Goodman, I. C. Munro, P. M. Newberne, P. S. Portoghese, W. J. Waddell, B. M. Wagner, T. B. Adams, and M. M. McGowen. 2001. GRAS Flavoring Substances 20. *Food Technol.* 55(12): 34.

Smith, R. L., S. M. Cohen, J. Doull, V. J. Feron, J. I. Goodman, L. J. Marnett, P. S. Portoghese, W. J. Waddell, B. M. Wagner, and T. B. Adams. 2003. GRAS Flavoring Substances 21. *Food Technol.* 57(5): 46.

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allylalkoxybenzenes exceeded 10,000, resulting in the Panel's conclusion that these estimated intakes of the allylalkoxybenzene constituents from the consumption of these NFCs as flavor ingredients do not present a safety concern (Davidsen et al. 2023b, EFSA 2005). The FEMA Expert Panel therefore reaffirmed their FEMA GRAS status. Because the MOE for the estimated intake of estragole from the consumption of Estragon Oil (FEMA 2412) was less than 10,000, the Panel required a refined estimate of intake based on the pattern of use. In response, industry-sponsored probabilistic modeling studies were conducted using a previously published approach (McNamara et al. 2003) and data from the U.S. National Health and Nutrition Examination Survey (NHANES). As the MOE calculations for estragole intake based on the mean and 90th percentile estimated intakes of Estragon Oil (FEMA 2412) from these refined estimates of intake were greater than 10,000, the FEMA Expert Panel also reaffirmed the GRAS status of Estragon Oil. Finally, the conditions of intended use for Basil Oil (FEMA 2119), Basil Oleoresin (FEMA 2120), Estragon Oil (FEMA 2412), Mace Oil (FEMA 2653), Mace Oleoresin (FEMA 2654), Nutmeg Oil (FEMA 2793), Parsley Oil (FEMA 2836), Parsley Oleoresin (FEMA 2837), and Snakeroot Canadian Oil (FEMA 3023) were revised to ensure consistency with the intake estimates used by the FEMA Expert Panel in their safety evaluations and are reported in Table 3.

Impact of Microwave-Assisted Extraction on Composition of Flavorings

Microwave-assisted extraction is a process in which microwave energy is utilized to heat a vessel containing a mixture of solvent and a sample, such as botanical materials. As the solvent is heated, compounds from the botanical material are extracted into the solvent (Ahmad et al. 2021, Destandau et al. 2013). Due to localized heating of the botanical sample and subsequent release of target compounds into the solvent, this technique is considered by many in the industry to be a more efficient extraction process when compared to conventional methods that involve maceration and/or conductive heating (Ahmad et al. 2021, Destandau et al. 2013). Additional benefits include reduced solvent and energy usage, lower production costs, and the ability to adjust extraction conditions and the production process to preserve the integrity of botanical constituents (Ahmad et al. 2021, Belwal et al. 2018, Destandau et al. 2013, de Castro and Castillo-Peinado 2016).

Extraction of natural products from botanical materials using microwave energy assistance dates to the mid-1990s (Destandau et al. 2013). Ongoing research aims to enhance extraction efficiency and quality (Mandel and Tandey 2016, de Castro and Castillo-Peinado 2016, Belwal et al. 2018, Kala et al. 2016), and current efforts focus on:

- further reducing solvent use or adopting solvent-free methods;
- assessing the impacts of variables that could improve extraction results (such as the type of solvent used, the extraction time and microwave power, the vessel environment, and pre- and post-treatment of the botanical sample);
- removing undesirable compounds from the botanical sample;
- comparing products obtained from microwave-assisted extraction with those from traditional extraction methods;
- efficiently scaling up from the lab to an industrial setting, including studying the heat and mass transfer kinetics to optimize extraction;
- assessing climate and other environmental impacts.

In Memoriam

The Expert Panel notes with sadness the passing of a former FEMA Expert Panel member, Dr. Bernard M. Wagner on July 21, 2015.

Dr. Wagner was a medical doctor at Hahnemann Medical College (now the Drexel University College of Medicine), a professor at Columbia University, and a Director of Laboratories at Overlook Hospital. He was a pathologist at the Walter Reed Army Hospital and Mount Sinai Hospital in New York. Dr. Wagner was past president of the International Academy of Pathology, founder and editor-in-chief of *Human Pathology* and *Modern Pathology*, served as a member of several editorial boards, and was a Fellow of the Royal College of Pathology. He was a diplomat of the American Board of Pathologists and was the chairman of the Committee of Pathology of the American College of Toxicology. Dr. Wagner retired from the FEMA Expert Panel in 2003 after serving for 20 years as a Panel member.

Companies within the flavor industry are currently exploring the value of this technique to create botanical extracts that may be more faithful to the flavor and taste of the source botanical.

The FEMA Expert Panel has considered examples of microwave-assisted production processes and the related extraction products and concluded that it does not have concerns regarding the use of this technology for flavoring production. The Expert Panel noted that the use of microwave-assisted extraction may in some instances result in changes in the composition of the resulting extracts compared to extracts from more traditional methods (which may already have uses considered to be FEMA GRAS). The Expert Panel relies on a congeneric grouping approach for its safety evaluation of NFCs (Cohen et al. 2018a). It advises companies to consider whether microwave-assisted extraction could result in significant changes in the relative percentages of congeneric groups present in the extract compared to those initially evaluated for FEMA GRAS status (which were produced using more traditional methods). When congeneric group changes are likely to be substantial, companies should consider these as significant manufacturing changes that could require evaluation by the FEMA Expert Panel. Companies are encouraged to consult with the Panel's Scientific Secretary.

Correction and Erratum to Previous GRAS Publications

Primary Name of FEMA 4711. The primary name of FEMA 4711, Luo Han Fruit Concentrate, has been corrected to Luo Han Fruit Extract.

Change in GRAS Status of estragole

The FEMA GRAS status of estragole (CAS 140-670-0, formerly FEMA No. 2411) under its conditions of intended use as a flavor ingredient was reviewed by the FEMA Expert Panel. The FEMA Expert Panel concluded

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that additional data were needed to support the continuation of its GRAS status, including data from studies that further probe the relevance of recently reported DNA adduct formation in *in vitro* studies conducted in human cell lines and their possible accumulation. Until such data are available for review by the Expert Panel, the flavor ingredient estragole, added as such, has been removed from the FEMA GRAS list.

Change in GRAS Status of 3-acetyl-2,5-dimethylfuran

The FEMA GRAS status of 3-acetyl-2,5-dimethylfuran (CAS 10599-70-9; formerly FEMA 3391) under conditions of intended use as a flavor ingredient was reviewed. The Panel concluded that additional data are required. Such data would include comprehensive metabolism and toxicity data as well as data that would support an in-depth evaluation of the mechanism of action for potential effects observed in toxicity and genotoxicity studies. Until such data are available and reviewed, the flavor ingredient 3-acetyl-2,5-dimethylfuran has been removed from the FEMA GRAS list. ft

Ivonne M. C. M. Rietjens, PhD, FEMA Expert Panel Chair, is Full Professor in Toxicology at the Division of Toxicology, Wageningen University, The Netherlands. **Samuel M. Cohen**, MD, PhD, is Havlik-Wall Professor of Oncology in the Dept. of Pathology, Microbiology and Immunology and the Buffett Cancer Center, University of Nebraska Medical Center. **Gerhard Eisenbrand**, PhD, is retired Professor from the University of Kaiserslautern, Dept. of Chemistry, Division of Food Chemistry and Toxicology, Germany. **Shoji Fukushima**, MD, PhD, is Research Advisor of the Japan Bioassay Research Center, Japan. **Nigel J. Gooderham**, PhD, Vice-Chair of the FEMA Expert Panel, is Emeritus Professor of Molecular Toxicology in the Dept. of Metabolism, Digestion and Reproduction and the Former Assistant Provost of Imperial College London, England. **F. Peter Guengerich**, PhD, is Professor and Tadashi Inagami Chair in Biochemistry, Vanderbilt University School of Medicine. **Stephen S. Hecht**, PhD, is the Wallin Land Grant Professor of Cancer Prevention, Masonic Cancer Center, and Dept. of Laboratory Medicine and Pathology, University of Minnesota. **Thomas J. Rosol**, DVM, PhD, MBA, is Professor of Veterinary and Toxicological Pathology in the Dept. of Biomedical Sciences, Heritage College of Osteopathic Medicine, The Ohio State University. **Jeanne M. Davidsen**, PhD, is with FEMA. **Christie L. Harman**, MPH, is the Senior Science and Policy Advisor to the FEMA Expert Panel. **Danarubini Ramanan** is with FEMA. **Sean V. Taylor**, PhD, is the Scientific Secretary to the FEMA Expert Panel.

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Table 1 - **Primary Names & Synonyms**
Primary names (in boldface) & synonyms (in lightface)

FEMA NO.	SUBSTANCE PRIMARY NAME AND SYNONYMS
4981	**8-Methyl-4-methylenenon-7-en-2-one** 8-Methyl-4-methylene-7-nonen-2-one
4982	**4-(4-Methylpent-3-en-1-yl)-5,6-dihydro-2*H*-pyran-2-one**
4983	**4-Mercapto-1-octanol**
4984	**2,11-Tetradecadienal** 2,11-Tetradecadien-1-al
4985	**4,9-Dodecadienal** 4,9-Dodecadien-1-al
4986	**Hyaluronic acid, sodium salt** Polymeric structure of sodium salt of (2*S*,3*S*,4*R*,5*R*,6*R*)-3-[(2*S*,3*R*,5*S*,6*R*)-3-acetamido-5-hydroxy-6-(hydroxymethyl)oxan-2-yl]oxy-4,5,6-trihydroxyoxane-2-carboxylate Poly[(1→3)-2-acetamido-2-deoxy-ß-d-glucose-(1→4)-ß-d-glucopyranosyluronic acid] sodium salt Hyaluronan sodium Sodium hyaluronate
4987	***Shorea stenoptera* seed butter** Illipe butter Borneo tallow
4988	**Nootkatone 50%**
4989	**Cocoa bean shell extract** Cocoa hull extract *Theobroma cacao* bean shell extract
4990	**Sichuan pepper extract (*Zanthoxylum armatum*)** Timur pepper extract *Zanthoxylum alatum* extract
4991	***Persea americana* oil hydrolyzed fraction**
4992	**Rubusosides enriched Glucosylated Steviol Glycosides**
4993	**Methyl 3-methyl-2-buten-1-yl disulfide** Methyl prenyl disulfide
4994	**Gallic acid** 3,4,5-Trihydroxybenzoic acid
4995	**Rebaudioside N 95%**
4996	**(2*S*)-7-(*beta*-D-Glucopyranosyloxy)-2,3-dihydro-5-hydroxy-2-(4-hydroxy-3-methoxyphenyl)-4*H*-1-benzopyran-4-one** Homoeriodictyol 7-O-glucoside
4997	**2-[4-(D-Glucopyranosyloxy)-3-hydroxyphenyl]-2,3-dihydro-5,7-dihydroxy-4*H*-1-benzopyran-4-one**
4998	**(2*S*)-2-(3,4-Dihydroxyphenyl)-8-*beta*-D-glucopyranosyl-2,3-dihydro-5,7-dihydroxy-4*H*-1-benzopyran-4-one** Eriodictyol-8-C-glucoside Eriodictyol-8-glucoside
4999	***Adenophora stenanthina* root extract**
5000	**Prepared Mixture of Chloride Salts of Potassium, Magnesium and Calcium**
5001	**Oak chips extract (*Quercus robur*)** English oak chips extract
5002	**(*E*)-3-(1,3-Benzodioxol-5-yl)-*N*-phenyl-*N*-tetrahydrofuran-3-yl-prop-2-enamide** (2*E*)-3-(1,3-Benzodioxol-5-yl)-*N*-phenyl-*N*-(tetrahydro-3-furanyl)-2-propenamide (2*E*)-3-(2*H*-1,3-benzodioxol-5-yl)-*N*-(oxolan-3-yl)-*N*-phenylprop-2-enamide
5003	**2,6-Octadienal** 2,6-Octadien-1-al Octa-2,6-dienal
5004	**2-Methyloctan-4-olide** 5-Butyl-3-methyloxolan-2-one
5005	**3-Hydroxyhexanoic acid**
5006	**3-Methyl-3-butene-1-thiol** 3-Methylbut-3-ene-1-thiol
5007	**Myoglobin**
5008	**Finger Lime distillate** Finger Lime extract *Microcitrus australasica* (F. Muell.) Swingle extract *Microcitrus australasica* (F. Muell.) Swingle distillate *Citrus australasica* F. Muell. extract *Citrus australasica* F. Muell. distillate
5009	**Steviol glycoside extract, *Stevia rebaudiana*, Rebaudioside A 40%**
5010	**Thaumatin II** Thaumatin 2
5011	**Heat-treated Glucosylated Steviol Glycosides 45% with Steviol Glycosides 20%**
5012	**Ethyl 5-acetoxyoctadecanoate** Ethyl 5-acetyloxyoctadecanoate
5013	**Prepared Mixture of Potassium Chloride, Magnesium Sulfate and Calcium Lactate**
5014	**Modified Patchouli oil** Oxidized Patchouli oil

FEMA NO.	SUBSTANCE PRIMARY NAME AND SYNONYMS
5015	**Heat-treated Glucosylated Steviol Glycosides 20% with Steviol Glycosides 8%**
5016	**Heat-treated Glucosylated Steviol Glycosides 40% with Steviol Glycosides 15%**
5017	**Celtuce distillate** *Lactuca sativa* var. *augustana* distillate Chinese lettuce distillate Stem lettuce distillate Asparagus lettuce distillate Celery lettuce distillate Wosun distillate Woju distillate
5018	**3,4-Dihydro-7-hydroxy-4-(4-hydroxy-3-methoxyphenyl)-2*H*-1-benzopyran-2-one** *alpha*-Ferulic coumarin
5019	**3,4-Dihydro-7-hydroxy-4-(4-hydroxy-3-methoxyphenyl)-6-methyl-2*H*-1-benzopyran-2-one** *beta*-Ferulic coumarin
5020	**4-(3,4-Dihydroxyphenyl)-3,4-dihydro-7-hydroxy-5-methyl-2*H*-1-benzopyran-2-one** *gamma*-Caffeic coumarin
5021	***S*-(3-Methylbut-3-en-1-yl) 4-(formyloxy)butanethioate** 4-[(3-Methylbut-3-en-1-yl)sulfanyl]-4-oxobutyl formate
5022	***S*-Butan-2-yl 4-(formyloxy)butanethioate** 4-[(Butan-2-yl)sulfanyl]-4-oxobutyl formate
5023	**Reactive distillation product of threonine and coconut oil**
5024	**Camu Camu distillate** Camu Camu extract *Myrciaria dubia* distillate *Myrciaria dubia* extract
5025	**Enzymatically modified *Stevia rebaudiana* extract enriched with Rebaudiosides AM, M and N2**
5026	***Eucommia ulmoides* leaf extract**
5027	**Fennel oleoresin (*Foeniculum vulgare* Miller)**
5028	**Nutmeg oleoresin (*Myristica fragrans* Houtt.)**
5029	***Corynebacterium casei* fermentation product**

Table 2 - **Average Usual Use Levels/Average Maximum Use Levels**
Average Usual Use Levels (ppm)/Average Maximum Use Levels (ppm) for new FEMA GRAS Flavoring Substances on which the FEMA Expert Panel based its judgments that the substances are generally recognized as safe (GRAS).

	8-Methyl-4-methylenenon-7-en-2-one	4-(4-Methylpent-3-en-1-yl)-5,6-dihydro-2*H*-pyran-2-one	4-Mercapto-1-octanol	2,11-Tetradecadienal	4,9-Dodecadienal	Hyaluronic acid, sodium salt	*Shorea stenoptera* seed butter	Nootkatone 50%
Category/FEMA No.	**4981**	**4982**	**4983**	**4984**	**4985**	**4986**	**4987**	**4988**
Baked Goods	0.2/1	0.05/0.5		5/50	5/50	500/500	1,000/5,000	2/20
Beverages Type I, Non-Alcoholic	1/5	0.01/0.1	0.1/1	2/20	2/20	100/500		5/10
Beverages Type II, Alcoholic	5/25	0.05/0.5	0.1/1	2/20	2/20	150/500		7/20
Breakfast Cereals		0.05/0.5		5/50	5/50	200/500		2/20
Cheeses	0.1/0.5	0.01/0.1		1/10	1/10		1,000/5,000	0.5/5
Chewing Gum	1/5	0.01/0.1	1/10	10/100	10/100			10/40
Condiments and Relishes	0.5/2.5		1/10	2/20	2/20			0.5/5
Confections and Frostings			1/10	2/20	2/20			2/20
Egg Products		0.01/0.1		1/10	1/10		1,000/5,000	0.5/5
Fats and Oils		0.01/0.1		5/50	5/50	200/500	1,000/5,000	
Fish Products		0.01/0.1					1,000/5,000	
Frozen Dairy	0.1/0.5	0.01/0.1	1/10	2/20	2/20	200/500		2/20
Fruit Ices		0.01/0.1	1/10	2/20	2/20			2/20
Gelatins and Puddings		0.01/0.1	1/10	2/20	2/20			1/20
Granulated Sugar				5/50	5/50			
Gravies	0.1/1		0.1/1	2/20	2/20		1,000/5,000	0.5/10
Hard Candy	0.5/2.5	0.01/0.1	1/10	5/50	5/50			10/20
Imitation Dairy Products		0.01/0.1		2/20	2/20	200/500	1,000/5,000	1/10
Instant Coffee and Tea		0.05/0.5	1/10	5/50	5/50	100/500		2/10
Jams and Jellies		0.01/0.1	1/10	2/20	2/20			2/20
Meat Products	0.1/0.5	0.01/0.1	1/10	1/10	1/10	200/500	1,000/5,000	0.5/10
Milk Products		0.05/0.5	1/10	2/20	2/20	200/500	1,000/5,000	1/20
Nut Products		0.01/0.1	1/10	2/20	2/20			
Other Grains		0.01/0.1	0.1/1	2/20	2/20			
Poultry Products			0.1/1				1,000/5,000	0.5/5
Processed Fruits		0.01/0.1	0.1/1	1/10	1/10			5/10
Processed Vegetables			0.1/1					0.5/5
Reconstituted Vegetable Protein				2/20	2/20		1,000/5,000	0.5/5
Seasonings and Flavors		0.5/5	0.1/1	10/100	10/100	200/500	5,000/10,000	
Snack Foods		0.05/0.5	0.1/1	2/20	2/20	200/500	1,000/10,000	1/20
Soft Candy	0.5/2.5	0.01/0.1	1/10	2/20	2/20			5/20
Soups		0.01/0.1	0.1/1	2/20	2/20	200/500		0.5/5
Sugar Substitutes		0.01/0.1		5/50	5/50			
Sweet Sauces		0.01/0.1		2/20	2/20			1/20

	Cocoa bean shell extract	Sichuan pepper extract (*Zanthoxylum armatum*)	*Persea americana* oil hydrolyzed fraction	Rubusosides enriched Glucosylated Steviol Glycosides	Methyl 3-methyl-2-buten-1-yl disulfide	Gallic acid	Rebaudioside N 95%	(2S)-7-(*beta*-D-Glucopyranosyloxy)-2,3-dihydro-5-hydroxy-2-(4-hydroxy-3-methoxyphenyl)-4*H*-1-benzopyran-4-one
Category/FEMA No.	**4989**	**4990**	**4991**	**4992**	**4993**	**4994**	**4995**	**4996**
Baked Goods	50/100	25/60	3/15	50/170	0.05/0.5	250/640	15/30	20/80
Beverages Type I, Non-Alcoholic	10/50	10/25		50/170	0.01/0.1		15/30	20/80
Beverages Type II, Alcoholic	20/50	15/40		50/170	0.01/0.1		15/30	20/80
Breakfast Cereals	50/100	25/60	3/15	50/170	0.05/0.5	200/400	15/30	20/80
Cheeses		40/80	3/15	50/170	0.01/0.1	200/400		
Chewing Gum		20/50		50/170			30/30	20/80
Condiments and Relishes		40/80	5/15	50/170	0.05/0.5	80/280	15/30	20/80
Confections and Frostings	50/100	25/60		50/170	0.01/0.1	100/250	15/30	20/80
Egg Products		30/60		50/170	0.01/0.1			
Fats and Oils		25/60		50/170	0.01/0.1	70/300		
Fish Products		25/60	3/15	50/170	0.01/0.1	100/400		
Frozen Dairy	10/50	30/60	3/15	50/170	0.01/0.1		15/30	20/80
Fruit Ices		15/30		50/170	0.01/0.1		15/30	20/80
Gelatins and Puddings	10/100	30/60		50/170			15/30	20/80
Granulated Sugar								
Gravies	10/50	30/60	3/15	50/170	0.05/0.5		15/30	
Hard Candy	10/50	25/60		50/170	0.01/0.1		15/30	20/80
Imitation Dairy Products	10/50	15/30	3/15	50/170	0.01/0.1	150/400	15/30	20/80
Instant Coffee and Tea	10/50	15/30		50/170	0.05/0.5		15/30	20/80
Jams and Jellies		10/50		50/170	0.01/0.1		15/30	20/80
Meat Products		25/80	3/15	50/170	0.01/0.1	150/280		
Milk Products	10/50	15/40	3/15	50/170	0.05/0.5		15/30	20/80
Nut Products	10/50	30/60	3/15	50/170	0.01/0.1	200/720	15/30	20/80
Other Grains		30/60	3/15	50/170	0.01/0.1	200/400	15/30	20/80
Poultry Products		30/80	3/15	50/170	0.05/0.5	200/280		
Processed Fruits		10/30		50/170	0.01/0.1		15/30	20/80
Processed Vegetables		15/30	3/15	50/170	0.05/0.5			
Reconstituted Vegetable Protein	10/100	15/30	5/25	50/170				
Seasonings and Flavors	10/100	40/80	5/25	50/170	0.5/5		15/30	20/80
Snack Foods	10/50	40/80	3/15	50/170	0.05/0.5	240/500	15/30	20/80
Soft Candy	10/50	15/30		50/170	0.01/0.1	70/200	15/30	20/80
Soups		20/60	3/15	50/170	0.01/0.1		15/30	20/80
Sugar Substitutes								
Sweet Sauces	10/50	20/60		50/170	0.01/0.1	80/280	15/30	20/80

Table 2 CONTINUED - **Average Usual Use Levels/Average Maximum Use Levels**
Average Usual Use Levels (ppm)/Average Maximum Use Levels (ppm) for new FEMA GRAS Flavoring Substances on which the FEMA Expert Panel based its judgments that the substances are generally recognized as safe (GRAS).

	2-[4-(D-Glucopyranosyloxy)-3-hydroxyphenyl]-2,3-dihydro-5,7-dihydroxy-4*H*-1-benzopyran-4-one	(2*S*)-2-(3,4-Dihydroxyphenyl)-8-*beta*-D-glucopyranosyl-2,3-dihydro-5,7-dihydroxy-4*H*-1-benzopyran-4-one	*Adenophora stenanthina* root extract	Prepared Mixture of Chloride Salts of Potassium, Magnesium and Calcium	Oak chips extract (*Quercus robur*)	(*E*)-3-(1,3-Benzodioxol-5-yl)-*N*-phenyl-*N*-tetrahydrofuran-3-yl-prop-2-enamide	2,6-Octadienal	2-Methyloctan-4-olide
CATEGORY/FEMA NO.	**4997**	**4998**	**4999**	**5000**	**5001**	**5002**	**5003**	**5004**
BAKED GOODS	20/80	30/80	50/150		10/50		0.02/0.2	
BEVERAGES TYPE I, NON-ALCOHOLIC	20/80	30/80	50/150	1,424/1,424	10/250	0.1/2	0.005/0.5	0.001/0.1
BEVERAGES TYPE II, ALCOHOLIC	20/80	30/80	50/150	1,424/1,424	10/250	0.2/5	0.005/0.5	0.001/0.1
BREAKFAST CEREALS	20/80	30/80			1/10		0.02/0.2	
CHEESES			50/150				0.05/0.5	
CHEWING GUM	20/80	30/80				300/1,000	0.05/0.5	
CONDIMENTS AND RELISHES	20/80	30/80	50/100		10/50		0.05/0.5	
CONFECTIONS AND FROSTINGS	20/80	30/80					0.05/0.5	
EGG PRODUCTS			50/200				0.02/0.2	
FATS AND OILS							0.1/1	
FISH PRODUCTS							0.1/1	
FROZEN DAIRY	20/80	30/80			10/50	1.5/5	0.05/0.5	0.001/0.1
FRUIT ICES	20/80	30/80		1,424/1,424			0.05/0.5	
GELATINS AND PUDDINGS	20/80	30/80					0.05/0.5	
GRANULATED SUGAR							0.1/1	
GRAVIES			50/150	1,424/1,424	10/20		0.1/1	
HARD CANDY	20/80	30/80			10/50	20/200	0.1/1	
IMITATION DAIRY PRODUCTS	20/80	30/80	100/200		10/50		0.05/0.5	0.001/0.1
INSTANT COFFEE AND TEA	20/80	30/80	100/200		10/50		0.05/0.5	0.001/0.1
JAMS AND JELLIES	20/80	30/80		1,424/1,424			0.05/0.5	
MEAT PRODUCTS					10/50		0.05/0.5	
MILK PRODUCTS	20/80	30/80	100/200		10/50	1.5/5	0.02/0.2	0.1/1
NUT PRODUCTS	20/80	30/80	100/200		10/50		0.1/1	0.1/1
OTHER GRAINS	20/80	30/80	100/200		10/50		0.1/1	
POULTRY PRODUCTS							0.5/5	
PROCESSED FRUITS	20/80	30/80						
PROCESSED VEGETABLES			50/250		10/150		0.05/0.5	
RECONSTITUTED VEGETABLE PROTEIN			50/500		10/150		0.1/1	
SEASONINGS AND FLAVORS	20/80	30/80	50/150		50/250		1/10	0.1/1
SNACK FOODS	20/80	30/80	50/150				0.1/1	0.1/1
SOFT CANDY	20/80	30/80				10/150	0.01/0.1	
SOUPS	20/80	30/80	50/150				0.1/1	0.001/0.1
SUGAR SUBSTITUTES				1,424/1,424			0.01/0.1	
SWEET SAUCES	20/80	30/80		1,424/1,424	10/50		0.05/0.5	

	3-Hydroxyhexanoic acid	3-Methyl-3-butene-1-thiol	Myoglobin	Finger Lime distillate	Steviol glycoside extract, *Stevia rebaudiana*, Rebaudioside A 40%	Thaumatin II	Heat-treated Glucosylated Steviol Glycosides 45% with Steviol Glycosides 20%	Ethyl 5-acetoxyoctadecanoate
Category/FEMA No.	**5005**	**5006**	**5007**	**5008**	**5009**	**5010**	**5011**	**5012**
Baked Goods	0.15/1	0.1/1		200/1,000	250/250	7/7	50/200	0.5/50
Beverages Type I, Non-Alcoholic	0.05/0.3	0.01/0.1		100/1,000	40/40	7/7	50/200	0.05/10
Beverages Type II, Alcoholic	0.05/0.3	0.01/0.1		200/1,000	40/40	7/7	50/200	0.1/10
Breakfast Cereals	0.15/1	0.1/1		200/1,000	175/175	7/7	50/200	0.05/50
Cheeses	0.05/0.5	0.05/0.5			40/40	7/7	50/200	0.1/10
Chewing Gum	0.15/1			100/1,000	40/40		50/200	0.5/50
Condiments and Relishes	0.1/0.5	0.1/1			40/40	7/7	50/200	0.1/50
Confections and Frostings	0.1/0.5	0.01/0.1		200/1,000	40/40	7/7	50/200	0.1/50
Egg Products					40/40	7/7	50/200	0.05/50
Fats and Oils	0.05/0.3			200/1,000	40/40	7/7	50/200	0.05/50
Fish Products				200/1,000	40/40	7/7	50/200	
Frozen Dairy	0.05/0.3	0.01/0.1		100/500	40/40	7/7	50/200	0.05/50
Fruit Ices	0.05/0.3			100/500	40/40	7/7	50/200	0.1/10
Gelatins and Puddings	0.05/0.3	0.02/0.2		100/500	40/40	7/7	50/200	0.1/10
Granulated Sugar								0.01/1
Gravies	0.15/1	0.1/1			40/40	7/7	50/200	0.1/50
Hard Candy	0.05/0.3	0.1/1		160/800	40/40	7/7	50/200	0.5/50
Imitation Dairy Products	0.05/0.3			100/500	40/40	7/7	50/200	0.05/50
Instant Coffee and Tea	0.05/0.3	0.1/1		60/300	40/40	7/7	50/200	0.05/10
Jams and Jellies	0.05/0.3	0.1/1		160/800	40/40	7/7	50/200	0.1/10
Meat Products	0.05/0.3	0.1/1	20,000/40,000		40/40	7/7	50/200	0.1/50
Milk Products	0.05/0.3	0.1/1			100/100	7/7	50/200	0.05/50
Nut Products		0.1/1		200/1,000	40/40	7/7	50/200	0.05/50
Other Grains		0.01/0.1		200/1,000	40/40	7/7	50/200	0.05/50
Poultry Products	0.05/0.3	0.1/1			40/40	7/7	50/200	0.05/50
Processed Fruits	0.05/0.3	0.01/0.1		40/200	40/40	7/7	50/200	0.05/50
Processed Vegetables				80/400	40/40	7/7	50/200	0.01/1
Reconstituted Vegetable Protein			20,000/40,000	80/400	40/40	7/7	50/200	0.05/50
Seasonings and Flavors	0.15/1	0.1/1		100/500	40/40	7/7	50/200	0.05/50
Snack Foods	0.1/0.5	0.1/1		160/800	40/40	7/7	50/200	0.1/50
Soft Candy	0.1/0.5	0.1/1		160/800	40/40	7/7	50/200	0.5/50
Soups	0.1/0.5	0.1/1		200/1,000	40/40	7/7	50/200	0.05/50
Sugar Substitutes				160/800				0.01/1
Sweet Sauces	0.05/0.3			60/300	40/40	7/7	50/200	0.1/10

Table 2 CONTINUED - **Average Usual Use Levels/Average Maximum Use Levels**
Average Usual Use Levels (ppm)/Average Maximum Use Levels (ppm) for new FEMA GRAS Flavoring Substances on which the FEMA Expert Panel based its judgments that the substances are generally recognized as safe (GRAS).

	Prepared Mixture of Potassium Chloride, Magnesium Sulfate and Calcium Lactate	Modified Patchouli oil	Heat-treated Glucosylated Steviol Glycosides 20% with Steviol Glycosides 8%	Heat-treated Glucosylated Steviol Glycosides 40% with Steviol Glycosides 15%	Celtuce distillate	3,4-Dihydro-7-hydroxy-4-(4-hydroxy-3-methoxyphenyl)-2*H*-1-benzopyran-2-one	3,4-Dihydro-7-hydroxy-4-(4-hydroxy-3-methoxyphenyl)-6-methyl-2*H*-1-benzopyran-2-one	4-(3,4-Dihydroxyphenyl)-3,4-dihydro-7-hydroxy-5-methyl-2*H*-1-benzopyran-2-one
CATEGORY/FEMA NO.	**5013**	**5014**	**5015**	**5016**	**5017**	**5018**	**5019**	**5020**
BAKED GOODS		0.2/2	50/400	50/200	500/1,000	30/60	20/50	30/60
BEVERAGES TYPE I, NON-ALCOHOLIC	2,037/2,037	0.05/1	50/400	50/200	100/500	30/60	20/50	30/60
BEVERAGES TYPE II, ALCOHOLIC	2,037/2,037	0.1/5	50/400	50/200	100/500	30/60	20/50	30/60
BREAKFAST CEREALS		0.2/5	50/400	50/200	1,500/4,000	30/60	20/50	30/60
CHEESES			50/400	50/200	100/500			
CHEWING GUM		1/5	50/400	50/200		30/60	20/50	30/60
CONDIMENTS AND RELISHES		0.2/5	50/400	50/200		30/60	20/50	30/60
CONFECTIONS AND FROSTINGS		0.5/5	50/400	50/200	250/1,000	30/60	20/50	30/60
EGG PRODUCTS			50/400	50/200				
FATS AND OILS		0.5/5	50/400	50/200				
FISH PRODUCTS		0.2/2	50/400	50/200				
FROZEN DAIRY		0.2/2	50/400	50/200	100/500	30/60	20/50	30/60
FRUIT ICES	2,037/2,037	0.2/2	50/400	50/200		30/60	20/50	30/60
GELATINS AND PUDDINGS		0.2/2	50/400	50/200	500/1,000	30/60	20/50	30/60
GRANULATED SUGAR								
GRAVIES	2,037/2,037	0.2/5	50/400	50/200	500/1,000	30/60	20/50	30/60
HARD CANDY		0.5/5	50/400	50/200	250/1,000	30/60	20/50	30/60
IMITATION DAIRY PRODUCTS		0.2/2	50/400	50/200		30/60	20/50	30/60
INSTANT COFFEE AND TEA		0.1/2	50/400	50/200		30/60	20/50	30/60
JAMS AND JELLIES	2,037/2,037	0.2/2	50/400	50/200	250/1,000	30/60	20/50	30/60
MEAT PRODUCTS		0.2/2	50/400	50/200	1,000/2,500			
MILK PRODUCTS		0.1/2	50/400	50/200	100/500	30/60	20/50	30/60
NUT PRODUCTS		0.2/5	50/400	50/200	500/1,000	30/60	20/50	30/60
OTHER GRAINS			50/400	50/200	1,500/4,000	30/60	20/50	30/60
POULTRY PRODUCTS		0.2/2	50/400	50/200	1,000/2,500			
PROCESSED FRUITS		0.1/1	50/400	50/200		30/60	20/50	30/60
PROCESSED VEGETABLES		0.1/1	50/400	50/200	100/500			
RECONSTITUTED VEGETABLE PROTEIN		0.1/1	50/400	50/200	1,000/2,500			
SEASONINGS AND FLAVORS		5/100	50/400	50/200	1,000/3,000	30/60	20/50	30/60
SNACK FOODS		0.2/5	50/400	50/200	1,000/2,500	30/60	20/50	30/60
SOFT CANDY		0.5/5	50/400	50/200	250/1,000	30/60	20/50	30/60
SOUPS		0.2/2	50/400	50/200	1,000/2,500	30/60	20/50	30/60
SUGAR SUBSTITUTES	2,037/2,037							
SWEET SAUCES	2,037/2,037	0.2/2	50/400	50/200	500/1,000	30/60	20/50	30/60

	S-(3-Methylbut-3-en-1-yl) 4-(formyloxy)butanethioate	*S*-Butan-2-yl 4-(formyloxy) butanethioate	Reactive distillation product of threonine and coconut oil	Camu Camu distillate	Enzymatically modified *Stevia rebaudiana* extract enriched with Rebaudiosides AM, M and N2	*Eucommia ulmoides* leaf extract	Fennel oleoresin (*Foeniculum vulgare* Miller)	Nutmeg oleoresin (*Myristica fragrans* Houtt.)	*Corynebacterium casei* fermentation product
Category/FEMA No.	**5021**	**5022**	**5023**	**5024**	**5025**	**5026**	**5027**	**5028**	**5029**
Baked Goods	0.1/2	0.1/2	0.1/1	1,000/10,000	175/175	80/500	65/100	39/45	
Beverages Type I, Non-Alcoholic	0.01/0.2	0.01/0.2	0.05/0.5	500/10,000	45/45	30/300	45/60	7/7	
Beverages Type II, Alcoholic	0.01/0.2	0.01/0.2	0.05/0.5	1,000/10,000	45/45	50/500	200/230	75/75	
Breakfast Cereals	0.1/2	0.1/2	0.1/1	1,000/10,000	240/240	50/500			
Cheeses	0.05/1	0.05/1	0.05/0.5		45/45				2,000/4,500
Chewing Gum	0.1/2	0.1/2		500/10,000	45/45	120/500	5/10		
Condiments and Relishes	0.1/2	0.1/2	0.1/1		45/45	20/200	100/200	75/75	4,000/10,000
Confections and Frostings	0.01/0.2	0.01/0.2	0.1/1	1,000/10,000	45/45	50/500			
Egg Products	0.1/2	0.1/2			45/45				2,000/4,500
Fats and Oils	0.1/2	0.1/2	0.1/1	1,000/10,000	45/45	50/500			
Fish Products	0.1/2	0.1/2			45/45				2,000/4,500
Frozen Dairy	0.01/0.2	0.01/0.2	0.1/1	500/5,000	45/45	50/300	120/140	18/18	
Fruit Ices	0.01/0.2	0.01/0.2		500/5,000	45/45	50/500			
Gelatins and Puddings	0.02/0.4	0.02/0.4	0.05/0.5	500/5,000	45/45	100/500	100/120	11/11	
Granulated Sugar	0.01/0.2	0.01/0.2	0.02/0.2						
Gravies	0.1/2	0.1/2	0.05/0.5		45/45		50/50		4,000/10,000
Hard Candy	0.1/2	0.1/2	0.02/0.2	800/8,000	45/45	80/500	1/22	2/6	
Imitation Dairy Products	0.05/1	0.05/1		500/5,000	45/45	50/500			2,000/4,500
Instant Coffee and Tea	0.1/5	0.1/5	0.05/1	300/3,000	45/45	50/500			
Jams and Jellies	0.1/2	0.1/2	0.02/0.2	800/8,000	45/45	50/500			
Meat Products	0.1/2	0.1/2	0.1/1		45/45		155/400	22/22	2,000/4,500
Milk Products	0.1/2	0.1/2	0.05/0.5		100/100	30/300			
Nut Products	0.1/2	0.1/2	0.1/1	1,000/10,000	45/45	30/300			
Other Grains	0.01/0.2	0.01/0.2	0.05/0.5	1,000/10,000	45/45	30/300			
Poultry Products	0.1/2	0.1/2	0.05/0.5		45/45				2,000/4,500
Processed Fruits	0.01/0.2	0.01/0.2		200/2,000	45/45	50/500			
Processed Vegetables	0.05/1	0.05/1	0.02/0.2	400/4,000	45/45				
Reconstituted Vegetable Protein	0.05/1	0.05/1	0.02/0.2		45/45	50/500			2,000/4,500
Seasonings and Flavors	0.1/2	0.1/2	0.05/0.5	500/5,000	45/45	50/500			4,000/15,000
Snack Foods	0.1/2	0.1/2	0.05/0.5	800/8,000	45/45	50/500			4,000/10,000
Soft Candy	0.1/2	0.1/2	0.02/0.2	800/8,000	45/45	80/500	50/75	75/75	
Soups	0.1/2	0.1/2	0.02/0.2	100/10,000	45/45		4/100		2,000/4,500
Sugar Substitutes	0.01/0.2	0.01/0.2	0.02/0.1	800/8,000					
Sweet Sauces	0.1/2	0.1/2	0.02/0.2	300/3,000	45/45	50/500			

Table 3 - **Updated Average Usual Use Levels/Average Maximum Use Levels**
Average Usual Use Levels (ppm)/Average Maximum Use Levels (ppm) for flavoring substances previously recognized as FEMA GRAS. [a] represents a change from previous FEMA GRAS publications.

	Basil oil (*Ocimum basilicum* L.)	Basil oleoresin (*Ocimum basilicum* L.)	Estragon oil (*Artemisia dracunculus* L.)	Hops extract (*Humulus lupulus* L.)	Mace oil (*Myristica fragrans* Houtt.)	Mace oleoresin (*Myristica fragrans* Houtt.)	Methylcyclopentenolone	Nutmeg oil (*Myristica fragrans* Houtt.)
GRAS PUBLICATION	**3**	**3**	**3 & 25**	**3**	**3**	**3**	**3 & 25**	**3**
CATEGORY/FEMA No.	**2119**	**2120**	**2412**	**2578**	**2653**	**2654**	**2700**	**2793**
BAKED GOODS	5[a]/5[a]	27[a]/29[a]	2[a]/2[a]	600/720	15[a]/15[a]	39/43[a]	12/27	13[a]/20[a]
BEVERAGES TYPE I, NON-ALCOHOLIC	0.8[a]/0.8[a]	5/5[a]	0.3[a]/0.3[a]	180/200	2[a]/3[a]	7[a]/7[a]	2/11	3[a]/3[a]
BEVERAGES TYPE II, ALCOHOLIC	2[a]/8[a]	6/48[a]	3[a]/3[a]	151/344	25[a]/25[a]	70[a]/70[a]	0.9/9	10[a]/34[a]
BREAKFAST CEREALS							40/100	
CHEESES							2[a]/15[a]	
CHEWING GUM	83[a]/83[a]		5/25[a]		32/39		690/3,560	12/340[a]
CONDIMENTS AND RELISHES	8[a]/8[a]	15/48[a]	3[a]/3[a]	10[a]/100[a]	25[a]/25[a]	70[a]/70[a]		6/34[a]
CONFECTIONS AND FROSTINGS								2/29[a]
EGG PRODUCTS								
FATS AND OILS	16[a]/17[a]		5[a]/5[a]	10[a]/100[a]				
FISH PRODUCTS			0.1/0.8[a]				2[a]/15[a]	
FROZEN DAIRY	1/2[a]	2/11[a]	0.6[a]/0.6[a]	167/186	6[a]/6[a]	17[a]/17[a]	5/17	8/8[a]
FRUIT ICES								
GELATINS AND PUDDINGS	1[a]/1[a]	7[a]/7[a]	0.4[a]/0.4[a]	180/200	4[a]/4[a]	10[a]/10[a]	5/14	
GRANULATED SUGAR								
GRAVIES			3[a]/3[a]		2/3		4[a]/30[a]	5[a]/34[a]
HARD CANDY	1/8[a]		0.9/3[a]		23/25[a]	2/6	17/18	19/34[a]
IMITATION DAIRY PRODUCTS							2[a]/15[a]	
INSTANT COFFEE AND TEA								
JAMS AND JELLIES								
MEAT PRODUCTS	3[a]/3[a]	15[a]/15[a]	0.8[a]/0.8[a]		7[a]/8[a]	21[a]/21[a]	2/15[a]	10[a]/10[a]
MILK PRODUCTS			0.8[a]/4[a]				2[a]/15[a]	3[a]/5[a]
NUT PRODUCTS								
OTHER GRAINS			0.01[a]/4[a]					0.002[a]/5[a]
POULTRY PRODUCTS							2[a]/15[a]	
PROCESSED FRUITS								
PROCESSED VEGETABLES	1/1[a]		0.2[a]/4[a]		2/3			
RECONSTITUTED VEGETABLE PROTEIN							2[a]/15[a]	
SEASONINGS AND FLAVORS							2[a]/15[a]	
SNACK FOODS	8[a]/8[a]						2[a]/15[a]	
SOFT CANDY	6/8[a]	14/49[a]	3[a]/3[a]	280/400	25[a]/25[a]	70[a]/70[a]	9/26	8/34[a]
SOUPS	1[a]/1[a]						2[a]/15[a]	0.1[a]/5[a]
SUGAR SUBSTITUTES								
SWEET SAUCES				10[a]/100[a]			10/30	12/34[a]

	Parsley oil (*Petroselinum crispum* (Miller) *Nyman* (*P. sativum* Hoffm.))	Parsley oleoresin (*Petroselinum crispum* (Miller) Nyman (*P. sativum* Hoffm.))	Snakeroot Canadian oil (*Asarum canadense* L.)	Tannic acid (*Quercus spp.*)	Yucca Mohave extract (*Yucca schidigera* Roezl ex Ortgies [*Y. mohavensis* Sarg.])	*L*-Cysteine	Propyl propane thiosulfonate	4-Aminobutyric acid
GRAS PUBLICATION	**24**	**3**	**3**	**3**	**3**	**5**	**23**	**23**
CATEGORY/FEMA NO.	**2836**	**2837**	**3023**	**3042**	**3121**	**3263**	**4263**	**4288**
Baked Goods	19/24	100[a]/100[a]	2[a]/2[a]	0.04/40		100/100		50/300
Beverages Type I, Non-Alcoholic	1/2	10/16[a]	0.4[a]/0.4[a]	50[a]/200[a]	522/618	100/100		20/100
Beverages Type II, Alcoholic	1/2	9/18	4[a]/4[a]	6/150				30/200
Breakfast Cereals						100/100		30/100
Cheeses								10[a]/100[a]
Chewing Gum	500[a]/500[a]							100/500
Condiments and Relishes	45/64	160[a]/160[a]	1/4		200[a]/400[a]	100/100	15[a]/40[a]	
Confections and Frostings				45[a]/50[a]				30/100
Egg Products								
Fats and Oils					200[a]/400[a]		15[a]/40[a]	30/100
Fish Products								10[a]/100[a]
Frozen Dairy	0.9/1	10/10	0.8[a]/0.8[a]	0.14/160				
Fruit Ices								20/100
Gelatins and Puddings	7/10	25[a]/25[a]		0.02/0.05				20/100
Granulated Sugar								
Gravies	2/6						0.01/1	
Hard Candy	10[a]/10[a]		4[a]/4[a]	0.2/100				40/300
Imitation Dairy Products				75[a]/100[a]				10[a]/100[a]
Instant Coffee and Tea								20/100
Jams and Jellies								
Meat Products	38/63	50[a]/50[a]		0.01/0.01		800[a]/1,200[a]		20/200
Milk Products				75[a]/100[a]		100/100		30/100
Nut Products								
Other Grains								
Poultry Products								10[a]/100[a]
Processed Fruits								
Processed Vegetables	0.8/1							
Reconstituted Vegetable Protein				75[a]/100[a]		800[a]/3,000[a]		10[a]/100[a]
Seasonings and Flavors							0.01/1	
Snack Foods							0.01/1	10/100
Soft Candy	3/6	30/50	4[a]/4[a]					20/200
Soups	33/66	25[a]/25[a]					0.01/1	30/200
Sugar Substitutes								
Sweet Sauces					200[a]/400[a]		15[a]/40[a]	

Table 3 CONTINUED - **Updated Average Usual Use Levels/Average Maximum Use Levels**
Average Usual Use Levels (ppm)/Average Maximum Use Levels (ppm) for flavoring substances previously recognized as FEMA GRAS. [a] represents a change from previous FEMA GRAS publications.

	4-Amino-5,6-dimethylthieno[2,3-d] pyrimidin-2(1*H*)one and 4-amino-5,6-dimethylthieno[2,3-d] pyrimidin-2(1*H*)one hydrochloride	Chrysanthemum extract	3-[(4-Amino-2,2-dioxido-1*H*-2,1,3-benzothiadiazin-5-yl)oxy]-2,2-dimethyl-*N*-propylpropanamide	Glucosyl steviol glycosides	Steviol glycoside extract, *Stevia rebaudiana*, Rebaudioside A 22%	Steviol glycoside extract, *Stevia rebaudiana*, Rebaudioside C 22%	3-(3-Hydroxy-4-methoxyphenyl)-1-(2,4,6-trihydroxyphenyl)propan-1-one	Glucosylated steviol glycosides, 70-80%	Refined Soybean oil extract
GRAS PUBLICATION	**29**	**25**	**29**	**28**	**27**	**27**	**28**	**29**	**29**
CATEGORY/FEMA No.	**4669**	**4689**	**4701**	**4728**	**4805**	**4806**	**4872**	**4909**	**4919**
BAKED GOODS	10[a]/10	50[a]/100[a]	15[a]/22	150/500	70/400[a]	100/100	5/10	55[a]/65[a]	1/5
BEVERAGES TYPE I, NON-ALCOHOLIC	15[a]/15	50[a]/100[a]	5/22	125/175	70/70	110/110	1.5/10	55/65	0.2/2
BEVERAGES TYPE II, ALCOHOLIC	15[a]/15	50[a]/100[a]	5/22	125/175	70/70	100/100	1.5/10	55[a]/65[a]	0.2/2
BREAKFAST CEREALS	15[a]/20		15[a]/22	200/500	70/70	100/100	5/10	55[a]/65[a]	1/5
CHEESES		20[a]/100[a]		100/133		50[a]/100[a]			
CHEWING GUM	40[a]/50	400/400	30/300	500/1500	70/70	100/100	5/10	55[a]/65[a]	1/5
CONDIMENTS AND RELISHES	10/20	50/200	5/22	125/200	70/70	100/100	4/10	55[a]/65[a]	0.5/2
CONFECTIONS AND FROSTINGS	10/25	50/200	10/22	50/100	70/70	100/100		55[a]/65[a]	0.5/2
EGG PRODUCTS		50[a]/100[a]			70/70				1[a]/5[a]
FATS AND OILS		50[a]/100[a]		125/189	70/70	100/100			
FISH PRODUCTS			5/22						
FROZEN DAIRY	15[a]/15	20[a]/100[a]	10[a]/22	125/133	70/70	100/100	3/10	55/65	0.2/2
FRUIT ICES	15[a]/15		10[a]/22	125/133	70/70	100/100	5/10	55[a]/65[a]	0.2/2
GELATINS AND PUDDINGS	5/10	20[a]/100[a]	5/22	125/133	70/70	100/100	3/10	55[a]/65[a]	
GRANULATED SUGAR									
GRAVIES		20/40	10[a]/22a	125/133	70/70	100/100	2/10	55[a]/65[a]	1/5
HARD CANDY	10/25	70/200	15/75	100/133	70/70	100/100	2/10	55[a]/65[a]	1/5
IMITATION DAIRY PRODUCTS	15[a]/15	20[a]/100[a]	10[a]/22	125/250	70/70	100/100	2[a]/10[a]	55/65	
INSTANT COFFEE AND TEA	15[a]/15	20[a]/100[a]	5/22	125/175	70/70	100/100	1.5/10	55/65	0.2/2
JAMS AND JELLIES	10/25		10/22	125/200	70/70	100/100		55[a]/65[a]	
MEAT PRODUCTS		20[a]/100[a]	5/22	125[a]/125[a]	70[a]/70[a]	100[a]/100[a]			1/5
MILK PRODUCTS	15[a]/15	20[a]/100[a]	10[a]/22	133/225	70/70	100/100	2/10	55/65	1/5
NUT PRODUCTS		20[a]/40[a]		133/175	70/105[a]	100/230[a]		55[a]/65[a]	1/5
OTHER GRAINS			10[a]/22[a]	100/133		50[a]/100[a]		55[a]/65[a]	1[a]/5[a]
POULTRY PRODUCTS		20[a]/100[a]	5/22						1/5
PROCESSED FRUITS				133/200	70/70	100/100	3/10	55[a]/65[a]	
PROCESSED VEGETABLES				100/133	70/70	100/100	2/10	55[a]/65[a]	1[a]/5[a]
RECONSTITUTED VEGETABLE PROTEIN		50[a]/100[a]		133/133			2/10	55[a]/65[a]	1[a]/5[a]
SEASONINGS AND FLAVORS	5/15	50/200	10/22	133/175	70/105[a]	100/230[a]	2/10	55[a]/65[a]	1/5
SNACK FOODS	5/15	50/200		133/133	70/105[a]	100/230[a]	6/10	55[a]/65[a]	1/5
SOFT CANDY	10/25	50/200	15/75	100/133	70/70	100/100	5/10	55[a]/65[a]	1/5
SOUPS		50/200	10[a]/22[a]	133/133	70/70	100/100	1/10	55[a]/65[a]	1/5
SUGAR SUBSTITUTES	600[a]/600				70/70	100/100			
SWEET SAUCES	10/25	50/200	10/22	133/133	70/70	100/100	4/10	55[a]/65[a]	