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# RECENT PROGRESS in the Consideration of Flavoring Ingredients Under the Food Additives Amendment

# 4. GRAS Substances

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☐ IN PREVIOUSLY published articles (Hall, 1959, 1960; Hall et al., 1961, 1965, 1968), the authors have discussed the procedures by which flavoring ingredients reported to be in prior use were considered with respect to the provisions of the Food Additives Amendment of 1958.

The initial screening, including gathering of all available information from industrial sources and the literature, was conducted by the Food Additives Committee of the Flavor and Extract Manufacturers' Association (FEMA). Finally, the collated data were studied by a panel of toxicologists and pharmacologists retained by FEMA. This panel consists of experts "qualified by training and experience," whose unanimous agreement on general recognition of safety is required for a substance to be generally recognized as safe (GRAS) under the provisions of the Food Additives Amendment.

In the course of that review (which took place from 1958–1964) 1,124 natural and synthetic ingredients were determined to be GRAS under conditions of intended use. Two hundred sixty-seven (267) were dropped from use because adequate information was not available to meet the criteria established by the panel or the substances in question were not of sufficient importance to justify developing the information needed. In a few cases, the existing data reflected unfavorably on the ingredients or other closely related substances, and resulted in their discontinuance from use.

One of the more recent papers (Hall et al., 1965) stressed that, since almost all of the substances then considered had been in use prior to January 1, 1958, "experience based on common use in food" (the language of the Food Additives Amendment) was an important factor in determining general recognition of their safety.

The same sentence in the Food Additives Amendment just quoted provides that a substance not in use prior to January 1, 1958, may be "generally recognized among experts qualified by scientific training and experience to evaluate its safety, as having been adequately shown through scientific procedures (or, in the case of a substance . . .) to be safe under the conditions of its intended use." Indeed, among the substances included in the list in our previous report (Hall et al., 1965), six were not in use prior to 1958, but were judged by the expert panel to be GRAS on the basis of scientific procedures. More specifically, the panel reviewed available information on the chemistry, metabolism, and toxicity of those substances and closely analogous ones, and judged that—under the conditions of intended use—there would be reasonable certainty among informed experts of their safety.

## NEW DATA

IN THIS PAPER, we wish to report a number of later developments. In part, these consist of action by the expert panel on a number of substances newly-proposed for intentional use as flavor additives. The panel has also reviewed additional toxicological and other information available on a number of ingredients previously judged to be GRAS. This served to affirm the previous judgment in all but two instances, in which the new information caused reversal of the prior finding.

In large part, the criteria previously established by the expert panel for the evaluation of safety (Hall et al., 1961) can still be applied to these new substances. Of particular value were toxicological and metabolic data available on many of these substances (Posternak et al., 1969), or others closely related by chemical structure, pharmacological effect, or metabolic fate. In accord with the cautions previously set forth, the panel applied reasoning by analogy, particularly where the analogy appeared close, the chemical structure was devoid of suspicion, and the levels of use were extremely low.

### Natural Occurrence

The panel attached substantial importance to natural occurrence in food, particularly where the substance has been found in a number of widely consumed foods. We have stated (Hall et al., 1968) that from a strictly toxicological point of view, the only basis for the popular assumption that a natural flavoring is safe is the lack of evidence of a causal relation to human illness due, in part, to failure even to suspect it. There is no scientific ground for the belief that complex natural products would respond any better to toxicological tests for safety than their synthetic equivalents. Human experience is relevant, however, and the more widely the substance occurs, the higher the levels (where known), and the greater the volume of consumption of the foods involved, the stronger the presumption of safety. It is reasonable (but unnecessary) to assume that such natural occurrence in food constitutes "common use" within the meaning of the Food Additives Amendment. In any event, it provides an indication of previous hu-

man consumption against which to evaluate the proposed use.

### GMP More Important

The panel does not consider that the proportions at which current information indicates the proposed ingredient naturally occurs, constitute a tolerance or limitation on intentional use. In part, such information merely reflects where, and how thoroughly, analytical chemists happened to have looked. The panel believes, however, that intended use at levels in excess of those toxicologically insignificant (National Academy of Sciences–National Research Council, 1969) would require stronger evidence of safety in the form of metabolic or toxicological data. Good manufacturing practice (GMP), rather than current knowledge of natural occurrence, is and should continue to be the governing rule on use. From this, it follows that levels of intended use figured importantly in the panel's judgments. This also conforms to past practice as well as the letter of the law.

The FEMA expert panel has considered a number of recent publications (Clegg, 1965; Daniel et al., 1965; Eickholt et al., 1965; Elworthy et al., 1967; Frawley et al., 1965; Hagan et al., 1965; Hagan et al., 1967; Johnson, 1965) reporting the results of animal testing of a large number of flavoring ingredients previously judged to be GRAS, as well as several, such as safrole, dihydrosafrole, *iso*-safrole, and coumarin, no longer intentionally used as flavor components, and other substances never in use. In the panel's opinion, the new data support previous judgments with one exception.

### List Changes

In a recent paper (Taylor et al., 1967) the authors reported that calamus oil, after 59 weeks of feeding at levels of 500 ppm and over, induced malignant tumors in rats. In view of this information, the panel concluded that calamus and its oil or extract can no longer be classified as "generally recognized as safe."

The expert panel has also reviewed recently available information concerning the production of cardiac lesions by high levels of brominated vegetable oils and the apparent tendency for bromine accumulation in body lipids as a result of the consumption of this material. In view of this, the panel has concluded that Brominated Vegetable Oils (No. 2,168) should continue under toxicological investigation, although at present they can no longer be regarded as generally recognized as safe.

No. 2,016, Alkanet Root, Extract, serves no function other than as a colorant. Since food colors are treated under a different section of the statute, it is appropriate to drop this item from the GRAS list.

No. 2,566, 2-Hexyl-4-Acetoxytetrahydrofuran, has been found not to have the identity indicated by this name, but instead to contain several non-isomeric components. In view of this, and shifting considerations of technological value, it is being dropped.

No. 2,744, 4-Methylquinoline, is actually 6-Methylquinoline. The term "*p*-Methylquinoline," though sometimes used, is clearly a misnomer.

No. 2,786, 3-Nonanon-1-yl Acetate, has been found actually to consist of a mixture of three related compounds. In view of this, it is being dropped, pending possible future review by the expert panel.

The names of the substances, No. 2,720, Methyl 2-methylthiopropionate, and No. 2,747, 2-methylthiopropionaldehyde are incorrect. Utilizing the same FEMA numbers, the corrected names are No. 2,720 Methyl 3-methylthiopropionate, and No. 2,747, 3-Methylthiopropionaldehyde.

### Methyl Salicylate Retained

The expert panel was privileged to review a large mass of recently available data from both government and private sources, much of it as yet unpublished, relating particularly to the possible effects of high dosages of methyl salicylate on reproduction efficiency in rats and mice. It was the panel's judgment that much of the data were not relevant to the question of safety for man under the conditions of use of methyl salicylate in food, including candy and chewing gum. Even greatly exaggerated human use patterns are very far below the levels shown to exert even a questionably toxic effect. The metabolic pathways involved in the excessive dosages employed in the animal studies are undoubtedly different from those experienced at the low levels of human consumption. In view of the wide and much more relevant human experience with all salicylates used medicinally, including methyl salicylate, and the lack of clinical evidence of toxicity at levels conceivably associated with food use, the panel reaffirmed its previous judgment on the safety of methyl salicylate as a flavoring substance and its conclusion that the substance for its intended use in flavoring is generally recognized as safe.

## NEW LISTINGS

ON THE BASIS of scientific procedures, the panel concludes that the substances listed in the following table are GRAS under the conditions of intended use listed for each. The levels shown correspond to the "Average Maximum Levels" defined in previous papers. While they would only rarely be exceeded, they are not to be regarded as setting rigid limits, but as general guidelines helping to define good manufacturing practice in accord with the exposition contained in the 1965 paper.

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# SURVEY OF FLAVORING INGREDIENT USAGE LEVELS

Flavor and Extract Manufacturers' Association average maximum use levels (in ppm) on which the expert panel based its judgments that the substances are generally recognized as safe. Those substances which are to be used at NOT more than 10 ppm in finished food are indicated with an asterisk.

| FEMA No. and Substance | Beverages | Ice Cream Ices, Etc. | Candy | Baked Goods | Gelatins & Puddings | Chewing Gum | Other Category Use | |
|---|---|---|---|---|---|---|---|---|
| *3,125*<br>ACETALDEHYDE, BUTYL PHENETHYL ACETAL | 5.0 | 5.0 | 5.0 | — | 5.0 | 5.0 | | |
| *3,126*<br>*ACETYLPYRAZINE<br>Methyl pyrazinyl ketone | 5.0 | 5.0 | — | 5.0 | — | — | | |
| *3,127*<br>ALLYL METHYL DISULFIDE | — | — | — | 1.0 | — | — | *Condiments* 1.0<br>*Meats & Meat Sauces* 1.0<br>*Pickles* 1.0 | *Soups* 1.0 |
| *3,128*<br>2-BENZOFURANCARBOXALDEHYDE—<br>2-Formylbenzofuran | — | 10. | 10. | 20. | 10. | — | | |
| *3,129*<br>BIPHENYL | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | — | | |
| *3,130*<br>BUTYLAMINE | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | — | | |
| *3,131*<br>*sec*-BUTYL ETHYL ETHER | 1.0 | 1.0 | 1.0 | 1.0 | — | — | | |
| *3,132*<br>*2-*iso*-BUTYL-3-METHOXYPYRAZINE | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | *Cereals* 0.05<br>*Condiments* 0.05<br>*Meats & Meat Sauces* 0.05<br>*Milk & Dairy Pdts.* 0.05 | *Soups* 0.05 |
| *3,133*<br>*2-*iso*-BUTYL-3-METHYLPYRAZINE—<br>2-Methyl-3-*iso*-butylpyrazine | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | — | | |
| *3,134*<br>2-*iso*-BUTYL THIAZOLE | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | — | *Meats & Meat Sauces* 1.0<br>*Sauces* 1.0<br>*Vegetables* 1.0 | *Soups* 1.0 |
| *3,135*<br>2-*trans*,4-*trans*-DECADIENAL | 10. | 10. | 10. | 10. | 10. | 10. | *Cereals* 10.<br>*Meats & Meat Sauces* 10.<br>*Vegetables* 10. | |
| *3,136*<br>*2,3-DIETHYLPYRAZINE | 1.0 | 1.0 | 1.0 | — | 1.0 | — | | |
| *3,137*<br>2,6-DIMETHOXYPHENOL | — | — | — | — | — | — | *Meats* 3.0<br>*Soups* 0.30 | *Seafood* 2.0 |
| *3,138*<br>3,4-DIMETHOXY-1-VINYLBENZENE | 2.0 | 2.0 | 2.0 | — | 2.0 | — | *Meats* 2.0 | *Soups* 2.0 |
| *3,139*<br>*p,α*-DIMETHYLBENZYL ALCOHOL—<br>Methyl *p*-tolyl carbinol | 10. | 10. | 10. | — | — | — | | |
| *3,140*<br>2,6-DIMETHYL-4-HEPTANOL—<br>di-*iso*-Butyl carbinol | 20. | 20. | 20. | — | 20. | 20. | | |
| *3,141*<br>2,6-DIMETHYL-10-METHYLENE-2,6,11-DODECATRIENAL—α-Sinensal | 10. | 10. | 10. | — | — | — | | |
| *3,142*<br>3,7-DIMETHYL-6-OCTENOIC ACID—<br>Citronellic acid | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | — | | |
| *3,143*<br>2,4-DIMETHYL-2-PENTENOIC ACID | — | — | 1.0 | 1.5 | — | — | | |
| *3,144*<br>*p,α*-DIMETHYLSTYRENE—<br>1-Methyl-4-*iso*-propenylbenzene;<br>*p-iso*-Propenyltoluene | 0.15 | — | 2.3 | — | 1.0 | — | | |
| *3,145*<br>2,4-DIMETHYL-5-VINYLTHIAZOLE | 0.10 | 0.50 | 0.50 | 0.50 | 0.50 | — | | |

| FEMA No. and Substance | Beverages | Ice Cream Ices, Etc. | Candy | Baked Goods | Gelatins & Puddings | Chewing Gum | Other Category Use |
|---|---|---|---|---|---|---|---|
| *3.146*<br>2,2'-(DITHIODIMETHYLENE)-DIFURAN—<br>2-Furfuryl disulfide | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | *Condiments* 1.0<br>*Meats & Meat Sauces* 1.0<br>*Milk & Dairy Pdts.* 1.0<br>*Soups* 1.0 |
| *3.147*<br>1-ETHYL-2-ACETYLPYRROLE | 5.0 | 5.0 | 5.0 | — | 5.0 | — | |
| *3.148*<br>ETHYL *trans*-2,*cis*-4-DECADIENOATE | 10. | 10. | 10. | — | 10. | — | |
| *3.149*<br>*2-ETHYL-3,5 or 6-DIMETHYLPYRAZINE | 5.0 | — | 5.0 | 5.0 | 2.0 | — | *Cereals* 2.0<br>*Condiments* 2.0<br>*Meats & Meat Sauces* 2.0<br>*Milk & Dairy Pdts.* 1.0 |
| *3.150*<br>*3-ETHYL-2,5-DIMETHYLPYRAZINE—<br>2,6-Dimethyl-3-ethylpyrazine | 5.0 | 5.0 | 5.0 | — | 5.0 | — | |
| *3.151*<br>2-ETHYL-1-HEXANOL | 10. | 10. | 10. | — | — | 10. | |
| *3.152*<br>3-ETHYL-2-HYDROXY-2-CYCLOPENTEN-1-ONE | 10. | 10. | 10. | 10. | 10. | — | *Cereals* 10.<br>*Condiments* 10.<br>*Meats & Meat Sauces* 10.<br>*Milk & Dairy Pdts.* 10.<br>*Soups* 10. |
| *3.153*<br>5-ETHYL-3-HYDROXY-4-METHYL-2(5H)-FURANONE—2,4-Dihydroxy-3-methyl-2-hexenoic acid, γ-lactone; 2-Ethyl-3-methyl-4-hydroxydihydro-(2,5)-furan-5-one; 2-Hydroxy-3-methyl-γ-2-hexenolactone | — | — | 1.0 | 1.0 | 1.0 | — | |
| *3.154*<br>*2-ETHYL-5-METHYLPYRAZINE | 5.0 | — | 5.0 | 5.0 | 2.0 | — | *Cereals* 2.0<br>*Condiments* 2.0<br>*Meats & Meat Sauces* 2.0<br>*Milk & Dairy Pdts.* 1.0<br>*Soups* 2.0 |
| *3.155*<br>*3-ETHYL-2-METHYLPYRAZINE | 3.0 | 3.0 | 3.0 | — | 3.0 | — | |
| *3.156*<br>*p*-ETHYLPHENOL | — | — | — | 0.20 | — | — | *Margarine* 0.20 |
| *3.157*<br>ETHYL (*p*-TOLYLOXY)ACETATE—<br>Ethyl *p*-cresoxyacetate | 8.0 | — | 40. | — | — | — | |
| *3158*<br>2-FURANMETHANETHIOL FORMATE | 1.0 | 1.0 | 1.0 | — | — | — | |
| *3.159*<br>FURFURYL METHYL ETHER | 2.0 | — | 2.0 | — | 2.0 | — | *Sauces* 2.0 |
| *3.160*<br>FURFURYL METHYL SULFIDE | 1.0 | 1.0 | 1.0 | — | 1.0 | — | |
| *3.161*<br>FURFURYL *iso*-PROPYL SULFIDE | 0.50 | 0.50 | 0.50 | — | 0.50 | — | |
| *3.162*<br>FURFURYL THIOACETATE | 0.20 | 1.0 | 1.5 | — | 1.0 | — | |
| *3.163*<br>2-FURYL METHYL KETONE—<br>2-Acetylfuran | — | — | — | 20. | — | — | *Condiments* 20.<br>*Meats & Meat Sauces* 20.<br>*Soups* 20. |
| *3.164*<br>2,4-HEPTADIENAL | — | — | 1.0 | 1.0 | — | — | *Condiments* 1.0<br>*Meats & Meat Sauces* 1.0<br>*Soups* 1.0 |

| FEMA No. and Substance | Beverages | Ice Cream Ices, Etc. | Candy | Baked Goods | Gelatins & Puddings | Chewing Gum | Other Category Use |
|---|---|---|---|---|---|---|---|
| *3.165*<br>2-HEPTENAL | — | — | 1.0 | 1.0 | — | — | *Condiments*<br>1.0<br>*Meats & Meat Sauces*<br>1.0<br>*Soups*<br>1.0 |
| *3.166*<br>4,4a,5,6,7,8-HEXAHYDRO-6-*iso*-PROPENYL-4,4a-DIMETHYL-2(3H)-NAPHTHALENONE—Nootkatone: 4a,5-Dimethyl-1,2,3,4,4a,5,6,7-octahydro-7-keto-3-*iso*-propenylnaphthalene; 5,6-Dimethyl-8-*iso*-propenyl bicyclo-(4,4,0)-dec-1-en-3-one | 10. | — | 10. | — | — | — | |
| *3.167*<br>δ-HEXALACTONE | 10. | 10. | 10. | 10. | 10. | — | *Margarine*<br>10.<br>*Salad Oil*<br>10.<br>*Shortening*<br>10. |
| *3.168*<br>3,4-HEXANEDIONE | 10. | 10. | 10. | — | 10. | — | |
| *3.169*<br>*trans*-2-HEXENOIC ACID | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 1.0 | *Salad Dressings*<br>50. |
| *3.170*<br>3-HEXENOIC ACID | 10. | 10. | 10. | 10. | 10. | 10. | *Milk & Dairy Pdts.*<br>50. |
| *3.171*<br>*cis*-3-HEXEN-1-YL ACETATE | 0.40 | 0.40 | 0.50 | 0.50 | — | — | |
| *3.172*<br>HEXYL *iso*-BUTYRATE | 20. | 20. | 20. | — | 20. | 20. | |
| *3.173*<br>1-HYDROXY-2-BUTANONE | 30. | 30. | 30. | — | 80. | — | |
| *3.174*<br>4-HYDROXY-2,5-DIMETHYL-3(2H)-FURANONE | — | 5.0 | 10. | 10. | 5.0 | — | |
| *3.175*<br>γ-IONONE—4-(2,2-Dimethyl-6-methylene-cyclohexyl)-3-buten-2-one | 10. | — | 10. | — | 10. | — | |
| *3.176*<br>*p*-MENTHAN-2-ONE<br>Tetrahydrocarvone; Carvomenthone | 10. | 10. | 10. | — | — | — | |
| *3.177*<br>*p*-MENTHA-8-THIOL-3-ONE—8-Mercapto-*p*-menthane-3-one | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | |
| *3.178*<br>*p*-MENTH-1-ENE-9-AL | 2.0 | 2.0 | 2.0 | — | 2.0 | — | |
| *3.179*<br>*p*-MENTH-1-EN-8-OL—Piperitol | 20. | 20. | 20. | — | — | — | |
| *3.180*<br>2-MERCAPTOPROPIONIC ACID<br>Thiolactic acid | — | — | — | — | — | — | *Meats & Meat Sauces*<br>50.<br>*Soups*<br>50. |
| *3.181*<br>*o*-METHOXYCINNAMALDEHYDE | — | — | 30. | 40. | — | 450. | |
| *3.182*<br>*p*-METHOXY-α-METHYL CINNAMALDEHYDE | 1.0 | — | 10. | — | — | — | |
| *3.183*<br>*2-,5 or 6-METHOXY-3-METHYL-PYRAZINE (Mixture of isomers) | — | 2.0 | 4.0 | 4.0 | 2.0 | — | |
| *3.184*<br>1-METHYL-2-ACETYLPYRROLE | 10. | 10. | 10. | — | 10. | — | |
| *3.185*<br>METHYLATED SILICA | — | — | 11. | 11. | 11. | 100. | |
| *3.186*<br>4-METHYLBIPHENYL—*p*-Methyldiphenyl | 5.0 | 5.0 | 5.0 | — | 5.0 | — | |
| *3.187*<br>3-METHYLCROTONIC ACID—3,3-Dimethylacrylic acid; β,β-Dimethylacrylic acid; Senecioic acid | 5.0 | 5.0 | 5.0 | — | 5.0 | — | |
| *3.188*<br>2-METHYL-3-FURANTHIOL | — | — | — | 0.25 | — | — | *Condiments*<br>0.25<br>*Meats & Meat Sauces*<br>0.25<br>*Soups*<br>0.25 |

| FEMA No. and Substance | Beverages | Ice Cream Ices, Etc. | Candy | Baked Goods | Gelatins & Puddings | Chewing Gum | Other Category Use | |
|---|---|---|---|---|---|---|---|---|
| 3.189 *2-METHYL-3-,5 or 6-FURFURYL THIOPYRAZINE (Mixture of isomers) | 1.0 | 1.0 | — | 1.0 | — | — | *Condiments* 1.0 | *Sauces* 1.0 |
| 3.190 5-METHYL-2,3-HEXANEDIONE | 20. | — | 20. | — | — | — | | |
| 3.191 2-METHYLHEXANOIC ACID | — | — | 3.0 | 2.0 | 2.0 | — | | |
| 3.192 2-METHYL-5-METHOXYTHIAZOLE | 2.0 | — | — | 4.0 | — | — | *Meats* 2.0 | *Soups* 2.0 |
| 3.193 1-METHYLNAPHTHALENE | 1.0 | 1.0 | 1.0 | — | 1.0 | — | | |
| 3.194 2-METHYL-2-PENTENAL | 30. | 30. | 30. | 30. | 30. | 30. | | |
| 3.195 2-METHYL-2-PENTENOIC ACID | — | — | 1.0 | 1.0 | — | — | *Condiments* 1.0 *Meats & Meat Sauces* 1.0 *Soups* 1.0 | |
| 3.196 3-METHYL-2-(2-PENTENYL)-2-CYCLO-PENTEN-1-ONE—Jasmone | 10. | 10. | 10. | — | 10. | — | | |
| 3.197 α-METHYLPHENETHYL BUTYRATE— 1-Phenyl-2-propyl butyrate | 0.60 | 3.0 | 6.0 | — | 3.0 | — | | |
| 3.198 METHYL PHENETHYL ETHER | 20. | — | — | — | — | — | | |
| 3.199 5-METHYL-2-PHENYL-2-HEXENAL | 25. | 25. | 25. | 25. | 25. | 25. | | |
| 3.200 4-METHYL-2-PHENYL-2-PENTENAL | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 | | |
| 3.201 METHYL PROPYL DISULFIDE | — | — | — | 1.0 | — | — | *Condiments* 1.0 *Meats & Meat Sauces* 1.0 *Pickles* 1.0 *Soups* 1.0 | |
| 3.202 METHYL 2-PYRROLYL KETONE— 2-Acetylpyrrole | 50. | 50. | 50. | — | 50. | — | | |
| 3.203 5-METHYLQUINOXALINE | 10. | 10. | 10. | — | 10. | — | | |
| 3.204 4-METHYL-5-THIAZOLEETHANOL— 4-Methyl-5-(β-hydroxyethyl)-thiazole | 55. | 55. | 55. | 55. | 55. | 55. | *Cereals* 55. *Condiments* 55. *Meats & Meat Sauces* 55. *Milk & Dairy Pdts.* 55. *Soups* 55. | |
| 3.205 4-METHYL-5-THIAZOLEETHANOL: ACETATE | 55. | 55. | 55. | 55. | 55. | 55. | *Cereals* 55. *Condiments* 55. *Meats & Meat Sauces* 55. *Milk & Dairy Pdts.* 55. | *Soups* 55. |
| 3.206 2-METHYLTHIOACETALDEHYDE | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | *Cereals* 0.50 *Condiments* 0.50 *Meats & Meat Sauces* 0.50 *Milk & Dairy Pdts.* 0.50 | *Soups* 0.50 |
| 3.207 1-(METHYLTHIO)-2-BUTANONE | — | — | — | — | — | — | *Condiments* 1.0 *Sauces* 1.0 *Soups* 1.0 | |
| 3.208 *(METHYLTHIO)METHYLPYRAZINE (Mixture of isomers)—2-Methyl-3-,5 or 6-methylthiopyrazine | — | 2.0 | 2.0 | 4.0 | 2.0 | — | | |

| FEMA No. and Substance | Beverages | Ice Cream Ices, Etc. | Candy | Baked Goods | Gelatins & Puddings | Chewing Gum | Other Category Use | |
|---|---|---|---|---|---|---|---|---|
| *3.209*<br>5-METHYL-2-THIOPHENECARBOXALDEHYDE | 0.50 | 0.50 | 0.50 | 0.60 | 0.50 | 0.50 | *Cereals* 0.50<br>*Condiments* 0.50<br>*Meats & Meat Sauces* 0.50<br>*Milk & Dairy Pdts.* 0.50<br>*Soups* 0.50 | |
| *3.210*<br>o-(METHYLTHIO)-PHENOL—2-(Methylthio)phenol; Thioguaiacol | 0.20 | 0.20 | 0.20 | — | 0.20 | — | | |
| *3.211*<br>*2-METHYL-6-VINYLPYRAZINE | 10. | 10. | 10. | — | 10. | — | | |
| *3.212*<br>2,4-NONADIENAL | — | — | — | 0.20 | — | — | *Cereals* 0.20<br>*Condiments* 0.20<br>*Meats & Meat Sauces* 0.20<br>*Milk & Dairy Pdts.* 0.20 | *Soups* 0.20 |
| *3.213*<br>2-NONENAL | — | — | — | 0.20 | — | — | *Cereals* 0.20<br>*Condiments* 0.20<br>*Meats & Meat Sauces* 0.20<br>*Milk & Dairy Pdts.* 0.20 | *Soups* 0.20 |
| *3.214*<br>δ-OCTALACTONE | 20. | 20. | 20. | 20. | 20. | — | *Margarine* 20.<br>*Salad Oil* 20.<br>*Shortening* 20. | |
| *3.215*<br>2-OCTENAL | — | — | 1.0 | 1.0 | — | — | *Condiments* 1.0<br>*Meats & Meat Sauces* 1.0<br>*Soups* 1.0 | |
| *3.216*<br>PARAFFIN WAX*—Petroleum wax; Paraffin | | | | | | | | |
| *3.217*<br>2,4-PENTADIENAL | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | *Cereals* 1.0<br>*Condiments* 1.0<br>*Meats & Meat Sauces* 1.0<br>*Milk & Dairy Pdts.* 1.0<br>*Soups* 1.0 | |
| *3.218*<br>2-PENTENAL | 10. | — | 10. | — | 10. | — | | |
| *3.219*<br>iso-PENTYLAMINE—iso-Amylamine; 3-Methylbutylamine | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | — | | |
| *3.220*<br>PHENETHYLAMINE | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | — | | |
| *3.221*<br>PHENETHYL HEXANOATE | 8.0 | — | — | — | — | — | | |
| *3.222*<br>PHENETHYL OCTANOATE | 5.0 | — | — | — | — | — | | |
| *3.223*<br>PHENOL | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | — | | |
| *3.224*<br>2-PHENYL-2-BUTENAL | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | | |
| *3.225*<br>PHENYL DISULFIDE—Diphenyl disulfide | 1.0 | 1.0 | 1.0 | — | 1.0 | — | | |
| *3.226*<br>1-PHENYL-1,2-PROPANEDIONE | 10. | 10. | 10. | — | 10. | — | | |

* For use as a flavor adjunct in accord with good manufacturing practice

| FEMA No. and Substance | Beverages | Ice Cream Ices, Etc. | Candy | Baked Goods | Gelatins & Puddings | Chewing Gum | Other Category Use | |
|---|---|---|---|---|---|---|---|---|
| 3.227<br>PROPENYL PROPYL DISULFIDE | — | — | — | 2.0 | — | — | *Condiments*<br>2.0<br>*Meats & Meat Sauces*<br>2.0<br>*Pickles*<br>2.0<br>*Soups*<br>2.0 | |
| 3.228<br>PROPYL DISULFIDE | — | — | — | — | — | — | *Soups*<br>6.0 | *Spices*<br>10. |
| 3.229<br>iso-PROPYL TIGLATE—<br>iso-Propyl α-methyl crotonic acid | — | — | — | 5.0 | 1.0 | — | *Salad Oil*<br>10. | *Soups*<br>1.0 |
| 3.230<br>*PYRAZINE ETHANETHIOL—<br>Pyrazinyl ethanethiol | 10. | 10. | — | 10. | — | — | | |
| 3.231<br>*PYRAZINYL METHYL SULFIDE—<br>Pyrazinyl methyl methyl sulfide | 1.0 | 1.0 | — | 1.0 | — | — | | |
| 3.232<br>2-PYRIDINEMETHANETHIOL—<br>2-Pyridylmethanethiol | 2.0 | 2.0 | 2.0 | — | 2.0 | — | | |
| 3.233<br>STYRENE | — | 0.20 | 0.20 | 0.20 | — | — | | |
| 3.235<br>4,5,6,7-TETRAHYDRO-3,6-DIMETHYL-BENZOFURAN—Menthofuran | 10. | 10. | 10. | — | — | — | | |
| 3.236<br>TETRAHYDRO-4-METHYL-2-(2-METHYL-PROPEN-1-YL)PYRAN—Rose oxide | 0.40 | — | 2.0 | 2.0 | — | — | | |
| 3.237<br>*2,3,5,6-TETRAMETHYLPYRAZINE | 5.0 | — | 5.0 | 5.0 | — | — | *Condiments*<br>10.<br>*Meats & Meat Sauces*<br>10.<br>*Milk & Dairy Pdts.*<br>5.0<br>*Soups*<br>10. | |
| 3.238<br>2,2'-(THIODIMETHYLENE)-DIFURAN—<br>2-Furfuryl monosulfide | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | *Condiments*<br>1.0<br>*Meats & Meat Sauces*<br>1.0<br>*Soups*<br>1.0 | |
| 3.239<br>4-THUJANOL—Sabinenehydrate | 10. | 10. | 10. | — | 10. | — | | |
| 3.240<br>o-TOLUENETHIOL—2-Methylthiophenol | — | — | — | 0.20 | — | — | *Sauces*<br>0.20 | *Soups*<br>0.20 |
| 3.241<br>TRIMETHYLAMINE | — | — | — | — | — | — | *Soups*<br>0.10 | |
| 3.242<br>p,α,α-TRIMETHYLBENZYL ALCOHOL—<br>*p*-Cymen-8-ol; Dimethyl *p*-tolyl carbinol | 0.20 | — | 2.3 | — | 1.0 | — | | |
| 3.243<br>4-[(2,6,6)-TRIMETHYL CYCLOHEX-1-ENYL] BUT-2-EN-4-ONE | 10. | 10. | 10. | 10. | 10. | 10. | | |
| 3.244<br>*2,3,5-TRIMETHYLPYRAZINE | 5.0<br>10. | — | 5.0<br>10. | 5.0<br>10. | — | — | *Cereals*<br>2.0<br>*Condiments*<br>2.0<br>*Meats & Meat Sauces*<br>2.0<br>*Milk & Dairy Pdts.*<br>1.0<br>*Soups*<br>2.0 | |
| 3.245<br>UNDECANOIC ACID | — | — | — | 2.0 | — | — | | |
| 3.246<br>2-UNDECANOL | — | — | — | 20. | — | — | | |
| 3.247<br>10-UNDECENOIC ACID | 0.50 | 0.50 | 0.50 | 0.50 | — | — | | |
| 3.248<br>o-VINYLANISOLE | 10. | — | 10. | 10. | — | — | | |
| 3.249<br>2,6-XYLENOL—2,6-Dimethylphenol | — | — | — | 1.0 | — | — | *Condiments*<br>1.0 | |