

***Recent Progress in the Consideration of Flavoring
Ingredients Under the Food Additives Amendment***

13. GRAS Substances

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□ IT IS NOW more than a quarter of a century since the passage of the Food Additives Amendment of 1958. At that time, the Flavor and Extract Manufacturers' Association (FEMA) initiated usage surveys and other steps toward evaluating the GRAS (Generally Recognized as Safe) status of flavoring substances under their conditions of use. The early results of this program were published in three articles (Hall, 1959, 1960; and Hall and Oser, 1961) and included the following issues among others; (a) the unique problems, methodologies, and approaches required in evaluating the safety of flavoring substances employed in the total diet at a few parts per billion or less; (b) the importance of obtaining accurate usage data (total poundage and concentration levels) for flavoring substances; and (c) the method by which FEMA would review the GRAS status of flavors.

EXPERT PANEL

By 1960, FEMA convened a panel of independent experts, toxicologists, and pharmacologists to review all data relevant to the safety of flavoring substances. This process was undertaken with the knowledge and encouragement of the Food and Drug Administration (FDA). The decision to create this panel, the qualifications required of potential participants, the names of the initial members, and the methods to be employed in review of flavors were previously reported (Hall and Oser, 1961; Oser and Hall, 1977).

A significant portion of the work of the expert panel during the early years involved reviewing information on the more than 1,400 flavoring substances reported to be in use prior to 1958.

The results of these deliberations and their relationship to the provisions of the 1958 Food Additives Amendment were published by Hall and Oser (1965).

In succeeding years, the expert panel has dealt less with substances already in use and more with new substances intended for use as flavors and additional uses for previously listed substances. It has been the policy of FEMA to encourage the industry to submit these additions and alterations to the expert panel for review of their GRAS status.

The results of these deliberations have been published as a series of articles (GRAS lists) in *Food*

Technology (Hall and Oser, 1965, and 1970; Oser and Hall, 1972; Oser and Ford, 1973a, 1973b; 1974; 1975; 1977; 1978; 1979). It has been the consistent policy of FEMA to publish, or require the publication of the background data and usage levels relevant to safety evaluation. Since the mid-1970s, these have been in the form of Scientific Literature Reviews (SLR) initially performed under contract with the FDA. All of this has resulted in the wide recognition of FEMA GRAS lists. The FDA adopted, with very few exceptions, the first such list of substances in the form of two Food Additive Regulations (Code of Federal Regulations Title 21). It is the view of all those involved with the GRAS concept, including FDA and FEMA, that only by publication can the scientific community have the opportunity to comment on or take issue with the opinion of other specialists in the field of food safety evaluation. The purpose of this report is to present the conclusions reached by the expert panel with respect to the substances submitted for GRAS consideration during the period 1979-1983. Release of GRAS 13 has been delayed pending completion of the SLR revisions. This process is now complete, and FEMA is exploring means by which these updated SLRs can be made available to the public.

The rationale for selection of the original panel has been previously described. The current panel consists of scientists who are qualified by training and years of experience in pharmacology, toxicology, nutrition, organic chemistry, metabolism, and animal and comparative pathology as related particularly to the safety evaluation of flavors. Panel members involved with decisions presented herein and their most recent institutional affiliation were: Dr. Ambrose, retired, Medical College of Virginia; Dr. John M. Doull, University of Kansas Medical Center; Dr. David W. Fassett, retired, Eastman Kodak Company; Dr. Paul M. Newberne, Massachusetts Institute of Technology; Professor Robert L. Smith, St. Mary's Hospital Medical School, University of London; Dr. Howard C. Spencer, retired, Dow Chemical Corporation; Mr. Carrol S. Weil, retired, Bushy Run Research Center; and Dr. Lauren A. Woods, Virginia Commonwealth University. Dr. Bernard L. Oser, consultant to FEMA, served as chairman. Dr. Anthony Ambrose, a long-time member of the panel, participated in nearly all of the deliberations but is since deceased. Professor R. Tecwyn Williams, St. Mary's Hospital Medical School, University of London, also deceased, had been unable to participate in the GRAS evaluations in this report. Dr. Spencer, an original panel member, participated in all GRAS 13 decisions and has recent-

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ly retired from the panel. Each of these three members made extensive and substantial contributions to the workings of the panel. Dr. Bernard M. Wagner, Overlook Hospital, Columbia College of Physicians and Surgeons, a recent addition to the panel, did not participate in the evaluations reported herein.

REAFFIRMATION OF GRAS STATUS

The importance of reevaluation at reasonable intervals, taking into account any new and relevant data on substances previously determined to be GRAS, has been discussed by FDA, FEMA, and others involved in the flavor and food industries. Such reexaminations are based on knowledge of changes in current usage levels and consumption patterns, pertinent toxicological data reported in the literature, and results of significant but not yet published studies. To this end, the process of GRAS reaffirmation of flavoring substances previously determined to be GRAS was undertaken by the expert panel several years ago. The process will be completed following a comprehensive review of past, current, and projected studies and updated usage and consumption data.

FEMA continues to sponsor studies on the safety evaluation of structural classes of flavor substances. A current example is the series of metabolism studies underway at St. Mary's Hospital Medical Center, University of London, on the species and dose-dependent metabolism of the substituted propyl benzene family (Zangouras et al., 1981; Caldwell et al., 1982, 1983; Sangster et al., 1983). Such work has direct application to the validity of employing animal data to evaluate potential risk in man.

ALTERATIONS FOR PREVIOUSLY LISTED SUBSTANCES

As has been the practice of FEMA, this publication lists the substances and their maximum use levels in various food categories as most recently reported to the panel and determined to be GRAS. With the passage of time, new uses (either in other food categories or at changed use levels) for substances previously listed are developed. Categories and levels of use reported in GRAS lists reflect current usage and are intended as a guide to good manufacturing practice (GMP), not as rigid limitations or tolerances. A more detailed discussion of the interpretation of this point by FEMA and FDA was previously published by Oser and Ford in 1979.

The panel recognizes, however, that any such increase in use levels should be evaluated to ensure continued GRAS status. With this in mind, the food categories and usage levels for D,L-valine (FEMA no. 3444) were reviewed and the subsequent changes can be found in the Table 2 of this report. New analytical data presented on FEMA no. 2804 indicated that the proper name for this substance should be 3-(hydroxymethyl)-2-heptanone. The panel reviewed the data and reaffirmed its GRAS status.

Three substances, 2-methyl-5-vinylpyrazine (FEMA no. 3211, GRAS 4), o-vinylanisole (FEMA no. 3248, GRAS 4), and musk ambrette (FEMA no. 2758, GRAS 3) were reviewed by the expert panel and found to require additional data including toxicological testing for the continuation of their GRAS status. As interest in these substances is insufficient to support the acquisition of the data required for further safety evaluation, these flavoring substances were dropped from the GRAS list.

NOTES TO THE READER

GRAS 13 includes D,L-phenylalanine as a newly listed substance (FEMA no. 3726). It should not be confused with L-phenylalanine (FEMA no. 3585) previously listed in GRAS 11 (Oser and Ford, 1978). Readers should be aware of use limitations on specific substances or groups of substances as well as the more general GMP guidelines.

Table I of this report is an alphabetical cross reference list. Substances with cis-trans stereochemical designations have also been named according to the more recent and less ambiguous IUPAC (E)-(Z) nomenclature system.

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—“Primary Names and Synonyms Alphabetical Cross Reference List” is on pp. 70-72

—“GRAS Flavoring Ingredients and Usage Levels” are on pp. 74-89

GRAS 13—Primary Names and Synonyms^a Alphabetical Cross Reference List

| FEMA No. | Substance | FEMA No. | Substance |
|----------|---|----------|---|
| 3651 | 6-ACETOXYDIHYDROTHEASPIRANE 1-Acetoxy-2-methoxybenzene (see Guaiacyl acetate, no. 3687) 1-Acetoxy-2-(2,2,3-trimethyl-3-cyclopentenyl)ethane (see Campholene acetate, no. 3657) | 3662 | DIHYDROXYACETOPHENONE 1-(x,y-Dihydroxyphenyl)ethanone (see Dihydroxyacetophenone, no. 3662) 2,6-Dimethoxy- <i>p</i> -cresol (see 4-Methyl-2,6-dimethoxyphenol, no. 3704) 2,6-Dimethylbenzenethiol (see 2,6-Dimethylthiophenol, no. 3666) |
| 3652 | 4-(<i>p</i> -ACETOXYPHENYL)-2-8UTANONE | 3663 | 2,6-DIMETHYL-6-HEPTEN-1-OL |
| 3653 | 4-ACETYL-6- <i>t</i> -BUTYL-1,1-DIMETHYLINDANE 1-Acetylcyclohexyl acetate (see Methyl 1-acetoxycyclohexyl ketone, no. 3701) Acetyl guaiacol (see Guaiacyl acetate, no. 3687) | 3664 | 2,5-DIMETHYL-4-METHOXY-3(2H)-FURANONE |
| 3654 | 4-ACETYL-2-METHYLPYRIMIDINE | 3665 | 2,2-DIMETHYL-5-(1-METHYLPROPEN-1-YL)TETRAHYDROFURAN |
| 3655 | 4-ALLYL-2,6-DIMETHOXYPHENOL 4-Allylsyringol (see 4-Allyl-2,6-dimethoxyphenol, no. 3655) α -Amino-4-imidazolepropionic acid (see L-Histidine, no. 3694) 2-Amino-3(4-imidazolyl)propionic acid (see L-Histidine, no. 3694) α -Amino- β -phenylpropionic acid (see D,L-Phenylalanine, no. 3726) 2-Aminobutanedioc acid (see L-Aspartic acid, no. 3656) 2-Aminoglutaramic acid (see L-Glutamine, no. 3684) α -Aminohydrocinnamic acid (see D,L-Phenylalanine, no. 3726) 2-Aminosuccinic acid (see L-Aspartic acid, no. 3656) | 3666 | 2,6-DIMETHYLTHIOPHENOL Dioxyacetophenone (see Dihydroxyacetophenone, no. 3662) |
| 3656 | L-ASPARTIC ACID α -Benzylidene methional (see 2-(Methylthiomethyl)-3-phenylpropenal, no. 3717) Benzyl isoeugenol (see Isoeugenyl benzyl ether, no. 3698) Benzyl 2-methoxy-4-propenylphenyl ether (see Isoeugenyl benzyl ether, no. 3698) 1-Benzyloxy-2-methoxy-4-propenylbenzene (see Isoeugenyl benzyl ether, no. 3698) Bois de rose oxide (see 2,6,6-Trimethyl-2-vinyltetrahydropyran, no. 3735) | 3667 | DIPHENYL ETHER Diphenyl oxide (see Diphenyl ether, no. 3667) |
| 3657 | CAMPHOLENE ACETATE 3-Carbomethoxy-pyridine (see Methyl nicotinate, no. 3709) | 3668 | DISODIUM 5-GUANYLATE |
| 3658 | 1,4-CINEOLE 2,4-Cresotaldehyde (see 2-Hydroxy-4-methylbenzaldehyde, no. 3697) <i>p</i> -Cresyl octanoate (see <i>p</i> -Tolyl octanoate, no. 3733) <i>o</i> -Cresyl salicylate (see <i>o</i> -Tolyl salicylate, no. 3734) | 3669 | DISODIUM 5-INOSINATE |
| 3659 | α -DAMASCONE | 3670 | <i>trans,trans</i> -2,4-DODECADIENAL (E,E)-2,4-Dodecadienal (see <i>trans,trans</i> -2,4-Dodecadienal, no. 3670) 1,4-Epoxy- <i>p</i> -menthane (see 1,4-Cineole, no. 3658) 4-Ethenylphenol (see <i>p</i> -Vinylphenol, no. 3739) 1-Ethoxy-4-hydroxybenzene (see Hydroquinone monoethyl ether, no. 3695) <i>p</i> -Ethoxyphenol (see Hydroquinone monoethyl ether, no. 3695) |
| 3660 | 9-DECENOIC ACID 6-Deoxy-L-mannose (see L-Rhamnose, no. 3730) | 3671 | 4-ETHYL-2,6-DIMETHOXYPHENOL |
| 3661 | 3,6-DIHYDRO-4-METHYL-2-(2-METHYLPROPEN-1-YL)-2H-PYRAN | 3672 | 2-ETHYL-4,5-DIMETHYLOXAZOLE |
| | | 3673 | 2-ETHYLFURAN Ethyl β -furfuryl- α -thiopropionate (see Ethyl 3-(furfurylthio) propionate, no. 3674) |
| | | 3674 | ETHYL 3-(FURFURYLTHIO)PROPIONATE Ethyl β -ketoheanoate (see Ethyl 3-oxoheanoate, no. 3683) |
| | | 3675 | ETHYL <i>trans</i> -2-HEXENOATE Ethyl (E)-2-hexenoate (see Ethyl <i>trans</i> -2-hexenoate, no. 3675) 1-Ethylhexyl 2-methyl-2-butenate (see 1-Ethylhexyl tiglate, no. 3676) 1-Ethylhexyl 2-methylcrotonate (see 1-Ethylhexyl tiglate, no. 3676) |
| | | 3676 | 1-ETHYLHEXYL TIGLATE |
| | | 3677 | ETHYL 3-MERCAPTOPROPIONATE |
| | | 3678 | ETHYL 2-METHYL-3,4-PENTADIENOATE |
| | | 3679 | ETHYL 3-METHYLPENTANOATE |
| | | 3680 | 2-ETHYL-4-METHYLTHIAZOLE |
| | | 3681 | ETHYL 4-(METHYLTHIO)BUTYRATE Ethyl 3-methylvalerate (see Ethyl 3-methylpentanoate, no. 3679) |
| | | 3682 | ETHYL <i>cis</i> -4,7-OCTADIENOATE Ethyl (Z)-4,7-octadienoate (see Ethyl <i>cis</i> -4,7-octadienoate, no. 3682) |

^aPrimary names, in capital letters, and synonyms, in lower case, are listed alphabetically. Synonyms are followed by reference to the primary name and FEMA number.

13. GRAS Substances (continued)

| FEMA No. | Substance | FEMA No. | Substance |
|----------|--|----------|--|
| 3683 | ETHYL 3-OXOHEXOANOATE Ethyl 3-thiopropionate (see Ethyl 3-mercaptopropionate, no. 3677) 2-Ethylxole (see 2-Ethylfuran, no. 3673) 4-Ethylsyringol (see 4-Ethyl-2,6-dimethoxyphenol, no. 3671) <i>iso</i> -Eugenyl benzyl ether (see Isoeugenyl benzyl ether, no. 3698) Glutamic acid-5-amide (see L-Glutamine, no. 3684) | 3699 | ISOPROPYL 2-METHYLBUTYRATE α -Ketobutyric acid (see 2-Oxobutyric acid, no. 3723) L-Mannomethylose (see L-Rhamnose, no. 3730) α -Melonol (see 2,6-Dimethyl-6-hepten-1-ol, no. 3663) |
| 3684 | L-GLUTAMINE | 3700 | 1- <i>p</i> -MENTHENE-8-THIOL 4-Methoxy-2,5-dimethyl-3(2H)-furanone (see 2,5-Dimethyl-4-methoxy-3(2H)-furanone, no. 3664) 6-Methoxyeugenol (see 4-Allyl-2,6-dimethoxyphenol, no. 3655) 6-Methoxyisoeugenol (see 4-Propenyl-2,6-dimethoxyphenol, no. 3728) <i>o</i> -Methoxyphenyl acetate (see Guaiacyl acetate, no. 3687) 2-Methoxy-4-propenylphenyl benzyl ether (see Isoeugenyl benzyl ether, no. 3698) |
| 3685 | GLYCERYL 5-HYDROXYDECANOATE | 3701 | METHYL 1-ACETOXYCYCLOHEXYL KETONE |
| 3686 | GLYCERYL 5-HYDROXYDODECANOATE | 3702 | METHYLBENZYL ACETATE (mixed <i>o,m,p</i>) |
| 3687 | GUAIACYL ACETATE | 3703 | 3-METHYL-2-BUTANOL |
| 3688 | <i>cis</i> -3-HEXENYL BENZOATE (<i>Z</i>)-3-Hexenyl benzoate (see <i>cis</i> -3-Hexenyl benzoate, no. 3688) | 3704 | 4-METHYL-2,6-DIMETHOXYPHENOL |
| 3689 | <i>cis</i> -3-HEXENYL <i>cis</i> -3-HEXENOATE (<i>Z</i>)-3-Hexenyl (<i>Z</i>)-3-hexenoate (see <i>cis</i> -3-Hexenyl <i>cis</i> -3-hexenoate, no. 3689) <i>cis</i> -3-Hexenyl 2-hydroxypropanoate (see <i>cis</i> -3-Hexenyl lactate, no. 3690) | 3705 | 2-METHYL-1,3-DITHIOLANE 3-Methylene-2-octanone (see 2-Pentyl-1-buten-3-one, no. 3725) 4-(1-Methylethyl)-3-cyclohexene-1-carboxylic acid (see 1,2,5,6-Tetrahydrocumic acid, no. 3731) Methyl 2,4-hexadienoate (see Methyl sorbate, no. 3714) Methyl (E,E)-2,4-hexadienoate (see Methyl sorbate, no. 3714) |
| 3690 | <i>cis</i> -3-HEXENYL LACTATE (<i>Z</i>)-3-Hexenyl lactate (see <i>cis</i> -3-Hexenyl lactate, no. 3690) | 3706 | METHYL 2-HYDROXY-4-METHYLPENTANOATE Methyl 2-hydroxyisocaproate (see Methyl 2-hydroxy-4-methylpentanoate, no. 3706) Methyl isopropyl carbinol (see 3-Methyl-2-butanol, no. 3703) Methyl 2-keto-3-methylvalerate (see Methyl 2-oxo-3-methylpentanoate, no. 3713) Methyl 3-methyl-2-oxovalerate (see Methyl 2-oxo-3-methylpentanoate, no. 3713) |
| 3691 | HEXYL BENZOATE | 3707 | METHYL 2-METHYLPENTANOATE |
| 3692 | HEXYL <i>trans</i> -2-HEXENOATE Hexyl (E)-2-hexenoate (see Hexyl <i>trans</i> -2-hexenoate, no. 3692) | 3708 | METHYL 2-METHYLTHIOBUTYRATE Methyl 2-methylvalerate (see Methyl 2-methylpentanoate, no. 3707) |
| 3693 | HEXYL 2-METHYL-3&4-PENTENOATE | 3709 | METHYL NICOTINATE |
| 3694 | L-HISTIDINE | 3710 | METHYL 3-NONENOATE |
| 3695 | HYDROQUINONE MONOETHYL ETHER | 3711 | 2-METHYL-2-OCTENAL |
| 3696 | 5-HYDROXY-2,4-DECADIENOIC ACID δ -LACTONE 4-Hydroxy-3-methoxybenzyl alcohol (see Vanillyl alcohol, No. 3737) 4-(4-Hydroxy-3-methoxyphenyl)but-3-en-2-one (see Vanillylidene acetone, no. 3738) 4-Hydroxy-3-methoxyphenylmethanol (see Vanillyl alcohol, no. 3737) | 3712 | METHYL <i>trans</i> -2-OCTENOATE Methyl (E)-2-octenoate (see Methyl <i>trans</i> -2-octenoate, no. 3712) |
| 3697 | 2-HYDROXY-4-METHYLBENZALDEHYDE β -(<i>p</i> -Hydroxyphenyl)alanine (see L-Tyrosine, no. 3736) 4-Hydroxystyrene (see <i>p</i> -Vinylphenol, no. 3739) 2-Isobutoxynaphthalene (see β -Naphthyl isobutyl ether, no. 3719) Isobutyl β -naphthyl ether (see β -Naphthyl isobutyl ether, no. 3719) Isodulcit (see L-Rhamnose, no. 3730) | | |
| 3698 | ISOEUGENYL BENZYL ETHER 4-Isopropyl-3-cyclohexene-1-carboxylic acid (see 1,2,5,6-Tetrahydrocumic acid, no. 3731) | | |

—Continued on page 73

| FEMA No. | Substance | FEMA No. | Substance |
|----------|--|----------|--|
| 3713 | METHYL 2-OXO-3-METHYLPENTANOATE 2-Methylphenyl 2-hydroxybenzoate (see <i>o</i> -Tolyl salicylate, no. 3734) <i>p</i> -Methylphenyl octanoate (see <i>p</i> -Tolyl octanoate, no. 3733) Methyl 3-pyridinecarboxylate (see Methyl nicotinate, no. 3709) 4-Methylsalicylaldehyde (see 2-Hydroxy-4-methylbenzaldehyde, no. 3697) 4-Methylsalicylic aldehyde (see 2-Hydroxy-4-methylbenzaldehyde, no. 3697) | 3723 | 2-OXOBUTYRIC ACID |
| 3714 | METHYL SORBATE 4-Methylsyringol (see 4-Methyl-2,6-dimethoxyphenol, no. 3704) | 3724 | 2-PENTADECANONE |
| 3715 | 7-METHYL-4,4a,5,6-TETRAHYDRO-2-(3H)-NAPHTHALENONE | 3725 | 2-PENTYL-1-BUTEN-3-ONE 6-Pentyl- α -pyrone (see 5-Hydroxy-2,4-decadienoic acid δ -lactone, no. 3696) |
| 3716 | 4-METHYLTHIAZOLE Methylthio 2-methylbutyrate (see Methyl 2-methylthiobutyrate, no. 3708) | 3726 | D,L-PHENYLALANINE Phenyl ether (see Diphenyl ether, no. 3667) 1-Phenyl-3 or 5-propyl-1,2-diazole (see 1-Phenyl-3 or 5-propylpyrazole, no. 3727) |
| 3717 | 2-(METHYLTHIOMETHYL)-3-PHENYLPROPENAL Methyl tridecyl ketone (see 2-Pentadecanone, no. 3724) | 3727 | 1-PHENYL-3 or 5-PROPYLPYRAZOLE 4-Propenyl-1-(benzyloxy)-2-methoxybenzene (see Isoeugenyl benzyl ether, no. 3698) |
| 3718 | 3-METHYL-1,2,4-TRITHIANE | 3728 | 4-PROPENYL-2,6-DIMETHOXYPHENOL 4-Propenylsyringol (see 4-Propenyl-2,6-dimethoxyphenol, no. 3728) |
| 3719 | β -NAPHTHYL ISOBUTYL ETHER Neroloxide (see 3,6-Dihydro-4-methyl-2-(2-methylpropen-1-yl)-2H-pyran, no. 3661) | 3729 | 4-PROPYL-2,6-DIMETHOXYPHENOL 4-Propylsyringol (see 4-Propyl-2,6-dimethoxyphenol, no. 3729) |
| 3720 | <i>cis</i> -2-NONEN-1-OL (Z)-2-Nonen-1-ol (see <i>cis</i> -2-Nonen-1-ol, no. 3720) Ocimen quintoxide (see 2,2-Dimethyl-5-(1-methylpropen-1-yl)tetrahydrofuran, no. 3665) | 3730 | L-RHAMNOSE Ribotide (see Disodium 5-guanylate, no. 3668) |
| 3721 | <i>trans,trans</i> -2,4-OCTADIENAL (E,E)-2,4-Octadienal (see <i>trans,trans</i> -2,4-Octadienal, no. 3721) | 3731 | 1,2,5,6-TETRAHYDROCUMINIC ACID (2RS,5SR,6SR)-2,6,10,10-Tetramethyl-1-oxaspiro[4,5]dec-6-yl acetate (mixture of C2 epimers) (see 6-Acetoxydihydrotheaspirane, no. 3651) |
| 3722 | <i>cis</i> -5-OCTEN-1-OL (Z)-5-Octen-1-ol (see <i>cis</i> -5-Octen-1-ol, no. 3722) 3-Octyl 2-methyl-2-butenolate (see 1-Ethylhexyl tiglate, no. 3676) 3-Octyl 2-methylcrotonate (see 1-Ethylhexyl tiglate, no. 3676) 3-Octyl tiglate (see 1-Ethylhexyl tiglate, no. 3676) | 3732 | THAUMATIN |
| | | 3733 | <i>p</i> -TOLYL OCTANOATE |
| | | 3734 | <i>o</i> -TOLYL SALICYLATE $\alpha, \alpha, 4$ -Trimethyl-3-cyclohexene-1-methanethiol (see 1- <i>p</i> -Menthene-8-thiol, no. 3700) 4-(2,6,6-Trimethyl-2-cyclohexenyl)-2-butene-4-one (see α -Damascone, no. 3659) 2-(2,2,3-Trimethyl-3-cyclopentenyl)ethyl acetate (see Campholene acetate, no. 3657) |
| | | 3735 | 2,6,6-TRIMETHYL-6-VINYLTETRAHYDROPYRAN |
| | | 3736 | L-TYROSINE |
| | | 3737 | VANILLYL ALCOHOL |
| | | 3738 | VANILLYLIDENE ACETONE |
| | | 3739 | <i>p</i> -VINYLPHENOL 2,6-Xylenethiol (see 2,6-Dimethylthiophenol, no. 3666) |

—“Gras Flavoring Ingredients and Usage Levels” start on page 74

GRAS FLAVORING INGREDIENTS AND USAGE LEVELS

Flavor and Extract Manufacturers' Association average maximum levels (in ppm) on which the Expert Panel based its judgements that the substances are generally recognized as safe for their intended uses

| Substance | Baked Goods | Frozen Dairy | Meat Products | Soft Candy | Gelatin & Puddings | Soups | Snack Foods | Nonalcoholic Beverages | Alcoholic Beverages | Gravies | Other Uses |
|--|-------------|--------------|---------------|------------|--------------------|-------|-------------|------------------------|---------------------|---------|--|
| ³⁶⁵¹ 6-ACETOXYDIHYDROTHEASPIRANE | 0.5 | — | 0.5 | — | — | 0.2 | 0.5 | — | — | 0.2 | Condiments & relishes—0.3; Instant coffee and tea—0.05; Seasonings & flavorings—0.1 |
| ³⁶⁵² 4-(p-ACETOXYPHENYL)-2-BUTANONE | — | — | — | 2.0 | 2.0 | — | — | 0.5 | — | — | Fruit ices—1.0; Confectionery & frosting—1.0; Jams & jellies—1.0; Imitation dairy—1.0; Hard candy—2.0; Chewing gum—10.0 |
| ³⁶⁵³ 4-ACETYL-6-t-BUTYL-1,1-DIMETHYLINDANE | — | — | — | 8.0 | — | — | — | — | — | — | |
| ³⁶⁵⁴ 4-ACETYL-2-METHYLPYRIMIDINE | 10.0 | 5.0 | 1.0 | 5.0 | 5.0 | 3.0 | 10.0 | 2.0 | 5.0 | 3.0 | Breakfast cereals—5.0; Milk products—1.0; Cheese—1.0; Egg products—0.5; Confectionery & frosting—5.0; Nut products—5.0; Hard candy—5.0; Chewing gum—10.0 |
| ³⁶⁵⁵ 4-ALLYL-2,6-DIMETHOXYPHENOL | — | — | 0.5 | — | — | 0.2 | 0.5 | — | — | 0.5 | Cheese—0.5; Seasonings & flavorings—5.0; Poultry—0.2; Condiments & relishes—5.0 |
| ³⁶⁵⁶ L-ASPARTIC ACID | 250 | — | 250 | — | — | — | — | 150 | — | — | Condiments & relishes—250; Seasonings & flavorings—250 |
| ³⁶⁵⁷ CAMPHOLENE ACETATE | — | — | — | 3 | 3 | — | — | 3 | 3 | — | Hard candy—3; Chewing gum—3 |
| ³⁶⁵⁸ 1,4-CINEOLE | 12.14 | 9.62 | 8.29 | 11.49 | 9.91 | — | — | 9.21 | 4.71 | — | Hard Candy—50.0; Chewing Gum—25.0 |

| Substance | Baked Goods | Frozen Dairy | Meat Products | Soft Candy | Gelatins & Puddings | Soups | Snack Foods | Nonalcoholic Beverages | Alcoholic Beverages | Gravies | Other Uses |
|--|-------------|--------------|---------------|------------|---------------------|-------|-------------|------------------------|---------------------|---------|--|
| ³⁶⁵⁹ α-DAMASCONE | — | — | — | 0.5 | 0.5 | — | — | 0.5 | 0.5 | — | Confectionery & frosting—0.5; Hard candy—0.5; Chewing gum—0.5 |
| ³⁶⁶⁰ 9-DECENOIC ACID | — | — | — | — | — | — | — | — | — | — | Fats & oils—100 |
| ³⁶⁶¹ 3,6-DIHYDRO-4-METHYL-2-(2-METHYLPROPEN-1-YL)-2H-PYRAN | 0.2 | 0.1 | — | 0.2 | 0.1 | — | — | 0.1 | — | — | Milk products—0.1; Processed fruit—0.1; Fruit ices—0.1; Jams & jellies—0.1; Hard candy—0.2; Instant coffee & tea—0.1 |
| ³⁶⁶² DIHYDROXYACETOPHENONE | — | — | 0.2 | — | — | — | — | — | — | — | |
| ³⁶⁶³ 2,6-DIMETHYL-6-HEPTEN-1-OL | — | 0.2 | — | 0.5 | 0.5 | — | — | 0.2 | — | — | Fruit ices—0.2; Confectionery & frosting—0.5; Imitation dairy—0.4; Hard candy—0.5; Chewing gum—2.0 |
| ³⁶⁶⁴ 2,5-DIMETHYL-4-METHOXY-3(2H)-FURANONE | 12.0 | 3.0 | — | 2.5 | 5.0 | — | — | 0.5 | 1.0 | — | Milk products—2.5; Fruit ices—3.0; Confectionery & frosting—2.5; Jams and jellies—2.5; Hard candy—5.0; Chewing gum—10.0 |
| ³⁶⁶⁵ 2,2-DIMETHYL-5-(1-METHYLPROPEN-1-YL)-TETRAHYDROFURAN | — | — | — | 0.5 | 0.5 | — | — | — | — | — | Confectionery & frostings—0.5; Hard candy—0.5; Chewing gum—0.5 |
| ³⁶⁶⁶ 2,6-DIMETHYLTHIOPHENOL | 3.0 | — | 1.0 | 1.5 | 0.25 | 2.0 | 5.0 | 0.05 | 0.05 | 0.5 | Confectionery & frosting—0.5; Breakfast cereals—3.0; Milk products—0.5; Cheese—0.5; Egg products—0.5; Condiments & relishes—0.5; Nut products—0.5; Hard candy—2.5; Chewing gum—5.0 |

13. GRAS Substances (continued)

| Substance | Baked Goods | Frozen Dairy | Meat Products | Soft Candy | Gelatins & Puddings | Soups | Snack Foods | Nonalcoholic Beverages | Alcoholic Beverages | Gravies | Other Uses |
|--|-------------|--------------|---------------|------------|---------------------|-------|-------------|------------------------|---------------------|---------|--|
| ³⁶⁶⁷ DIPHENYL ETHER | — | — | — | 7.5 | — | — | — | 2.5 | — | — | |
| ³⁶⁶⁸ DISODIUM 5-GUANYLATE | 143 | 3000 | 200 | 3000 | 2000 | 720 | 50 | 2000 | — | 240 | Fats and oils—2000; Other grains—240; Milk products—46; Cheese—0.4; Poultry—200; Fish products—10.0; Processed vegetables—140; Condiments & relishes—3200; Reconstituted vegetables—150; Main dishes, NEC—0.15; Seasonings & flavorings—1000 |
| ³⁶⁶⁹ DISODIUM 5-INOSINATE | 141 | 3000 | 314 | 3000 | — | 660 | 50 | 220 | — | 660 | Other grains—240; Fats and oils—2000; Milk products—46.0; Cheese—0.4; Poultry—200; Fish products—10.0; Processed vegetables—220; Condiments & relishes—3200; Reconstituted vegetables—50.0; Seasonings & flavorings—1000 |
| ³⁶⁷⁰ <i>trans, trans</i> -2,4-DODECADIENAL | 1.0 | — | 0.5 | — | — | 0.5 | 0.5 | — | — | 0.5 | Condiments & relishes—0.5 |
| ³⁶⁷¹ 4-ETHYL-2,6-DIMETHOXYPHENOL | — | — | 1.0 | — | — | 0.5 | 1.0 | — | — | 1.0 | Cheese—1.0; Poultry—0.5; Condiments & relishes—5.0; Seasonings & flavorings—5.0 |
| ³⁶⁷² 2-ETHYL-4,5-DIMETHYLOXAZOLE | 1.5 | — | 0.5 | 1.0 | 1.0 | 0.2 | — | — | — | 0.5 | Breakfast cereals—0.5; Confectionery & frosting—1.0; Chewing gum—2.5; Instant coffee & tea—0.2 |

| Substance | Baked Goods | Frozen Dairy | Meat Products | Soft Candy | Gelatins & Puddings | Soups | Snack Foods | Nonalcoholic Beverages | Alcoholic Beverages | Gravies | Other Uses |
|---|-------------|--------------|---------------|------------|---------------------|-------|-------------|------------------------|---------------------|---------|--|
| ³⁶⁷³ 2-ETHYLFURAN | 42.5 | 21.5 | — | 22.5 | 21.0 | — | — | 11.5 | 3.0 | — | |
| ³⁶⁷⁴ ETHYL 3-(FURFURYLTHIO)- PROPIONATE | 2.0 | — | — | — | 0.2 | 0.5 | 2.0 | 0.1 | — | 0.2 | Breakfast cereals—0.2; Fats & oils—20.0; Confectionery and frosting—0.2; Sweet sauce—0.1; Nut products—5.0; Imitation dairy—0.1; Hard candy—0.2; Chewing gum—1.0 |
| ³⁶⁷⁵ ETHYL <i>trans</i> -2-HEXENOATE | 12.0 | — | — | — | 5.0 | — | — | 0.5 | 1.0 | — | Milk products—2.5; Fruit ices—3.0; Confectionery & frosting—10.0; Hard candy—5.0 |
| ³⁶⁷⁶ 1-ETHYLHEXYL TIGLATE | — | — | 20.0 | — | — | 20.0 | 20.0 | — | — | 50.0 | Condiments & relishes—20.0; Seasonings & flavorings—25.0 |
| ³⁶⁷⁷ ETHYL 3-MERCAPTOPROPIONATE | 7.5 | — | — | — | — | — | — | 0.5 | — | — | Fruit ices—0.5; Hard candy—6.0 |
| ³⁶⁷⁸ ETHYL 2-METHYL- 3,4-PENTADIENOATE | — | — | — | 1.0 | 2.0 | — | — | 1.0 | — | — | Confectionery & frosting—2.0; Imitation dairy—1.0; Hard candy—2.0; Chewing gum—5.0 |
| ³⁶⁷⁹ ETHYL 3-METHYLPENTANOATE | 0.1 | 0.1 | — | 0.5 | 0.1 | — | — | 0.1 | 0.1 | — | Breakfast cereals—0.1; Fruit ices—0.1; Confectionery & frosting—0.5; Imitation dairy—0.1; Hard candy—0.1; Chewing gum—0.5 |
| ³⁶⁸⁰ 2-ETHYL-4-METHYLTHIAZOLE | — | 1.0 | — | 1.0 | 1.0 | — | — | 1.0 | — | — | Confectionery & frosting—1.0; Hard candy—1.0 |

13. GRAS Substances (continued)

| Substance | Baked Goods | Frozen Dairy | Meat Products | Soft Candy | Gelatins & Puddings | Soups | Snack Foods | Nonalcoholic Beverages | Alcoholic Beverages | Gravies | Other Uses |
|---|-------------|--------------|---------------|------------|---------------------|-------|-------------|------------------------|---------------------|---------|--|
| ³⁶⁸¹ ETHYL 4-(METHYLTHIO)-BUTYRATE | — | — | — | 0.2 | 0.2 | — | — | 0.2 | 0.2 | — | Confectionery & frosting—0.2; Hard candy—0.2; Chewing gum—0.2 |
| ³⁶⁸² ETHYL <i>cis</i> -4,7-OCTADIENOATE | 20.0 | 15.0 | — | 15.0 | 15.0 | — | 20.0 | 10.0 | 10.0 | — | Breakfast cereals—25.0; Milk products—10.0; Fruit ices—15.0; Confectionery & frosting—10.0; Jams & jellies—5.0; Sweet sauce—5.0; Imitation dairy—10.0; Hard candy—20.0; Chewing gum—25.0 |
| ³⁶⁸³ ETHYL 3-OXOHEXANOATE | 5.0 | — | — | — | 3.0 | — | — | 1.5 | 3.0 | — | Fats & oils—2.5; Fruit ices—2.5; Confectionery & frosting—3.0; Hard candy—7.5 |
| ³⁶⁸⁴ L-GLUTAMINE | 350 | — | 350 | 350 | — | — | — | — | — | — | Nut products—350; Seasonings & flavorings—350 |
| ³⁶⁸⁵ GLYCERYL 5-HYDROXYDECANOATE | 50.0 | — | — | — | — | — | — | — | — | — | Fats & oils—50.0; Imitation dairy—10.0 |
| ³⁶⁸⁶ GLYCERYL 5-HYDROXYDODECANOATE | 50.0 | — | — | — | — | — | — | — | — | — | Fats & oils—50.0; Imitation dairy—10.0 |
| ³⁶⁸⁷ GUAIACYL ACETATE | 15.2 | 9.59 | — | 11.2 | 10.0 | — | — | 10.0 | — | — | |
| ³⁶⁸⁸ <i>cis</i> -3-HEXENYL BENZOATE | 3.0 | — | — | 1.0 | 1.0 | — | — | 1.0 | 2.0 | — | Milk products—1.0; Confectionery & frosting—1.0; Jams & jellies—1.0; Sweet sauce—1.0; Hard candy—3.0; Chewing gum—10.0 |

| Substance | Baked Goods | Frozen Dairy | Meat Products | Soft Candy | Gelatins & Puddings | Soups | Snack Foods | Nonalcoholic Beverages | Alcoholic Beverages | Gravies | Other Uses |
|---|-------------|--------------|---------------|------------|---------------------|-------|-------------|------------------------|---------------------|---------|---|
| 3689 <i>cis</i> -3-HEXENYL <i>cis</i> -3-HEXENOATE | — | — | — | — | 1.0 | — | — | 0.5 | — | — | Fruit ices—0.2; Confectionery & frosting—0.5; Jams & jellies—1.0; Reconstituted vegetables—1.0; Imitation dairy—0.5; Hard candy—1.0; Chewing gum—2.0 |
| 3690 <i>cis</i> -3-HEXENYL LACTATE | 20.0 | 5.0 | — | — | 5.0 | — | — | 1.0 | 5.0 | — | Jams and jellies—10.0; Hard candy—10.0 |
| 3691 HEXYL BENZOATE | 10.0 | 7.5 | — | 10.0 | 7.5 | — | — | 7.5 | 5.0 | — | |
| 3692 HEXYL <i>trans</i> -2-HEXENOATE | 5.0 | — | — | — | 3.0 | — | — | 1.5 | 3.0 | — | Milk products—2.5; Fruit ices—2.5; Confectionery & frosting—3.0; Hard candy—7.5 |
| 3693 HEXYL 2-METHYL-3&4-PENTENOATE | — | — | — | 0.4 | 0.4 | — | — | 0.4 | 0.4 | — | Confectionery & frosting—0.4; Hard candy—0.4; Chewing gum—0.4 |
| 3694 L-HISTIDINE | 150 | — | 150 | — | — | — | — | — | — | — | Milk products—150; Confectionery & frosting—150 |
| 3695 HYDROQUINONE MONOETHYL ETHER | 5.0 | 5.0 | 0.5 | 5.0 | 5.0 | — | — | 5.0 | — | — | |
| 3696 5-HYDROXY-2,4-DECADIENOIC ACID δ -LACTONE | 0.2 | — | — | 0.1 | 0.05 | — | — | 0.2 | — | 0.2 | Cheese—0.2; Condiments & relishes—0.5; Confectionery & frosting—0.2; Reconstituted vegetables—0.2; Imitation dairy—0.1; Hard candy—0.2; Chewing gum—0.5 |

13. GRAS Substances (continued)

| Substance | Baked Goods | Frozen Dairy | Meat Products | Soft Candy | Gelatins & Puddings | Soups | Snack Foods | Nonalcoholic Beverages | Alcoholic Beverages | Gravies | Other Uses |
|---|-------------|--------------|---------------|------------|---------------------|-------|-------------|------------------------|---------------------|---------|---|
| ³⁶⁹⁷ 2-HYDROXY-4-METHYL-BENZALDEHYDE | 2.0 | 0.5 | — | 0.5 | 1.0 | — | — | — | — | — | Milk products—1.0; Processed fruit—0.5; Confectionery & frosting—0.5; Nut products—0.5; Hard candy—0.5 |
| ³⁶⁹⁸ ISOEUGENYL BENZYL ETHER | 13.0 | 5.0 | — | 5.0 | 5.66 | — | — | 8.66 | — | — | |
| ³⁶⁹⁹ ISOPROPYL 2-METHYLBUTYRATE | 10.0 | 10.0 | — | 15.0 | 10.0 | — | 20.0 | 5.0 | — | — | Breakfast cereals—10.0; Fruit ices—15.0; Confectionery & frosting—10.0; Jams & jellies—5.0; Sweet sauce—5.0; Imitation dairy—10.0; Hard candy—15.0; Chewing gum—20.0; Seasonings & flavorings—1.0 |
| ³⁷⁰⁰ 1- <i>p</i> -MENTHENE-8-THIOL | — | — | — | 0.002 | 0.001 | — | — | 0.001 | — | — | Chewing gum—0.004; Processed fruit—0.001; Fruit ices—0.001; Confectionery & frosting—0.002; Jams & jellies—0.001; Hard candy—0.002 |
| ³⁷⁰¹ METHYL 1-ACETOXYCYCLOHEXYL KETONE | 0.2 | — | — | 0.5 | 0.2 | — | — | 0.2 | 0.2 | — | Breakfast cereals—0.5; Processed fruit—0.1; Fruit ices—0.1; Confectionery & frosting—0.2; Jams & jellies—0.1; Hard candy—0.5; Chewing gum—0.5 |
| ³⁷⁰² METHYLBENZYL ACETATE (mixed <i>o,m,p</i>) | — | — | — | — | — | — | — | 1.0 | — | — | |
| ³⁷⁰³ 3-METHYL-2-BUTANOL | 20.0 | 5.0 | — | — | 5.0 | — | — | 1.0 | 5.0 | — | Jams & jellies—10.0; Hard candy—10.0 |

| Substance | Baked Goods | Frozen Dairy | Meat Products | Soft Candy | Gelatins & Puddings | Soups | Snack Foods | Nonalcoholic Beverages | Alcoholic Beverages | Gravies | Other Uses |
|--|-------------|--------------|---------------|------------|---------------------|-------|-------------|------------------------|---------------------|---------|---|
| <i>3704</i> 4-METHYL-2,6-DIMETHOXYPHENOL | — | — | 1.0 | — | — | 0.5 | 1.0 | — | — | 1.0 | Cheese—1.0; Poultry—0.5; Condiments & relishes—5.0; Seasonings & flavorings—5.0 |
| <i>3705</i> 2-METHYL-1,3-DITHIOLANE | 0.5 | — | 0.5 | — | — | 0.1 | 3.0 | — | — | 0.1 | Breakfast cereals—0.1; Cheese—0.5; Condiments & relishes—0.05; Nut products—0.1; Instant coffee & tea—0.05; Egg products—0.2 |
| <i>3706</i> METHYL 2-HYDROXY-4-METHYLPENTANOATE | 10.0 | 2.5 | — | — | 2.5 | — | — | 0.5 | 2.5 | — | Jams & jellies—5.0; Hard candy—5.0 |
| <i>3707</i> METHYL 2-METHYLPENTANOATE | — | 0.5 | — | 0.25 | 0.25 | — | 0.5 | 0.25 | 0.25 | — | Confectionery & frosting—0.25; Nut products—0.25; Hard candy—0.5; Chewing gum—1.0 |
| <i>3708</i> METHYL 2-METHYLTHIOBUTYRATE | — | 0.3 | — | 0.3 | 0.5 | — | — | — | 0.5 | — | Confectionery & frosting—0.3; Imitation dairy—0.3; Hard candy—0.5 |
| <i>3709</i> METHYL NICOTINATE | 40.0 | 10.0 | — | — | 10.0 | — | — | 2.0 | 10.0 | — | Jams & jellies—20.0; Hard candy—20.0 |
| <i>3710</i> METHYL 3-NONENOATE | 15.0 | — | — | 15.0 | — | — | — | 2.0 | — | — | Fruit ices—5.0; Confectionery & frosting—15.0; Hard candy—15.0; Chewing gum—25.0 |
| <i>3711</i> 2-METHYL-2-OCTENAL | 1.0 | 1.5 | 1.5 | — | — | 1.0 | 1.5 | — | — | 1.0 | Breakfast cereals—0.5; Fats & oils—0.5; Milk products—0.5; Cheese—1.0; Fish products—0.5; Condiments & relishes—0.5; Nut products—0.5; Imitation Dairy—0.5; Seasonings & flavorings—0.1 |

13. GRAS Substances (continued)

| Substance | Baked Goods | Frozen Dairy | Meat Products | Soft Candy | Gelatins & Puddings | Soups | Snack Foods | Nonalcoholic Beverages | Alcoholic Beverages | Gravies | Other Uses |
|---|-------------|--------------|---------------|------------|---------------------|-------|-------------|------------------------|---------------------|---------|--|
| ³⁷¹² METHYL <i>trans</i> -2-OCTENOATE | 7.5 | — | — | — | 3.0 | — | — | 1.5 | 3.0 | — | Milk products—2.5; Fruit ices—2.5; Confectionery & frosting—3.0; Hard candy—7.5 |
| ³⁷¹³ METHYL 2-OXO-3-METHYLPENTANOATE | 100 | 50.0 | — | 50.0 | — | — | 25.0 | 25.0 | 50.0 | — | Breakfast cereals—50.0; Other grains—50.0; Fats & oils—50.0; Milk products—25.0; Confectionery & frosting—50.0; Nut products—50.0; Imitation dairy—25.0; Hard candy—100; Chewing gum—100 |
| ³⁷¹⁴ METHYL SORBATE | 10.0 | 2.5 | — | — | 2.5 | — | — | 0.5 | 2.5 | — | Jams & jellies—5.0; Hard candy—5.0 |
| ³⁷¹⁵ 7-METHYL-4,4a,5,6-TETRAHYDRO-2(3H)-NAPHTHALENONE | 1.0 | — | — | 1.0 | 0.5 | — | — | 0.2 | — | — | Breakfast cereals—1.0; Confectionery & frosting—1.0; Nut products—0.5; Imitation dairy—0.5; Hard candy—1.0; Chewing gum—2.0 |
| ³⁷¹⁶ 4-METHYLTHIAZOLE | 5.0 | — | 5.0 | 5.0 | — | 5.0 | 5.0 | — | — | 5.0 | Breakfast cereals—5.0; Fats & oils—3.0; Milk products—3.0; Cheese—5.0; Condiments & relishes—1.5; Confectionery & frosting—5.0; Nut products—5.0; Reconstituted vegetables—5.0; Imitation dairy—2.5; Hard candy—5.0; Chewing gum—5.0; Instant coffee & tea—2.0 |

| Substance | Baked Goods | Frozen Dairy | Meat Products | Soft Candy | Gelatins & Puddings | Soups | Snack Foods | Nonalcoholic Beverages | Alcoholic Beverages | Gravies | Other Uses |
|--|-------------|--------------|---------------|------------|---------------------|-------|-------------|------------------------|---------------------|---------|---|
| <i>3717</i> 2-(METHYLTHIOMETHYL)-3-PHENYLPROPENAL | — | — | — | — | — | 1.0 | — | — | — | 1.0 | Nut products—1.0; Reconstituted vegetables—0.5; Imitation dairy—0.5 |
| <i>3718</i> 3-METHYL-1,2,4-TRITHIANE | 1.5 | 0.5 | 1.0 | 0.5 | 0.3 | 0.5 | 1.5 | 0.15 | 0.5 | 0.5 | Breakfast cereals—0.5; Egg products—0.05; Confectionery & frosting—0.5; Nut products—0.5; Hard candy—1.0; Chewing gum—5.0 |
| <i>3719</i> β -NAPHTHYL ISOBUTYL ETHER | 5.0 | 5.0 | — | 5.0 | 5.0 | — | — | 5.0 | 1.0 | — | |
| <i>3720</i> <i>cis</i> -2-NONEN-1-OL | 0.15 | 0.15 | 0.1 | 0.1 | 0.15 | 0.05 | 0.2 | 0.05 | — | 0.05 | Breakfast cereals—0.2; Fats & oils—0.35; Milk products—0.1; Cheese—0.1; Fruit ices—0.05; Condiments & relishes—0.05; Confectionery & frosting—0.15; Jams & jellies—0.05; Sweet sauce—0.1; Nut products—0.1; Imitation dairy—0.05; Hard candy—0.15; Chewing gum—0.2; Instant coffee & tea—0.05 |
| <i>3721</i> <i>trans,trans</i> -2,4-OCTADIENAL | 2.0 | — | 2.0 | — | — | 2.0 | — | — | — | 2.0 | |
| <i>3722</i> <i>cis</i> -5-OCTEN-1-OL | 15.0 | 15.0 | — | 15.0 | 20.0 | — | 30.0 | 10.0 | 15.0 | — | Breakfast cereals—15.0; Milk products—10.0; Processed fruit—5.0; Fruit ices—20.0; Confectionery & frosting—10.0; Jams & jellies—10.0; Sweet sauce—5.0; Nut products—5.0; Reconstituted vegetables—1.0; Hard candy—25.0; Chewing gum—25.0 |

13. GRAS Substances (continued)

| Substance | Baked Goods | Frozen Dairy | Meat Products | Soft Candy | Gelatins & Puddings | Soups | Snack Foods | Nonalcoholic Beverages | Alcoholic Beverages | Gravies | Other Uses |
|---|-------------|--------------|---------------|------------|---------------------|-------|-------------|------------------------|---------------------|---------|---|
| ³⁷²³ 2-OXOBUTYRIC ACID | 2.0 | 12.0 | — | — | — | — | — | 1.0 | — | — | |
| ³⁷²⁴ 2-PENTADECANONE | — | — | — | — | — | — | — | — | — | — | Fats & oils—75.0 |
| ³⁷²⁵ 2-PENTYL-1-BUTEN-3-ONE | 0.01 | — | — | — | — | 0.01 | 0.01 | — | — | 0.01 | Cheese—0.01; Egg products—0.01; Condiments & relishes—0.005; Reconstituted vegetables—0.01; Seasonings & flavorings—0.1 |
| ³⁷²⁶ D,L-PHENYLALANINE | 300 | — | 300 | — | — | — | — | — | — | — | Nut products—300; Condiments & relishes—300; Seasonings & flavorings—5.0 |
| ³⁷²⁷ 1-PHENYL-3 or 5-PROPYLPYRAZOLE | 1.0 | 1.0 | — | 1.0 | 1.0 | — | — | 1.0 | — | — | |
| ³⁷²⁸ 4-PROPENYL-2,6-DIMETHOXYPHENOL | — | — | 1.0 | — | — | 0.5 | 1.0 | — | — | 1.0 | Cheese—1.0; Poultry—0.5; Condiments & relishes—5.0; Seasonings & flavorings—300 |
| ³⁷²⁹ 4-PROPYL-2,6-DIMETHOXYPHENOL | — | — | 1.0 | — | — | 0.5 | 1.0 | — | — | 1.0 | Cheese—1.0; Poultry—0.5; Condiments & relishes—5.0; Seasonings & flavorings—5.0 |
| ³⁷³⁰ L-RHAMNOSE | 500 | — | 200 | 500 | — | — | 100 | 500 | — | — | Milk products—50.0; Confectionery & frosting—100; Chewing gum—100; Sugar substitutes—10.0; Instant coffee & tea—10.0 |
| ³⁷³¹ 1,2,5,6-TETRAHYDROCUMINIC ACID | 2.5 | — | 5.0 | — | — | 2.5 | 5.0 | — | — | 5.0 | Cheese—1.0; Poultry—5.0; Egg products—2.5; Fish products—5.0; Condiments & relishes—5.0; Imitation dairy—0.5; Seasonings & flavorings—200 |

| Substance | Baked Goods | Frozen Dairy | Meat Products | Soft Candy | Gelatins & Puddings | Soups | Snack Foods | Nonalcoholic Beverages | Alcoholic Beverages | Gravies | Other Uses |
|--|-------------|--------------|---------------|------------|---------------------|-------|-------------|------------------------|---------------------|---------|--|
| 3732 THAUMATIN | — | — | — | — | — | — | — | — | — | — | Chewing gum—300 |
| 3733 <i>p</i> -TOLYL OCTANOATE | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | — | — | 5.0 | — | — | |
| 3734 <i>o</i> -TOLYL SALICYLATE | — | — | — | — | — | — | — | — | — | — | Hard candy—15.0; Chewing gum—100 |
| 3735 2,6,6-TRIMETHYL-6-VINYLTETRAHYDROPYRAN | — | — | — | 0.5 | 2.0 | — | — | 0.5 | — | — | Confectionery & frosting—1.0 |
| 3736 L-TYROSINE | 250 | — | 250 | — | — | — | 250 | — | — | — | Condiments & relishes—250; Seasonings & flavorings—250 |
| 3737 VANILLYL ALCOHOL | 12.0 | 12.0 | — | 12.0 | 12.0 | — | — | 12.0 | — | — | |
| 3738 VANILLYLIDENE ACETONE | 8.0 | 8.0 | — | 8.0 | 8.0 | — | — | 8.0 | — | — | |
| 3739 <i>p</i> -VINYLPHENOL | 5.0 | 2.5 | 5.0 | — | 2.0 | — | — | 1.5 | 0.5 | 5.0 | Confectionery & frosting—2.0; Sweet sauce—2.5; Nut products—2.0; Imitation dairy—3.0; Hard candy—2.0; Chewing gum—10.0 |

Changes in Categories and Use Levels for Substances that Previously Received GRAS Status

| | | | | | | | | | | | |
|--------------------|-----|-------------------|-----|---|-------------------|---|---|-------------------|------------------|---|--|
| 3444 D,L-VALINE | 300 | 40.0 ^a | 300 | — | 80.0 ^a | — | — | 15.0 ^a | 0.9 ^a | — | Breakfast cereals—0.9 ^a ; Milk products—40.0 ^a ; Condiments & relishes—300; Confectionery & frosting—300; Chewing gum—200 ^a ; Seasonings & flavorings—300 |
|--------------------|-----|-------------------|-----|---|-------------------|---|---|-------------------|------------------|---|--|

^aUsage levels are identical to those in GRAS 8