

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

# 12. GRAS Substances

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□ CONSIDERABLE NEW KNOWLEDGE has been gained over the past few years from the isolation and characterization of components of natural flavors. This has necessarily led to the synthesis of new flavoring agents in an attempt to improve the simulation of the characteristics and nuances of these natural flavors. In addition, the organoleptic improvement of new food types, such as cheese foods and meat extenders, necessitates the development of new compounds and results in new uses for existing flavoring substances.

It has been the policy of the Flavor and Extract Manufacturers' Association (FEMA) to encourage flavor manufacturers to submit new substances intended for use in flavors—and significantly increased uses for previously listed substances—to an independent panel of scientific experts retained by FEMA for the purpose of evaluating the GRAS (General Recognized as Safe) status for these substances under the conditions of intended use. This paper is the latest in a series reporting the results of such evaluations. The panel membership was chosen as has been described before (Hall and Oser, 1961), and is made up of scientists who are qualified by training and years of experience in pharmacology, biochemistry, and toxicology as related particularly to the safety evaluation of flavors. The criteria used by the panel in arriving at judgments of GRAS status have been described previously (Oser and Hall, 1977). The panel currently consists of: Dr. Anthony M. 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; Dr. Howard C. Spencer, retired, Dow Chemical Company; Professor R. Tecwyn Williams, retired, St. Mary's Hospital Medical School, University of London; Dr. Lauren A. Woods, Virginia Commonwealth University. Dr. Newberne is a new member of the panel and did not participate in the review of all substances listed herein.

### NEW USES 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. Continued research in flavor technology often results not only in the discovery of the identity of substances not previously recognized in natural foods but in the synthesis of new compounds and in the development of new uses for substances on previous GRAS lists.

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These new uses may be either in other food categories or in previously listed categories but at higher use levels. In a previous publication, (Hall and Oser, 1965) it was stated that the reported use levels in the various food categories reflected then current usage and were intended as guidelines to "good manufacturing practice" (GMP), not as rigid limitations on use or as tolerances. As indicated by the Food and Drug Administration (FDA), "If food uses significantly exceed these GMP limits, food processors then have a responsibility to assure that such uses are GRAS. or must submit a petition for the new use if it is not covered by a food additive regulation" (Miles, 1979). It is the panel's position that increased use levels of a GRAS substance or uses in different food categories would still be considered GRAS as long as they do not enhance significantly its overall dietary intake. This is in keeping with the policy of the Food and Drug Administration which has stated, "If the ingredient is affirmed as GRAS with no limitation other than good manufacturing practice, it shall be regarded as GRAS if its conditions of use are not significantly different from those reported in the regulation as the basis on which the GRAS status of the substance was affirmed..." (21 CFR 184.1)

The panel feels, however, that any such increase in use levels or proposed new uses should be evaluated to insure continued GRAS status. In keeping with this policy, the panel has reviewed the following substances and uses and judged that they continue to qualify as GRAS: Decanoic acid, No. 2363, in fats and oils at 140 ppm;  $\delta$ -Dodecalactone, No. 2401, in fats and oils at 35 ppm; Lauric acid, No. 2614, in fats and oils at 315 ppm; 3-Ethyl-2-cyclopenten-1-one, No. 3152, in baked goods, breakfast cereals, soft candy and confectionery and frosting at 150 ppm, in milk products, meat products, jams and jellies and chewing gum at 50 ppm, in cheese products and soups at 10 ppm, in frozen dairy products, sweet sauces and hard candy at 200 ppm; in alcoholic and nonalcoholic beverages at 20 ppm; and in nut products at 100 ppm; and 4-Hydroxy-2, 5-dimethyl-3(2H) furanone, No. 3174, in alcoholic beverages at 60 ppm.

### REFERENCES

- Hall, R.L., 1960. Recent progress in the consideration of flavoring ingredients under the Food Additives Amendment. *Food Technol.* 14(10): 488.
- Hall, R.L. and Oser, B.L., 1961. Recent progress in the consideration of flavoring ingredients under the Food Additives Amendment. 2. *Food Technol.* 15(12): 20.
- Hall, R.L. and Oser, B.L., 1965. Recent progress in the consideration of flavoring ingredients under the Food Additives Amendment. 3. GRAS substances. *Food Technol.* 19(2, Part 2): 151.
- Hall, R.L. and Oser, B.L., 1970. Recent progress in the consideration of flavoring ingredients under the Food Additives Amendment. 4. *Food Technol.* 24(5): 25.

- "References" concluded on page 73
- "Alphabetical Cross References" on pp 66-67
- "Gras Flavoring Ingredients and Usage Levels" start on page 68

## GRAS 12—Primary Names and Synonyms Alphabetical Cross Reference List

- 3609 2-ACETYL-5-METHYLFURAN  
2-Amyl-4-methyl-1,3-dioxolane  
(see 4-Methyl-2-pentyl-1,3-dioxolane, no. 3630)  
BDS  
(see Benzyl disulfide, no. 3617)
- 3616 BENZENETHIOL  
Benzylcarbonyl 2-methylbutyrate  
(see Phenethyl 2-methylbutyrate, no. 3632)
- 3617 BENZYL DISULFIDE  
 $\alpha$ -(Benzylthio) toluene  
(see Benzyl disulfide, no. 3617)
- 3597 BENZYL METHYL SULFIDE
- 3619 2-(2-BUTYL)-4,5-DIMETHYL-3-THIAZOLINE  
6-Butylhexanolide  
(see  $\epsilon$ -Decalactone, no. 3613)  
Butyl *o*-hydroxybenzoate  
(see Butyl salicylate, no. 3650)
- 3650 BUTYL SALICYLATE  
7-Butyl-2-oxepanone  
(see  $\epsilon$ -Decalactone, no. 3613)  
Butyl propenyl ketone  
(see 2-Octen-4-one, no. 3603)  
 $\alpha$ - &  $\beta$ -Cyclocitral (50/50)  
(see 2,6,6-Trimethyl-1&2-cyclohexen-1-carboxaldehyde, no. 3639)
- 3631 CYCLOHEXYLMETHYL PYRAZINE
- 3622  $\Delta$ -DAMASCONE
- 3613  $\epsilon$ -DECALACTONE
- 3605 3-DECANOL  
Dibenzyl disulfide  
(see Benzyl disulfide, no. 3617)  
2,5-Dihydro-4,5-dimethyl-2-(1-methylpropyl)thiazole  
(see 2-(2-Butyl)-4,5-dimethyl-3-thiazoline, no. 3619)  
2,5-Dihydro-4,5-dimethyl-2-(2-methylpropyl) thiazole  
(see 4,5-Dimethyl-2-isobutyl-3-thiazoline, no. 3621)  
Dihydroeugenol  
(see 2-Methoxy-4-propylphenol, no. 3598)
- 3627 DIHYDRO- $\beta$ -IONOL
- 3628 DIHYDRO- $\alpha$ -IONONE
- 3626 DIHYDRO- $\beta$ -IONONE
- 3620 4,5-DIMETHYL-2-ETHYL-3-THIAZOLINE
- 3634 4,5-DIMETHYL-3-HYDROXY-2,5-DIHYDROFURAN-2-ONE  
2,3-Dimethyl-4-hydroxy-2,5-dihydrofuran-5-one  
(see 4,5-Dimethyl-3-hydroxy-2,5-dihydrofuran-2-one, no. 3634)
- 3621 4,5-DIMETHYL-2-ISOBUTYL-3-THIAZOLINE  
Dimethyl phenylethyl carbinol  
(see 2-Methyl-4-phenyl-2-butanol, no. 3629)  
1,1-Dimethyl-3-phenyl-1-propanol  
(see 2-Methyl-4-phenyl-2-butanol, no. 3629)  
1,4-Diphenyl-2,3-dithiobutane  
(see Benzyl disulfide, no. 3617)  
Di(phenylmethyl)disulfide  
(see Benzyl disulfide, no. 3617)
- 3637 2-*trans*-6-*cis*-DODECADIENAL
- 3610  $\epsilon$ -DODECALACTONE
- 3641 ETHYL *trans*-2-DECENOATE
- 3642 ETHYL *trans*-4-DECENOATE  
2-Ethyl-4,5-dimethyl-3-thiazoline  
(see 4,5-Dimethyl-2-ethyl-3-thiazoline, no. 3620)
- 3623 2-ETHYL-4-HYDROXY-5-METHYL-3(2H)FURANONE  
5-Ethyl-4-hydroxy-2-methyl-3(2H)furanone  
(see 2-Ethyl-4-hydroxy-5-methyl-3(2H)furanone, no. 3623)  
2-Ethylidene methional  
(see 2-[(Methylthio)methyl]-2-butenal, no. 3601)
- 3643 ETHYL *trans*-2-OCTENOATE  
Ethyl 2-pyrrolyl ketone  
(see 2-Propionylpyrrole, no. 3614)  
Heptyl ethyl carbinol  
(see 3-Decanol, no. 3605)
- 3608 1-HEXEN -3-OL
- 3633 3-HEXENYL PHENYLACETATE  
*cis*-3-Hexenyl phenylacetate  
(see 3-Hexenyl phenylacetate, no. 3633)  
3-Hexenyl  $\alpha$ -toluate  
(see 3-Hexenyl phenylacetate, no. 3633)  
 $\beta$ ,  $\gamma$ -Hexenyl  $\alpha$ -toluate  
(see 3-Hexenyl phenylacetate, no. 3633)  
6-Hexylhexanolide  
(see  $\epsilon$ -Dodecalactone, no. 3610)  
7-Hexyl-2-oxepanone  
(see  $\epsilon$ -Dodecalactone, no. 3610)  
4-Hydroxy-5-methyl-2,3-dihydrofuran-3-one  
(see 4-Hydroxy-5-methyl-3 (2H) furanone, no. 3635)  
3-Hydroxy-4,5-dimethyl-2(5H)-furanone  
(see 4,5-Dimethyl-3-hydroxy-2,5-dihydrofuran-2-one, no. 3634)
- 3635 4-HYDROXY-5-METHYL-3(2H)FURANONE  
2-Hydroxy-3-methyl-2-penten-4-olide  
(see 4,5-Dimethyl-3-hydroxy-2,5-dihydrofuran-2-one, no. 3634)
- 3624  $\alpha$ -IONOL
- 3625  $\beta$ -IONOL  
2-Isobutyl-4,5-dimethyl-3-thiazoline  
(see 4,5-Dimethyl-2-isobutyl-3-thiazoline, no. 3621)
- 3645 *cis*-5-ISOPROPENYL-*cis*-2-METHYLCYCLOPENTAN-1-CARBOXALDEHYDE
- 3598 2-METHOXY-4-PROPYLPHENOL  
Methyl benzyl sulfide  
(see Benzyl methyl sulfide, no. 3597)
- 3646 3-METHYL-2-BUTENAL
- 3599 *trans*-2-METHYL-2-BUTENOIC ACID
- 3647 3-METHYL-2-BUTEN-1-OL
- 3644 2-METHYLBUTYL ACETATE
- 3640 *p*-METHYLCINNAMALDEHYDE  
3-Methylcrotonaldehyde  
(see 3-Methyl-2-butenal, no. 3646)  
2-Methylcrotonic acid  
(see *trans*-2-Methyl-2-butenic acid, no. 3599)  
2-Methyl-4,5-dihydro-3-furanthiol acetate  
(see 2-Methyl-3-thioacetoxy-4,5-dihydrofuran, no. 3636)  
1-(5-Methyl-2-furyl)ethanone  
(see 2-Acetyl-5-methylfuran, no. 3609)  
2-Methyl-3-furyl propyl disulfide  
(see Propyl 2-methyl-3-furyl disulfide, no. 3607)

5-Methyl-4-hydroxy-3(2H)furanone  
(see 4-Hydroxy-5-methyl-3(2H)furanone, no. 3635)  
*cis*-2-Methyl-*cis*-5-isopropenylcyclopentan-1-carboxaldehyde  
(see *cis*-5-Isopropenyl-*cis*-2-methylcyclopentan-1-carboxaldehyde, no. 3645)  
1 $\alpha$ , 2 $\alpha$ , 5 $\alpha$ -2-Methyl-5-(1-methylethenyl)-cyclopentanecarboxaldehyde  
(see *cis*-5-Isopropenyl-*cis*-2-methylcyclopentan-1-carboxaldehyde, no. 3645)  
Methyl 5-methyl-2-furyl ketone  
(see 2-Acetyl-5-methylfuran, no. 3609)

3630 4-METHYL-2-PENTYL-1,3-DIOXOLANE

3629 2-METHYL-4-PHENYL-2-BUTANOL  
3-(*p*-Methylphenyl)propenal  
(see *p*-Methylcinnamaldehyde, no. 3640)

3636 2-METHYL-3-THIOACETOXY-4,5-DIHYDROFURAN

3600 4-(METHYLTHIO)BUTANOL  
Methylthiomethyl benzene  
(see Benzyl methyl sulfide, no. 3597)

3601 2-[(METHYLTHIO)METHYL]-2-BUTENAL  
 $\alpha$ -(Methylthio)toluene  
(see Benzyl methyl sulfide, no. 3597)

3602 3-OCTEN-2-OL

3603 2-OCTEN-4-ONE

3612 1-OCTEN-3-YL BUTYRATE

3604 OCTYL 2-METHYLBUTYRATE  
 $\alpha$ -Phenethyl  $\beta$ -methylbutanoate  
(see Phenethyl 2-methylbutyrate, no. 3632)

3632 PHENETHYL 2-METHYLBUTYRATE  
Phenylamyl alcohol  
(see 5-Phenylpentanol, no. 361B)  
2-Phenylethyl 2-methylbutanoate  
(see Phenethyl 2-methylbutyrate, no. 3632)

3618 5-PHENYLPENTANOL  
Photocitral  
(see *cis*-5-Isopropenyl-*cis*-2-methylcyclopentane-1-carboxaldehyde, no. 3645)  
Prenal  
(see 3-Methyl-2-butenal, no. 3646)  
Prenol  
(see 3-Methyl-2-buten-1-ol, no. 3647)  
Propenyl butyl ketone  
(see 2-octen-4-one, no. 3603)

3614 2-PROPIONYLPYRROLE

3611 2-PROPIONYLTHIAZOLE

3648 PROPYL 2,4-DECADIENOATE  
4-Propyl guaiacol  
(see 2-Methoxy-4-propylphenol, no. 3598)  
5-Propyl-*ortho*-hydroxyanisole  
(see 2-Methoxy-4-propylphenol, no. 3598)  
4-Propyl-*ortho*-methylphenol  
(see 2-Methoxy-4-propylphenol, no. 3598)

3607 PROPYL 2-METHYL-3-FURYL DISULFIDE

3649 *p*-PROPYLPHENOL  
4-Propylphenol  
(see *p*-Propylphenol, no. 3649)

2-Pyrazinyl cyclohexyl methane  
(see Cyclohexylmethyl pyrazine, no. 3631)  
(2-Pyrazinylmethyl)cyclohexane  
(see Cyclohexylmethyl pyrazine, no. 3631)  
1-(2-Pyrrolyl)-1-propanone  
(see 2-Propionylpyrrole, no. 3614)  
Senecialdehyde  
(see 3-Methyl-2-butenal, no. 3646)  
2,3,4,5-Tetrahydroxypentanal  
(see D-Xylose, no. 3606)

3615 THIAZOLE  
1-(2-Thiazolyl)-1-propanone  
(see 2-Propionylthiazole, no. 3611)  
Thiophenol  
(see Benzenethiol, no. 3616)  
Tiglic acid  
(see *trans*-2-methyl-2-butenic acid, no. 3599)  
3-*p*-Tolylpropenal  
(see *p*-Methylcinnamaldehyde, no. 3640)

3638 2-*trans*-4-*cis*-7-*cis*-TRIDECADIENAL

3639 2,6,6-TRIMETHYL-1&2-CYCLOHEXEN-1-CARBOXALDEHYDE  
4-(2,6,6-Trimethyl-1-cyclohexenyl)-butan-2-ol  
(see Dihydro- $\beta$ -ionol, no. 3627)  
4-(2,6,6-Trimethyl-1-cyclohexenyl)-butan-2-one  
(see Dihydro- $\beta$ -ionone, no. 3626)  
4-(2,6,6-Trimethyl-2-cyclohexen-1-yl)-butan-2-one  
(see Dihydro- $\alpha$ -ionone, no. 3628)  
4-(2,6,6-Trimethyl-1-cyclohexenyl)-3-buten-2-ol  
(see  $\beta$ -lonol, no. 3625)  
4-(2,6,6-Trimethyl-2-cyclohexenyl)-3-buten-2-ol  
(see  $\alpha$ -lonol, no. 3624)  
1-(2,6,6-Trimethyl-3-cyclohexen-1-yl)-2-buten-1-one  
(see  $\Delta$ -Damascone, no. 3622)  
1-Vinylbutan-1-ol  
(see 1-Hexen-3-ol, no. 3608)  
Vinyl propyl carbinol  
(see 1-Hexen-3-ol, no. 3608)

3606 D-XYLOSE

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## GRAS FLAVORING INGREDIENTS AND USAGE LEVELS

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

Substance	Baked Goods	Frozen Dairy	Meat Products	Soft Candy	Gelatins & Puddings	Soups	Snack Foods	Nonalcoholic Beverages	Alcoholic Beverages	Gravies	Other use Categories
<sup>3597</sup> BENZYL METHYL SULFIDE	0.2	—	0.1	—	—	0.05	0.2	—	—	0.05	Condiments & relishes—0.05
<sup>3598</sup> 2-METHOXY-4-PROPYLPHENOL	0.15	—	—	0.10	0.10	1.0	1.5	0.05	—	1.0	Fruit ices—0.07; Confectionery & frosting—1.5; Jams & jellies—1.5; Chewing gum—15.0
<sup>3599</sup> <i>trans</i> -2-METHYL-2-BUTENOIC ACID	1.5	—	10.0	—	—	10.0	—	10.0	—	—	Fruit ices—10.0; Confectionery & frosting—10.0
<sup>3600</sup> 4-(METHYLTHIO)BUTANOL	—	—	0.5	—	—	0.5	—	—	—	0.5	Condiments & relishes—0.5; Seasonings & flavorings—0.5
<sup>3601</sup> 2-[(METHYLTHIO)METHYL]-2-BUTENAL	—	—	—	—	—	0.5	1.0	—	—	0.5	Reconstituted vegetables—1.0
<sup>3602</sup> 3-OCTEN-2-OL	—	—	—	0.6	1.0	—	—	—	—	2.0	Confectionery & frosting—1.0; Nut products—1.0; Imitation dairy—1.0; Hard candy—2.0; Chewing gum—10.0
<sup>3603</sup> 2-OCTEN-4-ONE	—	1.0	—	—	1.0	—	—	1.0	1.0	—	Confectionery & frosting—5.0; Milk products—1.0; Chewing gum—10.0
<sup>3604</sup> OCTYL 2-METHYLBUTYRATE	—	0.5	—	1.0	2.0	—	—	2.0	2.0	—	Confectionery & frosting—1.0; Imitation dairy—1.0; Hard candy—2.0; Chewing gum—5.0
<sup>3605</sup> 3-DECANOL	—	1.0	—	1.5	2.0	1.0	—	1.0	—	1.0	Fruit ices—1.0; Confectionery & frosting—1.0; Sweet sauces—1.0; Imitation dairy—1.0; Hard candy—2.0; Chewing gum—4.0; Seasonings & flavorings—3.0
<sup>3606</sup> D-XYLOSE	—	—	—	—	—	—	60.0	—	—	40.0	Reconstituted vegetables—85.0; Seasonings & flavorings—40.0

Substance	Baked Goods	Frozen Dairy	Meat Products	Soft Candy	Gelatins & Puddings	Soups	Snack Foods	Nonalcoholic Beverages	Alcoholic Beverages	Gravies	Other use Categories
<sup>3607</sup> PROPYL 2-METHYL-3-FURYL DISULFIDE	0.5	—	0.5	—	—	0.5	0.5	—	—	0.5	Nut products—0.5
<sup>3608</sup> 1-HEXEN-3-OL	—	—	0.1	—	—	0.1	0.1	—	—	0.1	Condiments & relishes—0.1; Seasonings & flavorings—0.1
<sup>3609</sup> 2-ACETYL-5-METHYLFURAN	—	—	—	—	—	1.5	2.0	—	—	1.5	Nut products—1.5
<sup>3610</sup> ε-DODECALACTONE	—	—	—	2.0	2.0	—	—	2.0	—	5.0	Confectionery & frosting—2.0; Nut products—5.0; Imitation dairy—2.0; Hard candy—5.0; Chewing gum—10.0
<sup>3611</sup> 2-PROPIONYLTHIAZOLE	0.1	—	—	—	0.05	0.02	0.1	0.1	—	0.1	Imitation dairy—0.1; Hard candy—0.1; Chewing gum—0.2
<sup>3612</sup> 1-OCTEN-3-YL BUTYRATE	5.0	3.0	—	1.0	2.0	—	—	2.0	—	—	Sweet sauce—1.0; Imitation dairy—2.0; Hard candy—3.0; Chewing gum—5.0; Sugar substitutes—2.0; Breakfast cereals—5.0; Fats & oils—1.0; Milk products—2.0; Fruit ices—2.0; Confectionery & frosting—2.0; Jams & jellies—1.0
<sup>3613</sup> ε-DECALACTONE	10.0	—	—	—	5.0	—	5.0	5.0	—	5.0	Confectionery & frosting—5.0; Imitation dairy—5.0
<sup>3614</sup> 2-PROPIONYLPYRROLE	0.2	—	0.1	—	—	0.1	0.1	—	—	0.2	Breakfast cereal—0.2; Confectionery & frosting—0.2; Nut products—0.1; Imitation dairy—0.1; Hard candy—0.2; Cheese products—0.1
<sup>3615</sup> THIAZOLE	—	—	5.0	—	—	—	—	—	—	—	Nut Products—5.0; Reconstituted Vegetable—10.0; Imitation Dairy—5.0; Chewing gum—10.0; Seasonings & flavorings—5.0

## 12. GRAS Substances . . .

Substance	Baked Goods	Frozen Dairy	Meat Products	Soft Candy	Gelatins & Puddings	Soups	Snack Foods	Nonalcoholic Beverages	Alcoholic Beverages	Gravies	Other use Categories
<sup>3616</sup> BENZENETHIOL	5.3	5.5	3.1	5.6	2.5	—	—	1.5	3.7	—	Condiments & relishes 0.2
<sup>3617</sup> BENZYL DISULFIDE	1.0	1.3	1.0	1.3	1.3	—	—	1.3	—	—	—
<sup>3618</sup> 5-PHENYLPENTANOL	16.0	12.0	—	12.0	12.0	—	—	12.0	—	—	—
<sup>3619</sup> 2-(2-BUTYL)-4,5-DIMETHYL-3-THIAZOLINE	2.0	0.5	0.5	—	2.0	0.5	—	—	—	0.5	Confectionery & frosting—2.0
<sup>3620</sup> 4,5-DIMETHYL-2-ETHYL-3-THIAZOLINE	—	—	10.0	—	—	10.0	10.0	—	—	10.0	Poultry products—10.0; Fish & seafood—10.0
<sup>3621</sup> 4,5-DIMETHYL-2-ISOBUTYL-3-THIAZOLINE	2.0	—	0.5	—	2.0	0.5	—	—	—	0.5	Confectionery & frosting—2.0
<sup>3622</sup> $\beta$ -DAMASCONE	—	—	—	0.02	0.02	—	—	0.02	—	—	Confectionery & frosting—0.02; Hard candy—0.02; Chewing gum—0.1
<sup>3623</sup> 2-ETHYL-4-HYDROXY-5-METHYL-3(2H)-FURANONE	2.0	—	1.0	—	3.0	—	—	2.0	—	1.0	Milk products—0.5; Confectionery & frosting—0.5; Imitation dairy—1.0; Hard candy—2.0; Chewing gum—20.0
<sup>3624</sup> $\alpha$ -IONOL	3.0	2.0	—	2.5	2.0	—	—	1.0	—	—	Milk products—2.0; Fruit Ices—1.5; Confectionery & frosting—2.0; Jams & jellies—2.0; Imitation dairy—2.0; Hard candy—4.0; Chewing gum—5.0
<sup>3625</sup> $\beta$ -IONOL	3.0	1.5	—	2.5	2.0	—	—	1.0	—	—	Milk products—1.5; Fruit Ices—1.5; Confectionery & frosting—2.0; Jams & jellies—2.0; Imitation dairy—1.5; Hard candy—4.0; Chewing gum—5.0
<sup>3626</sup> DIHYDRO- $\beta$ -IONONE	1.5	1.0	—	1.2	1.0	—	—	0.5	—	—	Milk products—1.0; Fruit ices—0.7; Confectionery & frosting—1.0; Jams & jellies—1.0; Imitation dairy—1.0; Hard candy—2.5; Chewing gum—10.0

Substance	Baked Goods	Frozen Dairy	Meat Products	Soft Candy	Gelatins & Puddings	Soups	Snack Foods	Nonalcoholic Beverages	Alcoholic Beverages	Gravies	Other use Categories
<sup>3627</sup> DIHYDRO- $\beta$ -IONOL	9.0	5.0	—	7.5	6.0	—	—	3.0	—	—	Milk products—5.0; Fruit ices—4.5; Confectionery & frosting—6.0; Jams & jellies—6.0; Imitation dairy—5.0; Hard candy—9.0; Chewing gum—12.0
<sup>3628</sup> DIHYDRO- $\alpha$ -IONONE	1.5	1.0	—	1.0	0.5	—	—	0.5	0.5	—	Breakfast cereals—1.0; Milk products—0.5; Fruit ices—1.0; Jams & jellies—0.3; Sweet sauces—0.3; Hard candy—1.0; Chewing gum—2.0; Seasonings & flavorings—0.05
<sup>3629</sup> 2-METHYL-4-PHENYL-2-BUTANOL	45.0	—	—	36.0	30.0	—	—	15.0	—	—	Fruit ices—21.0; Confectionery & frosting—30.0; Jams & jellies—30.0; Hard candy—45.0; Chewing gum—60.0
<sup>3630</sup> 4-METHYL-2-PENTYL-1,3-DIOXOLANE	—	—	—	3.0	5.0	—	—	2.0	—	—	Confectionery & frosting—4.0; Jams & jellies—2.0; Sweet sauces—2.0; Imitation dairy—3.0; Hard candy—5.0; Chewing gum—5.0
<sup>3631</sup> CYCLOHEXYLMETHYL PYRAZINE	1.0	—	—	0.5	0.5	—	1.0	—	—	—	Confectionery & frosting—0.5; Nut products—0.5; Imitation dairy—0.2
<sup>3632</sup> PHENETHYL 2-METHYL-BUTYRATE	24.1	12.8	—	16.3	12.8	—	—	12.1	26.0	—	Chewing gum—0.8
<sup>3633</sup> 3-HEXENYL PHENYLACETATE	8.8	7.8	—	8.8	8.8	—	—	7.8	5.0	—	—
<sup>3634</sup> 4,5-DIMETHYL-3-HYDROXY-2,5-DIHYDROFURAN-2-ONE	10.0	—	10.0	—	—	10.0	—	—	—	10.0	Condiments & relishes—10.0; Fats & oils—10.0; Poultry products—10.0; Fish products—10.0; Sweet sauces—10.0

## 12. GRAS Substances . . .

Substance	Baked Goods	Frozen Dairy	Meat Products	Soft Candy	Gelatins & Puddings	Soups	Snack Foods	Nonalcoholic Beverages	Alcoholic Beverages	Gravies	Other use Categories
<sup>3635</sup> 4-HYDROXY-5-METHYL-3(2H)-FURANONE	--	--	35.0	--	10.0	10.0	35.0	--	--	10.0	Condiments & relishes—20.0; Seasonings & flavorings—1.0; Fats & oils—20.0; Poultry products—35.0; Fish products—35.0; Sweet sauces—20.0; Nut products—20.0
<sup>3636</sup> 2-METHYL-3-THIOACETOXY-4,5-DIHYDROFURAN	--	--	3.5	--	--	1.0	--	--	--	1.5	--
<sup>3637</sup> 2-trans-6-cis-DODECADIENAL	--	--	0.02	2.0	2.0	0.01	0.01	2.0	--	5.0	Fats & oils—0.02; Meat analogue—0.1; Seasonings & flavorings—0.01
<sup>3638</sup> 2-trans-4-cis-7-cis-TRIDECADIENAL	--	--	0.05	--	--	0.1	0.01	--	--	0.01	Meat analogs—2.0; Fats & oils—0.01; Seasonings & flavorings—0.01
<sup>3639</sup> 2,6,6-TRIMETHYL-1&2-CYCLOHEX-EN-1-CARBOXALDEHYDE	0.06	--	--	0.05	0.05	--	--	0.02	--	--	Fruit ices—0.1; Confectionery & Frosting—0.05; Jams & jellies—0.05; Hard candy—0.1; Chewing gum—0.5
<sup>3640</sup> <i>p</i> -METHYLCINNAMALDEHYDE	13.0	10.0	--	7.6	10.0	--	--	6.4	--	--	--
<sup>3641</sup> ETHYL <i>trans</i> -2-DECENOATE	90.0	--	--	90.0	60.0	--	--	30.0	--	--	Fruit ices—45.0; Confectionery & Frosting—60.0; Jams & jellies—60.0; Hard candy—150.0
<sup>3642</sup> ETHYL <i>trans</i> -4-DECENOATE	3.0	1.5	--	2.5	--	--	--	1.0	--	--	Confectionery & Frosting—2.5; Jams & jellies—2.0; Hard candy—5.0; Chewing gum—20.0
<sup>3643</sup> ETHYL <i>trans</i> -2-OCTENOATE	30.0	--	--	25.0	20.0	--	--	10.0	--	--	Fruit ices—15.0; Confectionery & frosting—20.0; Jams & jellies—20.0; Hard candy—30.0; Chewing gum—100.0



Substance	Baked Goods	Frozen Dairy	Meat Products	Soft Candy	Gelatins & Puddings	Soups	Snack Foods	Nonalcoholic Beverages	Alcoholic Beverages	Gravies	Other use Categories
<sup>3644</sup> 2-METHYLBUTYL ACETATE	180.0	-	-	150.0	120.0	-	-	60.0	-	-	Fruit ices-90.0; Confectionery & frosting-120.0; Jams & jellies-120.0; Hard candy-300.0; Chewing gum-1200.0
<sup>3645</sup> <i>cis</i> -5-ISOPROPENYL- <i>cis</i> -2-METHYLCYCLOPENTAN-1-CARBOXALDEHYDE	2.5	-	-	2.0	1.5	-	-	0.8	-	-	Fruit ices-1.2; Confectionery & frosting-1.5; Jams & jellies-1.5; Chewing gum-15.0
<sup>3646</sup> 3-METHYL-2-BUTENAL	7.5	3.75	-	7.25	5.0	-	-	2.5	-	-	Fruit ices-3.75; Confectionery & frosting-7.25; Jams & jellies-5.0; Hard candy-12.5; Chewing gum-50.0
<sup>3647</sup> 3-METHYL-2-BUTEN-1-OL	3.0	-	-	2.5	2.0	-	-	1.0	-	-	Fruit ices-1.5; Confectionery & frosting-2.0; Jams & jellies-2.0; Hard candy-5.0; Chewing gum-20.0
<sup>3648</sup> PROPYL 2,4-DECADIENOATE	-	-	-	-	20.0	-	-	10.0	-	-	Confectionery & frosting-20.0; Jams & jellies-20.0
<sup>3649</sup> <i>p</i> -PROPYLPHENOL	0.1	-	-	0.07	0.012	-	-	0.03	-	-	Fruit ices-0.05; Confectionery & frosting-0.06; Jams & jellies-0.06; Hard candy-0.15; Chewing gum-3.0
<sup>3650</sup> BUTYL SALICYLATE	1.0	1.0	-	1.5	1.0	-	-	1.0	-	-	Chewing gum-0.07

## 12. GRAS References (from page 65) . . .

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