

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

## 11. GRAS Substances

BERNARD L. OSER and RICHARD A. FORD

□ THIS PAPER is the latest in a series reporting the results of deliberations of the independent panel of experts retained by the Flavor and Extract Manufacturers' Association (FEMA) for evaluation of GRAS (Generally Recognized as Safe) status of new flavoring substances. This panel consists of members chosen as described before (Hall and Oser, 1961) and is made up of experts who are qualified by training and years of experience in pharmacology and toxicology as well as in the safety evaluation of flavors. The criteria used by the Expert Panel in arriving at judgements of GRAS status have been discussed in a recent publication (Oser and Hall, 1977). The Panel currently consists of: Dr. Anthony M. Ambrose, Medical College of Virginia; Dr. John Doull, University of Kansas Medical Center; Dr. David W. Fassett; Dr. Howard C. Spencer; Prof. R. Tecwyn Williams, St. Mary's Hospital Medical School, University of London; and Dr. Lauren A. Woods, Virginia Commonwealth University. Dr. Doull only recently joined the Panel and was not a member during the discussion of the GRAS status of the substances listed herein.

### SACCHARIN

The Expert Panel has not modified or retracted its GRAS determination of saccharin (Hall and Oser, 1965), despite the announced proposal of FDA to ban its use (FDA, 1977). It has taken cognizance of the three F<sub>0</sub>/F<sub>1</sub> generation feeding studies, in particular that of the Canadian Health Protection Branch, which formed the basis for FDA's regulatory decision. It was noted that neither the WARF nor the FDA study were regarded as conclusive by the NAS/NRC Subcommittee on Non-Nutritive Sweeteners, (Safety of Saccharin and Sodium Saccharin in the Human Diet. Subcommittee on Non-Nutritive Sweeteners. Committee on Food Protection. Food and Nutrition Board. National Research Council/National Academy of Sciences, Washington, D.C. 1974) for several reasons, including uncertainty with respect to the suspected impurity, orthotoluene sulfonamide. Whereas the HPB study exonerated this impurity, the results of its single level (5%) test of saccharin were reported to have satisfied FDA of the carcinogenicity of this artificial sweetener.

The panel noted certain questionable aspects of

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these 2-generation studies, viz. a) the rationale for, and consequences of the use of the "maximum tolerated dose"; b) the excessive dietary dose levels (7.5% in the FDA study and 5% in the other two) at which malignant neoplasms were reported, as contrasted with human exposure levels; c) the significantly higher incidence of tumors in the second generation (F<sub>1</sub>) rats than in the parent generation; d) uncertainty (and appropriateness) concerning the dosages to which the F<sub>1</sub> rats were exposed in utero, during lactation, and during the post-weaning period of normally high food consumption relative to body weight; e) the higher incidence of tumors in male rats than in female rats; and f) the absence of control groups to clarify the effect of sodium intake of the high test groups compared to that of the animals receiving the unsupplemented basal diets.

Because of these questions concerning the Canadian study (stemming in part from the methodology employed), and viewed against the total present information on the tests and use of saccharin, the Expert Panel concludes that it should not change its present GRAS classification until research and review now planned permit further clarification.

### REFERENCES

- FDA. 1977. Saccharin and its salts. Food and Drug Admin. Fed. Reg. 42: 19996.
- 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.
- Oser, B.L. and Hall, R.L. 1972. Recent progress in the consideration of flavoring ingredients under Food Additives Amendment. 5. GRAS substances. Food Technol. 26(5): 35.
- Oser, B.L. and Hall, R.L. 1977. Criteria employed by the Expert Panel of F.E.M.A. for the GRAS evaluation of food flavoring substances. Food Cosmet. Toxicol. 15:457.
- Oser, B.L. and Ford, R.A. 1973a. Recent progress in the consideration of flavoring ingredients under the Food Additives Amendment. 6. GRAS substances. Food Technol. 27(1): 64.
- Oser, B.L. and Ford, R.A. 1973b. Recent Progress in the consideration of flavoring ingredients under the Food Additives Amendment. 7. GRAS substances. Food Technol. 27(11): 56.
- Oser, B.L. and Ford, R.A. 1974. Recent progress in the consideration of flavoring ingredients under the Food Additives Amendment. 8. GRAS substances. Food Technol. 28(9): 76.
- Oser, B.L. and Ford, R.A. 1975. Recent progress in the consideration of flavoring ingredients under the Food Additives Amendment. 9. GRAS substances. Food Technol. 29(8): 70.
- Oser, B.L. and Ford, R.A. 1977. Recent progress in the consideration of flavoring ingredients under the Food Additives Amendment. 10. GRAS substances. Food Technol. 31(1): 65.

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## GRAS FLAVORING INGREDIENTS AND USAGE LEVELS

Flavor and Extract Manufacturer's 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
Acetoin acetate see 3526 3526											
2-ACETOXY-3-BUTANONE	49.3	20.0	—	47.8	20.0	—	—	20.0	20.0	—	
9-Acetoxy-1- <i>p</i> -menthene see 3566											
3-Acetoxyoctene see 3582 3527											
3-ACETYL-2,5-DIMETHYL-THIOPHENE	2.0	0.6	1.0	1.5	1.5	1.0	—	1.0	1.0	—	Milk products—0.6
Acetyl ethyl carbinol see 3550											
Acetyl methyl carbinyl acetate see 3526											
<i>o</i> -Acetylphenol see 3548											
Amyl ethyl carbinol see 3581											
Amyl ethyl carbinyl acetate see 3583											
<i>iso</i> -Amyl acetoacetate see 3551											
Amyl vinyl carbinyl acetate see 3582											
1,3-Benzenediol see 3589 3528											
1,2-BUTANEDITHIOL <sup>(a)</sup>	0.2	—	0.2	—	—	0.2	0.2	—	—	0.2	Nut products—0.2
3529											
1,3-BUTANEDITHIOL <sup>(a)</sup>	0.2	—	0.2	—	—	0.2	0.2	—	—	0.2	Nut products—0.2
2-Butanon-3-yl acetate see 3526											
Butyl ethyl carbinol see 3547											
Campholenic aldehyde see 3592											
Carvomenthol see 3562											
Celery ketone see 3577 3530											
<i>m</i> -CRESOL	1.0	—	0.5	—	—	0.5	0.5	—	—	0.5	Nut products—0.5; Instant coffee & tea—0.5; Household seasonings & flavorings—0.5;
3531											
CYCLOHEXANECARBOXYLIC ACID <sup>(b)</sup>	2.0	1.0	—	—	1.0	—	—	1.0	—	—	Fruit ices—1.0; Confectionery & frosting—2.0; Chewing gum—1.5
3532											
3-DECEN-2-ONE	19	5.8	—	7.8	4.8	—	—	4.3	4.0	—	
Diallyl di-, tri-, tetra-, and pentasulfides see 3533											
3533											
DIALLYL POLYSULFIDES	1.0	—	1.0	—	—	—	0.1	—	—	0.1	Processed vegetables—1.0; Household seasonings & flavorings—1.0

<sup>(a)</sup>Total dithiol added to any food not to exceed 1.0 ppm.

<sup>(b)</sup>Substance has not been covered in a Scientific Literature Review nor is it presently scheduled for future coverage.

<sup>(c)</sup>To be used at not more than 10.0 ppm in the finished food.

<sup>(d)</sup>To be used in cocoa substitute only.

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# 11. 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>3534</sup> 1,2-DI[(1'-ETHOXY)-ETHOXY] PROPANE	330	54.9	—	137	273	—	—	62.5	54.8	—	Milk products—54.9; Processed fruit—54.9; Fruit ices—54.9; Condiments & relishes—273; Confectionery & frosting—137; Jams & jellies—273; Sweet sauce—273; Nut products—62.5; Imitation dairy—54.9; Hard candy—137; Chewing gum—1546; Household seasonings & flavors—273
1, 3-Diethylacetyl 3-methyl-3-furyl sulfide see 3570 cis-Dihydrocarvone see 3565 Dihydrocumyl acetate see 3561 3,7-Dihydro-3,7-dimethyl- 1H-purine-2,6-dione see 3591 Dihydrojasmane see 3552 <i>m</i> -Dihydroxybenzene see 3589 Diisobutyl ketone see 3537 1,3-Diisopropylacetyl 2-methyl-3-furyl sulfide see 3538 1,2-Dimercaptobutane see 3528 1,3-Dimercaptobutane see 3529 1,3-Dimercaptopropane see 3588 2,5-Dimethyl-3- acetylthiophene see 3527											
<sup>3535</sup> 2,3-DIMETHYLBENZOFURAN	2.0	—	1.0	—	—	1.0	—	—	—	—	Condiments & relishes—1.0; Household seasonings & flavorings—1.0
<sup>3536</sup> DIMETHYL DISULFIDE	16.9	4.8	2.2	9.4	8.3	—	—	4.8	2.0	—	Condiments & relishes—3.8; Sweet sauce—0.007
<sup>3537</sup> 2,6-DIMETHYL-4-HEPTANONE 6,6-Dimethyl-3-hydroxy- 2-methylenebicyclo [3.1.1]heptane see 3587	5.0	2.0	—	5.0	1.1	—	—	0.8	1.1	—	
<sup>3538</sup> 2,6-DIMETHYL-3-[(2- METHYL-3-FURYL)THIO]- 4-HEPTANONE	1.0	—	1.0	—	—	1.0	1.0	—	—	1.0	Nut products—1.0

<sup>1a</sup>Total dithiol added to any food not to exceed 1.0 ppm.

<sup>1b</sup>Substance has not been covered in a Scientific Literature Review nor is it presently scheduled for future coverage.

<sup>1c</sup>To be used at not more than 10.0 ppm in the finished food.

<sup>1d</sup>To be used in cocoa substitute only.

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# 11. GRAS Substances . . .

Substance	Baked Goods	Frozen Dairy	Meat Products	Soft Candy	Gelatins & Puddings	Soups	Snack Foods	Nonalcoholic Beverages	Alcoholic Beverages	Gravies	Other use Categories
<i>3539</i> 3,7-DIMETHYL-1,3,6-OCTATRIENE	15.2	7.7	—	15.2	4.0	—	—	2.3	4.0	—	
2,5-Dimethylphenol see 3595											
3,4-Dimethylphenol see 3596											
<i>3540</i> 2,6-DIMETHYLPYRIDINE	10.0	—	5.0	—	3.0	5.0	10.0	—	—	5.0	Confectionery & frostings—3.0; Nut products—5.0; Instant coffee & tea—0.15
<i>3541</i> 3,5-DIMETHYL-1,2,4-TRITHIOLANE	—	—	0.3	—	—	0.3	—	—	—	0.3	Milk products—0.3
<i>3542</i> 6,10-DIMETHYL-5,9-UNDECADIEN-2-ONE 3,7-Dimethylxanthine see 3591	10.0	10.0	—	10.0	10.0	—	—	10.0	—	—	
1,3-Dipropylacetyl 2-methyl-3-furyl sulfide see 3571											
<i>3543</i> ETHYLENE BRASSYLATE Ethylene glycol brassylate cyclic diester see 3543	2.0	2.0	—	2.0	2.0	—	—	2.0	—	—	
<i>3544</i> ETHYL CYCLOHEXANE-CARBOXYLATE <sup>(*)</sup>	0.01	0.01	—	—	0.01	—	—	0.01	—	—	Fruit ices—0.01; Confectionery & frosting—0.05
<i>3545</i> ETHYL 3-HYDROXYHEXANOATE	5.0	1.0	—	—	1.0	—	—	1.0	1.0	—	Breakfast cereals—5.0; Other grains—5.0; Milk products—1.0; Fruit ices—1.0; Confectionery & frostings—1.0; Jams & jellies—1.0; Chewing gum—1.0
<i>3546</i> 5-ETHYL-2-METHYLPRIDINE	1.5	—	1.0	—	—	0.5	—	—	—	0.5	Breakfast cereals—1.0; Nut products—1.0; Instant coffee & tea—0.05
Ethyl vinyl carbinol see 3584											
2-Furfurylidenebenzylaldehyde see 3586											
Geranyl acetone see 3542											
<i>3547</i> 3-HEPTANOL Hexahydrocarvacrol see 3562	18.5	8.8	—	13.5	8.2	—	—	7.8	6.3	—	
2-Hexyl-2-cyclopenten-1-one and 2-hexylidene-cyclopentanone mixture see 3552											
<i>3548</i> 2-HYDROXYACETOPHENONE	0.2	—	0.1	—	—	0.1	0.2	—	—	0.1	Poultry—0.1; Condiments & relishes—0.1; Instant coffee & tea—0.1; Household seasoning & flavors—0.1

<sup>(\*)</sup>Total dithiol added to any food not to exceed 1.0 ppm.

<sup>(\*)</sup>Substance has not been covered in a Scientific Literature Review nor is it presently scheduled for future coverage.

<sup>(\*)</sup>To be used at not more than 10.0 ppm in the finished food.

<sup>(\*)</sup>To be used in cocoa substitute only.

Substance	Baked Goods	Frozen Dairy	Meat Products	Soft Candy	Gelatins & Puddings	Soups	Snack Foods	Nonalcoholic Beverages	Alcoholic Beverages	Gravies	Other use Categories
3549 6-HYDROXYDIHYDROTHEA-SPIRANE	—	0.2	—	0.2	0.2	—	—	0.05	—	—	
1-Hydroxy-2,5-dimethylbenzene see 3595											
1-Hydroxy-3,4-dimethylbenzene see 3596											
3550 3-HYDROXY-2-PENTANONE	10.0	10.0	—	10.0	10.0	—	—	10.0	—	—	
5-Hydroxytetradecanoic acid lactone see 3590											
6-Hydroxy-2,6,10,10-tetramethyl-1-oxaspiro-[4.5]decane see 3549											
3-Hydroxytoluene see 3530											
4-Hydroxy-2,6,6-trimethylbicyclo[3.1.1]hept-2-ene see 3594											
3551 ISOAMYL ACETOACETATE	166	83.2	—	106	81.6	—	—	80.8	54.0	—	
Isoamyl 3-oxobutanoate see 3551											
3552 ISOJASMONE	2.3	1.9	—	2.5	1.9	—	—	1.6	10.0	—	
3553 ISOPHORONE	50.0	4.7	—	50.0	50.0	—	—	10.0	—	—	Condiments & relishes—1.0; Chewing gum—1.0; Household seasoning & flavors—1.0
4-Isopropenyl-1-cyclohexene carbinyl acetate see 3561											
4-Isopropenyl-1-cyclohexene-1-carboxaldehyde see 3557											
4-Isopropenyl-1-methyl-1-cyclohexanol see 3564											
3-Isopropenyl-6-methylcyclohexanone see 3565											
3-Isopropyl-6-methylcyclohexanol see 3562											
4-Isopropyl-1-methyl-3-cyclohexen-1-ol see 3563											
3554 5-ISOPROPYL-2-METHYLPYRAZINE <sup>(1)</sup>	4.0	4.0	—	4.0	4.0	—	—	4.0	—	—	
3555 2-ISOPROPYL-4-METHYLTHIAZOLE	—	—	—	1.0	1.5	—	—	1.0	2.0	—	Confectionery & frosting—2.0; Jams & jellies—2.0; Sweet sauce—1.5; Imitation dairy—2.0; Hard candy—2.0; Chewing gum—4.0; Instant coffee & tea—2.0
3556 ISOPROPYL MYRISTATE	50.0	30.0	—	50.0	50.0	—	—	30.0	—	—	
Isopropyl tetradecanoate see 3556											
2,6-Lutidine see 3540											

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<sup>(2)</sup>Substance has not been covered in a Scientific Literature Review nor is it presently scheduled for future coverage.

<sup>(3)</sup>To be used at not more than 10.0 ppm in the finished food.

<sup>(4)</sup>To be used in cocoa substitute only.

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# 11. GRAS Substances . . .

Substance	Baked Goods	Frozen Dairy	Meat Products	Soft Candy	Gelatins & Puddings	Soups	Snack Foods	Nonalcoholic Beverages	Alcoholic Beverages	Gravies	Other use Categories
3557 <i>p</i> -MENTHA-1,8-DIEN-7-AL	4.5	6.3	20.0	9.7	4.5	—	—	4.0	6.0	—	
3558 <i>p</i> -MENTHA-1,3-DIENE	21.5	11.5	20.0	17.8	12.0	—	—	12.0	10.0	—	
3559 <i>p</i> -MENTHA-1,4-DIENE	13.6	8.6	20.0	10.3	8.6	—	—	8.5	10.0	—	Hard candy—50.0; Chewing gum—25.0
3560 <i>p</i> -MENTHA-1,4(8)-DIEN-3-ONE	5.0	5.0	—	5.0	5.0	—	—	5.0	—	—	
3561 <i>p</i> -MENTHA-1,8-DIEN-7-YL ACETATE	16.0	8.0	3.0	16.0	4.0	—	—	2.0	4.0	—	
3562 <i>p</i> -MENTHAN-2-OL	14.8	7.6	—	14.8	4.1	—	—	2.2	4.0	—	
3563 <i>p</i> -MENTH-3-EN-1-OL	30.0	10.0	—	25.0	20.0	—	—	10.0	—	—	
3564 <i>p</i> -MENTH-8-EN-1-OL	47.5	20.0	10.0	37.5	20.0	—	—	14.6	10.0	—	
3565 <i>p</i> -MENTH-8-EN-2-ONE	15.7	7.3	—	14.0	4.7	—	—	2.7	4.0	—	
3566 1- <i>p</i> -MENTHEN-9-YL ACETATE	9.0	4.5	—	7.0	4.0	—	—	4.0	—	—	
3567 <i>p</i> -METHOXYCINNAMALDEHYDE	5.0	—	2.0	—	5.0	—	—	—	—	—	Milk products—2.0; Condiments & relishes—4.0; Confectionery & frosting—5.0; Jams & jellies—5.0; Sweet sauce—4.0; Household seasoning & flavors—5.0
3-Methylbutyl 3-oxobutanoate see 3551											
3568 METHYL CYCLOHEXANE-CARBOXYLATE <sup>(a)</sup>	0.1	0.01	—	—	0.1	—	—	0.01	—	—	Fruit ices—0.01; Confectionery & frosting—0.05; Imitation dairy—0.01
Methyl disulfide see 3536											
Methyldithio-1-propene see 3576											
3569 2-METHYL-3,5 or 6-ETHOXY-PYRAZINE <sup>(b) (c)</sup>	—	0.5	—	—	3.0	—	—	0.5	—	—	Confectionery & frosting—2.0
2-Methyl-5-ethylpyridine see 3546											
3-[(2-Methyl-3-furyl)thio]-2,6-dimethyl-4-heptanone see 3538											
3570 3-[(2-METHYL-3-FURYL)-THIO]-4-HEPTANONE	1.0	—	1.0	—	—	1.0	1.0	—	—	1.0	Nut products—1.0
3571 4[(2-METHYL-3-FURYL)-THIO]-5-NONANONE	1.0	—	1.0	—	—	1.0	1.0	—	—	1.0	Nut products—1.0
3572 5-METHYLHEXANOIC ACID <sup>(b)</sup>	10.0	—	—	—	—	3.0	5.0	—	—	—	Imitation dairy—5.0
1-Methyl-3-hydroxybenzene see 3530											
1-Methyl-4-isopropenylcyclohexan-1-ol see 3564											

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<sup>(c)</sup>To be used at not more than 10.0 ppm in the finished food.

<sup>(d)</sup>To be used in cocoa substitute only.

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## 11. GRAS Substances . . .

Substance	Baked Goods	Frozen Dairy	Meat Products	Soft Candy	Gelatins & Puddings	Soups	Snack Foods	Nonalcoholic Beverages	Alcoholic Beverages	Gravies	Other use Categories
1-Methyl-4-isopropyl-1,3-cyclohexadiene see 3558											
1-Methyl-4-isopropyl-1,4-cyclohexadiene see 3559											
1-Methyl-4-isopropyl-2-cyclohexanol see 3562											
1-Methyl-4-isopropyl-3-cyclohexen-1-ol see 3563											
1-Methyl-4-isopropylidene-1-cyclohexen-3-one see 3560											
2-Methyl-5-isopropylpyrazine see 3554 3573											
METHYL 2-METHYL-3-FURYL DISULFIDE 3574	0.5	—	0.5	—	—	0.5	0.5	—	—	0.5	Nut products—0.5
4-METHYLNONANOIC ACID 3575	10.0	—	5.0	—	—	2.5	10.0	—	—	2.5	Milk products—5.0; Imitation dairy—5.0
4-METHYLOCTANOIC ACID <sup>(a)</sup> 3575	—	3.0	0.15	—	0.15	0.15	3.0	—	—	0.15	Milk products—3.0; Cheese—3.0; Confectionery & frosting—0.5
3-Methylphenol see 3530 3576											
METHYL 1-PROPENYL DISULFIDE 3577	1.0	1.0	—	1.0	1.0	—	—	1.0	—	—	
3-METHYL-5-PROPYL-2-CYCLOHEXEN-1-ONE 3578	14.7	6.5	9.3	10.5	4.0	—	—	5.9	—	—	
2-METHYL-4-PROPYL-1,3-OXATHIANE 3579	0.1	0.1	0.1	0.1	0.1	—	—	0.05	—	—	
1,4-NONANEDIOL DIACETATE 3580	9.0	7.0	—	7.0	7.0	—	—	7.0	—	—	
cis-6-NONENAL	1.0	0.3	—	—	0.5	—	—	0.2	0.1	—	Breakfast cereals—0.1; Fruit ices—0.3; Condiments & relishes—0.1; Confectionery & frosting—1.5; Chewing gum—1.0
<i>trans</i> -β-Ocimene see 3539 3581											
3-OCTANOL 3582	4.8	4.0	—	4.0	4.0	—	10.0	4.0	1.0	—	Chewing gum—11.2
1-OCTEN-3-YL ACETATE 3583	4.8	4.0	12.0	4.0	4.0	—	10.0	4.0	—	—	
3-OCTYL ACETATE 3584	4.4	4.0	2.6	4.0	4.0	—	10.0	4.0	—	—	Chewing gum—2.6
1-PENTEN-3-OL Perillaldehyde see 3557	8.8	4.3	—	5.0	4.3	—	—	3.5	2.0	—	
Perillyl acetate see 3561 3585											
L-PHENYLALANINE <sup>(d)</sup>	110	60.0	10.0	268	60.0	—	—	—	—	—	Milk products—66.0; Condiments & relishes—10.0; Confectionery & frosting—268; Sweet sauce—220

<sup>(a)</sup>Total dithiol added to any food not to exceed 1.0 ppm.

<sup>(b)</sup>Substance has not been covered in a Scientific Literature Review nor is it presently scheduled for future coverage.

<sup>(c)</sup>To be used at not more than 10.0 ppm in the finished food.

<sup>(d)</sup>To be used in cocoa substitute only.

Substance	Baked Goods	Frozen Dairy	Meat Products	Soft Candy	Gelatins & Puddings	Soups	Snack Foods	Nonalcoholic Beverages	Alcoholic Beverages	Gravies	Other use Categories
3586 2-PHENYL-3-(2-FURYL)- PROP-2-ENAL	2.0	1.0	—	—	2.0	—	—	1.0	—	—	Confectionery & frosting—2.0
3587 2(10)-PINEN-3-OL	1.0	1.0	—	1.0	1.0	—	—	1.0	—	—	
2-Pinen-4-ol see 3594											
Pinocarveol see 3587											
Piperitenone see 3560											
3588 1,3-PROPANEDITHIOL <sup>(a)</sup>	0.2	—	0.2	—	—	0.2	0.2	—	—	0.2	Nut products—0.2
1-Propenyl methyl disulfide see 3576											
2-Propenyl polysulfides see 3533											
3589 RESORCINOL	15.0	—	5.0	—	—	5.0	10.0	—	—	5.0	Condiments & relishes—5.0; Household seasoning & flavors—10.0
Tirpilene see 3558											
$\alpha$ -Terpinene see 3558											
$\gamma$ -Terpinene see 3559											
1-Terpineol see 3563											
$\beta$ -Terpineol see 3564											
3590 $\Delta$ -TETRADECALACTONE	40.0	—	30.0	30.0	—	15.0	30.0	—	—	15.0	Fats & oils—30.0; Milk products—20.0; Cheese—30.0; Poultry—30.0; Confectionery & frost- ing—30.0; Im- itation dairy products—40.0; Hard can- dy—15.0; Household seasoning & flavors—15.0
3591 THEOBROMINE <sup>(d)</sup>	1050	—	—	4020	795	—	—	—	—	—	Milk products—990; Confectionery & frost- ing—4020; Sweet sauces—3300
Tetradecanedioic acid cyclic ethylene glycol diester see 3543											
3,5,5-Trimethyl-2-cyclo- hexen-1-one see 3553											
3592 2,2,3-TRIMETHYLCYCLOPENT- 3-EN-1-YLACETALDEHYDE	8.0	—	—	—	—	—	—	—	5.0	—	Condiments & relishes—5.0; Reconstituted vegetables—5.0

<sup>(a)</sup>Total dithiol added to any food not to exceed 1.0 ppm.

<sup>(b)</sup>Substance has not been covered in a Scientific Literature Review nor is it presently scheduled for future coverage.

<sup>(c)</sup>To be used at not more than 10.0 ppm in the finished food.

<sup>(d)</sup>To be used in cocoa substitute only.

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## 11. 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>3593</sup> 1,2,3-TRIS [1'-ETHOXY) ETHOXY]-PROPANE	308	51.3	—	128	255	—	—	58.3	51.1	—	Milk products—51.3; Processed fruit—51.3; Fruit ices—51.3; Condiments & relishes—255; Confectionery & frosting—128; Jams & jellies—255; Sweet sauce—255; Nut products—58.3; Imitation dairy products—51.3; Hard candy—128; Chewing gum—1442; Household seasoning & flavors—255
<sup>3594</sup> VERBENOL	1.0	1.0	—	1.0	1.0	—	—	1.0	—	—	
<sup>3595</sup> 2,5-XYLENOL	4.0	—	2.0	—	—	2.0	—	—	—	2.0	Nut products—2.0; Instant coffee & tea—2.0; Household seasoning & flavors—2.0
<sup>3596</sup> 3,4-XYLENOL	4.0	—	2.0	—	—	2.0	—	—	—	2.0	Nut products—2.0; Instant coffee & tea—2.0; Household seasoning & flavors—2.0

<sup>(a)</sup>Total dithiol added to any food not to exceed 1.0 ppm.

<sup>(b)</sup>Substance has not been covered in a Scientific Literature Review nor is it presently scheduled for future coverage.

<sup>(c)</sup>To be used at not more than 10.0 ppm in the finished food.

<sup>(d)</sup>To be used in cocoa substitute only.