Why do we use sunscreen?

Sunscreen is a common body care product that many people use to protect themselves from the adverse effects of the sun. If used as instructed, sunscreen can prevent premature ageing, skin damage, and decrease your risk of developing skin cancer.[1] Almost all skin cancers are caused by too much UV radiation, whether from the sun or solaria.[2] The harmful effects of the sun are not restricted to sunny days, you can develop skin damage on cloudy days too since up to 80% of the sun's UV radiation reaches the earth's surface.[1]

Ingredients of concern

Sunscreen ingredients can be split into two groups, physical (inorganic) and chemical (organic). There are also inactive ingredients that make up 50-70% of the sunscreen you find on the shelves.[5] Many different ingredients are present in sunscreens because they need to be used in conjunction with other blockers and filters to give optimum protection.[3]

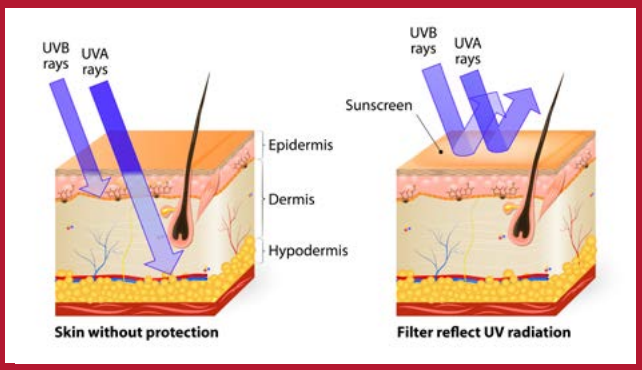
Physical components block and scatter the UV rays.[1] These ingredients are nanoparticles that sit on the surface of the skin so the body doesn't normally absorb these minerals.[3] Non-nanoparticle formats are also commercially available.[4] The Food and Drug Administration (FDA) in the United States has declared these physical components as GRASE (Generally Recognized As Safe and Effective).[5]

Examples of physical blockers include:

Titanium dioxide | (UVB and some UVA protection) Nanoparticle, inhalation concerns.

Zinc oxide | (UVA and UVB protection) Nanoparticle, inhalation concerns.

Chemical ingredients absorb UV rays and are under the spotlight because many can be absorbed by the body and even show up in blood, breast milk, and urine samples.[4] There is also evidence of hormone disruption in many and more studies are being conducted to assess the safety of these components.



Two types of UV light that can cause detrimental effects:

Ultraviolet A (UVA) light | contain longer wavelengths (320-400 nm) and penetrates deeply into the dermal layer (dermis) of the skin and is responsible for skin aging.[3]

Ultraviolet B (UVB) light | consist of shorter wavelengths (290-320 nm) and permeates the surface layer (epidermis) causing sunburn.[2]

Other modes of UVA and UVB prevention include limiting time spent outside, the use of shade, wearing sun-protective clothing, and avoiding the outdoors when the sun is at its highest point in the sky (between 10 am and 2 pm).[4]

Examples of chemical blockers include:

Oxybenzone | (UVA and UVB protection) Hormone disruption, organ toxicity, high rates of skin allergies.

Octinoxate | (UVB protection) Hormone and thyroid disruption, reproductive toxicity, moderate rates of skin allergies.

Homosalate | (UVB protection) Hormone disruption, enhance absorption of secondary chemicals on skin, including insect repellent.

Avobenzone | (UVA protection, must be mixed with stabilizers) Very limited skin penetration, high rates of skin allergies

Octisalate | (UVB protection) Possible skin penetrations and rare instances skin allergies

Octocrylene | (UVA protection) Possible skin penetrations, high rates of skin allergies

Mexoryl SX | (UVA protection) Very limited skin penetrations and rare instances skin allergies

These ingredients are rarely used in sunscreen but still are of concern:

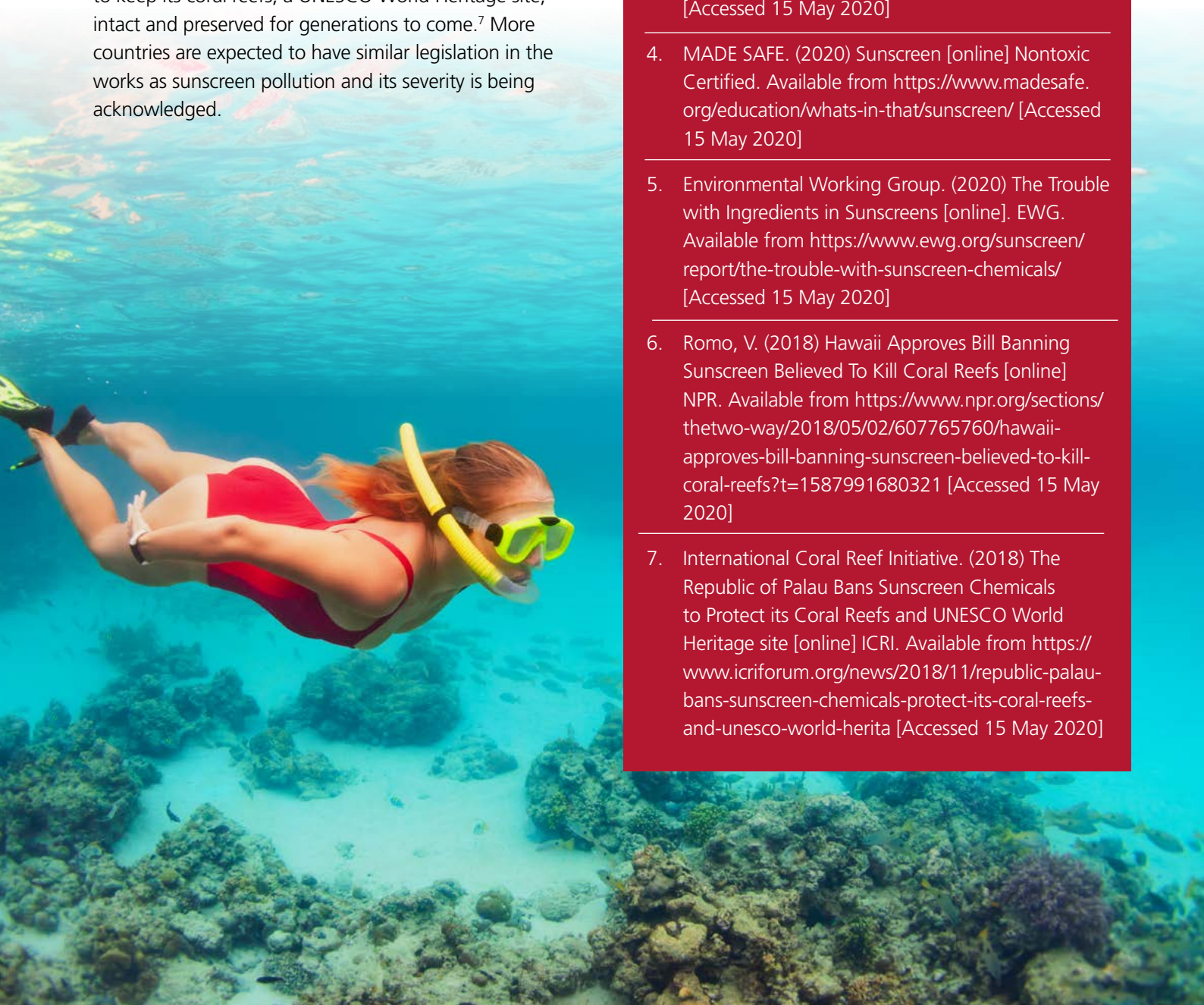
p-Aminobenzoic acid (PABA), trolamine salicylate, dioxybenzone (benzophenone-8), cinoxate, ensulizole, meradimate (menthyl anthranilate), padimate O, sulisobenzone (benzophenone-4)

The inactive ingredient, Methylisothiazolinone, is known to be a skin sensitizer and has shown an increase in skin allergy rates.[5]

Environmental Impacts

Sunscreen agents are not only developing a reputation for health concerns, but also environmental impacts. Some components are known to harm coral, disrupt hormones in fish and other aquatic life, and are persistent in the environment.

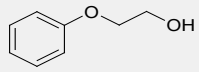
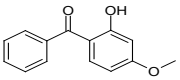
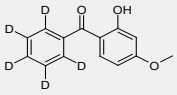
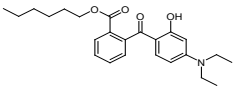
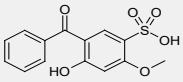
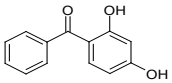
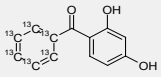
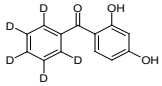
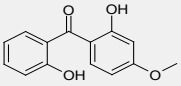
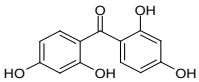
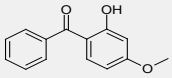
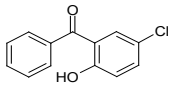
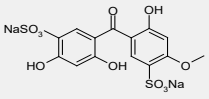
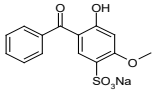
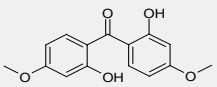
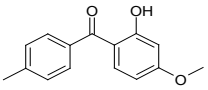
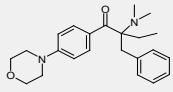
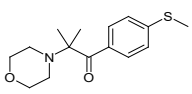
The UVB absorber, Homosalate, doesn't break down readily and accumulates in fish and the environment. Oxybenzone and Octinoxate have been banned in Hawaii and the U.S. Virgin Islands to protect coral reefs from degradation.[6] Many popular tourist beaches around the world have been closing in order to restore their coral health, revealing that sunscreen pollution is unsustainable tourism. The Republic of Palau has banned a total of ten sunscreen ingredients in order to keep its coral reefs, a UNESCO World Heritage site, intact and preserved for generations to come.[7] More countries are expected to have similar legislation in the works as sunscreen pollution and its severity is being acknowledged.



References:

1. The Skin Cancer Foundation. (2020) All About Sunscreen: Why You Need It. How it Works for You [online]. The Skin Cancer Foundation. Available from https://www.skincancer.org/skin-cancer-prevention/sun-protection/sunscreen/ [Accessed 15 May 2020]
2. Cancer Council NSW. (2015) How ultraviolet (UV) radiation causes skin cancer [online]. Cancer Council Australia. Available from https://www.cancercouncil.com.au/63295/cancer-prevention/sun-protection/sun-protection-sport-and-recreation/sun-protection-information-for-sporting-groups/how-ultraviolet-uv-radiation-causes-skin-cancer/ [Accessed 15 May 2020]
3. Rai, R., Shanmuga, S. C., & Srinivas, C. (2012). Update on photoprotection. Indian journal of dermatology, 57(5), 335–342. Available from: https://doi.org/10.4103/0019-5154.100472 [Accessed 15 May 2020]
4. MADE SAFE. (2020) Sunscreen [online] Nontoxic Certified. Available from https://www.madesafe.org/education/whats-in-that/sunscreen/ [Accessed 15 May 2020]
5. Environmental Working Group. (2020) The Trouble with Ingredients in Sunscreens [online]. EWG. Available from https://www.ewg.org/sunscreen/report/the-trouble-with-sunscreen-chemicals/ [Accessed 15 May 2020]
6. Romo, V. (2018) Hawaii Approves Bill Banning Sunscreen Believed To Kill Coral Reefs [online] NPR. Available from https://www.npr.org/sections/thetwo-way/2018/05/02/607765760/hawaii-approves-bill-banning-sunscreen-believed-to-kill-coral-reefs?t=1587991680321 [Accessed 15 May 2020]
7. International Coral Reef Initiative. (2018) The Republic of Palau Bans Sunscreen Chemicals to Protect its Coral Reefs and UNESCO World Heritage site [online] ICRI. Available from https://www.icriforum.org/news/2018/11/republic-palau-bans-sunscreen-chemicals-protect-its-coral-reefs-and-unesco-world-herita [Accessed 15 May 2020]

Sunscreen agents

Chiron No.	Structure / Class	Name	Synonyms	CAS	SVHC index
	Phenoxy derivatives:				
10222.8		2-Phenoxy-1-ethanol	Phenoxyethanol	122-99-6	
	Benzophenone derivatives				
10232.14		2-Hydroxy-4-methoxybenzophenone	Oxybenzone	131-57-7	
11794.14		2-Hydroxy-4-methoxybenzophenone-2',3',4',5',6'-d5	Oxybenzone-d5	1219798-54-5	
10233.24		Diethylaminohydroxybenzoyl hexylbenzoate	Uvinul A Plus, DHHB	302776-68-7	
10242.14		2-Hydroxy-4-methoxybenzophenone-5-sulfonic acid hydrate, contains 5-10% isopropyl alcohol	Sulisobenzone, Uvinul MS40, UV 284	4065-45-6	
10248.13		2,4-Dihydroxybenzophenone	Uvinul 3000, Uvinul 400, Uvinul M 400, UV 0, UV 12, UV 214 UV absorber, DHBP	131-56-6	
10249.13		2,4-Dihydroxybenzophenone-13C6	Uvinul 3000-13C6, Uvinul 400-13C6, Uvinul M 400-13C6, UV 214-13C6, DHBP-13C6	131-56-6 (unlabelled)	
14237.13		2,4-Dihydroxybenzophenone-2',3',4',5',6'-d5	Uvinul 3000-d5, Uvinul 400-d5, Uvinul M 400-d5, UV 214-d5, DHBP-d5	91586-06-0	
10269.14		2,2'-Dihydroxy-4-methoxybenzophenone	Dioxybenzone	131-53-3	
14246.13		2,2',4,4'-Tetrahydroxybenzoophenone	Uvinul 350, Uvinul D50	131-55-5	
14247.14		2-Hydroxy-4-methoxybenzophenone	Uvinul MC, Uvinul M40, Uvinul M9, Uvinul 3040	131-57-7	
14248.13		5-Chloro-2-hydroxybenzophenone	UV absorber NL/5, Benzophenone-7	85-19-8	
14249.15		2,2'-Dihydroxy-4,4'-dimethoxybenzophenone-5,5-disulfonic acid sodium salt	Uvinul 3049, Uvinul D549, Benzophenone-9 sodium salt	76656-36-5	
14250.14		2-Hydroxy-4-methoxybenzophenone-5-sulfonic acid sodium salt	Uvistat 1121, Uvin 1M540	6628-37-1	
14251.15		2,2'-Dihydroxy-4,4'-dimethoxybenzophenone	Uvinul 3040, Uvinul D49, UV 49, Benzophenone-6	131-54-4	
14252.15		2-Hydroxy-4-methoxy-4'-methylbenzophenone	Mexenone, Unistat 2211, Benzophenone-10	1641-17-4	
14219.23		2-Benzyl-2-dimethylamino-4'-morpholinobutyrophenone	UV369	119313-12-1	202
14218.15		2-Methyl-1-(4-methylthiophenyl)-2-morpholinopropan-1-one	UV 907	71868-10-5	203

Chiron No.	Structure / Class	Name	Synonyms	CAS	SVHC index
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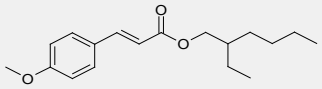
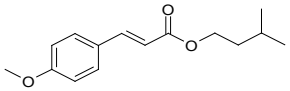
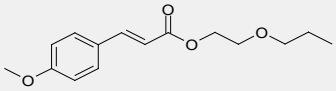
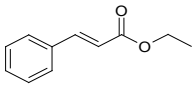
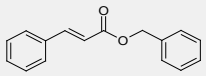
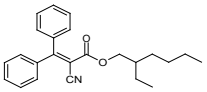
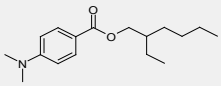
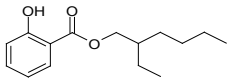
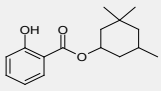
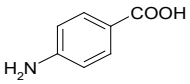
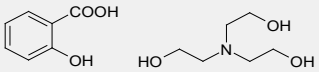
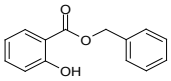
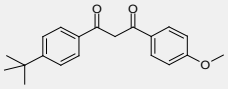
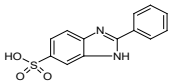
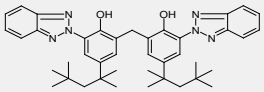
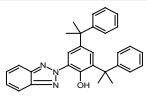
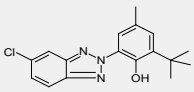
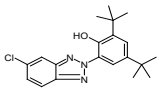
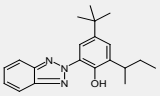
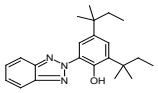
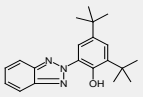
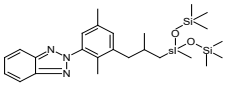
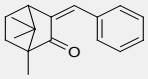
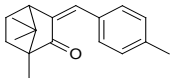
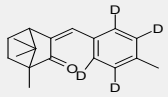
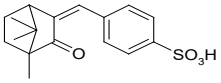
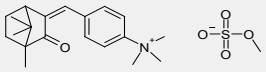
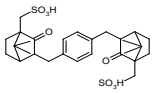
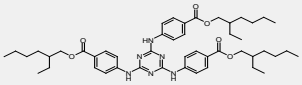
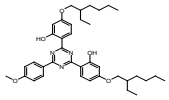
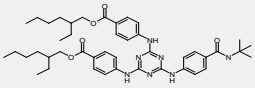
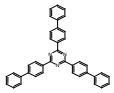
10237.18		Octyl methoxycinnamate 2-Ethylhexyl 3-methoxycinnamate	Uvinul MC 80, Uvinul MC 90, Uvinul 3088, OMC	5466-77-3	
10244.15		Isopentyl 4-methoxycinnamate	E 1000, NSC 408332	71617-10-2	
14260.14		Cinoxate	2-Ethoxyethyl 4-methoxycinnamate	104-28-9	
14262.11		Ethyl cinnamate	Ethyl 3-phenyl-2-propenoate, NSC 6773	103-36-6	
9088.16		Benzyl cinnamate	Benzyl 3-phenylpropenoate, Cinnamic acid benzyl ester	103-41-3	
10235.24		2-Ethylhexyl 2-cyano-3,3-diphenyl-2-propionate	Octocrylene, Octocrilene, Uvinul N 539T, Uvinol 3039	6197-30-4	
	Benzoates				
10236.17		2-Ethylhexyl p-dimethylaminobenzoate	Padimate O, Octyl dimethyl PABA	21245-02-3	
10239.15		2-Ethylhexyl salicylate	Octisalate, Uvinul 0-18	118-60-5	
10241.16		Homosalate	3,3,5-Trimethylhexyl 2-hydroxybenzoiate	118-56-9	
10243.7		p-Aminobenzoic acid	PABA	150-13-0	
14262.13		Trolamine salicylate	Triethanolamine, Tris(2-hydroxyethyl)amine	2174-16-5	
9091.14		Benzyl salicylate	Benzyl 4-hydroxybenzoate	118-58-1	CoRAP (Community rolling action plan)
	Dibenzoyl derivatives				
10238.20		1-[4-(1,1-Dimethylethyl)phenyl]-3-(4-methoxyphenyl)-1,3-propandione	Avobenzone	70356-09-1	
	Benzmidazole and benzotriazolenderivatives				
10231.13		2-Phenylbenzimidazole-5-sulfonic acid	PBI, UV T, Ensulizole	27503-81-7	
10240.41		2,2'-Methylenebis(6-(2H)-benzotriazol-2-yl)-4-tert-octylphenol	UV 360, UV 5431, Bisoctrizole, Tinosorb M	103597-45-1	
10250.30		2-2(H-Benzotrialzol-2-yl)-4,6-bis(1-methyl-1-phenylethyl)phenol	Benzotriazole BT, Uvinul 3034, UV 234 antioxidant	70321-86-7	
10251.17		2-(5-Chloro-2-benzotriazolyl)-6-tert-butyl-p-cresol	Bumetriazole, Uvinul 3026, UV 326	3896-11-5	
13132.20		2-(3',5'-Di-tert-butyl-2'-hydroxyphenyl)-5-chlorobenzotriazole	UV 327, UV 2 UV stabilizer	3864-99-1	167

Chiron No.	Structure / Class	Name	Synonyms	CAS	SVHC index
Benzmidazole and benzotriazolenderivatives					
13133.20		2-(2H-Benzotriazol-2-yl)-4-(tert-butyl)-6-(sec-butyl)phenol	UV350	36437-37-3	166
13135.22		2-(2'-Hydroxy-3'-5'-di-tert-amylphenyl)benzotriazole	UV 328, UV 2337, UV 74	25973-55-1	160
13136.20		2-(3,5-Di-tert-butyl-2-hydroxyphenyl)-2H-benzotriazole	UV 320	3846-71-7	159
14239.24		Drometrizole trisiloxane	Silatriazole, Mexoryl XL	155633-54-8	
Camphor-derivatives					
14058.17		3-Benzylidenecamphor	3-Benzylidene-2-bornanone	15087-24-8	197
10245.18		3-(4-Methylbenzylidene)camphor	Uvinul MBC 95	36861-47-9 38102-62-4 is a deleted CAS	
14062.18		(+/-)-3-(4-Methylbenzylidene-d4)camphor	Uvinul MBC 95-d4	1219806-41-3	
14059.17		3-Benzylidenecamphor-4'-sulfonic acid	3-Benzylidene-2-bornanone-4'-sulfonic acid	56039-58-8	
14061.21		Camphor benzalkonium methyl sulfate	BCM	52793-97-2	
14240.28		3,3'-(1,4-Phenylenemethylidyne)bis[7,7-dimethyl-2-oxobicyclo[2.2.1]heptane-1-methanesulfonic acid]	Ecamsule	92761-26-7	
Triazine-dervatives					
10247.48		Octyl triazone	Ethylhexyl triazone, Uvinul T 150, UVT 150	88122-99-0	
10234.38		2,2'-[6-(4-Methoxyphenyl)-1,3,5-triazine-2,4-diyl]bis[5-[(2-ethylhexyl)oxy]phenol	Bemotrizinol, Tinosorb S	187393-00-6	
14241.44		Diethylhexyl butamideo triazone	Iscotrizinol	154702-15-5	
14243.39		2,4,6-Tris([1,1'-biphenyl]-yl])-1,3,5-triazine	Tribiphenyl triazine	31274-51-8	
Miscellaneous compounds					
14244.0		Titanium oxide		13463-67-7	