INTERNATIONAL PROGRAMME ON CHEMICAL SAFETY

Health and Safety Guide No. 71

TRIMELLITIC ANHYDRIDE HEALTH AND SAFETY GUIDE

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Health and Safety Guide No. 71

TRIMELLITIC ANHYDRIDE HEALTH AND SAFETY GUIDE

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WORLD HEALTH ORGANIZATION, GENEVA 1992

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INTRODUCTION

This Health and Safety Guide is not based on an existing Environmental Health Criteria document, but on critical national reviews. The hazard evaluation in the Health and Safety Guide was made on the basis of carefully selected studies, after scrutiny of the original publications.

In order to assist the peer-review process of the present Health and Safety Guide, a background companion document was prepared by the IPCS and can be obtained from the Director on request; the IPCS does not intend that the background document should be published.

The first three sections of this Health and Safety Guide present essential technical information and the hazard evaluation. Section 4 includes advice on preventive and protective measures and emergency action; health workers should be thoroughly familiar with the medical information to ensure that they can act efficiently in an emergency. The section on regulatory information has been extracted from the legal file of the International Register of Potentially Toxic Chemicals (IRPTC) and from other United Nations sources.

The target readership includes occupational health services, those in ministries, governmental agencies, industry, and trade unions who are involved in the safe use of chemicals and the avoidance of environmental health hazards, and those wanting more information on this topic. An attempt has been made to use only terms that will be familiar to the intended user. However, sections 1 and 2 inevitably contain some technical terms.

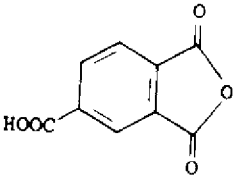
Revision of the information in this Guide will take place in due course, and the eventual aim is to use standardized terminology. Comments on any difficulties encountered in using the Guide would be very helpful and should be addressed to:

The Director
International Programme on Chemical Safety
World Health Organization
1211 Geneva 27
Switzerland

THE INFORMATION IN THIS GUIDE SHOULD BE CONSIDERED AS A STARTING POINT TO A COMPREHENSIVE HEALTH AND SAFETY PROGRAMME

1. PRODUCT IDENTITY AND USES

1.1 Identity

Chemical formula:	$C_9H_4O_5$
Chemical structure:	
Common name:	trimellitic anhydride
Common synonyms:	anhydro trimellitic acid; 1,2,4-benzenetricarboxylic acid 1,2-anhydride; 1,2,4-benzenetricarboxylic anhydride; 4-carboxyphthalic anhydride; 1,3-dioxo-5-phthalancarboxylic acid; 5-phthalancarboxylic acid, 1,3-dioxo-TMAN; trimellitic acid 1,2-anhydride; TMA;[a] TMAN
IUPAC systematic name:	1,3-dihydro-1,3-dioxo-5-isobenzofuran-carboxylic acid
CAS registry number:	552-30-7
RTECS registry number:	DC2050000
Conversion factor:	1 mg/m^3 ≈ 0.13 ppm
Relative molecular mass:	192.12

[a] TMA is also an acronym for i.a. trimethylamine.

1.2 Physical and chemical properties

Trimellitic anhydride is a white solid in the form of flakes. It is readily hydrolysed in water to trimellitic acid, which is moderately soluble in water. Trimellitic anhydride is readily soluble in acetone, cyclohexanone, 2-butane, ethyl acetate, and dimethyl formamide (from 49.6 to 15.5% w/w at 25 °C).

Trimellitic anhydride reacts with alcohols forming the corresponding esters. Reactions with ammonia yield amides, imides, and amide-imides.

Flaked or molten trimellitic anhydride will burn if ignited, producing an explosive dust. Similarly, the vapour from molten trimellitic anhydride forms dangerously explosive mixtures with air.

Some additional physical and chemical properties are given in the Summary of Chemical Safety Information (see section 6).

1.3 Composition

The purity of commercial trimellitic anhydride is greater than 99%.

1.4 Analytical methods

Airborne trimellitic anhydride can be sampled on various adsorbents, such as cellulose ester membrane filter, glass fibre filter, or PVC membrane. It can be determined by high performance liquid chromatography (HPLC), gas chromatography, or polarography. HPLC allows the accurate measurement of as little as 0.1 μg trimellitic anhydride.

1.5 Production and uses

Trimellitic anhydride has been produced since the 1960s. Production was estimated to be 50 000 tonnes per annum in 1990.

The preparation of trimellitic anhydride is based on the liquid-phase air-oxidation of pseudocumene to form trimellitic acid, this being subsequently dehydrated. An alternative process consists of heating crude trimellitic acid with vanadium pentoxide.

Trimellitic anhydride is a very reactive chemical of low relative molecular mass. Many of its industrial uses depend on the reactivity of the anhydride group. It is mainly used in the synthesis of trimellitate esters. These esters

are used as plasticizers for polyvinyl chloride, especially when temperature stability is required, e.g., in wire and cable coatings. Trimellitic anhydride esters are less volatile and less water soluble than corresponding phthalates, and have begun to replace them in some applications, e.g., car interior linings. An important use for trimellitic anhydride polymers is in the production of the wire enamels used to coat magnetic wire or for other applications where high thermal resistance is required.

Trimellitic anhydride is also used in the production of polyester resins for water-based and conventional solvent-based coatings and paints, to make resins for electrodeposition and powder coatings, and as a binder for glass fibres, sand, and other aggregates.

In addition, trimellitic anhydride is used as an embossing agent for foam-backed vinyl flooring and as a curing agent for epoxy and other resins. It is also used as a plasticizer in materials used to store and cover food and in the synthesis of various anticorrosive surface coatings, agricultural chemicals, and pharmaceutical products.

2. SUMMARY AND EVALUATION

2.1 Exposure to trimellitic anhydride

Exposure to trimellitic anhydride occurs in many different occupational settings; 20 000 workers are known to be exposed through manufacturing and use in the USA and the worldwide total is considerably greater. Exposure occurs mainly by inhalation of dust or fumes. Since trimellitic anhydride has a very low vapour pressure at room temperature, extensive exposure occurs mainly when dust is generated from the powder, by mixing or spraying, or by inhalation of the fumes generated during processes requiring high temperature, e.g., oven curing. Exposure to very high levels of trimellitic anhydride fumes occurs when heated metal surfaces are sprayed with anticorrosive materials containing trimellitic anhydride-based compounds. High levels of trimellitic anhydride dust are found in bagging areas.

Exposure of the general population to trimellitic anhydride is possible, for example, around industrial plants, through its use in food storage and protection materials, from car interior linings, and during transportation of the compound. However, the likelihood of exposure from these sources is very low. When trimellitate plasticizers are used, trimellitic anhydride itself is not present, but rather its ester derivatives; these are stable and do not migrate. There are no reports of populations being affected in the vicinity of industrial sites.

2.2 Absorption, metabolism, and excretion

In a distribution study, rats were exposed through inhalation to 950 μg ^{14}C-labelled trimellitic anhydride/m^3 for 45 minutes. Treated rats were sacrificed at intervals ranging from 3 hours to 32 days. Maximum concentrations of ^{14}C in all tissues occurred 3 hours after exposure; these levels then declined in all tissues, except for the lymph nodes associated with the lung, where there was an initial decline followed by a second increase, peaking at the eighth day and then declining.

There is no information on metabolism. Trimellitic anhydride reacts with the free amino groups on proteins to form conjugates.

2.3 Fate in the environment and effects on organisms

There is very limited information on the fate and effects of trimellitic anhydride in the environment. However, exposure is expected to be very low, except from spills and accidents.

In a laboratory degradation study, more than 60% of the theoretical quantity of carbon dioxide was generated in 10 days. Hydrolysis of the anhydride was not checked during the study. Trimellitic anhydride can thus be considered as readily degradable by by bacteria. Data on aquatic toxicity, e.g., on fish species, are not yet available

2.4 Effects on animals

2.4.1 *Acute toxicity*

The acute toxicity of trimellitic anhydride for experimental animals is low. For the mouse, the most susceptible species, the oral LD_{50} was 1300 mg/kg body weight. Treated mice showed gastrointestinal mucosal irritation, with hyperaemia and haemorrhage; in some cases, perforations were noted. For the rat, the oral LD_{50} was 2730 mg/kg body weight, and the dermal LD_{50} was estimated to be greater than 2000 mg/kg body weight.

A single application of trimellitic anhydride (TMA) to rabbit skin resulted in mild dermatitis. TMA caused severe irritation to the eyes of rabbits, leading to corrosive lesions and chemical burns in the cornea.

2.4.2 *Short-term toxicity*

Animal inhalation studies, for 2–13 weeks, have shown a clear correlation between TMA exposure and the occurrence of lung damage. The development of lung injury is concurrent with a rise in antibody levels in the products of broncho-alveolar lavage and in serum. There are marked species differences in susceptibility to trimellitic anhydride-induced respiratory sensitization. In one recent study, the rat appeared to be the most sensitive experimental animal. No sensitization response was observed on challenge 3 weeks after a 6-hour exposure at 1.6 μg TMA/m^3, but sensitization was seen after exposure at 7.7 μg/m^3. Repeated respiratory exposure to TMA resulted in dose-related focal haemorrhagic areas in the lungs, with oedema and lobular bronchopneumonia.

An unusual finding in a 13-week rat inhalation study was the apparent development of tolerance to TMA during the study, as indicated by reductions in antibody titres and the prevalence of lung lesions. The results suggest adaptation in rats to TMA after short-term continuous exposure (Leach et al. 1989).

Repeated skin applications of TMA in guinea-pigs induce significant dermal sensitization reactions.

Conjugates formed between protein groups and trimellitic anhydride are able to trigger an allergic response.

Data on genotoxicity and reproductive toxicity are limited; the only results available on genetic toxicity are those from Ames tests, which were negative. No developmental toxicity was recorded in a teratology screening-study on pregnant mice. However, trimellitic anhydride-specific antibody can be transferred from mother to fetus in rats and guinea-pigs.

2.4.3 *Long-term toxicity*

There are no data on which the long-term toxicity or carcinogenicity of TMA can be assessed.

2.5 Effects on human beings

Trimellitic anhydride dust or fumes are highly irritating to the eyes and respiratory system. The dust may cause corrosive eye damage, and frequent exposure can lead to respiratory sensitization, with, in rare cases, quite severe symptoms. Trimellitic anhydride can produce skin irritation following prolonged or repeated exposure.

TMA is a potent respiratory sensitizer; it has caused immunologically-mediated respiratory illness in 29% of workers, exposed prior to 1979 to levels considerably above the present threshold limit value. The period from 1979 to 1985 was characterized by implementation of control measures to reduce exposure to TMA in the workplace. These measures clearly resulted in a marked decrease in both clinical symptoms and levels of TMA antibody formation.

Four clinical syndromes have been identified. Three of these syndromes are associated with immunological reactions. The first is an *immediate type airway response* characterized by asthma or rhinitis, or both. These

symptoms only occur when individuals are sensitized following a latent period of exposure, which may be weeks or years. Once sensitization is acquired, symptoms occur within seconds or minutes of exposure. The syndrome is associated with an increase in antibody levels.

The second form, the *late respiratory systemic syndrome*, often termed "TMA-flu", also requires a latent period of exposure for sensitization. It is characterized by a delayed onset of symptoms after exposure, such as coughing and wheezing that occur 4–12 hours after exposure to trimellitic anhydride; however, the syndrome also includes muscle and joint pains, and fever. High levels of antibodies are also associated with this syndrome.

The most severe and rare reaction is the *pulmonary-disease-anaemia syndrome*, which may lead to respiratory failure. No fatal cases have been reported. This illness has appeared only after exposures to high concentrations of trimellitic anhydride fumes, from the heating of materials containing trimellitic anhydride, for relatively short periods. The symptoms vary in severity and may include cough, with blood-stained sputum, and breathlessness, resulting in severe pathological changes in the lung. The disease also requires a latent period of exposure before the onset of symptoms and it is characterized by high serum antibody levels. These symptoms are, however, reversible after trimellitic anhydride exposure has ceased.

The fourth respiratory syndrome is a *non-immunological irritant reaction* to trimellitic anhydride characterized by a transient irritation in the upper airways, with lacrimation and rhinorrhoea. The irritant symptoms are related to exposure level and can occur in any worker after a single high-level exposure to trimellitic anhydride powder or fumes.

Descriptions of the human syndromes are summarized in Table 1.

Table 1. Characteristics of syndromes in humans related to the inhalation of trimellitic anhydride [a]

Characteristic	Syndrome			
	Rhinitis and immediate-type asthma	Late respiratory systemic syndrome	Pulmonary disease-anaemia	Irritant syndrome
Latent period (duration of work exposure prior to onset of symptoms)	Months to years of work exposure	Months to years of work exposure	Weeks to months of work exposure	Occurs on first high-level exposure
Onset of symptoms after work exposure	Immediate (minutes)	4–12 hours	Progressive with further work exposure	Variable, depending on exposure
Type/degree of exposure	TMA dust or fumes/ mild	TMA dust or fumes/ moderate	TMA fumes/high	Fumes or dust/high

[a] From Zeiss et al. (1982).

3. CONCLUSIONS AND RECOMMENDATIONS

3.1 Conclusions

Trimellitic anhydride is extensively used in industry throughout the world. It is hazardous to human health in the workplace. Exposure may result in irritant and/or sensitization respiratory effects, ranging from mild to severe. It is a mild irritant and sensitizer to the skin, and corrosive to the eye. Eye damage is frequently irreversible.

Trimellitic anhydride-related immune response and illness can be reduced with proper workplace control.

Flaked or molten trimellitic anhydride will burn if ignited, producing an explosive dust. The vapour from molten trimellitic anhydride forms dangerously explosive mixtures with air.

3.2 Recommendations

(*a*) This compound should be handled strictly in accordance with safe work and good-housekeeping practices. If these are not feasible, the use of less hazardous alternatives to TMA should be considered.

(*b*) Since trimellitic anhydride is a respiratory sensitizer, some response in previously sensitized workers may occur even at the recommended threshold limit value (TLV); exposure to TMA in the workplace should, therefore, be kept as low as possible.

(*c*) Workers with a previous history of asthma or allergies should not be exposed to trimellitic anhydride. It is advisable to have a pre-employment chest X-ray.

(*d*) Pre-employment and subsequent periodic medical surveillance should be carried out, including the determination of antibody levels and careful examination of eyes, respiratory tract, and skin.

4. HUMAN HEALTH HAZARDS, PREVENTION AND PROTECTION, EMERGENCY ACTION

4.1 Main human health hazards, prevention and protection, first aid

Since the packaging and handling of trimellitic anhydride can result in exposure, procedures for diminishing worker exposures to trimellitic anhydride are essential. In the work area, closed systems with continuous ventilation should be used, or, if not feasible, mechanical ventilation and local exhaust should be installed. If ventilation is insufficient to maintain exposures below the recommended limit, a full face-piece, cartridge respirator is required as the minimum protection. A combination type cartridge may be used for dust or fume concentrations up to 50 times the recommended exposure limit. For higher concentrations, an air-supplied, full face-piece respirator is required. Overalls or other appropriate clothing, chemical goggles, and gloves must be worn by persons engaged in work that results in direct contact with trimellitic anhydride. Contaminated clothing should be removed and thoroughly cleaned and dried before reuse. High dust concentration may form a flammable or explosive mixture with air and should be avoided. Dry dust can be charged electrostatically by turbulence, pneumatic transport, pouring, and in exhaust ducts and during transportation. Build-up of electrostatic charges should be prevented by grounding.

Users of TMA should consult the manufacturers with regard to appropriate and effective exhaust ventilation, and precautions to be followed when using the compound.

4.1.1 *Surveillance*

Antibody titres should be determined in workers exposed to trimellitic anhydride every 6 months.

4.1.2 *First aid*

In the case of exposure to TMA, medical attention should be sought immediately; in the meantime, render first aid. Move the patient to fresh air, remove contaminated clothing. Wash contaminated skin with soap and water and provide artificial respiration if necessary. In the case of splashes in the eyes, irrigate the eyes with plenty of water for 15 minutes. If large

amounts are ingested, vomiting should not be in induced, to avoid the potential complication of aspiration pneumonitis.

4.2 Advice to physicians

No specific antidote is known. General symptomatic and supportive therapy is indicated, depending on the system affected: respiratory system, eyes, or skin.

4.3 Explosion and fire hazards

Trimellitic anhydride is not readily combustible. However, high dust concentrations have a potential for combustion or explosion. Trimellitic anhydride forms an explosive mixture with air; the lower and upper explosive limits are 1% and 7%, respectively. Care should be taken to keep dust concentrations low and to prevent ignition. High-voltage static electricity build-up is possible when significant quantities of dust are present.

In the event of a fire, use water fog, foam, or dry chemical. Personnel should wear full protective clothing and breathing apparatus.

4.4 Storage and transport

Containers of trimellitic anhydride should be protected from physical damage to prevent any leakage of the contents. The substance should be stored in well-ventilated areas.

During transport, containers should be sound and well sealed to prevent loss of contents.

4.5 Spillage

Spills should be carefully swept or gathered up to avoid producing dust and transferred to a sealable container. Alternatively, an approved high-efficiency vacuum may be used, fitted with high-efficiency (HEPA) filters, so that very fine dust will not be blown through the filters and become airborne. Subsequently, flush the area with water. Liquid spills should be absorbed with earth or sand and collected for disposal. Persons involved in cleaning up spills should be adequately protected against eye contact and

inhalation of the powder. The fire brigade should be called to deal with a large spill.

4.6 Disposal

Waste should be disposed of in an approved landfill site or in a suitable incinerator, unless directed otherwise by local authorities.

5. HAZARDS FOR THE ENVIRONMENT AND THEIR PREVENTION

Exposure of organisms in the environment to trimellitic anhydride is expected to be very low, except in the case of accidents or spills.

A laboratory study suggests that trimellitic anhydride is readily degraded by bacteria. Data on aquatic toxicity, e.g., on fish species, are not yet available.

6. SUMMARY OF CHEMICAL SAFETY INFORMATION

This summary should be easily available to all health workers concerned with, and users of, trimellitic anhydride. It should be displayed at, or near, entrances to areas where there is potential exposure to trimellitic anhydride, and on processing equipment and containers. The summary should be translated into the appropriate language(s). All persons potentially exposed to the chemical should also have the instructions in the summary clearly explained.

Space is available for insertion of the National Occupational Exposure Limit, the address and telephone number of the National Poison Control Centre, and local trade names.

SUMMARY OF CHEMICAL SAFETY INFORMATION

TRIMELLITIC ANHYDRIDE

(1,2,4-benzenetricarboxylic acid 1,2-anhydride;
4-carboxyphthalic anhydride; 1,3-dioxo-5-phthalancarboxylic acid; TMA)

$C_9H_4O_5$

IUPAC systematic name: 1,3-dihydro-1,3-dioxo-5-isobenzofurancarboxylic acid

CAS registry number: 552-30-7

RTECS registry number: DC2050000

PHYSICAL PROPERTIES		OTHER CHARACTERISTICS
Relative molecular mass	192.12	White flakes, musty acid odour; fine dust can be released during handling; flaked or molten trimellitic anhydride will burn if ignited, producing an explosive dust; the vapour from molten trimellitic anhydride forms dangerously explosive mixtures with air
Boiling point (°C)	390	
Melting point (°C)	165	
Solubility (g/100 g)(25 °C)		
acetone	49.6	
cyclohexanone	38.4	
2-butane	36.5	
ethyl acetate	21.6	
dimethylformamide	15.5	
mixed xylenes	0.4	
ligroin	0.06	
carbon tetrachloride	0.002	

Water solubility	moderate after hydrolysis to trimellitic acid
Specific density (20 °C)	1.54
Relative vapour density (air = 1)	6.6
Vapour pressure (mmHg) (25 °C)	below 1.1×10^{-7}
Flash point (°C) (open cup)	227

HAZARDS/SYMPTOMS	PREVENTION AND PROTECTION	FIRST AID
SKIN: Mildly irritating to skin; can cause skin sensitization	Avoid skin contact; wear suitable protective clothing and gloves	Wash exposed skin with soap and water; remove contaminated clothing and thoroughly clean and dry all garments before reuse
EYES: Causes eye burns	Avoid exposure; wear chemical goggles	Immediately flush eyes with plenty of water for at least 15 minutes; seek immediate medical advice

SUMMARY OF CHEMICAL SAFETY INFORMATION (*continued*)

HAZARDS/SYMPTOMS	PREVENTION AND PROTECTION	FIRST AID
INHALATION: Causes irritation of respiratory tract; may cause sensitization by inhalation, with effects such as pulmonary oedema, cough with blood-stained sputum, anaemia, and fever	Avoid exposure; use exhaust ventilation and breathing protection [a]	Remove patient to uncontaminated area; seek medical advice
INGESTION: May cause oral and gastrointestinal irritation	Unlikely occupational hazard	Give plenty of water to drink; do not induce vomiting; seek medical attention
Other effects: Children of women sensitized to trimellitic anhydride may also be sensitized	Avoid exposure	

[a] If ventilation is inadequate, use respirator that will protect against organic vapour/particulates. If dust concentration exceeds assigned protection limit for air-purifying respirator, use supplied-air respirator.

SPILLAGE	STORAGE	FIRE AND EXPLOSION
Spills must be carefully swept or gathered up; alternatively vacuum promptly, with high efficiency filters, into a dust-tight container; creation of dust is to be avoided; subsequently, flush the area with water; for personal protection use protective clothing and equipment to prevent inhalation, and eye or skin contact	Protect container from physical damage; provide adequate ventilation (8–10 air changes per hour)	High dust concentration may form a flammable or explosive mixture; its explosive limits are 1–7%; in case of fire, use dry chemical, carbon dioxide, water fog, or foam

WASTE DISPOSAL	NATIONAL INFORMATION
Deposit in an approved landfill site or incinerate in an approved facility, unless directed otherwise by local authorities	National occupational exposure limit: . National poison control centre: Local trade names:

7. CURRENT REGULATIONS, GUIDELINES, AND STANDARDS

7.1 Previous evaluations by international bodies

There have not been any previous evaluations by international bodies.

7.2 Exposure limit values

Some exposure limit values are given in the table on the page opposite. Some of these values are incorporated in regulations and some are recommendations. These have been taken from entries in the International Register of Potentially Toxic Chemicals (IRPTC) Legal File.

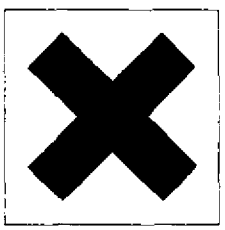
7.3 Specific restrictions

The United States of America permits trimellitic anhydride to be used as a cross-linking agent for epoxy resins intended for use with food (effective 1983) with limits of 15% by weight of the resin. The European Economic Community (EEC) has included TMA in Section B of Directive 90/128/EEC (List of substances that may still be used at national level, pending a decision on inclusion in Section A (Community list)). The Scientific Committee for Food has not yet evaluated TMA, because of the lack of technical and toxicological data.

Restrictions on the handling of trimellitic anhydride by pre-adults, pregnant women, and nursing mothers (effective 1980) are operative in Germany.

7.4 Transport and labelling

The European Community legislation requires labelling as a dangerous substance using the symbol:



* ES: Irritante
DA: Lokalirriterende
DE: Reizend
EL: Ερεθιστικο
EN: Irritant
FR: Irritant
IT: Irritante
NL: Irriterend
* PT: Irritante

CURRENT REGULATIONS, GUIDELINES, AND STANDARDS

Tolerances and exposure limits for air in the workplace [a]

Country	Exposure limit description	Value	Effective date
Australia	Threshold limit value (TLV)		
	- Time-weighted average (TWA)	0.04 mg/m^3 (0.005 ppm)	
Belgium	Threshold limit value TLV		
	- Time-weighted average (TWA)	0.04 mg/m^3 (0.005 ppm)	
Canada	Threshold limit value TLV		
	- Time-weighted average (TWA)	0.04 mg/m^3 (0.005 ppm)	1980
Czechoslovakia	Maximum workplace concentration (MAK)	0.005 mg/m^3 (fumes)	
		0.04 mg/m^3 (fine dust)	
Germany	Maximum workplace concentration (MAK)		
	- Time-weighted average (8-h) (TWA)	0.04 mg/m^3 (0.005 ppm)	
	- Short-term exposure limit (5 min) (STEL)	0.08 mg/m^3 (0.01 ppm)	
Netherlands	Maximum workplace concentration (MAK)	0.04 mg/m^3 (0.005 ppm)	
Sweden	Threshold limit value (TLV)	0.04 mg/m^3 (0.005 ppm)	1988
United Kingdom	Occupational exposure standard (OES)	0.04 mg/m^3 (0.005 ppm)	1987
USA	Threshold limit value (TLV)		
	- Time-weighted average (TWA)	0.04 mg/m^3 (0.005 ppm)	

[a] Where no effective date is given, the limits are recommendations, not regulations.

The label must read:

> *Irritating to eyes, respiratory system and skin; may cause sensitization by inhalation; do not breathe gas/fumes/vapour/spray (appropriate wording to be specified by the manufacturer); after contact with skin, wash immediately with plenty of* ..... (to be specified by the manufacturer).

The WHO Task Group that reviewed this publication did not consider that the above risk and safety expressions fully indicated the potential risk of severe and irreversible eye damage that has been reported for trimellitic anhydride.

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