UK Health Security Agency

Tributyl phosphate

Incident management

This document provides information needed for response to a chemical incident, such as physicochemical properties, health effects and decontamination advice.

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Contents

Main points

General

Tributyl phosphate is a colourless to yellow viscous liquid at room temperature. It is odourless.

Tributyl phosphate is combustible, and decomposes on burning to form toxic fumes including phosphorus oxides.

Attacks some forms of plastic, rubber and coatings. Reacts with bases and strong oxidants. Reacts with warm water, producing corrosive phosphoric acid and butanol.

Health

Toxic by inhalation, ingestion, and skin and eye contact.

Causes skin and eye irritation on exposure.

Inhalation may cause irritation of mucous membranes. Headaches and nausea can also occur. Severe exposures may lead to paralysis.

Casualty decontamination at the scene

Following disrobe, improvised dry decontamination should be considered for an incident involving tributyl phosphate, unless casualties are demonstrating signs or symptoms of exposure to caustic or corrosive substances.

Environment

Inform the Environment Agency where appropriate and avoid release into the environment.

Hazard identification

Table 1. Standard (UK) dangerous goods emergency action codes

UN		No values specified
EAC		
APP		
Hazards	**Class**	
	Sub-risks	
HIN		

Table 2. The GB classification, labelling and packaging (CLP) regulation for tributyl phosphate

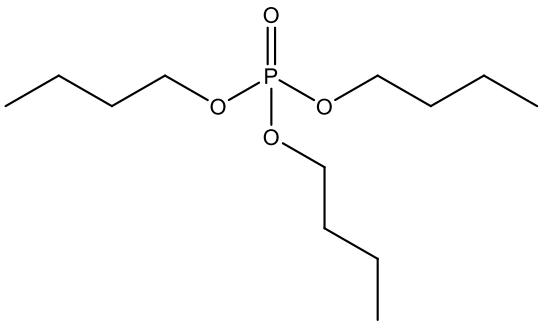
Hazard class and category	Carc. 2	Carcinogenicity, category 2	
	Acute Tox. 4	Acute toxicity (oral), category 4	
	Skin Irrit. 2	Skin irritation, category 2	
Hazard statement	H302	Harmful if swallowed	
	H315	Causes skin irritation	
	H351	Suspected of causing cancer	
Signal words	WARNING		

References

The Health and Safety Executive (HSE). ‘GB CLP Regulation’ (viewed on 27 February 2025).

Physicochemical properties

Table 3. Physicochemical properties

CAS number	126-73-8
Molecular weight	266.3
Formula	$C_{12}H_{27}O_4P$ / $(C_4H_9)_3PO_4$
Common synonyms	Tri-n-butyl phosphate, phosphoric acid tributyl ester
State at room temperature	Colourless to yellow viscous liquid
Volatility	Vapour pressure = 0.001 mmHg at 25°C
Specific gravity	0.98 (water = 1) 9.2 (air = 1)
Flammability	Combustible
Lower explosive limit	-
Upper explosive limit	-
Water solubility	Poor
Reactivity	When exposed to heat or flame, tributyl phosphate is combustible. Attacks some forms of plastic, rubber and coatings. Reacts with bases and strong oxidants. Decomposes on burning, producing toxic fumes including phosphorus oxides. Reacts with warm water, producing corrosive phosphoric acid and butanol.
Odour	Odourless
Structure	

References

World Health Organization. International Programme on Chemical Safety ‘International Chemical Safety Card entry for Tributyl Phosphate’ ICSC 0584, 2005 (viewed on 27 February 2025)

PubChem. Bethesda (MD): National Library of Medicine (US), National Center for Biotechnology Information. ‘PubChem Compound Summary for CID 31357, Tributyl Phosphate’ (viewed on 27 February 2025)

Reported effect levels from authoritative sources

Table 4. Exposure by inhalation

ppm	mg/m^3	Signs and symptoms	Reference
1.4	15	Nausea and headache	a

These values give an indication of levels of exposure that can cause adverse effects. They are not health protective standards or guideline values.

References

a. International Programme on Chemical Safety (IPCS). 'Environmental Health Criteria 112. Tri-n-butyl phosphate' 1991 (viewed on 27 February 2025)

Published emergency response guidelines

Table 5. Acute exposure guideline levels (AEGLs)

	Concentration				
	10 minutes	**30 minutes**	**60 minutes**	**4 hours**	**8 hours**
AEGL-1 [note 1]	No values specified				
AEGL-2 [note 2]					
AEGL-3 [note 3]					

Notes to Table 5

Note 1: Level of the chemical in air at or above which the general population could experience notable discomfort.

Note 2: Level of the chemical in air at or above which there may be irreversible or other serious long-lasting effects or impaired ability to escape.

Note 3: Level of the chemical in air at or above which the general population could experience life-threatening health effects or death.

Exposure standards, guidelines or regulations

Table 6. Occupational standards

	LTEL (8-hour reference period)		STEL (15-min reference period)	
	ppm	**mg/m³**	**ppm**	**mg/m³**
WEL	-	5	-	5

Abbreviations

WEL = workplace exposure limit.
LTEL = long-term exposure limit.
STEL = short-term exposure limit.

Reference

Health and Safety Executive (HSE). 'EH40/2005 Workplace Exposure Limits Fourth Edition' 2020 (viewed on 27 February 2025)

Table 7. Public health standards and guidelines

Drinking water standard	No values specified
WHO guideline for drinking water quality	
UK indoor air quality guideline	
WHO indoor air quality guideline	
WHO air quality guideline	

Health effects

Toxic by ingestion, inhalation and skin contact.

Table 8. Signs or symptoms of acute exposure

Route	Signs and symptoms
Inhalation	May cause irritation of the eyes, nose and throat. It may also cause nausea and headache. If inhalation is prolonged paralysis can occur.
Eyes	Irritation
Skin	Irritation

Reference

National Center for Biotechnology Information. PubChem 'Compound Summary for CID 31357, Tributyl Phosphate' 2025 (viewed on 27 February 2025)

Decontamination at the scene

Chemical specific advice

The approach used for decontamination at the scene will depend upon the incident, location of the casualties and the chemicals involved. Therefore, a risk assessment should be conducted to decide on the most appropriate method of decontamination.

Following disrobe, improvised dry decontamination should be considered for an incident involving tributyl phosphate unless casualties are demonstrating signs or symptoms of exposure to caustic or corrosive substances.

People who are processed through improvised decontamination should subsequently be moved to a safe location, triaged and subject to health and scientific advice. Based on the outcome of the assessment, they may require further decontamination.

Emergency services and public health professionals can obtain further advice from the UK Health Security Agency (UKHSA) Radiation, Chemicals, Climate and Environmental Hazards Directorate using the 24-hour chemical hotline number: 0344 892 0555.

Disrobe

The disrobe process is highly effective at reducing exposure to HAZMAT/CBRN material when performed within 15 minutes of exposure.

Therefore, disrobe must be considered the primary action following evacuation from a contaminated area.

Where possible, disrobing should be conducted at the scene and by the casualty themselves. Disrobing should be systematic to prevent transfer of contaminant from clothing to skin. Clothing should not be pulled over the head if possible.

Clothing stuck to the casualty by the contaminant should not be forcefully removed, as this risks causing further harm.

Consideration should be given to ensuring the welfare and dignity of casualties as far as possible. Immediately after decontamination the opportunity should be provided to dry and dress in clean robes or clothes.

Improvised decontamination

Improvised decontamination is an immediate method of decontamination prior to the use of specialised resources. This should be performed on all contaminated casualties unless medical advice is received to the contrary. Improvised dry decontamination should be considered for an incident involving chemicals unless the agent appears to be corrosive or caustic.

Unprotected first responders and members of the public should not approach casualties incapacitated by exposure to administer improvised decontamination, as they may be exposed to contaminants and become a casualty themselves.

Important note: Improvised decontamination should continue until a more structured intervention, such as an Interim Operational Response is conducted, or Specialist Operational Response are present.

Improvised dry decontamination

Improvised dry decontamination should be considered for an incident involving tributyl phosphate unless casualties are demonstrating obvious signs of chemical burns or skin irritation.

Any available dry absorbent material can be used such as kitchen towel, paper tissues (for example blue roll) and clean cloth.

Exposed skin surfaces should be blotted first and then rubbed, starting with the face, head, and neck, and moving down and away from the body.

Blotting and rubbing should not be too aggressive, as it could drive contamination further into the skin.

Casualties should also blow their nose to remove contaminants from the nasal cavities.

All waste material arising from decontamination should be left in situ, and ideally bagged, for disposal at a later stage.

Improvised wet decontamination

Wet decontamination should be used if contamination with a caustic chemical substance is suspected.

Wet decontamination may be performed using copious amounts of water from any available source such as taps, showers, water bottles, fixed installation hose-reels and sprinklers to gently rinse the affected skin. Other natural sources of water may be considered unless this creates greater risks to the individuals affected. Wet wipes or baby wipes may be used as an effective alternative.

Improvised decontamination should not involve overly aggressive methods to remove contamination as this could further damage affected tissues and drive the contamination further into the skin.

Where appropriate, seek professional advice on how to dispose of contaminated water and prevent run-off going into the water system.

Additional notes

Following improvised decontamination, remain cautious and observe for signs and symptoms in the decontaminated person and in unprotected staff.

If water is used to decontaminate casualties this may be contaminated, and therefore hazardous, and a potential source of further contamination spread.

All materials (paper tissues and so on) used in this process may also be contaminated and, where possible, should not be used on new casualties.

The risk from hypothermia should be considered when disrobe and any form of wet decontamination is carried out.

People who are contaminated should not eat, drink or smoke before or during the decontamination process and should avoid touching their face.

When vulnerable people are affected by a hazardous substance, they may need additional support to remove themselves, their clothing or the substance.

Casualties should remain in the area and should not leave to seek care at a hospital, as this presents a contamination risk. Further care will be administered on site by the appropriate emergency services.

Interim wet decontamination

Interim decontamination is the use of standard Fire and Rescue Service equipment to provide a planned and structured decontamination process prior to the availability of purpose-designed decontamination equipment.

Decontamination at the scene references

Home Office. ‘Initial operational response to a CBRN incident’ Version 2.0 2015 (viewed on 27 February 2025)

National Health Service England. ‘Emergency Preparedness, Resilience and Response (EPRR): Guidance for the initial management of self-presenters from incidents involving hazardous materials’ 2019 (viewed on 27 February 2025)

Joint Emergency Service Interoperability Programme. ‘Initial Operational Response (IOR) to Incidents Suspected to Involve Hazardous Substances or CBRN Materials’ 2024 (viewed on 27 February 2025)

Clinical decontamination and first aid

Clinical decontamination is the process where trained healthcare professionals, using purpose-designed decontamination equipment, treat contaminated persons individually.

Detailed information on clinical management can be found on TOXBASE.

Important notes

Once body surface contaminants have been removed or if your patient was exposed by ingestion or inhalation, the risk that secondary care givers may become contaminated is very low. Secondary carers should wear standard hospital PPE as a precaution against secondary contamination from vomit and body fluids.

If the patient has not been decontaminated following surface contamination, secondary carers must wear appropriate NHS PPE for chemical exposure to avoid contaminating themselves.

The area should be well ventilated.

For comprehensive clinical advice consult TOXBASE directly.

Clinical decontamination following surface contamination

Avoid contaminating yourself.

Carry out decontamination after resuscitation. This should be performed in a well-ventilated area preferably with its own ventilation system.

Contaminated clothing should be removed, double-bagged, sealed and stored safely.

Decontaminate open wounds first and avoid contamination of unexposed skin.

Any particulate matter adherent to skin should be removed and the patient washed with soap and water under low pressure for at least 10 to 15 minutes.

Pay particular attention to mucous membranes, moist areas such as skin folds, fingernails, and ears.

The earlier irrigation begins, the greater the benefit.

Dermal exposure

Decontaminate (as above) the patient following surface contamination.

Carry out other supportive measures as indicated by the patient's clinical condition.

Ocular exposure

If symptomatic immediately irrigate the affected eye thoroughly.

At home – use lukewarm water, trickled into the eye or in a small cup held over the eye socket. An eye dropper is an alternative.

In hospital - immediately irrigate the affected eye thoroughly with 1000 mL 0.9% saline or equivalent crystalloid (for example via an infusion bag with a giving set) for a minimum of 10 to 15 minutes. A Morgan Lens may be used if anaesthetic has been given.

If symptoms persist seek medical assistance.

Carry out other supportive measures as indicated by the patient's clinical condition.

Ingestion and Inhalation

Maintain a clear airway and ensure adequate ventilation.

Orher supportive measures as indicated by the patient's clinical condition.

Clinical decontamination and first aid references

National Poisons Information Service (NPIS). TOXBASE 'Eye irritants - features and management' 2022 (viewed on 27 February 2025)

National Poisons Information Service (NPIS). TOXBASE 'skin decontamination - irritants' 2019 (viewed on 27 February 2025)

About the UK Health Security Agency

UKHSA is responsible for protecting every member of every community from the impact of infectious diseases, chemical, biological, radiological and nuclear incidents and other health threats. We provide intellectual, scientific and operational leadership at national and local level, as well as on the global stage, to make the nation health secure.

UKHSA is an executive agency, sponsored by the Department of Health and Social Care.

This document from the UKHSA Radiation, Chemicals, Climate and Environmental Hazards Directorate reflects understanding and evaluation of the current scientific evidence as presented and referenced here.

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For queries relating to this document, please contact chemcompendium@ukhsa.gov.uk or enquiries@ukhsa.gov.uk

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