Public Health England

Protecting and improving the nation's health

Tributyl Phosphate

Incident Management

Key Points

Fire

- combustible
- reacts with bases and strong oxidants; attacks some forms of plastic, rubber and coatings
- emits toxic fumes including phosphorus oxides when heated to decomposition
- reacts with warm water producing corrosive phosphoric acid and butanol

Health

- major routes of exposure are ingestion, inhalation and skin contact
- inhalation causes headache and irritation to mucous membranes
- dermal exposure causes skin irritation, dermatitis and pain
- ocular exposure causes eye irritation and pain

Environment

- avoid release to the environment; inform the Environment Agency of substantial incidents

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Hazard Identification

Standard (UK) dangerous goods emergency action codes

Data not available

Classification, labelling and packaging (CLP)*

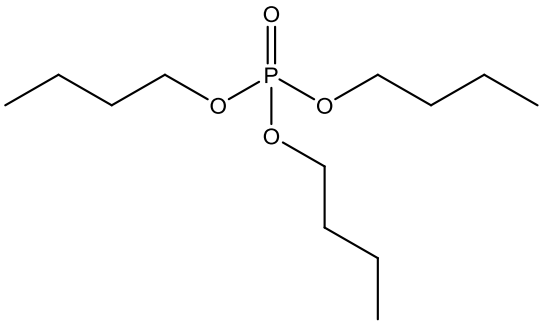
Hazard class and category	Acute Tox. 4	Acute toxicity (oral), category 4	
	Skin Irrit. 2	Skin irritation, category 2	
	Carc. 2	Carcinogenicity, category 2	
Hazard statement	H302	Harmful if swallowed	
	H315	Causes skin irritation	
	H351	Suspected of causing cancer	
Signal words	WARNING		

* Implemented in the EU on 20 January 2009

Reference

European Commission. Harmonised classification – Annexe VI to Regulation (EC) No. 1272/2008 on Classification, Labelling and Packaging of Substances and Mixtures. http://echa.europa.eu/information-on-chemicals/cl-inventory-database (accessed 07/2015).

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 liquid
Volatility	Vapour pressure: 0.067 mmHg at 25°C
Specific gravity **Vapour density**	0.98 at 25°C (water = 1) 9.2 (air = 1)
Flammability	Combustible
Lower explosive limit	Data not available
Upper explosive limit	Data not available
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
Reaction or degradation products	Decomposes on burning, producing toxic fumes including phosphorus oxides. Reacts with warm water, producing corrosive phosphoric acid and butanol
Odour	Odourless
Structure	

References

International Programme on Chemical Safety. International Chemical Safety Card entry for tributyl phosphate. ICSC 0584, 2005. World Health Organization: Geneva.

The Merck Index (14th Edition). Tributyl Phosphate, Entry 9619, 2006.

Tributyl Phosphate (HAZARDTEXT™ Hazard Management). In Klasco RK (Ed): TOMES® System, Truven Healthcare Analytics Inc, Greenwood Village CO, US. RightAnswer.com Inc, Midland MI, US. http://www.rightanswerknowledge.com (accessed 08/2015).

Reported Effect Levels from Authoritative Sources

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

Reference

a International Programme on Chemical Safety. Tributyl phosphate. Environmental Health Criteria 112, 1991. World Health Organization: Geneva.

Published Emergency Response Guidelines

Emergency response planning guideline (ERPG) values

	Listed value (ppm)	Calculated value (mg/m^3)
ERPG-1*	Data not available	
ERPG-2†		
ERPG-3‡		

* Maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hour without experiencing other than mild transient adverse health effects or perceiving a clearly defined, objectionable odour

† Maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hour without experiencing or developing irreversible or other serious health effects or symptoms which could impair an individual's ability to take protective action

‡ Maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hour without experiencing or developing life-threatening health effects

Acute exposure guideline levels (AEGLs)

	ppm				
	10 min	30 min	60 min	4 hours	8 hours
AEGL-1*	Data not available				
AEGL-2†					
AEGL-3‡					

* Level of the chemical in air at or above which the general population could experience notable discomfort

† 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

‡ 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

Occupational standards *(see note)*

	LTEL (8-hour reference period)		STEL (15-min reference period)	
	ppm	mg/m^3	ppm	mg/m^3
WEL	-	5	-	5

Note: Values relate to tributyl phosphate, all isomers

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, 2nd Edition, 2011.

Public health guidelines

Drinking water standard	No guideline value specified
Air quality guideline	No guideline value specified
Soil guideline values and health criteria values	No guideline value specified

Health Effects

Major route of exposure

- toxic by ingestion, inhalation and skin contact

Immediate signs or symptoms of acute exposure

- inhalation causes headache and irritation to mucous membranes
- dermal exposure causes skin irritation, dermatitis and pain
- ocular exposure causes eye irritation and pain

Health effects references

Tributyl Phosphate (MEDITEXT® Medical Management). In Klasco RK (Ed): TOMES® System, Truven Healthcare Analytics Inc, Greenwood Village CO, US. RightAnswer.com Inc, Midland MI, US. http://www.rightanswerknowledge.com (accessed 06/2016)

Decontamination at the Scene

Summary

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.**

Emergency services and public health professionals can obtain further advice from Public Health England (Centre for Radiation, Chemical and Environmental Hazards) 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, disrobe at the scene should be conducted by the casualty themselves and should be systematic to avoid transferring any contamination from clothing to the skin. Consideration should be given to ensuring the welfare and dignity of casualties as far as possible.

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**.

Improvised dry decontamination

- any available dry absorbent material can be used such as kitchen towel, paper tissues (eg blue roll) and clean cloth
- exposed skin surfaces should be blotted and rubbed, starting with the face, head and neck and moving down and away from the body
- rubbing and blotting should not be too aggressive, or it could drive contamination further into the skin

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

Improvised wet decontamination

- water should only be used for decontamination where casualty signs and symptoms are consistent with exposure to caustic or corrosive substances such as acids or alkalis
- wet decontamination may be performed using any available source of water such as taps, showers, fixed installation hose-reels and sprinklers
- when using water, it is important to try and limit the duration of decontamination to between 45 and 90 seconds and, ideally, to use a washing aid such as cloth or sponge
- improvised decontamination should not involve overly aggressive methods to remove contamination as this could 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 etc) 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
- 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/clothes
- 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

Interim wet decontamination

Interim decontamination is the use of standard fire and rescue service (FRS) equipment to provide a planned and structured decontamination process prior to the availability of purpose-designed decontamination equipment.

Decontamination at the scene references

National Ambulance Resilience Unit. Joint Emergency Services Interoperability Programme (JESIP). Initial operational response to a CBRN incident. Version 1.0, September 2013.

NHS England. Emergency Preparedness, Resilience and Response (EPRR). Chemical incidents: planning for the management of self-presenting patients in healthcare settings. April 2015.

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 – www.toxbase.org.

Important notes

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

Clinical decontamination following surface contamination

- avoid contaminating yourself with this product and wash any exposed area
- any particulate matter adherent to the skin should be removed and the patient washed with soap and water under low pressure for at least 10 – 15 minutes
- pay particular attention to mucous membranes, moist areas such as skin folds, fingernails and ears

Dermal exposure

- decontaminate (as above) the patient following surface contamination
- other supportive measures as indicated by the patient's clinical condition

Ocular exposure

- if symptomatic, immediately irrigate the affected eye thoroughly
- for patients at home, use lukewarm tap water, trickled into the eye or in a small cup held over the eye socket; an eye dropper is an alternative
- if symptoms persist seek medical assistance
- in hospital immediately irrigate the affected eye thoroughly with 0.9% saline 1000 mL (for example via an infusion bag with a giving set). A Morgan Lens may be used if anaesthetic has been given. Irrigate for 10-15 minutes
- refer for ophthalmological assessment if there is doubt regarding the management of corneal damage
- other supportive measures as indicated by the patient's clinical condition

Inhalation

- maintain a clear airway and ensure adequate ventilation
- other supportive measures as indicated by the patient's clinical condition

Ingestion

- maintain a clear airway and ensure adequate ventilation
- apply other supportive measures as indicated by the patient's condition

Clinical decontamination and first aid references

TOXBASE http://www.toxbase.org (accessed 11/2016)

TOXBASE Skin decontamination – irritants, 05/2012

TOXBASE Eye irritants – features and management, 01/2016

This document from the PHE Centre for Radiation, Chemical and Environmental Hazards reflects understanding and evaluation of the current scientific evidence as presented and referenced here.

For queries relating to this document, please contact: generaltox@phe.gov.uk

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