

PETRONAS TECHNICAL STANDARDS

HEALTH, SAFETY AND ENVIRONMENT

GUIDELINE

BENZENE

PTS 60.1502.01

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This revision of PTS **60.1501.02 - BENZENE (September 2011, Revision 1)** has been updated to incorporate PETRONAS Lessons Learnt, Best Practice and new information issued by relevant industry code and standards. All updates in the document are highlighted in *italic* font.

The previous version of this PTS **60.1501.02 BENZENE (September 2004)** will be removed from PTS binder / e-repository from herein onwards.

The custodian of this PTS is: Manager - HSE MS, Standards & Regulations, GHSED.

Please direct any questions regarding this PTS to the above-mentioned.

Document Approval

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PREFACE

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1.0 SCOPE

This document applies to work areas where exposure to benzene could be expected. This Guide is to be used by OPU/JV for the use, handling, storage and transportation of benzene either as a product or residue

2.0 OBJECTIVE

The specific objectives of this Guide are:

1. To protect workers/employees from the health effects arising from the exposure to benzene handled in workplaces
2. To state the requirement in meeting PETRONAS standards with respect to benzene
3. To outline steps involved to carry out benzene risk assessment, exposure monitoring, control measures and health surveillance

3.0 BACKGROUND

This document is intended as a Guide on the safe handling of benzene in the workplace. It provides guideline by which the management of each company can assess its own procedures and practices, and should be read in conjunction with PTS 60.1502 Chemical Management Program and the statutory regulations.

In Malaysia, a regulation on Occupational Safety and Health (Use and Standards of Exposure of Chemicals Hazardous to Health) Regulations 2000 or USECHH 2000 that address on the use of chemicals which includes benzene in the workplace is one of the main reference of this Guideline. Countries with more stringent statutory regulations shall use this Guideline as reference only.

The recommended precautionary measures may serve as a basis for the drafting of procedures of a company specific to its local conditions and circumstances.

Additional information concerning the handling of benzene may be obtained from the publications listed at the end of this Guide.

4.0 INTRODUCTION

Benzene is formed from both natural processes and human activities. Natural sources of benzene include volcanoes and forest fires. Benzene is also a natural part of crude oil, gasoline, and cigarette smoke. Some industries use benzene to make other chemicals that are used to make plastics, resins, and nylon and synthetic fibers. Benzene is also used to make some types of lubricants, rubbers, dyes, detergents, drugs, and pesticides.

Outdoor air contains low levels of benzene from tobacco smoke, motor vehicle exhaust, and industrial emissions. However, air around hazardous waste sites or gas stations may contain higher levels of benzene than in other areas while benzene in indoor air comes from products that contain benzene such as glues, paints, furniture wax, and detergents.

Benzene is a common agent in industrial (e.g. E&P operations, petroleum refineries and petrochemical manufacturing) and transportation settings leading to widespread environmental and occupational exposures. Hence, in PETRONAS OPU/JVs workers exposure to benzene could be expected.

5.0 HAZARD IDENTIFICATION

BENZENE (C₆H₆) CAS 71-43-2; UN NO : 1114

(Synonyms include benzol, coal tar naphtha, phenyl hydride, and cyclohexatriene).

Benzene is a highly volatile, flammable liquid. Its vapor is heavier than air and may accumulate in low-lying areas. Benzene is less dense than water and will float on the surface of water. It is only slightly soluble in water but readily soluble with most organic solvents.

At room temperature, benzene is a clear, colorless-to-light yellow liquid that is highly flammable. Because it is volatile, it can spread to a distant source of ignition. Benzene's sweet aromatic odor generally provides adequate warning of hazardous concentrations for acute exposure; however, inadequate for chronic exposure.

Benzene odor is a bad indicator for chronic exposure as at the range of 0.5 to 1 ppm, at which the presence of benzene in the environment would not be realized, it can cause adverse health effects.

Information of Benzene may be obtained from manufacturer's and supplier's SDS/MSDS/CSDS, labels on containers or manuals of products; databases or published texts (e.g. PETRONAS Datakimia); OPU / JV guidance material.

5.1 Routes Of Exposure

The main route of exposure to benzene, whether liquefied or gaseous form, is through inhalation of its vapour. Odour threshold of benzene is 1.5 ppm to 5 ppm and provides adequate warning of acutely hazardous concentrations.

Skin/eye contact with benzene may result in eye/skin irritation. Repeated or prolonged skin contact with liquid benzene can degrease the skin, causing it to crack and could contribute to systemic toxicity.

Ingestion of benzene could occur due to accidents, poor work practice or personal hygiene. Ingestion could result in acute toxic effects such as nausea, vomiting and abdominal pain and irritation of the respiratory and digestive systems.

Persons exposed only to benzene vapor do not pose substantial risks of secondary contamination to others. However, persons whose clothing or skin is contaminated with liquid benzene can cause secondary contamination by direct contact or through off-gassing.

5.2 Health Effects of Benzene

Benzene is classified as a proven human carcinogen by the Commission of the European Communities. The International Agency for Research on Cancer (IARC) has concluded that there is sufficient evidence for carcinogenicity to humans. The overall IARC evaluation is Group 1 - carcinogenic to humans.

The American Conference of Governmental Industrial Hygienists (ACGIH) has designated benzene as a confirmed human carcinogen (A1). There are many case reports and epidemiologic studies of exposed workers, that a causal relationship between benzene exposure and leukemia has been clearly established. Benzene exposure has also been associated with cancer of the lymph system (lymphoma), lung cancer and bladder cancer.

Benzene affects the hematologic (blood) system. For example, it can cause bone marrow not to produce enough red blood cells, which can lead to anemia. Also, it can damage the immune system by changing levels of antibodies in the blood as well as causing the loss of white blood cells.

The seriousness of poisoning caused by benzene depends on the amount, route, and length of time of exposure (duration), as well as the age and preexisting medical condition of the exposed person.

5.2.1 Acute Health Effects

The effects of acute exposure to high concentrations of benzene i.e. neurological, gastrointestinal, dermal and respiratory effects can be evident immediately after exposure.

Neurological effects

Neurological effects appear to be due primarily to the direct effects of benzene on the central nervous system. The anesthetic action of benzene on the central nervous system is similar to that of other anesthetic gases, first inducing excitation followed by depression, and if exposure continues, death through respiratory failure.

Gastrointestinal effects

Swallowing of the liquid may cause aspiration of vomit into the lungs. Signs and symptoms of chemical (aspiration) pneumonitis may include coughing, gasping, choking, burning of the mouth, difficult breathing, and bluish coloured skin (cyanosis).

Gastrointestinal tract discomfort may produce nausea and vomiting. In an occupational setting however, ingestion of insignificant quantities is not thought to be cause for concern. Accidental ingestion of benzene may be harmful; animal experiments indicate that ingestion of less than 150 gram may be fatal or may produce serious damage to the health of the individual.

Dermal effects

Benzene produces moderate skin irritation; evidence exists, or practical experience predicts, that the material produces moderate inflammation of the skin in a substantial number of individuals following direct contact. Skin irritation may also be present after prolonged or repeated exposure; this may result in a form of contact dermatitis (nonallergic). The dermatitis is often characterised by skin redness (erythema) and swelling (oedema) which may progress to blistering (vesiculation), scaling and thickening of the epidermis.