Naphtha: Human health tier II assessment

24 April 2015

CAS Number: 8030-30-6

Preface

This assessment was carried out by staff of the National Industrial Chemicals Notification and Assessment Scheme (NICNAS) using the Inventory Multi-tiered Assessment and Prioritisation (IMAP) framework.

The IMAP framework addresses the human health and environmental impacts of previously unassessed industrial chemicals listed on the Australian Inventory of Chemical Substances (the Inventory).

The framework was developed with significant input from stakeholders and provides a more rapid, flexible and transparent approach for the assessment of chemicals listed on the Inventory.

Stage One of the implementation of this framework, which lasted four years from 1 July 2012, examined 3000 chemicals meeting characteristics identified by stakeholders as needing priority assessment. This included chemicals for which NICNAS already held exposure information, chemicals identified as a concern or for which regulatory action had been taken overseas, and chemicals detected in international studies analysing chemicals present in babies' umbilical cord blood.

Stage Two of IMAP began in July 2016. We are continuing to assess chemicals on the Inventory, including chemicals identified as a concern for which action has been taken overseas and chemicals that can be rapidly identified and assessed by using Stage One information. We are also continuing to publish information for chemicals on the Inventory that pose a low risk to human health or the environment or both. This work provides efficiencies and enables us to identify higher risk chemicals requiring assessment.

The IMAP framework is a science and risk-based model designed to align the assessment effort with the human health and environmental impacts of chemicals. It has three tiers of assessment, with the assessment effort increasing with each tier. The Tier I assessment is a high throughput approach using tabulated electronic data. The Tier II assessment is an evaluation of risk on a substance-by-substance or chemical category-by-category basis. Tier III assessments are conducted to address specific concerns that could not be resolved during the Tier II assessment.

These assessments are carried out by staff employed by the Australian Government Department of Health and the Australian Government Department of the Environment and Energy. The human health and environment risk assessments are conducted and published separately, using information available at the time, and may be undertaken at different tiers.

This chemical or group of chemicals are being assessed at Tier II because the Tier I assessment indicated that it needed further investigation.

For more detail on this program please visit:www.nicnas.gov.au

Disclaimer

Acronyms & Abbreviations

Chemical Identity

Synonyms	petroleum naphtha petroleum ether solvent naphtha solvent naphtha naphtha VM & P
Structural Formula	No Structural Diagram Available
Molecular Formula	Unspecified
Molecular Weight (g/mol)	N/A
Appearance and Odour (where available)	Reddish-brown liquid with an aromatic odour
SMILES	C(C)(C)CC(C)CCCC

Import, Manufacture and Use

Australian

No specific Australian use, import, or manufacturing information has been identified.

International

The following international uses have been identified through:

- the European Union (EU) Registration, Evaluation, Authoriation and Restriction of Chemicals (REACH) dossiers;
- Galleria Chemica;
- the Substances and Preparations in Nordic countries (SPIN) database;
- the United States (US) Environmental Protection Agency's Aggregated Computer Toxicology Resource (ACToR);
- the US Household Products Database, US Department of Health and Human Services;
- the US National Library of Medicine's Hazardous Substances Data Bank (HSDB); and
- various international assessments (US EPA, 2011a; Government of Canada, 2011; Government of Canada, 2013; ATSDR).

The refined chemical, known as naphtha VM & P (Varnish Makers and Painter) is a specific boiling-point-range solvent that is used in a wide range of applications, the principal ones being (approximate percentage of consumption in Western Europe): adhesives (34 %); paints, lacquers and varnishes (20 %); polymerisation reaction diluents (10 %); rubber industry (11 %); and gravure inks and other miscellaneous applications (25 %) (IARC, 1989):

The chemical has reported domestic uses including:

- in adhesives, binding agents (18–37 % concentration; available in a liquid product);
- as cleaning/washing agents, e.g. automotive brake, rotor and fuel oil tank cleaning;
- in paints, lacquers and varnishes (up to 37 % concentration; available in a liquid product);
- in corrosion inhibitors (1–5 % concentration; formerly sold in an aerosol product);
- in fillers (5–10 % concentration; available in a paste product); and
- in surface treatments.

The chemical has reported commercial uses including:

- as a solvent for paints, lacquers and varnishes;
- in manufacturing wood preservatives, e.g. as a solvent for varnishing or sealing wood/furniture;
- in construction materials;
- as a solvent, e.g. rubber solvent and as a solvent in manufacturing adhesives, brake linings, rubber cements, tyres, intaglio inks, paints, lacquers, and in degreasing operations;
- in lubricants and additives;
- in anti-setoff and anti-adhesive agents; and
- in reprographic agents.

The chemical has reported site-limited use as a feedstock for petroleum refining and manufacture.

Restrictions

Australian

The chemical is listed in the *Poisons Standard—the Standard for the Uniform Scheduling of Medicines and Poisons* (SUSMP) in Schedule 5 (SUSMP, 2015).

Schedule 5:

'HYDROCARBONS, LIQUID, including kerosene, diesel (distillate), mineral turpentine, white petroleum spirit, toluene, xylene and light mineral and paraffin oils (but excluding their derivatives), except:

(a) toluene and xylene when included in Schedule 6;

(b) benzene and liquid aromatic hydrocarbons when included in Schedule 7;

(c) food grade and pharmaceutical grade white mineral oils;

(d) in solid or semi-solid preparations;

(e) in preparations containing 25 per cent or less of designated solvents;

(f) in preparations packed in pressurised spray packs;

(g) in adhesives packed in containers each containing 50 grams or less of adhesive;

(h) in writing correction fluids and thinners for writing correction fluids packed in containers having a capacity of 20 mL or less; or

(i) in other preparations when packed in containers with a capacity of 2 mL or less.'

Schedule 5 chemicals are described as 'Substances with a low potential for causing harm, the extent of which can be reduced through the use of appropriate packaging with simple warnings and safety directions on the label.' Schedule 5 chemicals are labelled with 'Caution' (SUSMP, 2015).

Depending on the composition of the chemical, the schedule entry for benzene may also be relevant. Benzene is listed in the *Poisons Standard—the Standard for the uniform scheduling of medicines and poisons* (SUSMP) in Schedule 7 (SUSMP, 2015).

Schedule 7:

'BENZENE (excluding its derivatives) except:

(a) preparations containing 15 mL/L or less of benzene; or

(b) petrol containing 50 mL/L or less of benzene.'

Schedule 7 chemicals are described as 'Substances with a high potential for causing harm at low exposure and which require special precautions during manufacture, handling or use. These poisons should be available only to specialised or authorised users who have the skills necessary to handle them safely. Special regulations restricting their availability, possession, storage or use may apply.' Schedule 7 chemicals are labelled with 'Dangerous Poison' (SUSMP, 2015).

International

The chemical is listed on the EU Cosmetics Regulation 1223/2009 Annex II—List of substances prohibited in cosmetic products, if the chemicals contain >0.1 % (w/w) benzene (CosIng).

Existing Work Health and Safety Controls

Hazard Classification

The chemical is classified as hazardous with the following risk phrases for human health in the Hazardous Substances Information System (HSIS) (Safe Work Australia):

- Carc. Cat. 2; R45 (May cause cancer)
- Muta. Cat. 2; R46 (May cause heritable genetic damage)
- Xn; R65 (May cause lung damage if swallowed).

These classifications are subject to notes H, P and E.

'**Note H:** The classification and label shown for this substance applies to the dangerous property(ies) indicated by the Risk Phrase(s) in combination with the category(ies) of danger shown. The manufacturers, distributors and importers of this substance shall be obliged to carry out an investigation to make themselves aware of the relevant and accessible data which exists for all other properties to classify and label the substance' (Safe Work Australia).

'**Note P:** The classification as a carcinogen or mutagen need not apply if it can be shown that the substance contains less than 0.1% w/w benzene (EINECS no. 200-753-7). When the substance is classified as a carcinogen or mutagen, Note E shall also apply. When the substance is not classified as a carcinogen or mutagen, at least the Safety Phrases (2-)23-24-62 shall apply. This note applies only to certain complex oil-derived substances in Annex I' (Safe Work Australia).

'**Note E:** For substances ascribed Note E, the Risk Phrases R20, R21, R22, R23, R24, R25, R26, R27, R28 R39, R68 (harmful), R48 and R65 and all combinations of these Risk Phrases should be preceded by the word ‘also’'(Safe Work Australia).

Exposure Standards

Australian

No specific exposure standards are available for the chemical (Galleria Chemica).

Benzene (CAS No. 71-43-2) has an exposure standard of 3.2 mg/m^3 (1 ppm) time weighted average (TWA) (Galleria Chemica).

International

The following exposure standards are identified (Galleria Chemica).

Exposure limits of 100–400 mg/m^3 (400–1600 ppm) TWA in different countries such as Canada, the USA and Singapore were identified for the chemical (Galleria Chemica).

Additionally, benzene has a number of exposure standards available internationally (Galleria Chemica).

Health Hazard Information

Naphtha (CAS No. 8030-30-6), also known as petroleum naphtha, is defined as refined, partly refined, or unrefined petroleum products produced by the distillation of natural gas. It consists of predominantly C5–C6 hydrocarbons and boiling at approximately 38–93 °C (100–200 °F) (SciFinder).

The chemical falls within the low boiling point petroleum naphtha (gasoline) category as defined by the CONservation of Clean Air and Water in Europe (CONCAWE). It is considered a substance of unknown or variable composition, complex reaction product or biological materials (UVCB) containing a mixture of aliphatic (branched, linear, and cyclic paraffins: unspecified %) and aromatic hydrocarbons (up to 20 %) (IARC, 1989; Government of Canada, 2011; Government of Canada, 2013; NICNASa). The aromatic components of the chemical, in general, are more toxic than the aliphatic components. Of these, benzene (CAS No. 71-43-2) (NICNAS, 2001) has the highest toxicity and also serves as a marker for the aromatic content of these UVCBs.

Unrefined naphtha: the chemical in its unrefined form is expected to contain concentrations of 1–20 %; benzene, similar to other low-boiling-point naphthas. According to the US EPA Robust Summaries, the chemical is within a broad high benzene naphthas category that defines hydrocarbon mixtures of C5–C11 with boiling points of 343 °C (650 °F) or higher, where significant levels of benzene at concentrations >10 % and averaging 55 % is expected (US EPA). However, it should be noted that this definition is inconsistent with the boiling point of benzene (approximately 100 °C) (SciFinder).

Refined naphtha: the refined chemical, a petroleum solvent known as naphtha VM & P, falls within a specified boiling-point-range category. The benzene content in petroleum solvents ranges from <0.1 % to 1 % (IARC, 1989). Special boiling-point-range solvents are produced from petroleum distillation fractions, which have been further refined by one or more processes to produce a narrower boiling point range (30–160 °C), thus differing from petroleum fuel mixtures, as they are not produced by blending various refinery process streams. Although increasing aromatic content often increases solvency, these solvents are currently manufactured with minimal aromatic content (IARC, 1989).

Naphtha VM & P is available in finished products for domestic use (refer to **Import, manufacture and use** section) and is expected to contain a low aromatic content. However, since the chemical may contain benzene (CAS No. 71-43-2), albeit at low concentrations, the hazards of this component will also be included in this assessment (IARC, 1989; NICNAS, 2001). Given the low boiling point of this solvent, low concentrations of other low boiling-point hazardous hydrocarbons such as isoprene (CAS No. 78-79-5) and 1,3-butadiene (CAS No. 106-99-0) are possible (NICNASb).

Since there is limited hazard information specific to the chemical, the hazards of reference chemicals with known PONA (paraffinic, olefinic, naphthenic, and aromatic) hydrocarbon content (US EPA, 2011) will be relevant in assessing the chemical, where appropriate. The reference chemicals used as markers for the hydrocarbon content of the 'low boiling point naphthas' include (US EPA, 2011; Government of Canada, 2013; NICNASa):

- **P (Paraffinic):** light alkylate naphtha (CAS No. 64741-66-8) and naphtha (petroleum) sweetened (CAS No. 64741-87-3);
- **O (Olefinic):** light catalytic cracked naphtha (CAS No. 64741-55-5);
- **N (Naphtha):** heavy straight run naphtha (CAS No. 64741-41-9); and
- **A (Aromatic):** full range catalytic reformed naphtha (CAS No. 68955-35-1), light aromatic solvent naphtha (petroleum) (CAS No. 64742-95-6), light catalytic reformed naphtha (CAS No. 64741-63-5) and heavy catalytic reformed naphtha (CAS No. 64741-68-0)

Additionally, unspecified PONA content reference chemicals also include:

- heavy catalytic cracked naphtha (CAS No. 64741-54-4);
- hydrotreated heavy naphtha (petroleum) (CAS No. 64742-48-9); and
- light straight-run naphtha (CAS No. 64741-46-4).

Toxicokinetics

It has been reported that highly volatile C5–C7 paraffins, cycloparaffins, and aromatic hydrocarbons readily pass across the alveolar membrane of rats into the bloodstream and are transported within minutes to the central nervous system (CNS) (HSDB).

Acute Toxicity

Oral

No data are available for this chemical.

The reference chemicals identified by CAS Nos. 64741-55-5 (olefinic), 64741-66-8 (paraffinic), and 68955-35-1 (aromatic), have low acute oral toxicity based on results from animal tests with median lethal doses (LD50s) in Sprague Dawley (SD) rats reported to be >2000 mg/kg bw (Government of Canada, 2011; US EPA, 2011; NICNASa).

Dermal

No data are available for this chemical.

The reference chemicals have low acute dermal toxicity based on results from animal tests with LD50s in New Zealand White rabbits for the chemicals identified by the CAS Nos. 64741-55-5 (olefinic) and 68955-35-1 (aromatic) reported to be >2000 mg/kg bw (Government of Canada, 2011; US EPA, 2011; NICNASa). No mortalities occurred at any doses for any of the reference chemicals specified above.

Inhalation

No data are available for this chemical.

The reference chemicals have moderate to high acute toxicity based on results from animal tests following inhalation exposure. The median lethal concentrations (LC50s) in SD rats for the chemicals identified by the CAS Nos. 64741-55-5 (olefinic), 64741-66-8 (paraffinic), and 64741-87-3 (paraffinic) are >5.3, 6.31, and >5.2 mg/L, respectively.

Mortalities occurred in CD albino rats post-exposure to the chemical with CAS No. 64742-48-9 (hydrotreated heavy naphtha (petroleum)). The LC50 was estimated to be between 1.1 and 1.9 mg/L (US EPA, 2011; NICNASa).

In the absence of specific data on the chemical grade of naphtha (particularly the aromatic content), classification for acute toxicity inhalation should apply to the chemical (refer to **Recommendation** section).

Corrosion / Irritation

Skin Irritation

No data are available for the chemical.

The reference chemicals are shown to cause low to moderate skin irritation in animal studies. The chemicals identified with CAS Nos. 64741-55-5 (olefinic), 64741-66-8 (paraffinic) and 68955-35-1 (aromatic) are moderately irritating to rat or rabbit skin, while the chemical identified by the CAS No. 64741-87-3 (paraffinic) was found to be slightly irritating to rabbit skin (US EPA, 2011; NICNASa).

Low boiling point range (<250 °C) petroleum solvents are reported to have the greatest defatting action and dermatitis potential among the hydrocarbon solvents (Chew et al., 2006).

The component chemical, benzene (CAS No. 71-43-2), is classified as hazardous with the risk phrase 'Irritating to skin' (R38) in the HSIS (Safe Work Australia). In humans, vapour levels >60 ppm have been associated with skin irritation, including second degree burns (NICNAS, 2001).

The reported concentrations of benzene in the low boiling-point petroleum naphthas (up to 20 % but typically 1 %) (Government of Canada, 2011; Government of Canada, 2013) and in refined naphthas (<0.1–1 %) (IARC; 1989) are not above the cut-off concentrations for classification for skin irritation (Safe Work Australia, 2004; GHS, 2009). Therefore, while the classification for skin irritation is not warranted for the chemical, the chemical should be classified for repeated exposure causing skin dryness or cracking.

Eye Irritation

No data are available for the chemical.

In eye irritation studies in rabbits, the reference chemicals were found to cause low to moderate eye irritation. The chemicals identified with CAS Nos. 64741-55-5 (olefinic) and 64741-66-8 (paraffinic) were not irritating to rabbit eyes, whereas the chemical with CAS No. 68955-35-1 (aromatic) was moderately irritating to rabbit eyes (US EPA, 2011; NICNASa).

The component chemical, benzene, is classified as hazardous with the risk phrase 'Irritant: Irritating to eyes' (R36) in the HSIS (Safe Work Australia). Benzene vapours have been reported to cause eye irritation in humans and rats at concentrations ≥33 ppm and ≥10 ppm, respectively (NICNAS, 2001).

The reported concentrations of benzene in the low boiling-point petroleum naphthas (up to 20 % but typically 1 %) (Government of Canada, 2011; Government of Canada, 2013) and in refined naphthas (<0.1–1 %) (IARC; 1989) are not above the cut-off concentrations for classification for eye irritation (Safe Work Australia, 2004; GHS, 2009). Therefore, classification for eye irritation is not warranted for the chemical.

Sensitisation

Skin Sensitisation

No data are available for the chemical.

The reference chemicals were not found to induce dermal sensitisation when tested on guinea pigs in various skin sensitisation studies. The chemicals with CAS Nos. 64741-55-5 (olefinic), 64741-66-8 (paraffinic), and 68955-35-1 (aromatic) were found to be non-sensitising to guinea pig skin in the reported studies (US EPA, 2011; NICNASa).

Repeated Dose Toxicity

Oral

No data are available for the chemical.

In an oral gavage study, the reference chemical identified by CAS No. 64742-95-6 (aromatic) had reported effects that included increased alanine aminotransferase and total protein in males, increased relative liver and kidney weights in females, and liver cell hypertrophy in both males and females with a no observed adverse effect level (NOAEL) established at 125 mg/kg bw/day (Government of Canada, 2011; US EPA, 2011; NICNASa).

The component chemical, benzene (CAS No. 71-43-2), is classified as hazardous with the risk phrase 'Toxic: Danger of serious damage to health by prolonged exposure by inhalation, in contact with skin and if swallowed' (R48/23/24/25) (Safe Work Australia) (refer to **Repeat dose inhalation toxicity** section).

Dermal

No data are available for the chemical.

Occluded applications of the reference chemical CAS No. 64741-55-5 (olefinic) resulted in no treatment-related systemic effects in 28–90-day repeated dose toxicity studies in SD rats at doses up to 652 mg/kg bw/day (US EPA, 2011; NICNASa).

Studies in rabbits (strain not specified) for the chemicals identified by the CAS Nos. 64741-54-4 (heavy catalytic cracked naphtha) and 68955-35-1 (aromatic) had reported lowest observed adverse effect levels (LOAELs) of 200 mg/kg bw/day (decreased growth rate) and 1000 mg/kg bw/day (increased mortality), respectively, from 28-day repeated dermal dose toxicity studies (Government of Canada, 2011; NICNASa).

The component chemical, benzene (CAS No. 71-43-2), is classified as hazardous with the risk phrase 'Toxic: Danger of serious damage to health by prolonged exposure by inhalation, in contact with skin and if swallowed' (R48/23/24/25) in the HSIS (Safe Work Australia) (refer to **Repeat dose inhalation toxicity** section).

Inhalation

No data are available for the chemical.

In an inhalation study, the reference chemicals identified by CAS Nos. 64741-41-9 (naphtha), 64741-55-5 (olefinic), 64741-63-5 (aromatic), 64742-48-9 (hydrotreated heavy naphtha (petroleum)), and 64742-95-6 (aromatic) (Government of Canada, 2011; US EPA, 2011) had reported minimal systemic effects in rodents, which included: renal effects (increased kidney weight and renal lesions such as tubule dilation); liver effects (increased liver weight); and haematological changes (NICNASa).

The component chemical, benzene (CAS No. 71-43-2), is classified as hazardous with the risk phrase 'Toxic: Danger of serious damage to health by prolonged exposure by inhalation, in contact with skin and if swallowed' (R48/23/24/25) (Safe Work Australia). This classification is based on bone marrow depression observed with repeated occupational exposure to benzene vapours at ≥7.6 ppm (0.024 mg/L) (NICNAS, 2001).

The reported concentrations of benzene in the low boiling-point petroleum naphthas (up to 20 % but typically 1 %) (US EPA, 2011; Government of Canada, 2011; Government of Canada, 2013) and in refined naphthas (<0.1–1 %) (IARC; 1989) may be above the cut-off concentrations for classification (Safe Work Australia, 2004; GHS, 2009). Therefore, classification for repeated dose toxicity could be warranted for the chemical (refer to **Recommendation** section).

Genotoxicity

The chemical is classified as hazardous—Category 2 mutagenic substance—with the risk phrase ‘May cause heritable genetic damage’ (T; R46) in the HSIS (Safe Work Australia). This classification need not apply if it can be shown that the chemical contains less than 0.1 % w/w benzene. Although there are no available data for the chemical, the data from the reference chemicals support the overall classification.

Several in vitro assays for some of the reference chemicals indicate the following mixed results (US EPA, 2011; Government of Canada, 2011; Government of Canada, 2013; NICNASa):

- positive results in chromosomal aberrations in mouse lymphoma assays with metabolic activation (doses up to 400 µg/mL for the chemical with CAS No. 68955-35-1 (aromatic));
- negative results in chromosomal aberrations in mouse lymphoma assays with and without metabolic activation (the chemicals with CAS Nos. 64741-55-5 (olefinic) and 64741-66-8 (paraffinic)); and,
- equivocal for sister chromatid exchange (SCE) in Chinese hamster ovary (CHO) cells without metabolic activation (the chemicals with CAS No. 64741-55-5 (olefinic)).

The chemicals gave negative results in several in vivo genotoxicity assays, which included induction of bone marrow chromosomal aberration of SD rats (inhalation exposure and intraperitoneal (i.p.) injection of the chemical with CAS No. 64741-55-5 (olefinic); i.p. injection of the chemicals with CAS Nos. 64741-66-8 (paraffinic) and 68955-35-1 (aromatic).

The component chemicals, benzene and 1,3-butadiene are classified as a hazardous, Category 2 mutagenic substances, with the risk phrase ‘May cause heritable genetic damage’ (T; R46) in the HSIS (Safe Work Australia). The component chemical, isoprene, is classified as hazardous, a Category 3 mutagenic substance with the risk phrase ‘Possible risk of irreversible effects’ (Xn; R68) in the HSIS (Safe Work Australia).

The reported concentrations of benzene in the low boiling-point petroleum naphthas (up to 20 % but typically 1 %) (Government of Canada, 2011; Government of Canada, 2013) and in refined naphthas (<0.1–1 %) (IARC; 1989) may be above the cut-off concentrations for classification (Safe Work Australia, 2004; GHS, 2009). Classification for mutagenicity could be warranted for the chemical if it can be demonstrated that the benzene content is at or above the cut-off concentrations for this classification (refer to **Recommendation** section). Concentrations of isoprene and 1,3-butadiene should also be taken into account (NICNASb).

Carcinogenicity

The chemical is classified as a hazardous, Category 2 carcinogenic substance, with the risk phrase 'May cause cancer' (T; R45) in the HSIS (Safe Work Australia). This classification need not apply if it can be shown that the chemical contains less than 0.1 % w/w benzene. While there is no available information related to the carcinogenicity of the chemical, it is expected that any carcinogenic activity from exposure to the chemical will be caused, predominantly, by the levels of aromatic content such as benzene.

The reference chemicals identified by CAS Nos. 64741-46-4 (light straight-run naphtha**)** and 64741-55-5 (olefinic) were carcinogenic in C3H mice, with reported increased incidence of malignant dermal neoplasms, which include squamous cell carcinomas and fibrosarcomas (US EPA, 2011; NICNASa).

The chemicals identified by the CAS Nos. 64741-66-8 and 64741-87-3 (paraffinic); and 64741-68-0 (aromatic) were negative in lifetime carcinogenicity studies in C3H mice (US EPA, 2011; NICNAS).

The International Agency for Research on Cancer (IARC) has classified petroleum solvents, inclusive of specific boiling range solvents such as naphtha VM & P (CAS No. 8030-30-6) as ‘Not classifiable as to its carcinogenicity to humans (Group 3)’ based on inadequate evidence for the carcinogenicity of petroleum solvents in humans. No data were available on the carcinogenicity of special boiling-point range solvents or white spirits in laboratory animals.

The component chemicals, benzene and 1,3-butadiene, are classified as a hazardous, Category 1 carcinogenic substances, with the risk phrase ‘May cause cancer’ (T; R45) in HSIS (Safe Work Australia). The component chemical, isoprene, is classified as a hazardous, Category 2 carcinogenic substance, with the risk phrase ‘May cause cancer’ (T; R45) in the HSIS (Safe Work Australia).

The reported concentrations of benzene in the low boiling-point petroleum naphthas (up to 20 % but typically 1 %) (Government of Canada, 2011; Government of Canada, 2013) and in refined naphthas (<0.1–1 %) (IARC; 1989) are above the cut-off concentrations for classification (Safe Work Australia, 2004; GHS, 2009). Classification for carcinogenicity could be warranted for the chemical if it can be demonstrated that the benzene content is at or above the cut-off concentrations for this classification (refer to **Recommendation** section). Concentrations of isoprene and 1,3-butadiene should also be taken into account (NICNASb).

Reproductive and Developmental Toxicity

No data are available for the chemical. The reference chemicals are not reproductive or developmental toxicants.

In several combined reproductive/developmental toxicity screening tests, SD rats exposed by inhalation to the chemicals with CAS Nos. 64741-41-9 (naphtha), 64741-55-5 (olefinic), and 64741-66-8 (paraffinic) showed no adverse effects on reproductive and developmental toxicity parameters at doses up to 13.4, 23.9, and 25 mg/L, respectively (Government of Canada, 2011; US EPA, 2011; NICNASa).

Other Health Effects

Neurotoxicity

No data are available for the chemical.

The reference chemicals identified by the CAS Nos. 64741-55-5 (olefinic) and 64741-66-8 (paraffinic) were not neurotoxic to SD rats exposed by inhalation (US EPA, 2011; NICNASa). However, a study with the reference chemical CAS No. 64741-63-5 (aromatic) at a concentration of 27.8 mg/L reported an increase in motor activity in SD rats (US EPA, 2011; NICNASa)

Human data indicate that CNS effects from accidental ingestion of petroleum solvents are most likely due to gasoline and kerosene. In cases where aspiration does not occur, and especially with the lower boiling-point solvents, CNS symptoms such as lethargy, convulsions, and coma could develop (HSDB).

Risk Characterisation

Critical Health Effects

The critical health effects of the chemical depend on the composition, particularly the concentrations, of benzene, isoprene and 1,3-butadiene. Systemic long-term effects include carcinogenicity and mutagenicity; systemic acute effects include potential acute toxicity from inhalation exposure; and local effects from repeated exposure causing skin dryness or cracking. The chemical could also cause harmful effects following repeated oral, dermal and inhalation exposure. Components other than benzene are associated with a range of hazardous properties, but the available data for the chemical indicate that the content of hazardous components is generally low. Exposure to the hazardous components of the chemical is expected to be very limited, and so only the most severe effect will contribute to the likely risk.

Public Risk Characterisation

The use of the refined chemical as a solvent in domestic products (refer to **Import, manufacture and use** section) has public exposure implications. However, the risks from exposure to the chemical depend on its benzene content, which is generally low for the chemical as used in domestic products. The *Poisons Standard* includes hydrocarbon solvents containing benzene at 15 mL/L or greater in Schedule 7, which should not be available to the public (refer to **Restrictions: Australian** section). Therefore, the public risk from this chemical is not considered to be unreasonable.

Occupational Risk Characterisation

Given the critical systemic acute and chronic health effects, the chemical could pose an unreasonable risk to workers unless adequate control measures to minimise oral, dermal and inhalation exposure are implemented. The chemical should be appropriately classified and labelled to ensure that a person conducting a business or undertaking (PCBU) at a workplace (such as an employer) has adequate information to determine the appropriate controls.

The chemical benzene should be monitored as part of any air monitoring programme in the workplace.

The data available support an amendment to the hazard classification in the HSIS (refer to **Recommendation** section).

NICNAS Recommendation

Assessment of this chemical is considered to be sufficient, provided that the recommended amendment to the classification is adopted, and labelling and all other requirements are met under workplace health and safety and poisons legislation as adopted by the relevant state or territory.

Companies introducing or processing the chemical should continually seek to reduce fugitive emissions as far as reasonably practicable.

Regulatory Control

Public Health

Products containing the chemical should be labelled in accordance with state and territory legislation (SUSMP, 2015).

Work Health and Safety

The chemical is recommended for classification and labelling under the current Approved Criteria and adopted GHS as below. This assessment does not consider classification of physical and environmental hazards.

For acute inhalation toxicity, the classification need not apply if data are available to show the specific chemical grade of naphtha has low acute inhalation toxicity.

For chronic health effects, the classification will depend on the concentration of benzene as follows.

Repeated dose toxicity

In the absence of specific test data, the classification should be determined based on the levels of benzene.

Genotoxicity

In the absence of specific test data, the classification should be determined based on the levels of benzene, isoprene and 1,3-butadiene.

Carcinogenicity

In the absence of specific test data, the classification should be determined based on the levels of benzene, isoprene and 1,3-butadiene.

The classification criteria for mixtures (Safe Work Australia, 2004; GHS, 2009) should be applied to this UVCB substance, based on its concentration of benzene and other constituents including isoprene and butadiene. The classifications below represent the highest possible classifications for each endpoint under these rules. Should empirical data become available for the chemical to indicate that a lower (or higher) classification is appropriate, the default classification for the chemical may be amended.

Hazard	Approved Criteria (HSIS)[a]	GHS Classification (HCIS)[b]
Acute Toxicity	Harmful: may cause lung damage if swallowed (Xn; R65)* Harmful by inhalation (Xn; R20)	May be fatal if swallowed and enters airways - Aspi. Cat. 1 (H304) Harmful if inhaled - Cat. 4 (H332)
Irritation / Corrosivity	Repeated exposure may cause skin dryness or cracking (R66)	Repeated exposure may cause skin dryness and cracking (AUH066)
Repeat Dose Toxicity	Toxic: danger of serious damage to health by prolonged exposure through inhalation, in contact with skin and if swallowed (T; R48/23/24/25)	Causes damage to organs through prolonged or repeated exposure - Cat. 1 (H372)
Genotoxicity	Muta. Cat 2 - May cause heritable genetic damage (T; R46)*	May cause genetic defects - Cat. 1B (H340)
Carcinogenicity	Carc. Cat 2 - May cause cancer (T; R45)*	May cause cancer - Cat. 1B (H350)

[a] Approved Criteria for Classifying Hazardous Substances [NOHSC:1008(2004)].

[b] Globally Harmonized System of Classification and Labelling of Chemicals (GHS) United Nations, 2009. Third Edition.

[*] Existing Hazard Classification. No change recommended to this classification

Advice for consumers

Products containing the chemical should be used according to the instructions on the label.

Advice for industry

Control measures

Control measures to minimise the risk from oral, dermal and inhalation exposure to the chemical should be implemented in accordance with the hierarchy of controls. Approaches to minimise risk include substitution, isolation and engineering controls. Measures required to eliminate, or minimise risk arising from storing, handling and using a hazardous chemical depend on the physical form and the manner in which the chemical is used. Examples of control measures which could minimise the risk include, but are not limited to:

- using closed systems or isolating operations;
- using local exhaust ventilation to prevent the chemical from entering the breathing zone of any worker;
- health monitoring for any worker who is at risk of exposure to the chemical[s], if valid techniques are available to monitor the effect on the worker's health;
- air monitoring to ensure control measures in place are working effectively and continue to do so;
- minimising manual processes and work tasks through automating processes;
- work procedures that minimise splashes and spills;
- regularly cleaning equipment and work areas; and
- using protective equipment that is designed, constructed, and operated to ensure that the worker does not come into contact with the chemical.

Guidance on managing risks from hazardous chemicals are provided in the *Managing risks of hazardous chemicals in the workplace—Code of practice* available on the Safe Work Australia website.

Personal protective equipment should not solely be relied upon to control risk and should only be used when all other reasonably practicable control measures do not eliminate or sufficiently minimise risk. Guidance in selecting personal protective equipment can be obtained from Australian,

Australian/New Zealand or other approved standards.

Obligations under workplace health and safety legislation

Information in this report should be taken into account to help meet obligations under workplace health and safety legislation as adopted by the relevant state or territory. This includes, but is not limited to:

- ensuring that hazardous chemicals are correctly classified and labelled;
- ensuring that (material) safety data sheets ((M)SDS) containing accurate information about the hazards (relating to both health hazards and physicochemical (physical) hazards) of the chemical are prepared; and
- managing risks arising from storing, handling and using a hazardous chemical.

Your work health and safety regulator should be contacted for information on the work health and safety laws in your jurisdiction.

Information on how to prepare an (M)SDS and how to label containers of hazardous chemicals are provided in relevant codes of practice such as the *Preparation of safety data sheets for hazardous chemicals—Code of practice* and *Labelling of workplace hazardous chemicals—Code of practice*, respectively. These codes of practice are available from the Safe Work Australia website.

A review of the physical hazards of the chemical has not been undertaken as part of this assessment.

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