Gas oils produced by secondary processing: Human health tier II assessment

12 December 2019

Chemicals in this assessment

Chemical Name in the Inventory	CAS Number
Distillates, petroleum, catalytic reformer fractionator residue, high boiling	68477-29-2
Distillates, petroleum, catalytic reformer fractionator residue, intermediate boiling	68477-30-5
Distillates, petroleum, catalytic reformer fractionator residue, low boiling	68477-31-6
Distillates, petroleum, cracked steam cracked petroleum distillates	68477-38-3
Condensates, petroleum, vacuum tower	64741-49-7
Gas oils, petroleum, light vacuum	64741-58-8
Distillates, petroleum, light catalytic cracked	64741-59-9
Distillates, petroleum, intermediate catalytic cracked	64741-60-2
Distillates, petroleum, light thermal cracked	64741-82-8

Chemical Name in the Inventory	CAS Number
Raffinates, petroleum, sorption process	64741-85-1
Distillates, petroleum, sweetened middle	64741-86-2
Gas oils, petroleum, solvent refined	64741-90-8
Distillates, petroleum, solvent refined middle	64741-91-9
Extracts, petroleum, middle distillate solvent	64742-06-9
Gas oils, petroleum, acid treated	64742-12-7
Distillates, petroleum, acid treated middle	64742-13-8
Distillates, petroleum, acid treated light	64742-14-9
Gas oils, petroleum, chemically neutralized	64742-29-6
Distillates, petroleum, chemically neutralized middle	64742-30-9
Distillates, petroleum, clay treated	64742-38-7
Distillates, petroleum, hydrotreated middle	64742-46-7
Distillates, petroleum, catalytic dewaxed middle	64742-72-9
Gas oils,, petroleum, hydrodesulfurized	64742-79-6
Distillates, petroleum, hydrodesulfurized middle	64742-80-9
Gas oils, petroleum, hydrodesulfurized, light vacuum	64742-87-6
Extracts, petroleum, gas oil solvent	64743-06-2
Distillates, petroleum, hydrodesulfurized light catalytic cracked	68333-25-5
Aromatic hydrocarbons, C9-17	68333-88-0
Gas oils, petroleum, steam cracked	68527-18-4

Chemical Name in the Inventory	CAS Number
Distillates, petroleum, hydrotreated light catalytic cracked	68921-07-3
Gas oils, paraffinic	93924-33-5

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**

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ACRONYMS & ABBREVIATIONS

Grouping Rationale

The chemicals in this group are gas oils produced by secondary processing of the materials derived from the vacuum distillation of the residuum from the atmospheric distillation of crude oil (API Petroleum HPV Testing Group, 2012). This group was originally assessed and published in Tranches 13 and 14. The report has been republished in Tranche 28 with additional chemicals (CAS Nos. 64741-85-1, 64742-06-9 and 64743-06-2).

The chemical composition depends on both the original crude oil and on the processes used during refining. The chemicals are UVCBs (unknown or variable composition, complex reaction products or biological materials) containing variable amounts of straight and branched chain alkanes (paraffins, and cycloparaffins), cycloalkanes (naphthenes), aromatic hydrocarbons and mixed aromatic cycloalkanes. The chemical components have a wide range of molecular weights, with carbon numbers usually between C9 and C30, and boiling points between 150 °C and 471 °C. As the boiling point ranges of the fractions increase, the levels of polycyclic aromatic hydrocarbons (PAHs), polycycloparaffins and heteroatoms (nitrogen, oxygen, and sulfur) increase, while the levels of paraffins decrease. Most commercial gas oils contain PAHs.

Import, Manufacture and Use

Australian

Australian information is available for two of the chemicals in this group. Distillates, petroleum, hydrotreated middle (CAS No. 64742-46-7) has reported commercial use as a colouring agent, lubricant, additive and solvent in the fuel, oil and printing industries. The chemical is listed on the 2006 High Volume Industrial Chemicals List (HVICL) with a total reported volume of between 1000–9999 tonnes.

Distillates, petroleum, sweetened middle (CAS No. 64741-86-2) has reported commercial/domestic use in inks.

International

The following international uses have been identified through the European Union (EU) Registration, Evaluation, Authorisation and Restrictions 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 National Library of Medicine's Hazardous Substances Data Bank (HSDB); and various International assessements (Government of Canada, 2011; API Petroleum HPV Testing Group, 2012; Government of Canada; 2013; Government of Canada, 2019).

There are a wide range of uses for the chemicals in this group including:

- as blending stocks for producing fuels that are used in diesel engines and in domestic and industrial heating;
- as lubricants, fuels and fuel additives;
- as solvents;
- in plating and surface finishing, coatings, paints and lacquers;
- in adhesive and binding agents;
- in colourants, including pigment/stain/dye/ink;
- in reprographic agents;
- in publishing and printing recorded media;
- as cleaning agents,

- in cutting and metal-working fluids;
- in manufacturing coke-refined petroleum products;
- as a chemical reagent in the mining sector; and
- in rubber production and processing.

The chemicals identified by the CAS Nos. 64741-86-2, 64742-14-9, 64742-46-7, 64741-85-1 and 64742-06-9 have reported domestic use in auto and home maintenance products such as polishes and waxes (up to a concentration of 100 %) and brush cleaners (at concentrations of 20–80 %) (US Household Products Database).

Some of the chemicals in this group have reported use in the manufacture of food contact articles (Government of Canada, 2019).

Restrictions

Australian

The chemicals in this group fall under the scope of the entry for liquid hydrocarbons which are listed in the *Poisons Standard—the Standard for the Uniform Scheduling of Medicines and Poisons* (SUSMP) in Schedule 5 (SUSMP, 2019).

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, 2019).

Major hazard facilities

Industry facilities that introduce or process the chemicals could meet the criteria for major hazard facilities (MHFs) due to the quantities of chemicals such as methane, natural gas and liquefied petroleum gas stored, handled or processed.

'Operators of determined MHFs have obligations to:

- Identify all major incidents and major incident hazards for the facility;

- Conduct and document a safety assessment in relation to the operation of the facility that involves a comprehensive and systematic investigation and analysis of all aspects of risks to health and safety that could occur in the operation of the MHF;
- Implement control measures that eliminate or minimise the risk of a major incident occurring at the MHF;
- Prepare an emergency plan;
- Establish a Safety Management System (SMS) for the operation of the MHF;
- Prepare a Safety Case for the MHF that demonstrates that the MHF's SMS will control risks arising from major incidents and major incident hazards and demonstrates the adequacy of the measures to be implemented by the operator to control risks associated with the occurrence of major incidents' (Safe Work Australia).

In addition, activities on these facilities are covered by a number of state and territory legislation and licensing requirements and reporting requirements under the National Environment Protection (National Pollutant Inventory—NPI) Measure, where reporting thresholds are met.

International

The chemicals (excluding CAS Nos. 64741-49-7, 64741-85-1, 64741-58-8, 64742-06-9, 64742-72-9, 64742-87-6, 64743-06-2, 68333-88-0 and 68921-07-3) are listed on at least one of the following (Galleria Chemica);

- EU Cosmetics Regulation 1223/2009 Annex II—List of substances prohibited in cosmetic products;
- New Zealand Cosmetic Products Group Standard—Schedule 4: Components cosmetic products must not contain; and
- ASEAN Cosmetic Directive Annex II Part 1: List of substances which must not form part of the composition of cosmetic products

The chemicals (excluding the following CAS Nos. 64741-49-7, 64741-58-8, 64741-85-1, 64742-06-9, 64742-72-9, 64742-87-6, 64743-06-2, 68333-88-0 and 68921-07-3) are also restricted by Annex XVII to the REACH Regulations. The chemicals cannot be used in substances and preparations placed on the market for sale to the general public in individual concentrations ≥0.1 % (European Commission, 2006).

Existing Worker Health and Safety Controls

Hazard Classification

The chemicals, except CAS Nos. 64741-85-1, 64742-06-9 and 64743-06-2, are classified as hazardous, with the following hazard categories and hazard statements for human health in the Hazardous Chemicals Information System (HCIS) (Safe Work Australia). This classification is based on the recommended amendment to the hazard classification in the Hazardous Substances Information System (HSIS) from the original IMAP assessments published in Tranches 13 and 14.

- Aspiration Hazard – Category 1; H304 (May be fatal if swallowed and enters airways);
- Acute Toxicity – Category 4; H332 (Harmful if inhaled);
- Carcinogenicity – Category 1B; H350 (May cause cancer); and
- Skin Irritation – Category 2; H315 (Causes skin irritation).

The classification is subject to notes N, 8 and 9 (for all classified chemicals).

'**Note N:** The classification as a carcinogen need not apply if the full refining history is known and it can be shown that the substance from which it is produced is not a carcinogen. This note only applies to certain complex oil-derived substances in Annex I' (Safe Work Australia).

'Note 8: The tables in schedule 6 of the WHS regulations replace some tables in the GHS, this may affect the cut off concentration for this chemical' (Safe Work Australia).

'**Note 9**: The aspiration hazard classification should only be applied if the kinematic viscosity criteria for aspiration classification in the GHS is met' (Safe Work Australia).

Exposure Standards

Australian

No specific exposure standards are available. Guidance on the interpretation of workplace exposure standards for airborne contaminants provides advice that exposure to carcinogens should be eliminated or minimised so far as is reasonably practicable (Safe Work Australia, 2013).

International

No specific exposure standards are available.

Health Hazard Information

The toxicity profile of the chemicals in this group is dictated by the levels of PAHs. In general terms, petroleum streams from thermal or catalytic cracking processes that have higher PAH content than straight-run distillation fractions or streams derived from other non-cracking processes (e.g., hydrotreating). The PAH analysis data indicate that where PAHs are present, the aromatics typically contain up to three fused aromatic rings, with negligible amounts of 4–7 rings (API HPV Testing Group, 2012). Health hazard information is available for some of the chemicals in this group. However, the results from the studies reported below depend on the sample and the PAH content.

Acute Toxicity

Oral

Based on the available data, the chemicals in this group are considered to have low acute toxicity following oral exposure (Government of Canada, 2011; API Petroleum HPV Testing Group, 2012; Government of Canada, 2013).

For the chemicals, CAS Nos. 64741-59-9, 64742-80-9, 68477-31-6 and 68527-18-4 the median lethal dose (LD50) in rats has been measured as >2000 mg/kg bw (RTECS). Reported signs of toxicity included hypoactivity, diarrhoea and hair loss (EPA, 2010).

The chemicals could have the potential to cause chemical pneumonitis if aspirated (Mckee et al., 2014). The viscosity depends on the carbon number range (API HPV Testing Group, 2012). The chemicals in this group could meet the criteria for classification for aspiration toxicity (GHS, 2009). The threshold viscosity value for classification as an aspiration hazard is 20.5 mm^2/s at 40 °C.

Dermal

Based on the available data, the chemicals in this group are considered to have low acute toxicity following dermal exposure (Government of Canada, 2011; API Petroleum HPV Testing Group, 2012; Government of Canada; 2013).

For the chemicals, distillates, petroleum, light catalytic cracked (CAS No. 64741-59-9) and distillates, petroleum, hydrodesulfurized middle (CAS No. 64742-80-9), the LD50 in rats has been measured as >2000 mg/kg bw. Reported signs of toxicity included slight to moderate erythema.

Inhalation

Based on the data available, the chemicals in this group are expected to have low to moderate acute toxicity following inhalation exposure (Government of Canada, 2011; API Petroleum HPV Testing Group, 2012; Government of Canada; 2013).

Differences in toxicity could occur, depending on variations in aerosol particle size and subsequent deposition in the lungs. Based on the reported median lethal concentration (LC50) values of <5 mg/L/4 hours, and given the harmful effects observed with related petroleum chemicals (NICNAS), classification is considered warranted in the absence of more specific information (see **Recommendation** section).

In separate acute inhalation studies on the chemicals distillates, petroleum, light catalytic cracked (CAS No. 64741-59-9) and distillates, petroleum, hydrodesulfurized middle (CAS No. 64742-80-9), conducted similarly to the Organisation for Economic Co-operation and Development Test Guideline (OECD TG) 403, the LC50 was determined to be 4.65 mg/L and 4.6 mg/L, respectively. Reported signs of toxicity included decreased activity, dyspnoea and discharge from the eyes and nose. Microscopic findings were limited to the lungs, where moderate to severe pulmonary irritation was apparent (REACHa; REACHb). Other LC50 values reported for these two substances are 3.55 mg/L, 5.4 mg/L and 7.64 mg/L (API Petroleum HPV Testing Group, 2012; Government of Canada, 2013).

The chemical, gas oils, petroleum, steam cracked (CAS No. 68527-18-4) was investigated for acute inhalation toxicity in Fischer 344 (F344) rats via whole body aerosol exposure at a concentration of 4.95 mg/L. The LC50 was above the tested concentration (>4.95 mg/L) (EPA, 2010).

Corrosion / Irritation

Skin Irritation

Based on the available data, the chemicals in this group could be slightly to moderately irritating to the skin. Overall, based on the results of a study conducted according to OECD TG 404, classification is considered warranted (refer **Recommendation** section).

In a study performed in accordance with OECD TG 404, distillates, petroleum, light catalytic cracked (CAS No. 64741-59-9), when applied to intact rabbit skin for four hours, produced moderate erythema (mean score of 2.7) and oedema (mean score of 1.33). Ten days after the application, the exposed areas were free of irritation (REACHa).

Several other studies are available for various gas oils, including the chemical distillates, petroleum, hydrodesulfurized middle (CAS No. 64742-80-9), in which the exposure period was 24 hours. Moderate erythema and oedema were observed (Government of Canada, 2011; API Petroleum HPV Testing Group, 2012; Government of Canada, 2013; REACHa; REACHb). Irritant responses could be more pronounced where the chemicals are tested under occlusive patch conditions and for extended periods of time.

Dermal application of gas oils, petroleum, steam cracked (CAS No. 68527-18-4) at 0, 1000 or 2000 mg/kg bw/day for an exposure period of 6 hours/day over 5 days, indicated a positive skin irritation response in rats. In both males and females, erythema and eschar formation were seen at all doses, as well as slight oedema in high dose males (EPA, 2010).

Eye Irritation

Based on the data available, the chemicals in this group are considered to be, at most, slightly irritating to the eyes.

The chemicals, distillates, petroleum, light catalytic cracked (CAS No. 64741-59-9) and distillates, petroleum, hydrodesulfurized middle (CAS No. 64742-80-9) (4 samples) were reported to be, at most, slightly irritating to the eyes (unrinsed and rinsed) when

tested equivalently or similarly to OECD TG 405. In general, conjunctival redness and swelling, but no corneal opacity or iritis, were observed. Where reported, effects were generally reversible within 72 hours (API Petroleum HPV Testing Group, 2012; REACHa; REACHb). The effects were not sufficient to warrant a hazard classification.

Sensitisation

Skin Sensitisation

Based on the data available, the chemicals in this group are not considered to be skin sensitisers.

The chemicals, distillates, petroleum, light catalytic cracked (CAS No. 64741-59-9) and distillates, petroleum, hydrodesulfurized middle (CAS No. 64742-80-9) (4 samples) were not skin sensitisers in the guinea pig Buehler test (API Petroleum HPV Testing Group, 2012; REACHa; REACHb).

Repeated Dose Toxicity

Oral

No data are available.

Dermal

Based on the weight of evidence from the repeated dose toxicity studies on chemicals in this group, the chemicals are not expected to cause damage to health from repeated dermal exposure. Effects were not observed at doses sufficient to warrant classification. The systemic toxicity of high boiling petroleum substances (HBPS), such as the chemicals in this group, could be correlated with concentrations of PAHs, particularly those composed of 3, 4, 5, 6 and/or 7 fused aromatic rings. However, other compositional characteristics could also influence toxicity (TERA, 2008).

Overall, 13-week studies were available for three chemicals, condensates, petroleum, vacuum tower, distillates, petroleum, light catalytic cracked (CAS No. 64741-49-7), distillates, petroleum, light catalytic cracked (CAS No. 64741-59-9) and distillates, petroleum, light thermal cracked (CAS No. 64741-82-8). The samples had dimethylsulfoxide (DMSO)-extractable aromatic constituents with three or more rings in the range of 4.6 % to 14 %. Similar to other HBPS effects observed included increased liver weights, reduced thymus weights, and changes in serum chemistry and haematological parameters. Significant histopathological findings were not observed in organs with weight changes. Skin irritation was observed in some, but not all, studies. The lowest observed adverse effects level (LOAEL) was ≥125 mg/kg bw/day in most studies. In the study with distillates, petroleum, light thermal cracked (CAS No. 64741-82-8), the LOAEL was reported as 30 mg/kg bw/day based on decreased thymus weight in males and increased lymphocytes in females (API Petroleum HPV Testing Group, 2012; Government of Canada, 2013; McKee et al., 2014).

A number of 4-week studies were available for several of the chemicals in this group, the studies showed slight to moderate skin irritation, but minimal systemic toxicity (Government of Canada, 2011; API Petroleum HPV Testing Group, 2012).

Inhalation

Limited data are available. While adverse effects were observed in the 28-day study with the chemical, gas oils, petroleum, steam cracked (CAS No. 68527-18-4), the effects occurred at concentrations above the classification criteria. Therefore, hazard classification is not warranted.

In a 4-week study in rats, two samples of distillates, petroleum, hydrodesulfurized middle (CAS No. 64742-80-9) were administered at a nominal concentration of 25 mg/m^3, 6 hours/day, 5 days a week. Microscopic changes in nasal tissue and

subacute inflammation of the respiratory mucosa were observed. An approximate 30 % increase in leukocytes was also noted, but no macroscopic changes were observed at necropsy (API Petroleum HPV Testing Group, 2012; Government of Canada, 2013).

The inhalation toxicity of the chemical gas oils, petroleum, steam cracked (CAS No. 68527-18-4) was investigated in a 28-day whole body aerosol study in F344 rats. Actual doses were determined at 0, 0.51, 1.26 or 2.54 mg/L (10/sex/group) with exposure of the chemical for 6 hours/day, 5 days/week. Significant mortality (75 %) occurred at the highest dose. Treatment and dose related effects included nasal discharge, porphyrin accumulation and closing of the eyelids. Haematological changes at concentrations above 0.51 mg/L included a decrease in mean corpuscular haemoglobin in females, and increased total white blood cell as well as platelet counts in both sexes. Elevated blood glucose levels were observed in males at or above concentrations of 1.26 mg/L, and in females at the highest dose. Further gross pathological findings included alopecia, perianal soiling, abnormal liver colouration and a general lack of body fat. Organ toxicity was reported including thymus, spleen, lung and kidney. The following histopathological effects were seen at or concentrations above 1.26 mg/L: necrosis of cortical thymocytes and atrophy of the thymic cortex; hyperplasia of lung lymphoid tissue; hypoplastic bone marrow; generalized vascular congestion (bone marrow, kidney, adrenal, lung and thymus); degeneration of kidney tubular epithelium; and associated hyaline droplet accumulation (EPA, 2010).

In a 13-week study with a diesel fuel (which is blended from various gas oils), no histopathological changes or effects on pulmonary function were noted in rats exposed up to 1500 mg/m^3 (Government of Canada, 2013).

Genotoxicity

Based on the data available, the chemicals in this group have demonstrated a potential for inducing gene mutations in vitro. Limited in vivo data are available.

Several of the chemicals in this group have been reported as mutagenic in the optimised Ames test in bacteria. Distillates, petroleum, light catalytic cracked (CAS No. 64741-59-9) samples, which generally contain higher levels of aromatics with ≥3 rings, induced higher mutagenicity indices than the other tested chemicals. Petroleum substances containing >3 % w/w DMSO extractables (as measured by the IP346 assay) are generally mutagenic in the optimised Ames test (API Petroleum HPV Testing Group, 2012; Government of Canada, 2013).

In vitro, distillates, petroleum, light catalytic cracked (CAS No. 64741-59-9) was positive in two mouse lymphoma assays with metabolic activation (results without metabolic activation were mixed). Both positive and negative results were reported in this assay for distillates, petroleum, hydrodesulfurized middle (CAS No. 64742-80-9). Equivocal results were reported for the above two chemicals (CAS No. 64741-59-9 and 64742-80-9) in sister chromatid exchange assays in Chinese hamster ovary (CHO) cells (API Petroleum HPV Testing Group, 2012; Government of Canada, 2013).

The chemical, gas oils, petroleum, steam cracked (CAS No. 68527-18-4) was investigated in several in vitro studies, including an in vitro mammalian cell transformation assay in mouse embryo cells. Concentrations of 20, 60, 90 or 110 µg/mL produced a negative result for cell transformation (REACHc).

In an unscheduled DNA synthesis assay (UDS) in F344 rat primary hepatocyte cultures, gas oils, petroleum, steam cracked (CAS No. 68527-18-4), induced unscheduled DNA synthesis at all doses (8, 16, 32, 64, 128, 256, 512 or 1024 µg/mL). At doses above 64 µg/mL, significant cytotoxicity was observed (EPA, 2010).

The chemical, gas oils, petroleum, steam cracked (CAS No. 68527-18-4) did not induce a significant increase in the frequency of micronucleated polychromatic erythrocytes in mouse bone marrow in an oral gavage micronucleus assay at single doses of 0, 250, 500 or 1000 mg/kg bw/day (EPA, 2010).

In vivo, distillates, petroleum, light catalytic cracked (CAS No. 64741-59-9) induced sister chromatid exchange when administered to mice via intraperitoneal (i.p.) injection at doses of 1700 and 3400 mg/kg bw. An increase in chromosome aberrations was not observed in the bone marrow of rats following i.p. injection at doses of up to 3000 mg/kg bw/day (API Petroleum HPV Testing Group, 2012).

Carcinogenicity

The majority of chemicals in this group are classified as hazardous—Carcinogenicity – Category 1B; H350 (May cause cancer) in the HCIS (Safe Work Australia). This classification need not apply if the full refining history is known and it can be shown that the substance from which it is produced is not a carcinogen. The available data support this classification for all the chemicals in this group.

The dermal carcinogenic potential of distillates, petroleum, light catalytic cracked (CAS No. 64741-59-9) has been investigated in multiple skin painting studies in mice. Tumour types and relative incidences were consistent across different studies, with squamous cell carcinomas being the most common, followed by fibrosarcomas and papillomas. A study investigating the tumour initiating and promoting activity of this chemical indicated that it could exhibit significant tumour promoting and carcinogenic activity when applied chronically to the skin of mice (API Petroleum HPV Testing Group, 2012; Government of Canada, 2013).

The dermal carcinogenic potential of distillates, petroleum, light thermal cracked (CAS No. 64741-82-8) was assessed as a test substance blend with three other gas oil substances. Mice were dermally exposed to 1389 mg/kg bw of the blended substance twice per week for 80 weeks. At 80 weeks, 98 % of exposed mice had developed skin tumours (Government of Canada, 2013).

Depending on the types and levels of aromatics present, some gas oils can initiate skin tumours, whereas others exhibit only promoting activity (API Petroleum HPV Testing Group, 2012).

Petroleum substances containing <3 % w/w DMSO extractables (as measured by the IP346 assay) are not carcinogenic to skin (IPIECA, 2010). Analytical data, where available, indicate that the chemicals not currently classified have >3 % DMSO-extractable aromatic constituents with three or more rings (API Petroleum HPV Testing Group, 2012). Therefore, the classification should also be extended to these chemicals.

Reproductive and Developmental Toxicity

Certain petroleum stream chemicals have been shown to be developmentally toxic by dermal exposure. Effects include increased incidence of early and total resorptions, and decreased foetal body weight (IPIECA, 2010; Murray et al., 2013). Similar embryotoxic effects have been described in laboratory animals exposed to PAHs such as benz[a]anthracene, benzo[a]pyrene, and naphthalene (IPCS, 1998).

Similar effects have been observed in developmental toxicity studies with two of the chemicals in this group (CAS Nos. 64741-49-7 and 6471-59-9). The samples had DMSO-extractable aromatic constituents with three or more rings in the range of 4.6 % and 20.4 %. The LOAELs for developmental toxicity were 125–500 mg/kg bw/day. In addition to increased incidence of resorptions and decreased foetal bodyweight, foetal malformations were observed in studies with condensates, petroleum, vacuum tower (CAS No. 64741-49-7). Effects were generally seen at doses that produced maternal toxicity. Developmental effects were not observed in studies with distillates, petroleum, light thermal cracked (CAS No. 64741-82-8) and distillates, petroleum, sweetened middle (CAS No. 64741-86-2) (API Petroleum HPV Testing Group, 2012; Government of Canada, 2013). Developmental effects, particularly the increased incidence of foetal death and resorption, are associated with aromatics containing 3 or more rings and that other constituents of these substances (aliphatic constituents and 1- and 2-ring aromatics) do not make any significant contribution to the developmental toxicity of these substances (McKee et al., 2014). In general, the chemicals in this group contain negligible amounts of PAHs with 4–7 rings. Given that effects are observed at relatively high doses and in the presence of maternal toxicity, classification is not considered warranted.

Whilst the chemicals have not been tested for reproductive toxicity, reproductive effects are considered to be a less sensitive endpoint than developmental toxicity for other HBPS. Significant effects in the reproductive organs were not observed in the dermal repeated dose toxicity studies (API HPV Testing Group, 2012; McKee et al., 2014).

Risk Characterisation

Critical Health Effects

The critical health effects for risk characterisation will depend on the composition of the chemicals, but could include systemic long-term effects (carcinogenicity), systemic acute effects (acute toxicity from inhalation exposure) and local effects (skin irritation). Repeated dose toxicity and developmental effects could occur where there is exposure to relatively high doses. The chemicals could also be an aspiration hazard if they have a low kinematic viscosity.

Public Risk Characterisation

Given the uses identified for the majority of the chemicals in this group, dermal contact is expected to be the predominant route of exposure to gas oils (Government of Canada, 2019). Oral exposure may also occur from use in food contact articles (Government of Canada). Overall the risk to the public is not considered to be unreasonable due to expected use patterns and the use of highly refined gas oils in consumer products provided they meet the SUSMP concentration limits.

Five of the chemicals in this group have reported domestic use in automotive and home maintenance products expected to be used infrequently including polishes, waxes and brush cleaners. Although gas oils are known to contain carcinogenic PAHs, it is expected that the gas oils used in consumer products are highly refined such that the concentration of PAHs are reduced to residual levels (Government of Canada, 2019). For example, the highest concentration of PAHs identified in household cleaning products were 630 ppm naphthalene, 7.5 ppm fluorene and 1.9 ppm phenantherene. This is further supported by analytical data for two of the chemicals in the group, distillates, petroleum, hydrotreated middle (CAS No. 64742-46-7) and distillates, petroleum, sweetened middle (CAS No. 64741-86-2) (API Petroleum HPV Testing Group, 2012). The chemical, CAS No 64742-46-7, was reported to have a probable daily intake (PDI) of 0.26 µg/kg bw/day from migration from food packaging. It was concluded that the risk from dermal and oral exposure to gas oils in consumer products is low (Government of Canada, 2019).

Occupational Risk Characterisation

During product formulation, dermal exposure might occur, particularly where manual or open processes are used. Inhalation exposure could occur where mists are generated. These could include transfer and blending activities, quality control analysis, and cleaning and maintaining equipment. Worker exposure to the chemicals at lower concentrations could also occur while using formulated products containing the chemicals. The level and route of exposure will vary depending on the method of application and work practices employed.

Given the critical systemic long-term, systemic acute and local health effects, the chemicals could pose an unreasonable risk to workers unless adequate control measures to minimise dermal and inhalation exposure are implemented. The chemicals 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.

Guidance on the interpretation of workplace exposure standards for airborne contaminants provides advice that exposure to carcinogens should be eliminated or minimised so far as is reasonably practicable (Safe Work Australia, 2013).

The data available support an amendment to the hazard classification in the HCIS (Safe Work Australia) (refer to **Recommendation** section).

NICNAS Recommendation

Assessment of these chemicals 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.

Regulatory Control

Work Health and Safety

The chemicals are recommended for classification and labelling aligned with the Globally Harmonized System of Classification and Labelling of Chemicals (GHS) as below. This does not consider classification of physical hazards and environmental hazards.

Classification of chemicals in this group as an aspiration hazard should only be applied if the kinematic viscosity criteria for classification are met (Note 9 should apply). Carcinogenicity classifications should be subject to Note N.

From 1 January 2017, under the model Work Health and Safety Regulations, chemicals are no longer to be classified under the Approved Criteria for Classifying Hazardous Substances system.

Hazard	Approved Criteria (HSIS)[a]	GHS Classification (HCIS)[b]
Acute Toxicity	Not Applicable	May be fatal if swallowed and enters airways - Aspi. Cat. 1 (H304) Harmful if inhaled - Cat. 4 (H332)
Irritation / Corrosivity	Not Applicable	Causes skin irritation - Cat. 2 (H315)
Carcinogenicity	Not Applicable	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 industry

Control measures

Control measures to minimise the risk from oral, dermal and inhalation exposure to the chemicals 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 chemicals are used. Examples of control measures which could minimise the risk include, but are not limited to:

- using closed systems or isolating operations;
- health monitoring for any worker who is at risk of exposure to the chemicals, if valid techniques are available to monitor the effect on the worker's health;
- 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 chemicals.

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 chemicals 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 these chemicals has not been undertaken as part of this assessment.

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Last Update 12 December 2019

Chemical Identities

Chemical Name in the Inventory and Synonyms	**Distillates, petroleum, catalytic reformer fractionator residue, high boiling** heavy aromatic, petroleum
CAS Number	68477-29-2
Structural Formula	

	
Molecular Formula	Unspecified
Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Distillates, petroleum, catalytic reformer fractionator residue, intermediate boiling** light aromatic, petroleum
CAS Number	68477-30-5
Structural Formula	
Molecular Formula	Unspecified
Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Distillates, petroleum, catalytic reformer fractionator residue, low boiling** aromatic solvent, petroleum

CAS Number	68477-31-6
Structural Formula	**No Structural Diagram Available**
Molecular Formula	Unspecified
Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Distillates, petroleum, cracked steam cracked petroleum distillates** distillates (petroleum), cracked steam-cracked petroleum distillates cracked gas oil
CAS Number	68477-38-3
Structural Formula	**No Structural Diagram Available**
Molecular Formula	Unspecified
Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Condensates, petroleum, vacuum tower**
CAS Number	64741-49-7
Structural Formula	**No Structural Diagram Available**
Molecular Formula	Unspecified
Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Gas oils, petroleum, light vacuum** light vacuum gas oil, petroleum
CAS Number	64741-58-8
Structural Formula	**No Structural Diagram Available**
Molecular Formula	Unspecified
Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Distillates, petroleum, light catalytic cracked** light catalytic cracked distillate, petroleum spent gas oil
CAS Number	64741-59-9
Structural Formula	**No Structural Diagram Available**
Molecular Formula	Unspecified
Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Distillates, petroleum, intermediate catalytic cracked**
CAS Number	64741-60-2
Structural Formula	**No Structural Diagram Available**

Molecular Formula	Unspecified
Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Distillates, petroleum, light thermal cracked**
CAS Number	64741-82-8
Structural Formula	**No Structural Diagram Available**
Molecular Formula	Unspecified
Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Raffinates, petroleum, sorption process** isonaphtha petroleum, branched and cyclic hydrocarbons, C5-C8, sorption process
CAS Number	64741-85-1
Structural Formula	

	
Molecular Formula	Unspecified
Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Distillates, petroleum, sweetened middle**
CAS Number	64741-86-2
Structural Formula	
Molecular Formula	Unspecified
Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Gas oils, petroleum, solvent refined**

CAS Number	64741-90-8
Structural Formula	No Structural Diagram Available
Molecular Formula	Unspecified
Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Distillates, petroleum, solvent refined middle**
CAS Number	64741-91-9
Structural Formula	No Structural Diagram Available
Molecular Formula	Unspecified
Molecular Weight	Unspecified

Chemical Name in the	**Extracts, petroleum, middle distillate solvent**

Inventory and Synonyms	
CAS Number	64742-06-9
Structural Formula	
Molecular Formula	Unspecified
Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Gas oils, petroleum, acid treated**
CAS Number	64742-12-7
Structural Formula	
Molecular Formula	Unspecified
Molecular Weight	Unspecified

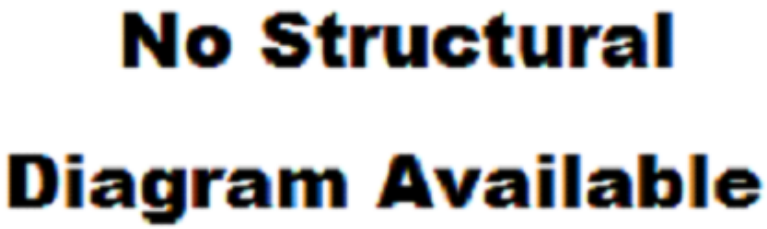
Chemical Name in the Inventory and Synonyms	**Distillates, petroleum, acid treated middle**
CAS Number	64742-13-8
Structural Formula	**No Structural Diagram Available**
Molecular Formula	Unspecified
Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Distillates, petroleum, acid treated light**
CAS Number	64742-14-9
Structural Formula	**No Structural Diagram Available**
Molecular Formula	Unspecified
Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Gas oils, petroleum, chemically neutralized** Gas oils,, petroleum, chemically neutralized
CAS Number	64742-29-6
Structural Formula	**No Structural Diagram Available**
Molecular Formula	Unspecified
Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Distillates, petroleum, chemically neutralized middle**
CAS Number	64742-30-9
Structural Formula	**No Structural Diagram Available**

Molecular Formula	Unspecified
Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Distillates, petroleum, clay treated**
CAS Number	64742-38-7
Structural Formula	
Molecular Formula	Unspecified
Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Distillates, petroleum, hydrotreated middle** distillates, petroleum, straight run middle, hydrotreated
CAS Number	64742-46-7
Structural Formula	

	
Molecular Formula	Unspecified
Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Distillates, petroleum, catalytic dewaxed middle**
CAS Number	64742-72-9
Structural Formula	
Molecular Formula	Unspecified
Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Gas oils,, petroleum, hydrodesulfurized** gas oils, petroleum, hydrodesulfurized

CAS Number	64742-79-6
Structural Formula	No Structural Diagram Available
Molecular Formula	Unspecified
Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Distillates, petroleum, hydrodesulfurized middle**
CAS Number	64742-80-9
Structural Formula	No Structural Diagram Available
Molecular Formula	Unspecified
Molecular Weight	Unspecified

Chemical Name in the	**Gas oils, petroleum, hydrodesulfurized, light vacuum**

Inventory and Synonyms	
CAS Number	64742-87-6
Structural Formula	
Molecular Formula	Unspecified
Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Extracts, petroleum, gas oil solvent**
CAS Number	64743-06-2
Structural Formula	
Molecular Formula	Unspecified
Molecular Weight	Unspecified

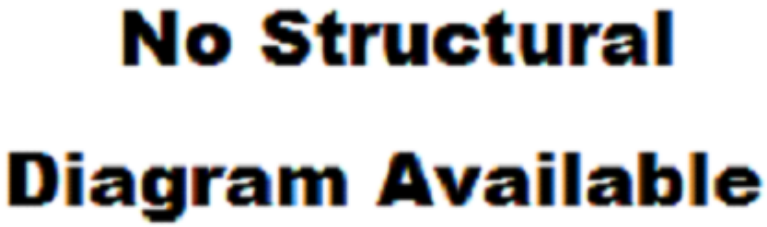
Chemical Name in the Inventory and Synonyms	**Distillates, petroleum, hydrodesulfurized light catalytic cracked** hydrodesulfurized light catalytic cracked distillate
CAS Number	68333-25-5
Structural Formula	**No Structural Diagram Available**
Molecular Formula	Unspecified
Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Aromatic hydrocarbons, C9-17**
CAS Number	68333-88-0
Structural Formula	**No Structural Diagram Available**
Molecular Formula	Unspecified
Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Gas oils, petroleum, steam cracked** steam cracked gas oil, petroleum gas oils (petroleum), steam-cracked cracked gas oil
CAS Number	68527-18-4
Structural Formula	**No Structural Diagram Available**
Molecular Formula	Unspecified
Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Distillates, petroleum, hydrotreated light catalytic cracked** light catalytic cracked petroleum distillate, hydrotreated
CAS Number	68921-07-3
Structural Formula	**No Structural Diagram Available**

Molecular Formula	Unspecified
Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Gas oils, paraffinic**
CAS Number	93924-33-5
Structural Formula	
Molecular Formula	Unspecified
Molecular Weight	Unspecified

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