Dyes that could release selected carcinogenic amines (not listed on AICS): Human health tier II assessment

02 March 2018

Chemicals in this assessment

Chemical Name in the Inventory	CAS Number
2,7-Naphthalenedisulfonic acid, 3-hydroxy-4-((2,4,5-trimethylphenyl)azo)-, disodium salt	3564-09-8
Benzenesulfonic acid, 3-[[4-[(2-methoxy-5-methylphenyl)azo]-1-naphthalenyl]azo]-, sodium salt	75627-17-7

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

NICNAS has made every effort to assure the quality of information available in this report. However, before relying on it for a specific purpose, users should obtain advice relevant to their particular circumstances. This report has been prepared by NICNAS using a range of sources, including information from databases maintained by third parties, which include data supplied by industry. NICNAS has not verified and cannot guarantee the correctness of all information obtained from those databases. Reproduction or further distribution of this information may be subject to copyright protection. Use of this information without obtaining the permission from the owner(s) of the respective information might violate the rights of the owner. NICNAS does not take any responsibility whatsoever for any copyright or other infringements that may be caused by using this information.

ACRONYMS & ABBREVIATIONS

Grouping Rationale

The critical health concern for the chemicals in this group is the potential for carcinogenic effects following exposure to certain aromatic amines, present as both impurities and breakdown products.

All chemicals in this group are azo compounds that share a similar molecular structure (R—N = N—R). These chemicals contain one or more azo linkages, in which the attached functional groups differ for each chemical.

The significance of azo-reduction in the mutagenicity and carcinogenicity of azo dyes is well established. The chemicals in this group have the potential to undergo reductive cleavage to form one of the following carcinogenic and/or genotoxic aromatic amines that are not listed in the Australian Inventory of Chemical Substances (AICS) and therefore no IMAP reports have been produced:

- 2,4,5-trimethylaniline (CAS No. 137-17-7); and
- 6-methoxy-*m*-toluidine (*p*-cresidine) (CAS No. 120-71-8).

Whilst these aromatic amines are not listed in AICS, they are reported to be used overseas. Therefore, these chemicals could potentially be present as impurities in products imported into Australia.

In the European Union (EU), these amines are classified as carcinogens and are included in Regulation on Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) list of 22 aromatic amines in Annex XVII Appendix 8 (European Commission, 2006) (see **International restrictions** section).

This assessment was published in February 2015 and revised in February 2018. In the revised version, two azo compounds (CAS Nos. 85186-64-7 and 85186-66-9) have been removed from the assessment based on new information (for further information see **IMAP assessments—public comment**). The original assessment included information on the carcinogenic aromatic amine 2-naphthylamine (CAS No. 91-59-8) expected to be potential reductive cleavage product from these azo compounds. Whilst the azo compounds are not included in the revised assessment, the information on 2-naphthylamine has been retained in this assessment to provide information on this important amine of concern.

Import, Manufacture and Use

Australian

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

None of three aromatic amines are listed on AICS. Therefore, manufacture of these chemicals in Australia is not expected.

International

There is a lack of information on the cosmetic, domestic, commercial and industrial uses of the chemicals in this group. CAS No. 3564-09-8 (Ponceau 3R) is reported to be used as a dye for wool (IARC, 1975; Haz-Map). The last report of its commercial production in the United States (US) was in 1960 and it was not believed to be produced commercially in either Western Europe or Japan in the 1970s (IARC, 1975). Ponceau 3R was used in cosmetics in the US, but was phased out from 1960.

Whilst the use of the aromatic amine 2-napthylamine is strictly controlled in the US, Japan and Europe, *p*-cresidine is still being produced in various countries (IARC, 2010; NTP, 2011).

The chemicals are not listed in the US Personal Care Product Council International Nomenclature of Cosmetic Ingredients (INCI) Dictionary. Available North American databases do not give evidence for the use of these chemicals in consumer products.

Restrictions

Australian

No known restrictions have been identified for the chemicals in this group. However, 2-naphthylamine is identified as a prohibited carcinogen (Table 10.1, Schedule 10) in workplace health and safety legislation (WHS Regulations, 2011).

International

The chemicals are restricted by the EU Annex XVII to EU Regulation as follows:

1. Azodyes which, by reductive cleavage of one or more azo groups, may release one or more of the aromatic amines listed in Appendix 8, in detectable concentrations,

i.e. above 30 ppm in the finished articles or in the dyed parts thereof, according to the testing methods listed in Appendix 10, shall not be used in textile and leather articles which may come into direct and prolonged contact with the human skin or oral cavity, such as:

- clothing, bedding, towels, hairpieces, wigs, hats, nappies and other sanitary items, sleeping bags;
- footwear, gloves, wristwatch straps, handbags, purses/wallets, briefcases, chair covers, purses worn round the neck;
- textile or leather toys and toys which include textile or leather garments; and
- yarn and fabrics intended for use by the final consumer.

2. Furthermore, the textile and leather articles referred to in paragraph 1 above shall not be placed on the market unless they conform to the requirements set out in that paragraph' (Galleria Chemica).

Existing Worker Health and Safety Controls

Hazard Classification

The chemicals are not listed on the Hazardous Substances Information System (HSIS) (Safe Work Australia).

Exposure Standards

Australian

No specific exposure standards are available.

International

No specific exposure standards are available.

Health Hazard Information

The critical concern for this group of chemicals and the focus of this assessment relates to the potential carcinogenic effects following exposure. The toxicological data for the chemicals in this group are limited. However, these azo compounds could undergo reductive cleavage of their azo bonds, releasing the following aromatic amines that have known carcinogenic potential: 2,4,5-trimethylaniline and *p*-cresidine. Data for these aromatic amines are considered in this assessment. No data are available for acute toxicity or local effects. However, compared with the concerns on carcinogenicity, these effects would be a secondary concern.

Toxicokinetics

Varying molecular weights and polarity are expected to influence the toxicokinetics of azo dyes (Bafana et al., 2011; Government of Canada, 2014). Although limited data are available for the chemicals in this assessment, data for similar azo dyes indicate a potential for azo reduction (NICNAS).

Azo bond reduction and cleavage occurs by an enzyme-mediated metabolism in the liver, skin and intestines. In the liver, cytosolic and microsomal enzymes (Platzek et al., 1999), including NADH cytochrome P450 reductase, NAD(P)H quinone oxidoreductase and cytochrome P450s (OEHHA, 2012), facilitate metabolism. Bacterial strains in human faeces have been shown to cleave azo dyes, suggesting that intestinal microflora play an important role in azo reduction (Platzek et al., 1999).

Although azo bond reduction occurs favourably in anaerobic conditions, several in vitro and in vivo studies indicated that this process could also occur aerobically when azo dyes are applied to the skin (SCCP, 2005). In vitro, the skin microflora of mice, guinea pigs and humans caused reductive cleavage of the azo dyes, followed by percutaneous absorption (SCCNFP, 2002). In addition, non-biological processes, such as thermal and photochemical degradation, have been reported to break azo linkages (Engel et al., 2009).

Azo bond reduction of the chemicals in this assessment would form the following aromatic amines: *p*-cresidine (for CAS No.75627-17-7) and 2,4,5-trimethylaniline (for Ponceau 3R). These aromatic amines are expected to have greater absorption than the dye from which they are derived (Platzek et al., 1999). For this reason, azo reduction by skin and intestinal microflora, followed by the carcinogenic amine absorption, is of particular concern.

Ponceau 3R has been demonstrated to undergo azo bond reduction by human intestinal bacteria *Fusobacterium* sp. 2, which formed the aromatic amine 2,4,5-trimethylaniline (Hartman et al., 1979). This aromatic amine was also identified as one of the major urinary metabolites in rabbits after oral administration of Ponceau 3R (IARC, 1975).

Aromatic amines undergo ring oxidation, N-glucuronidation, N-acetylation, and N-oxidation (SCCNFP, 2002). The toxicity of these chemicals is largely influenced by N-oxidation, a process primarily mediated by cytochrome P450 enzymes, such as CYP1A2 and CYP3A4, although other enzymes could also play a role. Under an acidic environment, the N-hydroxylamines produced from the N-oxidation process can form reactive nitroxide radicals or nitrenium ions (SCCNFP, 2002; OEHHA, 2012). These molecules are highly reactive and are capable of DNA binding (NICNAS).

Repeated Dose Toxicity

Oral

Limited data are available. Chronic oral exposures of Ponceau 3R (0.5–5 % or 5000–50000 mg/kg diet) to rats have been demonstrated to cause high mortality, growth inhibition and enlarged liver and kidneys (IARC, 1975). The chemically-induced pathological changes were more prominent in the liver, with observed features including fatty changes, cirrhosis, focal haemorrhage and focal necrosis (Aiso et al., 1966; IARC, 1975). Pathological changes in the liver and increased kidney weights were also observed in subchronic studies for the potential cleavage product, 2,4,5-trimethylaniline (Wiley VCH).

Dermal

No data are available.

Inhalation

No data are available.

Genotoxicity

Based on the limited data available, it is not possible to draw a definite conclusion about the genotoxicity of the chemicals in this group. Although available data are neither sufficient nor adequately comprehensive for classification, a genotoxic mode of action cannot be ruled out.

Although Ponceau 3R is included in the list of dyes suggested by the EU's Food Safety Authority (EFSA) that 'should be viewed as genotoxic and/or carcinogenic', no specific studies or data are available (EFSA, 2005). However, studies on the aromatic amines that are potential cleavage products of the chemicals in this group, 2,4,5-trimethylaniline and *p*-cresidine, demonstrated genotoxicity/mutagenicity in a number of in vitro and in vivo assays.

In vitro, these aromatic amines were mutagenic in *Salmonella typhimurium* strains TA98 and TA100 in the presence of metabolic activation (IARC, 2010; REACH; Wiley VCH).

In an *umu* gene expression assay, 2-napthylamine induced DNA damage in the NM2009 strain of *S. typhimurium* in the presence of CYP4B1 isoenzyme from rat bladder epithelium and a NAT-1 overexpressing *S. typhimurium* strain. The chemical was also mutagenic in Chinese hamster ovary (CHO) cells with and without metabolic activation (IARC, 2010).

In a 6-thioguanine resistance assay, 2,4,5 trimethylaniline was mutagenic in cultured fibroblasts from Sprague Dawley (SD) rats (Wiley VCH). The chemical was reported positive in chromosome aberration and sister chromatid exchange tests in CHO cells in vitro (NTP). The chemical produced mutation in a wing spot test in *Drosophila melanogaster* (somatic and recombination). By contrast, the chemical tested negative in the sex-linked recessive lethal assay in *D. melanogaster* (Wiley VCH).

In vivo, *p*-cresidine produced significant DNA damage in mouse bladder mucosa when tested using a modified single-cell gel electrophoresis (comet) assay (REACH). The chemical was negative in an in vivo mouse micronucleus assay (REACH).

Carcinogenicity

Limited data are available for the carcinogenic potential of the chemicals in this group.

Ponceau 3R is reported to produce tumours in rat livers and mouse urinary bladders. Long-term oral exposure (feeding studies) to Ponceau 3R of up to two years with 0.5–5 % doses in the diet) produced liver tumours in rats (Wistar, Osborne–Mendel, Bethesda Black). These include hepatomas, hepatic adenomas, bile duct adenoma, and adenomatous or nodular hyperplasia (Grice et al., 1961; Mannell, 1964; Aiso et al., 1966; IARC, 1975). The authors suggested that the component compounds present in the chemical, such as 2,4,5-trimethylaniline, contributed to the observed carcinogenic activity of Ponceau 3R (Mannell, 1964). In mice, Ponceau 3R produced bladder tumours on implantation in the urinary bladder (IARC, 1975).

The International Agency for Research on Cancer (IARC) has classified Ponceau 3R as 'Possibly carcinogenic to humans' (Group 2B), based on inadequate evidence for carcinogenicity in humans, but sufficient evidence for carcinogenicity in animal testing (IARC, 1987).

Although data are not available for the other chemicals in this group, the aromatic amines that could be released following the azo bond reductive cleavage of these chemicals are known carcinogens.

The aromatic amine, 2-naphthylamine, is classified as hazardous—Category 1 carcinogenic substance—with the risk phrase 'May cause cancer by inhalation' (T; R45) in the (HSIS) (Safe Work Australia).

IARC has classified 2-naphthylamine as 'known to be a human carcinogen based on the sufficient evidence of carcinogenicity from studies in humans'. A number of studies reported a significant increase in human urinary bladder tumours caused by occupational exposure. Experimentally, urinary bladder tumours were also seen in several species of laboratory animals (rat, hamster, dog and monkey) following repeated exposures to 2-napthylamine via a number of routes including oral, dermal, subcutaneous, intraperitoneal, intravesicular implantation and bladder-instillation (IARC, 2010). Liver and lung tumours were also observed in mice.

The aromatic amines, *p*-cresidine and 2,4,5-trimethylaniline are classified as Category 2 carcinogenic substances—with the risk phrase 'May cause cancer' (T; R45) in HSIS (Safe Work Australia). These aromatic amines are considered as 'reasonably anticipated to be human carcinogens based on sufficient evidence of carcinogenicity from studies in experimental animals' (IARC, 1982; NTP, 2011)

Long-term oral exposure to *p*-cresidine produced malignant and benign tumours in the urinary bladder and liver of rats and mice, and nasal cancer in rats (NTP, 2011). Chronic exposure of rats and mice to 2,4,5-trimethylaniline caused lung and liver tumours (NCI, 1979; NTP; Wiley VCH).

Metabolic activation of aromatic amines to produce nitrenium ion metabolites, which cause DNA adduct formation and induction of DNA damaging effects, has been postulated to be the likely mechanism of action for their carcinogenicity (SCCNFP, 2002). IARC concluded that 'there is strong mechanistic evidence that the carcinogenicity of 2-napthylamine operates by a genotoxic mechanism of action' (IARC, 2010).

Based on the potential for the chemicals in this group to release classified carcinogens on metabolism, classification is considered appropriate (refer **Recommendation** section). Due to the greater level of evidence of carcinogenicity (positive results observed in two species) for Ponceau 3R compared with the other chemicals in this group, differing classifications are considered appropriate.

Reproductive and Developmental Toxicity

No data are available.

Risk Characterisation

Critical Health Effects

The available data for characterising the critical health effects are limited. There are a number of uncertainties regarding the toxic effects of the chemicals in this group being assessed, including limited data for carcinogenicity, incomplete genotoxicity data and the expected variation in the bioavailability of the chemicals. However, the chemicals are all considered to have the potential to be metabolised to classified carcinogens through reductive cleavage of the azo linkage in the intestines and on the skin. In addition, azo dyes are generally known to be contaminated with their respective starting amine material (SCCNFP, 2002).

Based on the limited data available, it is not possible to draw a definite conclusion regarding the genotoxicity of the chemicals in this group. However, while available data are insufficient or inadequately comprehensive for classification, genotoxicity as a mode of action cannot be ruled out.

Public Risk Characterisation

Whilst the commercial production of Ponceau 3R and dyes based on 2-naphthylamine is restricted in some countries, this does not appear to be the case for dyes based on *p*-cresidine. In addition, commercial production in other countries such as India and China is not known. Therefore the introduction of these dyes for home use cannot be excluded.

Hence, the public could potentially be exposed to classified carcinogens as an impurity in, or through the release of, these aromatic amines derived from the chemicals in this group being assessed and risk management controls should be considered.

In addition, textiles and other products manufactured with these chemicals in other countries could be imported into Australia. Therefore, the public could be exposed to classified carcinogenic aromatic amines as impurities, or through the release of these aromatic amines derived from the chemicals in this group through:

- prolonged exposure to articles of clothing and leathergoods containing the dyes; and
- young children exposed by sucking the materials containing the dye.

However, these aromatic amines have not been detected in textiles in the EU (RAPEX). In considering the NICNAS recommendation for previously assessed azo dyes, the Australian Competition and Consumer Commission (ACCC) conducted a market survey to determine if any dyes of concern had been used in manufacturing consumer goods supplied in Australia. The ACCC has negotiated several recalls of products based on the results of the surveys (ACCC, 2014a). The ACCC tested for the concentration of aromatic amines that could be released from the chemicals in this group, but these amines were not detected.

An international assessment of the risk of cancer due to textiles and leather goods coloured with certain azo dyes concluded that, while consumer exposure is likely to be 'very low', the associated cancer risks give cause for concern. Although this assessment was not publicly available, the European Scientific Committee on Toxicity, Ecotoxicity and the Environment (CSTEE) considers that the report adequately reviews the situation regarding the risk of cancer for consumers as a result of using fabrics dyed with azo compounds, and that the conclusions are, in general, acceptable. The CSTEE also supported the recommendation that using azo dyes with the potential to give rise to 22 aromatic amines (these include the three aromatic amines that would be formed following azo bond reductive cleavage of the chemicals in this group), should be restricted to the lowest possible levels or completely eliminated.

The ACCC has published guidance on the safe concentrations of particular chemicals in consumer goods (ACCC, 2014). The guidance prescribes concentrations of chemicals in clothing, textiles and leather articles in direct and prolonged contact with the human skin or oral cavity, below which a safety concern does not exist. It also includes a list of the 22 hazardous aromatic amines (including the three aromatic amines that would be formed following azo bond reductive cleavage of the chemicals in this group).

The ACCC is considering mechanisms to restrict the supply of textiles and leather articles that could come into direct and prolonged contact with the human skin that might plausibly result in human exposure to certain aromatic amines at unacceptable levels. Options being considered will also be relevant for the chemicals in this group.

Occupational Risk Characterisation

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

Given the critical systemic long-term health effects, the chemicals could pose an unreasonable risk to workers unless adequate control measures to minimise dermal, ocular 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.

The *Guidance on the interpretation of workplace exposure standards for airborne contaminants* advises that 'exposure to carcinogens should be eliminated or minimised so far as is reasonably practicable' (Safe Work Australia, 2012).

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

NICNAS Recommendation

Overall, there is sufficient uncertainty regarding the safety of these chemicals in consumer products that risk management controls through changes to the Poisons Standard should be considered. Risks for workplace health and safety should be managed through changes to classification and labelling. A Tier III assessment may be necessary if the information in this report is not considered sufficient to justify these measures.

It is also recommended that the ACCC consider mechanisms to restrict the supply of textiles and leather articles that could come into direct and prolonged contact with the human skin that might plausibly result in human exposure to these chemicals at unacceptable levels.

Regulatory Control

Public Health

Appropriate scheduling and labelling should be undertaken to mitigate risk when the chemicals are used in domestic and cosmetic products. Due to the carcinogenicity concern for the aromatic amines present as impurities, or released through the metabolism of the chemicals in this group, and in the absence of data establishing safety, these chemicals and/or the aromatic amine precursors should be considered for listing in Schedule 7 or Appendix C of the *Standard for the Uniform Scheduling of Medicines and Poisons* (SUSMP), consistent with the scheduling policy framework guidelines. Matters to be taken into consideration include the following:

- Whilst the commerical production of Ponceau 3R and dyes based on 2-naphthylamine is restricted in some countries, this does not appear to be the case for dyes based on *p*-cresidine. In addition, commercial production in other countries such as India and China is not known.
- Whilst the data for the dyes themselves are limited, the chemicals are all considered to have the potential to be metabolised to classified carcinogens through reductive cleavage of the azo linkage.
- Trace levels of the aromatic amines used in dye production could be technologically inevitable.

Work Health and Safety

The chemicals are 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.

Due to the greater level of evidence of carcinogenicity (postive results observed in two species) for Ponceau 3R compared with the other chemicals in this group, CAS No. 3564-09-8 should be classified as a Category 2 carcinogen with the risk phrase ‘May cause cancer’ (T; R45) (Approved Criteria) and 'May cause cancer' - Cat. 1B (H350) (GHS).

Hazard	Approved Criteria (HSIS)[a]	GHS Classification (HCIS)[b]
Carcinogenicity	Carc. Cat 3 - Limited evidence of a carcinogenic effect (Xn; R40)	Suspected of causing cancer - Cat. 2 (H351)

[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 chemicals should be used according to the instructions on the label.

Advice for industry

Control measures

Control measures to minimise the risk from oral, dermal, ocular, 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;
- using local exhaust ventilation to prevent the chemicals from entering the breathing zone of any worker;
- 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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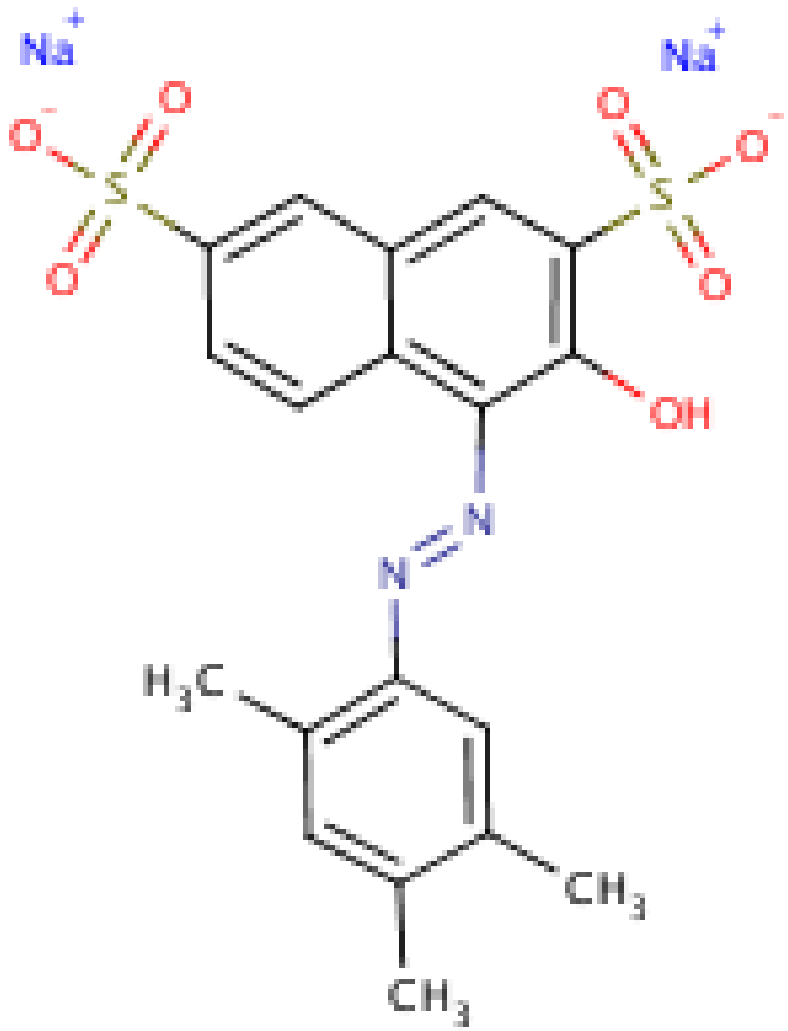
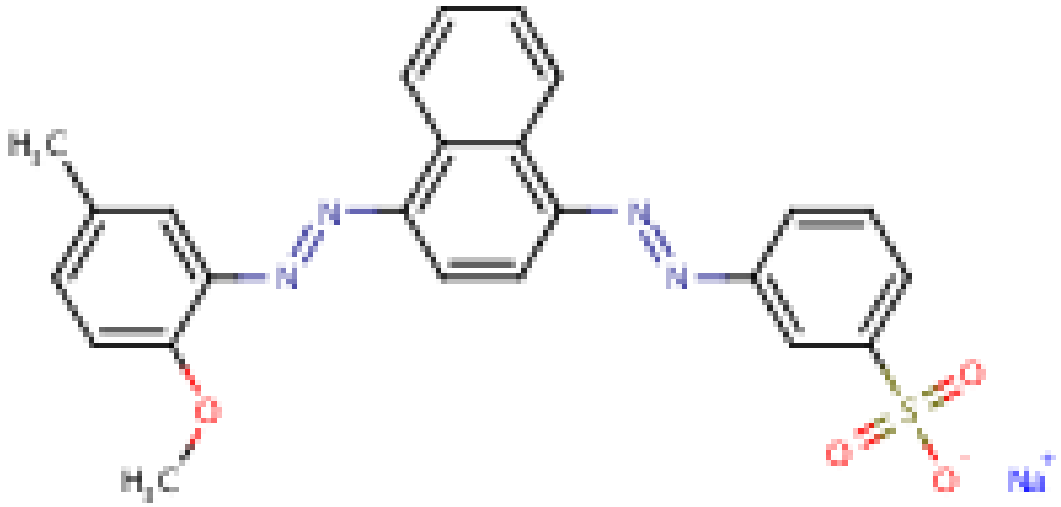
Last Update 02 March 2018

Chemical Identities

Chemical Name in the Inventory and Synonyms	**2,7-Naphthalenedisulfonic acid, 3-hydroxy-4-((2,4,5-trimethylphenyl)azo)-, disodium salt** Ponceau 3R C.I. 16155 C.I. Food Red 6

	AF Red No. 1 3-hydroxy-4-((2,4,5-trimethylphenyl)azo)-2,7-naphthalenedisulfonic acid disodium salt
CAS Number	3564-09-8
Structural Formula	
Molecular Formula	C19H18N2O7S2.2Na
Molecular Weight	494.45

Chemical Name in the Inventory and Synonyms	**Benzenesulfonic acid, 3-[[4-[(2-methoxy-5-methylphenyl)azo]-1-naphthalenyl]azo]-, sodium salt** 3-((4-((2-methoxy-5-methylphenyl)azo)-1-naphthalenyl)azo)benzenesulfonic acid, sodium salt sodium 3-((4-((2-methoxy-5-methylphenyl)azo)-1-naphthyl)azo)benzenesulphonate
CAS Number	75627-17-7
Structural Formula	

	
Molecular Formula	C24H20N4O4S.Na
Molecular Weight	482.49

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