Polymers incorporating formaldehyde and nonyl- or octylphenol: Human health tier II assessment

12 December 2019

Chemicals in this assessment

Chemical Name in the Inventory	CAS Number
Rosin, maleated, polymer with formaldehyde, nonylphenol, pentaerythritol and stearic acid	428823-49-8
Rosin, maleated, polymer with p-tert-butylphenol, formaldehyde, pentaerythritol, stearic acid and (1,1,3,3-tetramethylbutyl)phenol	428824-49-1
Linseed oil, polymer with p-tert-butylphenol, formaldehyde, rosin, and (1,1,3,3-tetramethylbutyl)phenol	428826-36-2
Formaldehyde, polymer with oxirane and 4-(1,1,3,3-tetramethylbutyl)phenol	25301-02-4
Formaldehyde, polymer with nonylphenol	9040-65-7
Formaldehyde, polymer with .alpha.-[4-(1,1,3,3-tetramethylbutyl)phenyl]-.omega.-hydroxypoly(oxy-1,2-ethanediyl)	9046-29-1
Formaldehyde, polymer with (1,1,3,3-tetramethylbutyl)phenol	9086-40-2

Chemical Name in the Inventory	CAS Number
Formaldehyde, polymer with 4-octylphenol	26335-33-1
Formaldehyde, polymer with 4-(1,1,3,3-tetramethylbutyl)phenol	26678-93-3
Formaldehyde, polymer with 4-nonylphenol and oxirane	30846-35-6
Formaldehyde, polymer with 4-nonylphenol	31605-35-3
Formaldehyde, polymer with nonylphenol and phenol	37238-34-9
Formaldehyde, polymer with methyloxirane and 4-nonylphenol	37523-33-4
Formaldehyde, polymer with methyloxirane, nonylphenol and oxirane, graft	39335-54-1
Formaldehyde, polymer with nonylphenol and oxirane	55845-06-2
Formaldehyde, polymer with .alpha.-(nonylphenyl)-.omega.-hydroxypoly(oxy-1,2-ethanediyl)	59006-81-4
Formaldehyde, polymer with 4-(1,1-dimethylethyl)phenol, dinonylphenol, nonylphenol and oxirane	68958-82-7
Formaldehyde, polymer with methyloxirane, 4-nonylphenol and oxirane	63428-92-2
Formaldehyde, polymer with 2,4-dinonylphenol, 1,2-ethanediamine and 4-nonylphenol	63428-94-4
Formaldehyde, polymer with 4-methyl-2-nonylphenol and 4-methylphenol	63494-85-9
Formaldehyde, polymer with dinonylphenol and nonylphenol	63494-86-0
Rosin, fumarated, polymer with formaldehyde, glycerol, nonylphenol and pentaerythritol	70248-44-1
Rosin, maleated, polymer with formaldehyde, glycerol, nonylphenol and pentaerythritol	70248-46-3

Chemical Name in the Inventory	CAS Number
Rosin, polymer with formaldehyde, 4-octylphenol and pentaerythritol	67700-46-3
2-Propenoic acid, polymer with formaldehyde, 2,5-furandione, methyloxirane, 4-nonylphenol and oxirane	67905-91-3
Formaldehyde, polymer with 4-(1,1-dimethylethyl)phenol, 4-(1,1-dimethylpropyl)phenol and 4-nonylphenol	67905-94-6
Formaldehyde, polymer with 4-(1,1-dimethylethyl)phenol, nonylphenol and phenol	68110-37-2
Formaldehyde, polymer with dinonylphenol, nonylphenol and oxirane	68140-83-0
Rosin, fumarated, polymer with dipentaerythritol, formaldehyde and nonylphenol	68152-52-3
Rosin, maleated, polymer with formaldehyde, nonylphenol and pentaerythritol	68152-62-5
Formaldehyde, polymer with 4-(1,1-dimethylethyl)phenol, 4-(1,1-dimethylpropyl)phenol, methyloxirane, 4-nonylphenol and oxirane	68155-79-3
Formaldehyde, polymer with 4-(1,1-dimethylethyl)phenol, 4-nonylphenol and oxirane	68171-44-8
Formaldehyde, polymer with 4-isooctylphenol	68184-25-8
Formaldehyde, polymer with 4-(1,1-dimethylethyl)phenol, methyloxirane, 4-nonylphenol and oxirane	68188-99-8
Formaldehyde, polymer with 4-(1,1-dimethylethyl)phenol and 4-octylphenol	68480-36-4
Formaldehyde, polymer with 4-nonylphenol, propoxylated	68511-70-6
Rosin, polymer with formaldehyde, glycerol, pentaerythritoland (1,1,3,3-tetramethylbutyl)phenol	68512-70-9

Chemical Name in the Inventory	CAS Number
Benzoic acid, 2-hydroxy-, polymer with formaldehyde, 2-methylphenol and nonylphenol	68540-71-6
Formaldehyde, polymers with ethylenediamine and phenol nonyl derivs.	68583-69-7
Formaldehyde, polymer with ethylenediamine and phenol nonylderivatives, calcium salt	68583-70-0
Formaldehyde, polymers with branched 4-nonylphenol and ethylenediamine	1152269-15-2
Rosin, maleated, polymer with formaldehyde, pentaerythritoland 4-(1,1,3,3-tetramethylbutyl)phenol	68952-49-8
Fatty acids, tall oil, polymers with formaldehyde, maleic anhydride, pentaerythritol, rosin, stearic acid and 4-(1,1,3,3-tetramethylbutyl)phenol	68956-33-2
Formaldehyde, polymer with 4-(1,1-dimethylethyl)phenol, dinonylphenol and nonylphenol	68958-83-8
Formaldehyde, polymer with nonylphenol and oxirane, hydrogen sulfobutanedioate monosodium salt	69029-29-4
Formaldehyde, polymer with 4-(1,1-dimethylethyl)phenol, phenol and 4-(1,1,3,3-tetramethylbutyl)phenol	70750-60-6
Formaldehyde, polymer with 4-bromophenol and 4-octylphenol	70401-75-1
Benzoic acid, 2-hydroxy-, polymer with formaldehyde, 4-nonylphenol and zinc oxide (ZnO)	71077-22-0
Rosin, maleated, polymer with p-butylphenol, formaldehyde, glycerol and nonylphenol	71243-71-5
Hydrocarbons, C9-unsaturated, polymers with formaldehyde, rosin and 4-(1,1,3,3-tetramethylbutyl)phenol	71302-89-1

Chemical Name in the Inventory	CAS Number
Formaldehyde, polymer with 4-(1,1,3,3-tetramethylbutyl)phenol, vulcanization products with ethylene-5-ethylidenebicyclo[2.2.1]hept-2-ene-propene polymer and polypropylene	72162-18-6
Formaldehyde, polymer with 1,3-benzenedimethanamine, 4-(1,1-dimethylethyl)phenol, octylphenol and C,C,C-trimethyl-1,6-hexanediamine	72441-90-8
Formaldehyde, polymer with 4-(1,1,3,3-tetramethylbutyl)phenol, 6-diazo-5,6-dihydro-5-oxo-1-naphthalenesulfonate	84135-66-0
Fatty acids, tall oil, polymers with formaldehyde, glycerol, linseed oil, neopentyl glycol, nonylphenol, phthalic anhydride and polymerized linseed oil	103819-34-7
Poly(ethylene, propylene) glycol and ethoxylated (4-nonylphenol) formaldehyde resin, esters with polyacrylic acid	256653-60-8
Formaldehyde, polymer with branched nonylphenol, ethylene oxide and hexamethylenediamine	104376-66-1
Formaldehyde, polymers with branched nonylphenol, sulfonated, sodium salts	104376-67-2
Rosin, polymer with p-tert-butylphenol, formaldehyde, glycerol, nonylphenol and pentaerythritol	110775-74-1
Rosin, polymer with formaldehyde, glycerol and nonylphenol	110775-75-2
Poly(oxy-1,2-ethanediyl), .alpha.-hydro-.omega.-hydroxy-, mixed benzoate and sulfosuccinate, ether with formaldehyde nonylphenol polymers, sodium salt	111062-45-4
Formaldehyde, polymer with isononylphenol and oxirane, block	111497-90-6
Formaldehyde, polymer with isononylphenol, methyloxirane and oxirane, block	111497-91-7
Rosin, maleated, polymer with dinonylphenol, formaldehyde and pentaerythritol	112623-47-9

Chemical Name in the Inventory	CAS Number
Formaldehyde, polymer with isononylphenol, methyloxirane and oxirane	112742-89-9
Sulfurous acid, monosodium salt, reaction products with (cresol, formaldehyde, nonylphenol) polymer	115535-44-9
Sulfurous acid, monosodium salt, reaction products with (m-cresol, formaldehyde, nonylphenol) polymer	115559-71-2
Petroleum resins, polymers with dicyclopentadiene, formaldehyde, glycerol, maleic anhydride, rosin and 4-(1,1,3,3-tetramethylbutyl)phenol	119209-66-4
Rosin, polymer with p-tert-butylphenol, formaldehyde, glycerol and 4-(1,1,3,3-tetramethylbutyl)phenol	119209-67-5
Rosin, polymer with dicyclopentadiene, formaldehyde, pentaerythritol and 4-(1,1,3,3-tetramethylbutyl)phenol	119209-68-6
Rosin, polymer with formaldehyde and 4-(1,1,3,3-tetramethylbutyl)phenol	119209-69-7
Rosin, polymer with formaldehyde, glycerol and 4-(1,1,3,3-tetramethylbutyl)phenol	119209-70-0
2-Propenoic acid, polymer with formaldehyde, 4-octylphenol and 3a,4,7,7a-tetrahydro-4,7-methano-1H-indene	119337-95-0
Formaldehyde, polymer with 4-nonylphenol and oxirane, mono(hydrogen sulfate), ammonium salt, graft	120792-34-9
Rosin, polymer with formaldehyde, glycerol and octylphenol	126755-06-4
2-Propenoic acid, polymer with formaldehyde, methyloxirane,4-nonylphenol and oxirane	185529-31-1
Rosin, maleated, polymer with branched 4-nonylphenol, formaldehyde and pentaerythritol	185765-80-4

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

Grouping Rationale

The chemicals covered by this assessment are polymers with monomers that include both formaldehyde (CAS No. 50-00-0) and isomers of nonylphenol (NP) or octylphenol (OP).

During polymerisation, chemically inert methylene bridges form between NP and OP monomers and; therefore, polymers in this group are not expected to breakdown significantly following biological or chemical degradation (Kopf, 2002; The Environment Agency, 2009). Depending on polymerisation conditions, terminal methylol groups and a small proportion of dimethylene ether bridges may form (Kopf, 2002). This may result in the release of formaldehyde under certain conditions.

These polymers are generally expected to be of low concern to human health. However, the products manufactured using these polymers may contain low levels of free formaldehyde, NP or OP as impurities following incomplete polymerisation. They may also release formaldehyde (formaldehyde donors) when heated, for example as part of the curing process, or following alkaline or acidic hydrolysis of terminal methylol groups (Danish EPA, 2014). Breakdown of the polymers in the environment may also produce NP or OP.

Import, Manufacture and Use

Australian

Australian uses have been reported under previous mandatory and/or voluntary calls for information for other polymers containing formaldehyde not included in this assessment (CAS Nos. 68002-20-0, 68082-96-2, and 9011-05-6). Further information on the uses of these formaldehyde-based polymers are available at **www.nicnas.gov.au** (NICNASa).

Formaldehyde-based polymers may be used in products such as formaldehyde resins, film processing products, surface coating products, and preservatives in Australia. Other uses for these polymers may include cosmetic products and other consumer products such as fabric softeners, surface liquid cleaners and dishwashing liquids (NICNAS, 2006).

The chemical CAS No. 25301-02-4, under the name 'Tyloxapol', has reported non-industrial use as an active ingredient and excipient by the Therapeutic Goods Administration (TGA).

International

The following international uses have been identified through Galleria Chemica; the Substances in Preparations in Nordic countries (SPIN) database; the United States Environmental Protection Agency (US EPA) Chemical and Product Categories (CPCat); Danish EPA, 2015; and The Environment Agency, 2009:

International use data suggests NP and OP-formaldehyde resins are to some extent used interchangeably. This includes as rubber tackifiers in tyres (at concentrations normally of ~1.5 %, but up to 10 %), electrical insulating varnishes, printing inks (at concentrations of 7–8 %), adhesives, paper coatings, marine paints (at concentrations of ~25 %) and ethoxylated resins for off-shore oil recovery (OSPAR, 2006; The Environment Agency, 2009; Danish EPA, 2015).

Specific use information is available as follows:

The chemicals have reported domestic uses, including in:

- adhesives and binding agents (CAS Nos. 68152-62-5, 26678-93-3, 9040-65-7 and 37238-34-9); and
- paints, lacquers and varnishes (CAS Nos. 68152-62-5, 9040-65-7 and 55845-06-2).

The chemicals have reported commercial uses, including:

- in reprographic agents (CAS Nos. 68152-62-5 and 68480-36-4);
- in packaging and printing inks (CAS Nos. 68152-62-5, 31605-35-3, 55845-06-2, 69029-29-4 and 111062-45-4).
- as impregnation materials (for use with textiles, wood, leather and paper; CAS No. 55845-06-2);
- as thermoplastics suitable for wire coverings (CAS No. 72162-18-60); and
- in woven break lining (at a concentration of 20–30 %, CAS No. 26335-33-1).

The chemicals have reported site limited uses, including:

- as rubber curing agents (CAS Nos. 9086-40-2 and 26678-93-3);
- as plasticisers (CAS Nos. 68152-62-5 and 26678-93-3);

- as fuel additives (CAS Nos. 9040-65-7, 9091-65-7 and 63428-92-2);
- in the manufacture of fabricated metal products (CAS Nos. 9040-65-7, 9091-65-7 and 55845-06-2);
- as fluid property modulators (CAS No. 55845-06-2);
- in the manufacture of building materials (wood and cork; CAS No 55845-06-2); and
- in hydraulic fracturing fluids (CAS Nos. 30846-35-6 and 63428-92-2).

The following non-industrial uses have been identified for various chemicals in the group:

- as a therapeutic agent(CAS No. 25301-02-4; Tyloxapol); and
- as inert ingredients used in pesticides (CAS Nos. 30846-35-6, 37523-33-4, 55845-06-2 and 68152-62-5).

Some chemicals in this group have reported uses in food contact articles including adhesives, coatings, paper and paper board components, polymers and adjuvants and production aids (CAS Nos. 9086-40-2, 31605-35-3 and 26335-33-1).

Further information on the uses of formaldehyde-based polymers are available at **www.nicnas.gov.au** (NICNASa).

Restrictions

Australian

There are no restrictions specific to the use of polymers in Australia.

International

There are no restrictions specific to the use of these polymers internationally.

Existing Worker Health and Safety Controls

Hazard Classification

The polymers are not listed on the Hazardous Chemical Information System (HCIS) (Safe Work Australia).

Exposure Standards

Australian

No specific exposure standards are available.

Safe Work Australia has an exposure standard for formaldehyde. Where the polymers in this group contain free formaldehyde or release formaldehyde, exposure standards of 1.2 mg/m^3 (1 part per million) time weighted average (TWA) and 2.5 mg/m^3 (2 parts per million) short term exposure limit (STEL) apply.

International

There are no international exposure standards for the individual polymers in this group.

Health Hazard Information

The polymers in this group contain NP, OP and formaldehyde. It is considered that free NP and OP released following incomplete polymerisation, or following partial break down of the polymer, and formaldehyde released during curing or off-gassing will generally be the critical drivers of toxicity.

Nonyl- and octylphenol

Tier II Human Health risk assessments of NP, OP, and NP and OP ethoxylates and related compounds have been previously conducted by NICNAS under the IMAP framework (NICNASb, NICNASc, NICNASe). Assessments of nonylphenol-based polymers have also been conducted (NICNASf). These assessments are available at **www.nicnas.gov.au**.

The reports identify the critical health hazards of the alkylphenols and alkylphenol ethoxylates (which generally degrade to the alkylphenols). These include local effects (corrosivity), acute effects from oral exposure, and systemic long-term effects (reproductive and developmental toxicity). The chemicals have been shown to have weak oestrogenic activity, but there are currently no established adverse outcome pathways for weak oestrogenic activity. At the concentrations likely to be present from polymer breakdown, local and acute effects are not expected.

Incorporation of octyl or nonylphenol into a phenol/formaldehyde type polymer is expected to reduce the likelihood of release of the alkylphenols from the polymeric matrix compared with polymers where these are incorporated by hydrolysable links through oxygen.

Formaldehyde

Where the polymers in this group contain terminal methylol groups, there is potential for release of formaldehyde and toxicity. Free formaldehyde is extremely reactive. Its key health hazards have been previously described in the NICNAS PEC report (NICNAS, 2006) and in the IMAP Tier II human health assessment of formaldehyde donors (NICNASd).

In humans and experimental animals, formaldehyde is readily absorbed via all exposure routes. The critical health effects of formaldehyde for risk characterisation are sensory irritation and skin sensitisation. At higher exposure levels, formaldehyde is a probable carcinogen (IARC, 2006; NICNAS, 2006).

Formaldehyde causes moderate acute toxicity in animals following exposure via the oral, dermal and inhalation routes. When in solution, formaldehyde produces skin irritation and skin sensitisation. Following inhalational exposure, formaldehyde reacts rapidly at the site of contact and is quickly metabolised in the respiratory tissue. Upon inhalation, humans experience sensory irritation, which is defined as irritation of the nerve endings in the eyes and nose, and can produce symptoms including a sensation of stinging or burning in the eyes, nose and/or throat. The concentration of ambient formaldehyde at which these symptoms are reported to begin to occur is at 0.5 ppm and higher (NICNAS, 2006).

Formaldehyde (in solution) does not produce systemic toxicity following repeated oral or dermal exposures in animals. Repeated inhalational exposures to formaldehyde (as a gas) do not produce systemic toxicity. Studies show that the target organ following formaldehyde exposure is the nasal tract, where effects observed have included dose-dependent alterations in mucociliary clearance, cell proliferation and histopathological changes to the nasal epithelium (NICNAS, 2006).

Formaldehyde has been shown to be genotoxic in vitro. The chemical may also produce genotoxicity at the site of contact in vivo. Overall, the chemical is considered to possess weak genotoxic potential. Formaldehyde has been shown to produce squamous cell carcinomas in inhalational studies in rats, but not in mice and hamsters. Several epidemiological studies demonstrated that occupational exposure to formaldehyde may be associated with an increased risk of nasopharyngeal cancers; however, the data are not consistent. Formaldehyde exposure has also been associated with myeloid leukaemia; however, the available data are insufficient to establish a causal link. The International Agency for Research on Cancer has concluded that there are sufficient evidence to classify formaldehyde as a ‘known human carcinogen’ (IARC, 2006).

Chemical-specific data

Limited data are available on the health hazards of polymers in this group; however, based on their large molecular size, bioavailability is expected to be limited. Two polymers (CAS Nos. 68540-71-6 and 25301-02-4) were reported to have oral

median lethal dose (LD50) values of greater than 5000 mg/kg bw in rats (Galleria Chemica; RTECS). A third polymer (CAS No. 30846-35-6) was reported as a mild eye irritant in the standard Draize test in rabbits (100 µL, 24 hours) (RTECS).

A number reproductive studies with few details reported, were conducted via the intraperitoneal (i.p.) or intravenous (i.v.) routes were reported for a therapeutic substance, Tyloxapol (CAS No. 25301-02-4, an ethoxylated octylphenol reacted with formaldehyde). Female rats, mice and rabbits 6-11 days post conception received the chemical with lowest published toxic doses of 600-1600 mg/kg bw, 600-1200 mg/kg bw and 150-200 mg/kg bw (i.p.), respectively. In 2 additional studies, female rats 8-11 days post conception received the chemical with lowest published toxic doses of 1000 mg/kg bw (i.v.). This resulted in post-implantation mortality (at doses starting at 600 mg/kg bw (i.p) in rats and mice; and 200 mg/kg bw (i.p.) in rabbits); formation of extra embryonic structures including the placenta and umbilical cord (at a dose of 1000 mg/kg bw (i.v.) in rats); and developmental abnormalities affecting the central nervous system, eyes/ears, body wall and musculoskeletal system (at doses starting at 1600 mg/kg bw (i.p.) in rats; 600 mg/kg bw (i.p) in mice and 150 mg/kg bw (i.p.) in rabbits)(RTECS). Tyloxapol has been shown to inhibit lipid metabolism and subsequently induce hyperlipidaemia in animal models. Following a single 400 mg/kg bw (i.v.) dose in male Wistar rats, serum triglycerides, cholesterol and phospholipids increased 48, 6 and 7 fold, respectively (Rasouli et al., 2016).

Risk Characterisation

Critical Health Effects

The polymers in this group are not expected to contain or readily release significant quantities of NP or OP. As a result, no significant health effects are expected.

Where the polymers in this group degrade to free formaldehyde or are capable of releasing formaldehyde, the critical health effects for risk characterisation include sensory irritation and allergic skin reactions. Under some circumstances, workers may be exposed at levels where these effects may occur. In worksites where these polymers are produced and/or used, care should be taken to ensure formaldehyde levels are managed to prevent these adverse effects.

For polymers that contain free NP and OP the critical health effects for risk characterisation include local effects (corrosivity) and systemic long-term effects (reproductive and developmental toxicity). Any release of NP or OP from the polymers in this group is expected to be within concentration levels where local effects would not be observed.

Several polymers (CAS Nos. 68540-71-6, 9086-40-2, 63494-85-9, 104376-66-1, 37238-34-9) have been evaluated by Health Canada and Environment and Climate Change Canada — Rapid Screening of Polymers (Government of Canada, 2018). The polymers were determined to be ‘not likely to be of concern’ to human health and the environment.

Public Risk Characterisation

The reproductive effects associated with Tyloxapol (CAS No. 25301-02-4) likely result from the bioavailability of low molecular weight chemicals with therapeutic uses. These effects are not expected to be relevant to the equivalent high molecular weight polymers used industrially.

International information indicate the polymers in this group are used in consumer products (e.g. adhesives and paints) and building materials (e.g. pressed wood products) which may result in exposure to formaldehyde.

Unlike some other NP based polymers (NICNASf), release of NP and OP from the chemicals in this group is not expected except at low concentrations due to incomplete polymerisation (See **Grouping Rationale** section). NP- and OP-formaldehyde resins are estimated to contain approximately 3-4 % unreacted NP or OP; however, where these resins are further processed concentrations are expected to be significantly reduced (The Environment Agency, 2009; Danish EPA, 2015). For example, residual 4-tert-OP in tyres and ethoxylated resins was reported to be ~0.3 % and <0.01 %, respectively (The Environment Agency, 2009). At these concentrations systemic and local effects would not be observed and; therefore, are not considered to pose an unreasonable risk to public health.

The chemicals in this group may be used in food contact materials including adhesives, coatings, paper and paper board components, polymers and adjuvants and production aids. The EU Risk Assessment Report (EU RAR) on 4-NP(branched) and

NP estimates a systemic exposure of ~0.2 µg/kg/day NP from food contact articles. These levels are not considered a risk to human health, even in combination with exposure from other sources (EU RAR, 2002).

Australian Standards limit the amount of formaldehyde that can be released from reconstituted wood-based panels and flooring wood products supplied according to the Australian Standards (AS/NZS 1859.2:2004 - Australian/New Zealand Standard: Reconstituted wood-based panels—Specifications) also have the classification of formaldehyde emission limits indicated on the label (Standards Australia/Standards New Zealand, 2004). Use of wood products labelled in this way should ensure wood products of only low formaldehyde release are used.

Formaldehyde resins can be used in the textile industry as a finishing treatment to produce ‘permanent press’ fabric products including carpets, curtains, blankets, sheets, bedding, upholstery fabrics and garments. As formaldehyde is highly water soluble, washing these sorts of products where possible will generally reduce the amount of formaldehyde released from the fabric.

The Australian Competition and Consumer Commission (ACCC) has published safety guidance information on acceptable concentrations of formaldehyde in clothing, textiles and clothing finishes (ACCC, 2014).

The main potential for public exposure to formaldehyde-containing products is expected to be via the inhalation of indoor air. The levels of formaldehyde in the air in a home will depend on a number of factors, including the presence of emission sources such as the presence of those products listed above, the age and use patterns of the sources, indoor temperature and humidity, and ventilation of the home. NICNAS has a recommended indoor air guidance value of 80 parts per billion (ppb) for formaldehyde (NICNAS, 2006).

Before allowing occupation of mobile homes and of relocatable buildings by members of the public, manufacturers should aim to minimise levels of formaldehyde in indoor air and these should be designed to ensure the recommended indoor air guidance of 80 ppb is not exceeded. The pressed wood products should also be allowed to outgas under conditions of good ventilation (NICNAS, 2006). The overall risk to the public using the above products is low, both from breathing formaldehyde vapour and from absorption of formaldehyde into the skin, provided these precautions are taken. At these formaldehyde levels in public spaces, the carcinogenic risk is very low (NICNAS, 2006).

While the risk of health effects from exposure via the products listed above is generally low, individuals already sensitised to formaldehyde can experience skin reactions even at low concentrations. Therefore, caution is advised in the use of formaldehyde-containing products that come into contact with the skin. The SUSMP specifies limits for the levels of formaldehyde in cosmetic and domestic products (SUSMP, 2019). The current controls in Schedule 6 and 10 of the *Standard for the Uniform Scheduling of Medicines and Poisons* (SUSMP) are considered adequate to minimise the risk to public health posed by domestic and cosmetic products containing the polymers. Therefore, the polymers in this group are not considered to pose an unreasonable risk to public health provided the concentrations of the free formaldehyde present in products meet the SUSMP limit.

Occupational Risk Characterisation

During product formulation exposure might occur, particularly where manual or open processes are used. 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 effects of NPs and local effects of formaldehyde, the polymers in this group could pose an unreasonable risk to workers unless adequate control measures to minimise exposure and implemented. These polymers should be appropriately labelled to ensure that a person conducting a business or undertaking, e.g. employer, at a workplace, has adequate information to determine appropriate controls.

Workers may be inhalationally exposed to formaldehyde during off-gassing from unsealed or freshly cut pressed wood products, and from the associated dust particles.

Occupational risks from exposure to formaldehyde from these polymers can be mitigated by ensuring effective ventilation when these products are used in indoor environments. Handling and storage of pressed wood products should only be undertaken in well ventilated areas. When machining pressed wood products, the use of local exhaust ventilation which extracts dusts and vapours at source is recommended in controlling exposure to formaldehyde. If symptoms of burning, stinging or itching of the

eyes and/or nose, sore throat, watery eyes, blocked sinuses, runny nose or sneezing occurs, the worker is advised to move to an area with fresh air.

NICNAS Recommendation

Assessment of these polymers is considered to be sufficient, provided that all requirements are met under workplace health and safety and poisons legislation as adopted by the relevant state or territory.

NICNAS recommends that formulators of products containing these polymers should take into account the concentration of NP, OP and formaldehyde in the products when determining label instructions in order to take appropriate risk management measures to control the hazards stipulated in the HCIS.

It is recommended that occupational and public health controls for the formaldehyde vapours released from these polymers be implemented in line with the recommendations of the NICNAS PEC assessment report on formaldehyde (NICNAS 2006).

Regulatory Control

Public Health

At present, free formaldehyde or formaldehyde released from the products fall within the scope of the listing of 'Formaldehyde' in Schedules 6 and 10 of the SUSMP. Therefore, products containing the polymers in this group with more than 0.05 % free or readily available formaldehyde should be labelled in accordance with state and territory legislation (SUSMP, 2019).

Work Health and Safety

Based on available data, the amount of NP and OP expected to be available from these polymers is very low and; therefore, the health risk to workers from these polymers is controlled when adequate control measures to minimise occupational exposure and protective clothing are implemented.

Based on the available data, the polymers in this group are not recommended for hazard classification in the HCIS (Safe Work Australia). Should empirical data become available for the individual polymers indicating that a classification is appropriate, the data may be used to make recommendation(s) for classification.

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

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 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 that could minimise the risk include, but are not limited to:

- 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	**Rosin, maleated, polymer with formaldehyde, nonylphenol, pentaerythritol and stearic acid** gum rosin, polymer with maleic anhydride, nonylphenol, paraformaldehyde, pentaerythritol and stearic acid
CAS Number	428823-49-8
Structural Formula	**No Structural Diagram Available**
Molecular Formula	Unspecified
Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Rosin, maleated, polymer with p-tert-butylphenol, formaldehyde, pentaerythritol, stearic acid and (1,1,3,3-tetramethylbutyl)phenol** p-tert-butylphenol, polymer with gum rosin, maleic anhydride, octylphenol,

	paraformaldehyde, pentaerythritol and stearic acid
CAS Number	428824-49-1
Structural Formula	
Molecular Formula	Unspecified
Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Linseed oil, polymer with p-tert-butylphenol, formaldehyde, rosin, and (1,1,3,3-tetramethylbutyl)phenol** p-tert-butylphenol, polymer with gum rosin, linseed oil, octylphenol and paraformaldehyde
CAS Number	428826-36-2
Structural Formula	
Molecular Formula	Unspecified
Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Formaldehyde, polymer with oxirane and 4-(1,1,3,3-tetramethylbutyl)phenol** tyloxapol phenol, 4-(1,1,3,3-tetramethylbutyl)-, polymer with formaldehyde and oxirane p-isooctylpolyoxyethylenephenol, formaldehyde polymer ethylene oxide, polymer with formaldehyde and p-(1,1,3,3-tetramethylbutyl)phenol
CAS Number	25301-02-4
Structural Formula	**No Structural Diagram Available**
Molecular Formula	(C14H22O.C2H4O.CH2O)x
Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Formaldehyde, polymer with nonylphenol** nonylphenol, formaldehyde polymer
CAS Number	9040-65-7
Structural Formula	**No Structural Diagram Available**

Molecular Formula	(C15H24O.CH2O)x
Molecular Weight	Unspecified

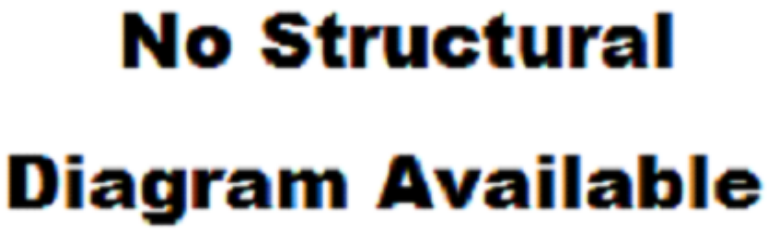
Chemical Name in the Inventory and Synonyms	**Formaldehyde, polymer with .alpha.-[4-(1,1,3,3-tetramethylbutyl)phenyl]-.omega.-hydroxypoly(oxy-1,2-ethanediyl)**
CAS Number	9046-29-1
Structural Formula	**No Structural Diagram Available**
Molecular Formula	((C2H4O)nC14H22O.CH2O)x
Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Formaldehyde, polymer with (1,1,3,3-tetramethylbutyl)phenol** octylphenol, formaldehyde polymer tert-octyl phenol, formaldehyde polymer
CAS Number	9086-40-2
Structural Formula	

	
Molecular Formula	(C14H22O.CH2O)x
Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Formaldehyde, polymer with 4-octylphenol** 4-octylphenol, formaldehyde polymer
CAS Number	26335-33-1
Structural Formula	
Molecular Formula	(C14H22O.CH2O)x
Molecular Weight	Unspecified

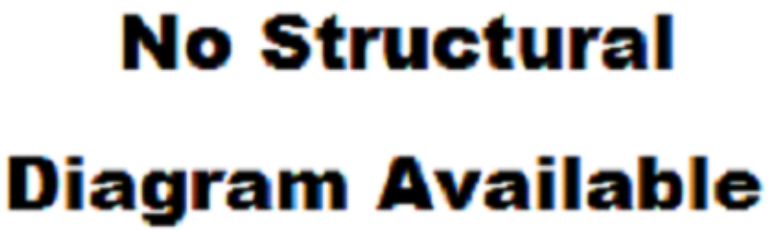
Chemical Name in the Inventory and Synonyms	**Formaldehyde, polymer with 4-(1,1,3,3-tetramethylbutyl)phenol** phenol, 4-(1,1,3,3-tetramethylbutyl)-, polymer with formaldehyde p-tert-octylphenol, formaldehyde polymer

CAS Number	26678-93-3
Structural Formula	
Molecular Formula	(C14H22O.CH2O)x
Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Formaldehyde, polymer with 4-nonylphenol and oxirane** p-nonylphenol, formaldehyde, oxirane polymer
CAS Number	30846-35-6
Structural Formula	
Molecular Formula	(C15H24O.C2H4O.CH2O)x
Molecular Weight	Unspecified

Chemical Name in the	**Formaldehyde, polymer with 4-nonylphenol**

Inventory and Synonyms	
CAS Number	31605-35-3
Structural Formula	
Molecular Formula	(C15H24O.CH2O)x
Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Formaldehyde, polymer with nonylphenol and phenol**
CAS Number	37238-34-9
Structural Formula	
Molecular Formula	(C15H24O.C6H6O.CH2O)x
Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Formaldehyde, polymer with methyloxirane and 4-nonylphenol** 4-nonylphenol, formaldehyde polymer, propoxylated
CAS Number	37523-33-4
Structural Formula	**No Structural Diagram Available**
Molecular Formula	(C15H24O.C3H6O.CH2O)x
Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Formaldehyde, polymer with methyloxirane, nonylphenol and oxirane, graft** formaldehyde, nonylphenol, ethoxylated polypropyleneglycol polymer nonyl phenol, formaldehyde, ethylene oxide, propylene oxide polymer
CAS Number	39335-54-1
Structural Formula	**No Structural Diagram Available**
Molecular Formula	(C15H24O.C3H6O.C2H4O.CH2O)x

Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Formaldehyde, polymer with nonylphenol and oxirane**
CAS Number	55845-06-2
Structural Formula	**No Structural Diagram Available**
Molecular Formula	(C15H24O.C2H4O.CH2O)x
Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Formaldehyde, polymer with .alpha.-(nonylphenyl)-.omega.-hydroxypoly(oxy-1,2-ethanediyl)** poly(oxy-1,2-ethanediyl), .alpha.-(nonylphenyl)-.omega.-hydroxy-, polymer with formaldehyde
CAS Number	59006-81-4
Structural Formula	

	
Molecular Formula	((C2H4O)nC15H24O.CH2O)x
Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Formaldehyde, polymer with 4-(1,1-dimethylethyl)phenol, dinonylphenol, nonylphenol and oxirane** p-tert-butylphenol nonylphenol, dinonylphenol, formaldehyde, oxirane polymer
CAS Number	68958-82-7
Structural Formula	
Molecular Formula	(C24H42O.C15H24O.C10H14O.C2H4O.CH2O)x
Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Formaldehyde, polymer with methyloxirane, 4-nonylphenol and oxirane** methyl oxirane, oxirane, 4-nonylphenol, formaldehyde polymer p-nonylphenol, formaldehyde copolymer, ethoxylated and propoxylated

CAS Number	63428-92-2
Structural Formula	**No Structural Diagram Available**
Molecular Formula	(C15H24O.C3H6O.C2H4O.CH2O)x
Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Formaldehyde, polymer with 2,4-dinonylphenol, 1,2-ethanediamine and 4-nonylphenol**
CAS Number	63428-94-4
Structural Formula	**No Structural Diagram Available**
Molecular Formula	(C24H42O.C15H24O.C2H8N2.CH2O)x
Molecular Weight	Unspecified

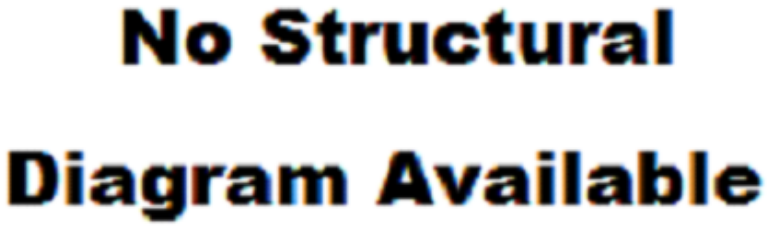
Chemical Name in the Inventory and Synonyms	**Formaldehyde, polymer with 4-methyl-2-nonylphenol and 4-methylphenol** 4-methyl-2-nonylphenol, polymer with formaldehyde and 4-methylphenol
CAS Number	63494-85-9
Structural Formula	**No Structural Diagram Available**
Molecular Formula	(C16H26O.C7H8O.CH2O)x
Molecular Weight	Unspecified

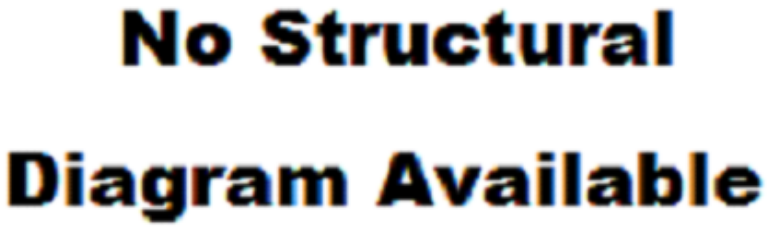
Chemical Name in the Inventory and Synonyms	**Formaldehyde, polymer with dinonylphenol and nonylphenol** dinonylphenol, nonylphenol, formaldehyde polymer phenol, dinonyl-, polymer with formaldehyde and nonylphenol polymer of nonylphenol, dinonylphenol and formaldehyde
CAS Number	63494-86-0
Structural Formula	**No Structural Diagram Available**
Molecular Formula	(C24H42O.C15H24O.CH2O)x

Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Rosin, fumarated, polymer with formaldehyde, glycerol, nonylphenol and pentaerythritol**
CAS Number	70248-44-1
Structural Formula	**No Structural Diagram Available**
Molecular Formula	(C15H24O.C5H12O4.C3H8O3.CH2O.)x
Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Rosin, maleated, polymer with formaldehyde, glycerol, nonylphenol and pentaerythritol**
CAS Number	70248-46-3
Structural Formula	

	
Molecular Formula	(C15H24O.C5H12O4.C3H8O3.CH2O.)x
Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Rosin, polymer with formaldehyde, 4-octylphenol and pentaerythritol** 4-octylphenol, polymer with formaldehyde and pentaerythritol modified with rosin
CAS Number	67700-46-3
Structural Formula	
Molecular Formula	(C14H22O.C5H12O4.CH2O.)x
Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**2-Propenoic acid, polymer with formaldehyde, 2,5-furandione, methyloxirane, 4-nonylphenol and oxirane**

CAS Number	67905-91-3
Structural Formula	No Structural Diagram Available
Molecular Formula	(C15H24O.C4H2O3.C3H6O.C3H4O2.C2H4O.CH2O)x
Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Formaldehyde, polymer with 4-(1,1-dimethylethyl)phenol, 4-(1,1-dimethylpropyl)phenol and 4-nonylphenol** 4-tert-butylphenol, 4-tert-amylphenol, 4-p-nonylphenol, formaldehyde polymer
CAS Number	67905-94-6
Structural Formula	No Structural Diagram Available
Molecular Formula	(C15H24O.C11H16O.C10H14O.CH2O)x
Molecular Weight	

Chemical Name in the Inventory and Synonyms	**Formaldehyde, polymer with 4-(1,1-dimethylethyl)phenol, nonylphenol and phenol** nonylphenol, 4-tert-butylphenol, phenol, formaldehyde polymer
CAS Number	68110-37-2
Structural Formula	**No Structural Diagram Available**
Molecular Formula	(C15H24O.C10H14O.C6H6O.CH2O)x
Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Formaldehyde, polymer with dinonylphenol, nonylphenol and oxirane** nonylphenol, dinonylphenol, formaldehyde, oxirane polymer
CAS Number	68140-83-0
Structural Formula	**No Structural Diagram Available**
Molecular Formula	(C24H42O.C15H24O.C2H4O.CH2O)x

Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Rosin, fumarated, polymer with dipentaerythritol, formaldehyde and nonylphenol** rosin, nonylphenol, formaldehyde, fumaric acid, dipentaerythritol polymer
CAS Number	68152-52-3
Structural Formula	**No Structural Diagram Available**
Molecular Formula	(C15H24O.C10H22O7.CH2O.)x
Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Rosin, maleated, polymer with formaldehyde, nonylphenol and pentaerythritol** rosin, maleic anhydride, pentaerythritol, nonylphenol, formaldehyde polymer
CAS Number	68152-62-5
Structural Formula	

	
Molecular Formula	(C15H24O.C5H12O4.CH2O.)x
Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Formaldehyde, polymer with 4-(1,1-dimethylethyl)phenol, 4-(1,1-dimethylpropyl)phenol, methyloxirane, 4-nonylphenol and oxirane**
CAS Number	68155-79-3
Structural Formula	
Molecular Formula	(C15H24O.C11H16O.C10H14O.C3H6O.C2H4O.CH2O)x
Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Formaldehyde, polymer with 4-(1,1-dimethylethyl)phenol, 4-nonylphenol and oxirane** p-nonylphenol, p-tert-butylphenol, formaldehyde, ethylene oxide polymer

CAS Number	68171-44-8
Structural Formula	**No Structural Diagram Available**
Molecular Formula	(C15H24O.C10H14O.C2H4O.CH2O)x
Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Formaldehyde, polymer with 4-isooctylphenol** formaldehyde, p-isooctylphenol copolymer
CAS Number	68184-25-8
Structural Formula	**No Structural Diagram Available**
Molecular Formula	(C14H22O.CH2O)x
Molecular Weight	Unspecified

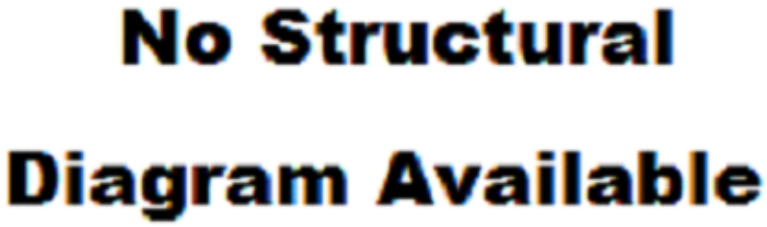
Chemical Name in the Inventory and Synonyms	**Formaldehyde, polymer with 4-(1,1-dimethylethyl)phenol, methyloxirane, 4-nonylphenol and oxirane** p-nonylphenol, p-tert-butylphenol, formaldehyde, ethylene oxide, propylene oxide polymer
CAS Number	68188-99-8
Structural Formula	**No Structural Diagram Available**
Molecular Formula	(C15H24O.C10H14O.C3H6O.C2H4O.CH2O)x
Molecular Weight	Unspecified

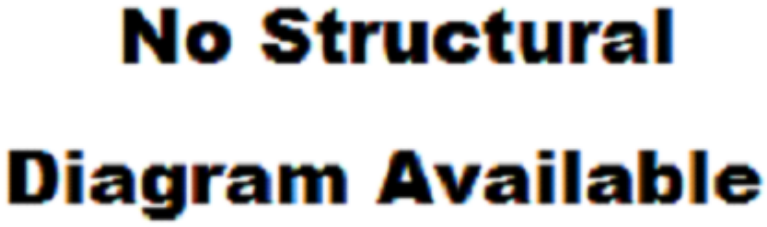
Chemical Name in the Inventory and Synonyms	**Formaldehyde, polymer with 4-(1,1-dimethylethyl)phenol and 4-octylphenol** p-tert-butylphenol, formaldehyde, 4-octylphenol polymer
CAS Number	68480-36-4
Structural Formula	**No Structural Diagram Available**
Molecular Formula	(C14H22O.C10H14O.CH2O)x

Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Formaldehyde, polymer with 4-nonylphenol, propoxylated** p-nonylphenol, formaldehyde polymer, propoxylated
CAS Number	68511-70-6
Structural Formula	**No Structural Diagram Available**
Molecular Formula	Unspecified
Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Rosin, polymer with formaldehyde, glycerol, pentaerythritoland (1,1,3,3-tetramethylbutyl)phenol** octyl phenol, formaldehyde, rosin, pentaerythritol, glycerol polymer
CAS Number	68512-70-9
Structural Formula	

	
Molecular Formula	(C14H22O.C5H12O4.C3H8O3.CH2O.)x
Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Benzoic acid, 2-hydroxy-, polymer with formaldehyde, 2-methylphenol and nonylphenol** 2-methylphenol, nonylphenol, salicylic acid, formaldehyde polymer
CAS Number	68540-71-6
Structural Formula	
Molecular Formula	(C15H24O.C7H8O.C7H6O3.CH2O)x
Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Formaldehyde, polymers with ethylenediamine and phenol nonyl derivs.** (C9) alkylated phenol, paraformaldehyde, ethylenediamine polymer

CAS Number	68583-69-7
Structural Formula	
Molecular Formula	
Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Formaldehyde, polymer with ethylenediamine and phenol nonylderivatives, calcium salt** (C9) alkylated phenol, paraformaldehyde, ethylene diamine reaction products, calcium salt
CAS Number	68583-70-0
Structural Formula	
Molecular Formula	(C6H6O.C2H8N2.CH2O.Ca)x
Molecular Weight	Unspecified

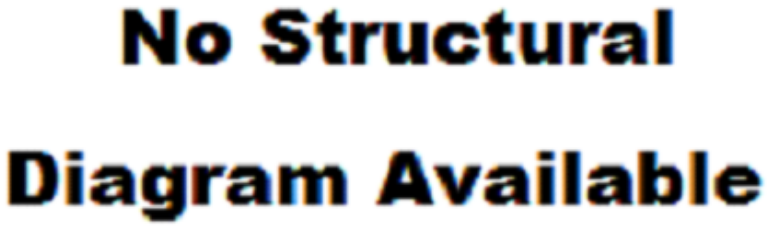
Chemical Name in the Inventory and Synonyms	**Formaldehyde, polymers with branched 4-nonylphenol and ethylenediamine** nonylphenol, formaldehyde, ethylenediamine polymer
CAS Number	1152269-15-2
Structural Formula	**No Structural Diagram Available**
Molecular Formula	Unspecified
Molecular Weight	Unspecified

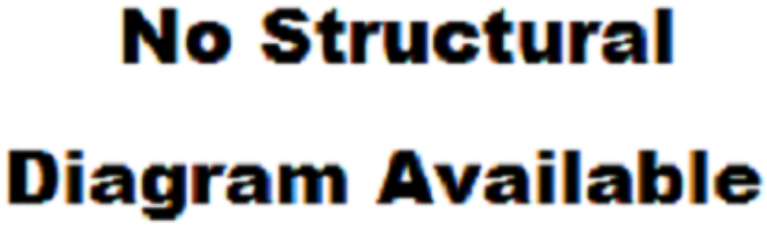
Chemical Name in the Inventory and Synonyms	**Rosin, maleated, polymer with formaldehyde, pentaerythritoland 4-(1,1,3,3-tetramethylbutyl)phenol**
CAS Number	68952-49-8
Structural Formula	**No Structural Diagram Available**
Molecular Formula	(C14H22O.C5H12O4.CH2O.)x

Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Fatty acids, tall oil, polymers with formaldehyde, maleic anhydride, pentaerythritol, rosin, stearic acid and 4-(1,1,3,3-tetramethylbutyl)phenol**
CAS Number	68956-33-2
Structural Formula	**No Structural Diagram Available**
Molecular Formula	(C18H36O2.C14H22O.C5H12O4.C4H2O3.CH2O..)x
Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Formaldehyde, polymer with 4-(1,1-dimethylethyl)phenol, dinonylphenol and nonylphenol** p-tert-butylphenol, nonylphenol, dinonylphenol, formaldehyde polymer
CAS Number	68958-83-8
Structural Formula	

	
Molecular Formula	(C24H42O.C15H24O.C10H14O.CH2O)x
Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Formaldehyde, polymer with nonylphenol and oxirane, hydrogen sulfobutanedioate monosodium salt**
CAS Number	69029-29-4
Structural Formula	
Molecular Formula	Unspecified
Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Formaldehyde, polymer with 4-(1,1-dimethylethyl)phenol, phenol and 4-(1,1,3,3-tetramethylbutyl)phenol** phenol, p-tert-butylphenol, p-tert-octylphenol, formaldehyde polymer

CAS Number	70750-60-6
Structural Formula	**No Structural Diagram Available**
Molecular Formula	(C14H22O.C10H14O.C6H6O.CH2O)x
Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Formaldehyde, polymer with 4-bromophenol and 4-octylphenol** phenol, 4-bromo-, polymer with formaldehyde and 4-octylphenol
CAS Number	70401-75-1
Structural Formula	**No Structural Diagram Available**
Molecular Formula	(C14H22O.C6H5BrO.CH2O)x
Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Benzoic acid, 2-hydroxy-, polymer with formaldehyde, 4-nonylphenol and zinc oxide (ZnO)** 4-nonylphenol, 2-hydroxybenzoic acid, formaldehyde, zinc oxide polymer
CAS Number	71077-22-0
Structural Formula	**No Structural Diagram Available**
Molecular Formula	(C15H24O.C7H6O3.CH2O.OZn)x
Molecular Weight	Unspecified

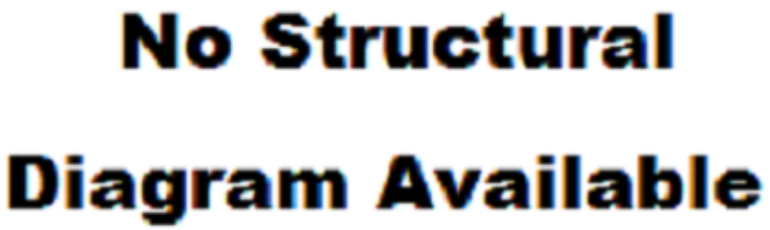
Chemical Name in the Inventory and Synonyms	**Rosin, maleated, polymer with p-butylphenol, formaldehyde, glycerol and nonylphenol** nonylphenol, p-butylphenol, rosin, formaldehyde, maleic anhydride, glycerol polymer
CAS Number	71243-71-5
Structural Formula	**No Structural Diagram Available**
Molecular Formula	(C15H24O.C10H14O.C3H8O3.CH2O.)x

Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Hydrocarbons, C9-unsaturated, polymers with formaldehyde, rosin and 4-(1,1,3,3-tetramethylbutyl)phenol**
CAS Number	71302-89-1
Structural Formula	**No Structural Diagram Available**
Molecular Formula	(C14H22O.CH2O..)x
Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Formaldehyde, polymer with 4-(1,1,3,3-tetramethylbutyl)phenol, vulcanization products with ethylene-5-ethylidenebicyclo[2.2.1]hept-2-ene-propene polymer and polypropylene**
CAS Number	72162-18-6
Structural Formula	

	
Molecular Formula	(C14H22O.C9H12.C3H6.C2H4.CH2O)x
Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Formaldehyde, polymer with 1,3-benzenedimethanamine, 4-(1,1-dimethylethyl)phenol, octylphenol and C,C,C-trimethyl-1,6-hexanediamine** 1,3-benzenedimethanamine, polymer with 4-(1,1-dimethylethyl)phenol, octylphenol, paraformaldehyde and C,C,C-trimethyl-1,6-hexanediamine 1,6-hexanediamine, C,C,C-trimethyl-, polymer with 1,3-benzenedimethanamine, 4-(1,1-dimethylethyl)phenol, octylphenol and paraformaldehyde paraformaldehyde, polymer with 1,3-benzenedimethanamine, 4-(1,1-dimethylethyl)phenol, octylphenol and C,C,C-trimethyl-1,6-hexanediamine phenol, 4-(1,1-dimethylethyl)-, polymer with 1,3-benzenedimethanamine, octylphenol, paraformaldehyde and trimethyl-1,6-hexanediamine
CAS Number	72441-90-8
Structural Formula	
Molecular Formula	(C14H22O.C10H14O.C9H22N2.C8H12N2.CH2O)x
Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Formaldehyde, polymer with 4-(1,1,3,3-tetramethylbutyl)phenol, 6-diazo-5,6-dihydro-5-oxo-1-naphthalenesulfonate**
CAS Number	84135-66-0
Structural Formula	**No Structural Diagram Available**
Molecular Formula	(C14H22O.CH2O)x.xC10H6N2O4S
Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Fatty acids, tall oil, polymers with formaldehyde, glycerol, linseed oil, neopentyl glycol, nonylphenol, phthalic anhydride and polymerized linseed oil** linseed oil, polymer with dimerised linseed oil, tall oil fatty acids, glycerol, neopentylglycol, phthalic anhydride, nonylphenol and formaldehyde
CAS Number	103819-34-7
Structural Formula	**No Structural Diagram Available**

Molecular Formula	(C15H24O.C8H4O3.C5H12O2.C3H8O3.CH2O..)x
Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Poly(ethylene, propylene) glycol and ethoxylated (4-nonylphenol) formaldehyde resin, esters with polyacrylic acid**
CAS Number	256653-60-8
Structural Formula	**No Structural Diagram Available**
Molecular Formula	
Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Formaldehyde, polymer with branched nonylphenol, ethylene oxide and hexamethylenediamine** oxirane, polymer with branched nonylphenol, formaldehyde and 1,6-hexamethylenediamine
CAS Number	104376-66-1
Structural Formula	

	
Molecular Formula	(C6H16N2.C2H4O.CH2O.)x
Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Formaldehyde, polymers with branched nonylphenol, sulfonated, sodium salts**
CAS Number	104376-67-2
Structural Formula	
Molecular Formula	(CH2O.Na.)x
Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Rosin, polymer with p-tert-butylphenol, formaldehyde, glycerol, nonylphenol and pentaerythritol**

CAS Number	110775-74-1
Structural Formula	
Molecular Formula	(C15H24O.C10H14O.C5H12O4.C3H8O3.CH2O.)x
Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Rosin, polymer with formaldehyde, glycerol and nonylphenol**
CAS Number	110775-75-2
Structural Formula	
Molecular Formula	(C15H24O.C3H8O3.CH2O.)x
Molecular Weight	Unspecified

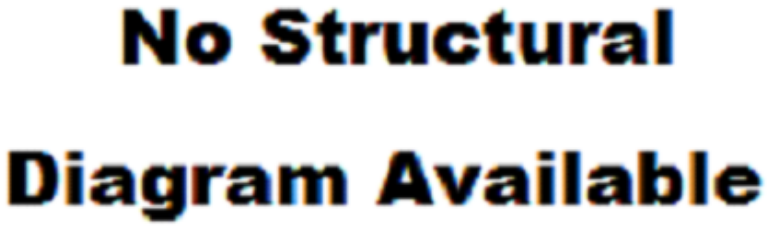
Chemical Name in the Inventory and Synonyms	**Poly(oxy-1,2-ethanediyl), .alpha.-hydro-.omega.-hydroxy-, mixed benzoate and sulfosuccinate, ether with formaldehyde nonylphenol polymers, sodium salt**
CAS Number	111062-45-4
Structural Formula	**No Structural Diagram Available**
Molecular Formula	(C15H24O.(C2H4O)nH2O.CH2O.Na)x
Molecular Weight	Unspecified

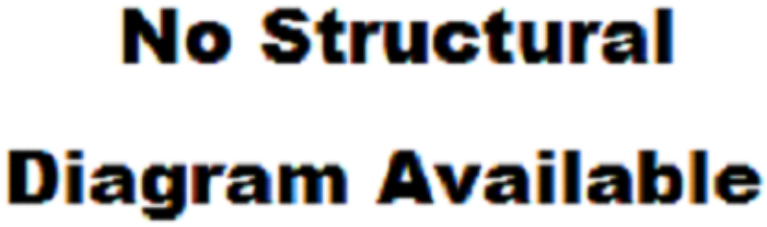
Chemical Name in the Inventory and Synonyms	**Formaldehyde, polymer with isononylphenol and oxirane, block** oxirane, polymer with formaldehyde and isononylphenol, block
CAS Number	111497-90-6
Structural Formula	**No Structural Diagram Available**
Molecular Formula	(C15H24O.C2H4O.CH2O)x

Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Formaldehyde, polymer with isononylphenol, methyloxirane and oxirane, block** oxirane, polymer with formaldehyde, isononylphenol and methyloxirane, block
CAS Number	111497-91-7
Structural Formula	**No Structural Diagram Available**
Molecular Formula	(C15H24O.C3H6O.C2H4O.CH2O)x
Molecular Weight	Unspecified

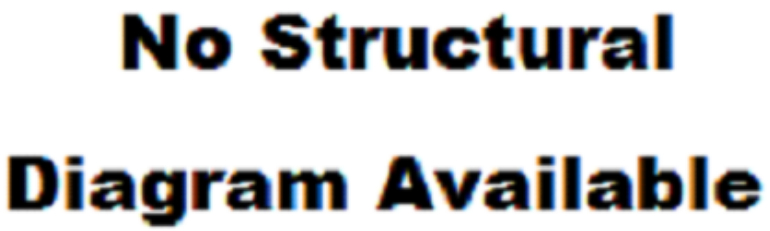
Chemical Name in the Inventory and Synonyms	**Rosin, maleated, polymer with dinonylphenol, formaldehyde and pentaerythritol**
CAS Number	112623-47-9
Structural Formula	

	
Molecular Formula	(C24H42O.C5H12O4.CH2O.)x
Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Formaldehyde, polymer with isononylphenol, methyloxirane and oxirane** oxirane, polymer with formaldehyde, isononylphenol and methyloxirane
CAS Number	112742-89-9
Structural Formula	
Molecular Formula	(C15H24O.C3H6O.C2H4O.CH2O)x
Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Sulfurous acid, monosodium salt, reaction products with (cresol, formaldehyde, nonylphenol) polymer**

CAS Number	115535-44-9
Structural Formula	
Molecular Formula	(C15H24O.C7H8O.CH2O.H2O3S.Na)x
Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Sulfurous acid, monosodium salt, reaction products with (m-cresol, formaldehyde, nonylphenol) polymer**
CAS Number	115559-71-2
Structural Formula	
Molecular Formula	(C15H24O.C7H8O.CH2O.H2O3S.Na)x
Molecular Weight	Unspecified

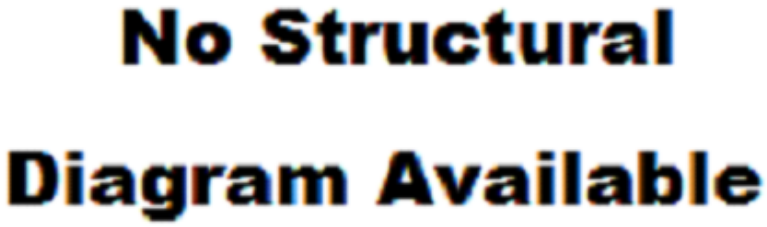
Chemical Name in the Inventory and Synonyms	**Petroleum resins, polymers with dicyclopentadiene, formaldehyde, glycerol, maleic anhydride, rosin and 4-(1,1,3,3-tetramethylbutyl)phenol**
CAS Number	119209-66-4
Structural Formula	**No Structural Diagram Available**
Molecular Formula	(C14H22O.C10H12.C4H2O3.C3H8O3.CH2O..)x
Molecular Weight	Unspecified

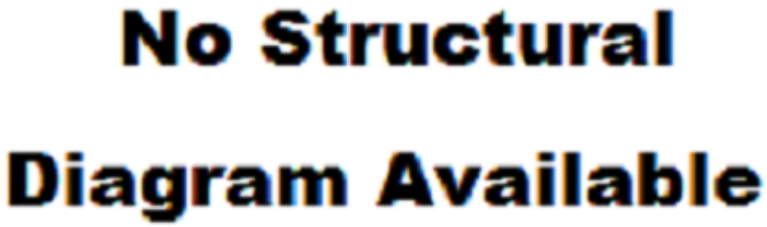
Chemical Name in the Inventory and Synonyms	**Rosin, polymer with p-tert-butylphenol, formaldehyde, glycerol and 4-(1,1,3,3-tetramethylbutyl)phenol**
CAS Number	119209-67-5
Structural Formula	**No Structural Diagram Available**
Molecular Formula	(C14H22O.C10H14O.C3H8O3.CH2O.)x

Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Rosin, polymer with dicyclopentadiene, formaldehyde, pentaerythritol and 4-(1,1,3,3-tetramethylbutyl)phenol**
CAS Number	119209-68-6
Structural Formula	**No Structural Diagram Available**
Molecular Formula	(C14H22O.C10H12.C5H12O4.CH2O.)x
Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Rosin, polymer with formaldehyde and 4-(1,1,3,3-tetramethylbutyl)phenol**
CAS Number	119209-69-7
Structural Formula	

	
Molecular Formula	(C14H22O.CH2O.)x
Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Rosin, polymer with formaldehyde, glycerol and 4-(1,1,3,3-tetramethylbutyl)phenol**
CAS Number	119209-70-0
Structural Formula	
Molecular Formula	(C14H22O.C3H8O3.CH2O.)x
Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**2-Propenoic acid, polymer with formaldehyde, 4-octylphenol and 3a,4,7,7a-tetrahydro-4,7-methano-1H-indene**

CAS Number	119337-95-0
Structural Formula	**No Structural Diagram Available**
Molecular Formula	(C14H22O.C10H12.C3H4O2.CH2O)x
Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Formaldehyde, polymer with 4-nonylphenol and oxirane, mono(hydrogen sulfate), ammonium salt, graft**
CAS Number	120792-34-9
Structural Formula	**No Structural Diagram Available**
Molecular Formula	Unspecified
Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Rosin, polymer with formaldehyde, glycerol and octylphenol**
CAS Number	126755-06-4
Structural Formula	**No Structural Diagram Available**
Molecular Formula	(C14H22O.C3H8O3.CH2O.)x
Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**2-Propenoic acid, polymer with formaldehyde, methyloxirane,4-nonylphenol and oxirane**
CAS Number	185529-31-1
Structural Formula	**No Structural Diagram Available**
Molecular Formula	(CH2O.C3H4O2.C15H24O.C3H6O.C2H4O)x

Molecular Weight	Unspecified

Chemical Name in the Inventory and Synonyms	**Rosin, maleated, polymer with branched 4-nonylphenol, formaldehyde and pentaerythritol**
CAS Number	185765-80-4
Structural Formula	**No Structural Diagram Available**
Molecular Formula	Unspecified
Molecular Weight	Unspecified

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