Polymers including formaldehyde and Bisphenol S (BPS): Human health tier II assessment

28 June 2019

Chemicals in this assessment

Chemical Name in the Inventory	CAS Number
Naphthalenesulfonic acid, polymer with formaldehyde and 4,4'-sulfonylbis[phenol]	9017-72-5
2-Naphthalenesulfonic acid, polymer with formaldehyde and 4,4'-sulfonylbis[phenol]	27416-78-0
Formaldehyde, polymer with 4,4'-sulfonylbis[phenol]	27775-64-0
Benzenesulfonic acid, 4-hydroxy-, polymer with formaldehydeand 4,4'-sulfonylbis[phenol]	31455-16-0
Sulfurous acid, disodium salt, polymer with formaldehyde and 4,4'-sulfonylbis[phenol]	37372-10-4
Formaldehyde, polymer with sulfonylbis[phenol]	51990-55-7
Naphthalenesulfonic acid, sodium salt, polymer with formaldehyde and 4,4'-sulfonylbis[phenol]	63951-50-8

Chemical Name in the Inventory	CAS Number
Formaldehyde, polymer with sulfonated naphthalene and 4,4'-sulfonylbis[phenol]	68411-62-1
Benzenesulfonic acid, methyl(methylphenoxy)-, polymer with formaldehyde and 4,4'-sulfonylbis[phenol]	68567-70-4
Naphthalenesulfonic acid, polymer with formaldehyde and 4,4'-sulfonylbis[phenol], sodium salt	69961-73-5
Benzenesulfonic acid, hydroxy-, monosodium salt, polymer with formaldehyde and 4,4'-sulfonylbis[phenol]	71832-81-0
Formaldehyde, polymer with 4,4'-sulfonylbis[phenol], sulfomethylated, sodium salts	73892-06-5
Benzenesulfonic acid, 4-hydroxy-, polymer with formaldehydeand 4,4'-sulfonylbis[phenol], sodium salt	75199-12-1
Naphthalenesulfonic acids, polymers with formaldehyde, sulfonated 1,1'-oxybis[methylbenzene] and sulfonylbis[phenol], ammonium sodium salts	82640-14-0
Formaldehyde, polymers with sulfonated 1,1'-oxybis[methylbenzene] and sulfonylbis[phenol], ammonium sodium salts	82640-16-2
Lignosulfonic acid, sodium salt, polymer with formaldehyde, hydroxybenzenesulfonic acid and 4,4'-sulfonylbis(phenol), sodium salt	94334-57-3
Benzenesulfonic acid, hydroxy-, polymer with formaldehyde and 4,4'-sulfonylbis[phenol], sodium salt	94334-58-4
Benzenesulfonic acid, polymer with formaldehyde and 4,4'-sulfonylbis(phenol)	96318-41-1
Benzenesulfonic acid, 4-hydroxy-, polymer with formaldehyde, 4,4'-sulfonylbis[phenol] and urea	102561-66-0
Sulfurous acid, monosodium salt, compound with formaldehydepolymer with 4,4'-sulfonylbis[phenol]	102958-53-2

Chemical Name in the Inventory	CAS Number
Naphthalenesulfonic acids, polymers with formaldehyde and 4,4'-sulfonylbis[phenol], ammonium salts	103332-00-9

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 chemicals in this group are polymers with monomers that contain both:

- bisphenol S (4,4'-sulfonyldiphenol (BPS), CAS No. 80-09-1); and
- formaldehyde (CAS No. 50-00-0).

The polymers in this group are generally considered to be of low concern to human health based on their end-related commercial use in the manufacture of textiles (see **Import, manufacture and use** section).

In the worst-case scenario, due to the formaldehyde monomer, the polymers may contain free formaldehyde or may release some, or all the formaldehyde they contain (formaldehyde donors). The hazardous properties of free formaldehyde or released formaldehyde is the main driver for acute toxicity related to these polymers (NICNASa). In comparison, the BPS monomer (potential release of BPS as a result of incomplete polymerisation or hydrolysis from the polymers), is not expected to be a degradation product of concern at levels that produce risk to human health (NICNASb). It is likely that the conditions of polymerisation will ring-alkylate the BPS monomer by reaction with formaldehyde, and so regeneration of BPS from the finished polymer molecule is not likely.

Import, Manufacture and Use

Australian

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

International

The following international uses have been identified through Galleria Chemica, the Substances in Preparations in Nordic Countries (SPIN) database and the Health Canada Chemicals Management Plan 3 Draft Screening Assessment (Health Canada, 2019).

Some of the polymers in this group (CAS Nos. 9017-72-5, 71832-81-0, 37372-10-4, 69961-73-5 and 102958-53-2) have reported commercial uses including:

- in pigment, dye and printing inks;
- in impregnation materials;
- in the manufacture of textile products and finishes;
- in the manufacture of leather/tanning applications;
- as surface treatments; and
- as fixing agents.

The polymer (CAS No. 9017-72-5) has reported site-limited use as an intermediate in the primary manufacture of textiles.

Restrictions

Australian

There are no restrictions specific to the use of these polymers in Australia or for the monomer BPS (SUSMP, 2019).

However, due to the formaldehyde monomer, if the polymers in this group contain free formaldehyde or if formaldehyde is released from formaldehyde donors, these polymers may be covered by the entry for ‘Formaldehyde’ in Schedule 6 and

Schedule 10 of the *Poisons Standard— the Standard for the Uniform Scheduling of Medicines and Poisons* (SUSMP, 2019) as follows:

Schedule 6:

'FORMALDEHYDE (excluding its derivatives) in preparations containing 0.05 per cent or more of free formaldehyde **except**:

(a) for human therapeutic use;

(b) in oral hygiene preparations;

(c) in nail hardener cosmetic preparations containing 5 per cent or more of free formaldehyde;

(d) in nail hardener cosmetic preparations containing 0.2 per cent or less of free formaldehyde when labelled with the statement: PROTECT CUTICLES WITH GREASE OR OIL;

(e) in all other cosmetic preparations; or

(f) in other preparations containing 0.2 per cent or less of free formaldehyde when labelled with the warning statement: CONTAINS FORMALDEHYDE.'

Schedule 6 chemicals are labelled with 'Poison' and are 'substances with a moderate potential for causing harm, the extent of which can be reduced through the use of distinctive packaging with strong warnings and safety directions on the label'.

Schedule 10:

'FORMALDEHYDE (excluding its derivatives):

(a) in oral hygiene preparations containing more than 0.1 per cent of free formaldehyde;

(b) in aerosol sprays for cosmetic use containing 0.005 per cent or more of free formaldehyde;

(c) in nail hardener cosmetic preparations containing 5 per cent or more of free formaldehyde; or

(d) in all other cosmetic preparations containing 0.05 per cent or more of free formaldehyde **except** in preparations containing 0.2 per cent or less of free formaldehyde when labelled with the warning statement: CONTAINS FORMALDEHYDE.'

Schedule 10 chemicals are 'substances, other than those included in Schedule 9, of such danger to health as to warrant prohibition of sale, supply and use'.

Formaldehyde donors are mentioned in the definition of free formaldehyde in Part I of the *Poisons Standard* (SUSMP, 2019) as follows:

"Free formaldehyde" includes all hydrated and non-hydrated formaldehyde present in aqueous solution, including methylene glycol and formaldehyde released from formaldehyde donors.

International

No known restrictions specific to these polymers have been identified.

However, due to the formaldehyde monomer, the polymers in this group may contain free formaldehyde or release formaldehyde from formaldehyde donors and; therefore, may be subject to the restrictions on formaldehyde, under certain conditions.

Using formaldehyde in cosmetics in the European Union (EU) is subject to the restrictions described in EU Regulation, Annex III (List of substances which cosmetic products must not contain except subject to the restrictions laid down) and Annex V (List of preservatives allowed in cosmetic products) (CosIng).

Formaldehyde may be present in the following cosmetic and personal care products (CosIng):

- nail hardening products at a maximum concentration of 5 % in ready for use preparation; if the concentration exceeds 0.05 %, the label must indicate 'Contains formaldehyde';
- preservatives for oral products with a maximum concentration of 0.1 % as free formaldehyde in ready for use preparation; and
- preservatives for other products with a maximum concentration of 0.2 % as free formaldehyde in ready for use preparation.

Existing Worker Health and Safety Controls

Hazard Classification

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

The monomer formaldehyde (CAS No. 50-00-0) is individually classified as hazardous, and has the following hazard categories and hazard statements for human health in the HCIS (Safe Work Australia):

Acute toxicity (oral) – Category 3; H301 (Toxic if swallowed)

Acute toxicity (dermal) – Category 3; H311 (Toxic in contact with skin)

Acute toxicity (inhalation) – Category 2; H330 (Fatal if inhaled)

Skin corrosion – Category 1; H314 (Causes severe skin burns and eye damage)

Skin sensitisation – Category 1; H317 (May cause an allergic skin reaction)

Carcinogencity – Category 1B; H350i (May cause cancer by inhalation)

The monomer BPS (CAS No. 80-09-1) is individually classified as hazardous, and has the following hazard categories and hazard statements for human health in the HCIS (Safe Work Australia):

Reproductive toxicity – Category 2; H361f (Suspected of damaging fertility)

Exposure Standards

Australian

There are no specific exposure standards available for the polymers in this group or for the monomer BPS.

Safe Work Australia has an exposure standard for the monomer formaldehyde. Where the polymers in this group contain free formaldehyde or release formaldehyde, exposure standards of 1.2 mg/m³ (1 part per million) time weighted average (TWA) and 2.5 mg/m³ (2 parts per million) short term exposure limit (STEL) apply.

International

There are no specific exposure standards available for the polymers in this group.

Health Hazard Information

The chemicals in this group are polymers with monomers that contain both bisphenol S (4,4'-sulfonyldiphenol, CAS No. 80-09-1) and formaldehyde (CAS No. 50-00-0). No specific studies are available for the chemicals in this group. The bioavailability of

these polymers is likely to be negligible due to their large molecular size. End use in commercial applications including the manufacture of textiles will further reduce the risk from the polymers. Formaldehyde may be released through their decomposition (whether from environmental degradation or during end use) and will generally be the main driver of toxicity for sensory irritation and allergic skin reactions, as compared to BPS.

The critical health hazards of the monomers formaldehyde and BPS have been previously identified in the NICNAS Tier II Human Health assessments under the Inventory Multi-tiered Assessment and Prioritisation (IMAP) Framework. These include local effects and systemic acute effects from dermal and inhalational exposure (sensory irritation and allergic skin reactions) associated with free formaldehyde; and systemic long-term effects (reproductive and developmental toxicity) associated with BPS (NICNASa; NICNASb).

Free formaldehyde is extremely reactive, and its key health hazards are those identified in the NICNAS Priority Existing Chemical (PEC) assessment of formaldehyde (NICNAS, 2006) and the NICNAS IMAP Tier II Human Health assessment of polymers containing formaldehyde monomers (NICNASa).

Bisphenol S is classified; as hazardous with a hazard category for Reproductive toxicity – Category 2, and hazard statement 'Suspected of damaging fertility (H361f)' (Safe Work Australia) based on adverse effects related to reproductive and developmental parameters (prolongation of estrous cycle and diestrus period, decreased fertility index and decreased implantation index). The NICNAS IMAP Tier II Human Health assessment of BPS-based polymers (NICNASb) identifies the key health hazards associated with BPS (including analogues bisphenol A [phenol, 4,4'-(1-methylethylidene)bis-, (CAS No. 80-05-7)] and related polymers) (NICNASb).

Risk Characterisation

Critical Health Effects

The polymers in this group may release formaldehyde under normal circumstances. Release of BPS when in normal use is not expected.

Any release of BPS is expected to be well within concentration levels where systemic or local effects would not be observed. Therefore, no significant health effects are expected from the presence of BPS in these polymers.

Polymers in this group which do not readily release/produce free formaldehyde, are not expected to have significant health effects. However, 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.

Sensory irritation is defined as irritation of the nerve endings in the eyes and nose and can produce symptoms such as stinging or burning sensations in the eyes, nose and/or a sore throat. The level of formaldehyde in the air at which these symptoms have been known to start to occur is 0.5 parts per million (ppm). Long term exposure to higher levels of gaseous formaldehyde may lead to certain cancers (NICNAS, 2006).

The polymer identified as CAS No. 71832-81-0 in this group has been evaluated by Health Canada and Environment and Climate Change Canada as part of the Chemicals Management Plan’s Rapid Screening of Polymers (Health Canada, 2019). The polymer was subject to screening and was assessed as not posing a concern to human health and the environment.

Public Risk Characterisation

In the absence of Australian use information for the polymers in this group, international information indicate predominantly commercial use in the manufacture of formaldehyde resin products within the textile industry (see **Import, manufacture and use** section).

Formaldehyde resins are used in textile finishes that produce a durable ‘permanent press’ type fabric. Carpets, curtains, blankets, sheets, garments and upholstery items used in the home may be treated with formaldehyde containing products. Formaldehyde is very water soluble, and washing the new garments or blankets before wearing or using will generally reduce the amount of formaldehyde released from the fabric.

Formaldehyde can be released as a vapour, due to off-gassing from products containing formaldehyde-based resins. Increased levels of formaldehyde in air can occur if resin is heated to temperatures where it decomposes or when in contact with high humidity levels. Breathing formaldehyde vapour can result in irritation of nerves in the eyes and nose, which may cause burning, stinging or itching sensations, a sore throat, teary eyes, blocked sinuses, runny nose, and sneezing (NICNAS, 2006).

Formaldehyde is released from textile finishes, such as those conferring crease resistance, while the garment is new. These textile finishes are most likely to be used in fabrics that otherwise crease easily, such as cotton or wool. The most likely health effects arising from the release of formaldehyde from textile products such as blankets and clothing are irritation of the eyes and nose, and allergic reactions on skin in contact with the fabric.

The Australian Competition and Consumer Commission (ACCC) has published safety guidance on concentrations of formaldehyde in clothing, textiles and clothing finishes (ACCC, 2014). Provided this guidance is followed, the public risk from these polymers are low based on their uses. Public and occupational risks associated with uses outside the scope of this assessment will be covered under the NICNAS IMAP Tier II Human Health assessment of polymers containing formaldehyde monomers (NICNASa).

Occupational Risk Characterisation

During product formulation, dermal, ocular and inhalation 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.

Based on the available data the amount of formaldehyde and BPS expected to be available from these chemicals is very low and; therefore, these polymers are unlikely to pose a risk to workers. Information in this report can be used by a person conducting a business or undertaking (PCBU) at a workplace (such as an employer) to determine the appropriate controls.

However, in the worst-case-scenario, workers may be exposed to formaldehyde-containing products by both inhalation and skin contact, ingestion is unlikely to be a route of exposure in the occupational environment. Under extreme conditions, workers may be exposed by breathing in fumes from formaldehyde-containing products as a result of off-gassing from unsealed or freshly cut pressed wood and the associated dust particles. Exposure can also occur from breathing in dust particles containing formaldehyde. Inhalation of aerosol droplets from accidental releases or some application modes such as spraying or brushing is also possible. Formaldehyde-containing particles can be inhaled when paraformaldehyde or formaldehyde resin powder is being used in the workplace. Dermal exposure may occur from spills and splashes and exposure of the skin to aerosol droplets during formulation process.

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 the breakdown formaldyde (whether the polymer contains free formaldehyde or releases formaldehyde) and BPS in the products when determining label instructions in order to take appropriate risk management measures to control the hazards stipulated in the HCIS, and the advice and controls in the SUSMP.

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 formaldehyde and BPS expected to be available from these polymers is very low and; therefore, the polymers in this group are not recommended for classification in the Hazardous Chemical Information System (HCIS). 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.

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

Advice for consumers

Products containing the polymers in this group should be used according to the instructions on the label.

Advice for industry

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

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

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.

Obligations under workplace health and safety legislation

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

- ensuring that hazardous chemicals are correctly classified and labelled;
- ensuring that (material) safety data sheets ((M)SDS) containing accurate information about the hazards (relating to both health hazards and physicochemical (physical) hazards) of the chemical are prepared; and

- managing risks arising from storing, handling and using a hazardous chemical.

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

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

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

References

Australian Competition and Consumer Commission (ACCC), 2014. Safety guidance on concentrations of particular chemicals in certain consumer goods, Oct 2014. Accessed June 2019 at **https://www.productsafety.gov.au/publication/safety-guidance-on-concentrations-of-particular-chemical**s-in-certain-consumer-goods

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National Industrial Chemicals Notification and Assessment Scheme (NICNASb). Inventory Multi-tiered Assessment and Prioritisation (IMAP) Human Health Tier II Assessment for BPS-based polymers. Available at **http://www.nicnas.gov.au**

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Substances in Preparations in Nordic countries (SPIN) database. Accessed June 2019 at **http://www.spin2000.net/spinmyphp/**

The Poisons Standard June 2019. The Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP) No. 24. Accessed June 2019 at **https://www.tga.gov.au/publication/poisons-standard-susmp**

Last Update 28 June 2019

Chemical Identities

Chemical Name in the Inventory and Synonyms	**Naphthalenesulfonic acid, polymer with formaldehyde and 4,4'-sulfonylbis[phenol]**

CAS Number	9017-72-5
Structural Formula	
Molecular Formula	(C12H10O4S.C10H8O3S.CH2O)x
Molecular Weight	

Chemical Name in the Inventory and Synonyms	**2-Naphthalenesulfonic acid, polymer with formaldehyde and 4,4'-sulfonylbis[phenol]** 2-naphthalenesulfonic acid, polymer with formaldehyde and 4,4-sulfonyldiphenol
CAS Number	27416-78-0
Structural Formula	
Molecular Formula	(C12H10O4S.C10H8O3S.CH2O)x
Molecular Weight	

Chemical Name in the Inventory and Synonyms	**Formaldehyde, polymer with 4,4'-sulfonylbis[phenol]** bis(4-hydroxyphenyl) sulfone, formaldehyde copolymer formaldehyde, 4,4-sulfonyldiphenol copolymer phenol, 4,4-sulfonyldi-, polymer with formaldehyde
CAS Number	27775-64-0
Structural Formula	**No Structural Diagram Available**
Molecular Formula	(C12H10O4S.CH2O)x
Molecular Weight	

Chemical Name in the Inventory and Synonyms	**Benzenesulfonic acid, 4-hydroxy-, polymer with formaldehydeand 4,4'-sulfonylbis[phenol]**
CAS Number	31455-16-0
Structural Formula	**No Structural Diagram Available**
Molecular Formula	(C12H10O4S.C6H6O4S.CH2O)x

Molecular Weight	

Chemical Name in the Inventory and Synonyms	**Sulfurous acid, disodium salt, polymer with formaldehyde and 4,4'-sulfonylbis[phenol]**
CAS Number	37372-10-4
Structural Formula	**No Structural Diagram Available**
Molecular Formula	(C12H10O4S.CH2O.H2O3S.2Na)x
Molecular Weight	

Chemical Name in the Inventory and Synonyms	**Formaldehyde, polymer with sulfonylbis[phenol]** dihydroxydiphenyl sulfone, formaldehyde polymer
CAS Number	51990-55-7
Structural Formula	

	
Molecular Formula	(C12H10O4S.CH2O)x
Molecular Weight	

Chemical Name in the Inventory and Synonyms	**Naphthalenesulfonic acid, sodium salt, polymer with formaldehyde and 4,4'-sulfonylbis[phenol]** naphthalenesulfonic acid, sodium salt, p,p-dihydroxydiphenyl sulfone, formaldehyde polymer
CAS Number	63951-50-8
Structural Formula	
Molecular Formula	(C12H10O4S.C10H8O3S.CH2O.Na)x
Molecular Weight	

Chemical Name in the Inventory and Synonyms	**Formaldehyde, polymer with sulfonated naphthalene and 4,4'-sulfonylbis[phenol]** sulfonated naphthalene, p,p-dihydroxydiphenyl sulfone, formaldehyde

	condensate
CAS Number	68411-62-1
Structural Formula	
Molecular Formula	(C12H10O4S.CH2O.)x
Molecular Weight	

Chemical Name in the Inventory and Synonyms	**Benzenesulfonic acid, methyl(methylphenoxy)-, polymer with formaldehyde and 4,4'-sulfonylbis[phenol]**
CAS Number	68567-70-4
Structural Formula	
Molecular Formula	(C14H14O4S.C12H10O4S.CH2O)x
Molecular Weight	

Chemical Name in the Inventory and Synonyms	**Naphthalenesulfonic acid, polymer with formaldehyde and 4,4'-sulfonylbis[phenol], sodium salt** naphthalenesulfonic acid, 4,4-sulfonylbisphenol, formaldehyde polymer, sodium salt
CAS Number	69961-73-5
Structural Formula	**No Structural Diagram Available**
Molecular Formula	(C12H10O4S.C10H8O3S.CH2O)x.xNa
Molecular Weight	

Chemical Name in the Inventory and Synonyms	**Benzenesulfonic acid, hydroxy-, monosodium salt, polymer with formaldehyde and 4,4'-sulfonylbis[phenol]** formaldehyde, polymer with hydroxybenzenesulfonic acid monosodium salt and 4,4-sulfonylbis[phenol
CAS Number	71832-81-0
Structural Formula	**No Structural Diagram Available**

Molecular Formula	(C12H10O4S.C6H6O4S.CH2O.Na)x
Molecular Weight	

Chemical Name in the Inventory and Synonyms	**Formaldehyde, polymer with 4,4'-sulfonylbis[phenol], sulfomethylated, sodium salts**
CAS Number	73892-06-5
Structural Formula	**No Structural Diagram Available**
Molecular Formula	(C12H10O4S.CH2O.Na)x
Molecular Weight	

Chemical Name in the Inventory and Synonyms	**Benzenesulfonic acid, 4-hydroxy-, polymer with formaldehydeand 4,4'-sulfonylbis[phenol], sodium salt** 4-[(1-butyl-5-cyano-1,6-dihydro-2-hydroxy-4-methyl-6-oxo-3-pyrimidinyl)azo
CAS Number	75199-12-1
Structural Formula	

	
Molecular Formula	(C12H10O4S.C6H6O4S.CH2O)x.xNa
Molecular Weight	

Chemical Name in the Inventory and Synonyms	**Naphthalenesulfonic acids, polymers with formaldehyde, sulfonated 1,1'-oxybis[methylbenzene] and sulfonylbis[phenol], ammonium sodium salts**
CAS Number	82640-14-0
Structural Formula	
Molecular Formula	(C14H14O.C12H10O4S.CH2O.H3N.Na.)x
Molecular Weight	

Chemical Name in the Inventory and Synonyms	**Formaldehyde, polymers with sulfonated 1,1'-oxybis[methylbenzene] and sulfonylbis[phenol], ammonium sodium salts**

CAS Number	82640-16-2
Structural Formula	
Molecular Formula	(C14H14O.C12H10O4S.CH2O.H3N.Na)x
Molecular Weight	

Chemical Name in the Inventory and Synonyms	**Lignosulfonic acid, sodium salt, polymer with formaldehyde, hydroxybenzenesulfonic acid and 4,4'-sulfonylbis(phenol), sodium salt**
CAS Number	94334-57-3
Structural Formula	
Molecular Formula	Not specified
Molecular Weight	

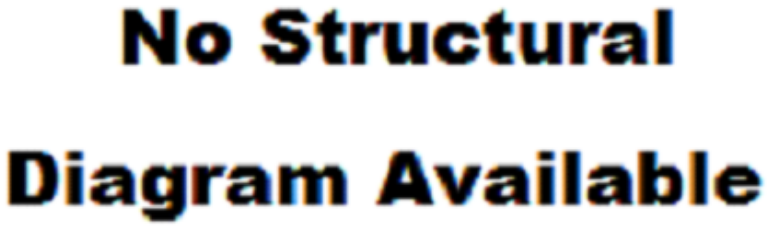
Chemical Name in the Inventory and Synonyms	**Benzenesulfonic acid, hydroxy-, polymer with formaldehyde and 4,4'-sulfonylbis[phenol], sodium salt**
CAS Number	94334-58-4
Structural Formula	**No Structural Diagram Available**
Molecular Formula	(C12H10O4S.C6H6O4S.CH2O)x.xNa
Molecular Weight	

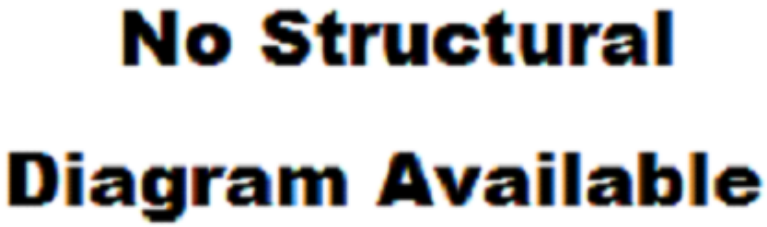
Chemical Name in the Inventory and Synonyms	**Benzenesulfonic acid, polymer with formaldehyde and 4,4'-sulfonylbis(phenol)**
CAS Number	96318-41-1
Structural Formula	**No Structural Diagram Available**
Molecular Formula	(C12H10O4S.C6H6O3S.CH2O)x

Molecular Weight	

Chemical Name in the Inventory and Synonyms	**Benzenesulfonic acid, 4-hydroxy-, polymer with formaldehyde, 4,4'-sulfonylbis[phenol] and urea**
CAS Number	102561-66-0
Structural Formula	**No Structural Diagram Available**
Molecular Formula	(C12H10O4S.C6H6O4S.CH4N2O.CH2O)x
Molecular Weight	

Chemical Name in the Inventory and Synonyms	**Sulfurous acid, monosodium salt, compound with formaldehydepolymer with 4,4'-sulfonylbis[phenol]** phenol, 4,4-sulfonylbis-, polymer with formaldehyde, compound with sodium hydrogen sulfite
CAS Number	102958-53-2
Structural Formula	

	
Molecular Formula	(C12H10O4S.CH2O)x.xH2O3S.xNa
Molecular Weight	

Chemical Name in the Inventory and Synonyms	**Naphthalenesulfonic acids, polymers with formaldehyde and 4,4'-sulfonylbis[phenol], ammonium salts**
CAS Number	103332-00-9
Structural Formula	
Molecular Formula	(C12H10O4S.CH2O.H3N.)x
Molecular Weight	

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