BASIS STATEMENT FOR CHAPTER 883, DESIGNATION OF THE CHEMICAL CLASS NONYLPHENOL AND NONYLPHENOL ETHOXYLATES AS A PRIORITY CHEMICAL

AND

SAFER CHEMICALS PROGRAM SUPPORT DOCUMENT FOR THE DESIGNATION AS A PRIORITY CHEMICAL OF

Nonylphenol and Nonylphenol Ethoxylates

Prepared by Andrea Lani
Bureau of Remediation and Waste Management
Maine Department of Environmental Protection

September 2, 2010

PREFACE

In April 2008, the Legislature adopted Public Law Chapter 643, *An Act to Protect Children's Health and the Environment from Toxic Chemicals in Toys and Children's Products* [38 MRSA §§1691 through 1699-B]. The goal of the law as set forth in the Legislature's Declaration of Policy under 38 MRSA §1692 is to reduce the exposure of children and other vulnerable populations to chemicals of high concern by substituting safer alternatives when feasible. To accomplish this goal, the law confers upon the department the regulatory power to collect information on chemical use and prohibit the sale of children's products containing priority chemicals when safer alternatives are available.

The Board of Environmental Protection adopted regulations to implement the law in February 2010. Chapter 880, *Regulation of Chemical Use in Children's Products* established rulemaking as the process by which the department will designate priority chemicals. The law and rule require that a substance meet certain criteria in order to be designated a Priority Chemical, and that the department provide findings of fact in support of a proposed designation. This document serves as the support document providing the findings of fact required for designation of the chemical class nonylphenol and nonylphenol ethoxylates as a Priority Chemical, as well as the Basis Statement for the department's proposed Chapter 883, *Designation of the Chemical Class Nonylphenol and Nonylphenol Ethoxylates as a Priority Chemical.*

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INTRODUCTION

Through this rulemaking, the Department of Environmental Protection (department) designates the chemical class of nonylphenol (NP) and nonylphenol ethoxylates (NPE) as a Priority Chemical and requests information on use of this chemical in certain consumer products.

Nonylphenol and nonylphenol ethoxylates are listed on the Chemicals of High Concern list because these chemicals have been identified as endocrine disruptors. Additionally, nonylphenol has been identified as persistent, bioaccumulative and toxic. NP and NPE are the most widely-used members of the larger alkylphenol and alkylphenol ethoxylate family of nonionic surfactants. NP demonstrates estrogenic and endocrine disrupting characteristics and is toxic to aquatic organisms and moderately persistent in the environment. The metabolites and degradation products of NPE are more toxic than the parent compounds. NP has been detected in human tissues and in household dust, as well as in environmental media. The European Union has effectively eliminated use of NP/NPE in most industrial and product sectors and Canada has implemented a pollution prevention plan designed to drastically reduce use of NP/NPE.

The department is proposing to designate nonylphenol and nonylphenol ethoxylates as a priority chemical in accordance with 38 MRSA §1694 and gather information on certain specified uses of the chemical.

NONYLPHENOL AND NONYLPHENOL ETHOXYLATES

IDENTITY

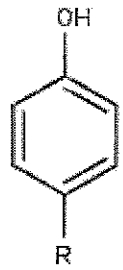
The chemicals described in this section are those that APERC (the Alkylphenols & Ethoxylates Research Council, an association composed of manufacturers, processors, users and raw material suppliers of alkylphenols) considers commercially relevant. However, department designation of nonylphenol and nonylphenol ethoxylates as a priority chemical is not limited to the chemical structures or CAS RNs (Chemical Abstract Service Registry Numbers) listed below.

Nonylphenol: Phenol, 4-nonyl-, branched

CAS Registry Number: 84852-15-3

Chemical Formula: C15-H24-O

Structural Formula:



Select Names and Synonyms for phenol, 4-nonyl, branched:

Branched p-nonylphenol
C9 branched alkyl phenol
EINECS 284-325-5
Nonylphenol
Phenol, 4-nonyl-, branched
p-Nonylphenol, branched

Systematic Name
Phenol, 4-nonyl-, branched

Superlist Name
Nonylphenol, 4-branched
Phenol, 4-nonyl-, branched

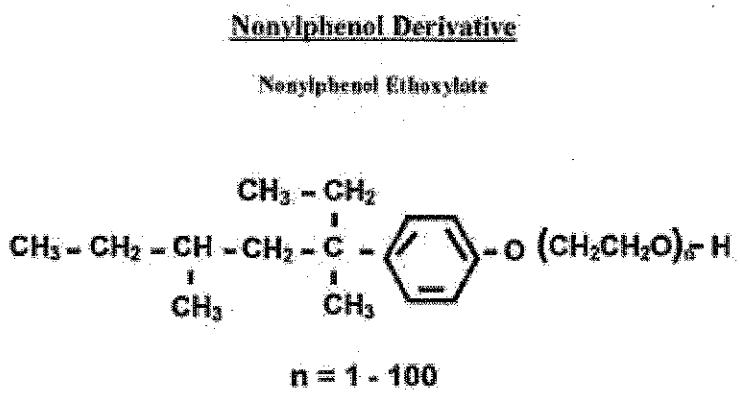
Nonylphenol ethoxylates: Polyethylene glycol nonylphenyl ether

Select CAS Registry Numbers:[a]

9016-45-9	Poly (oxy-1,2-ethanediyl), *alpha*-(nonylphenyl)-*omega*-hydroxy-
26027-38-3	Poly (oxy-1,2-ethanediyl), *alpha*-(4-nonylphenyl)-*omega*-hydroxy-
37205-87-1	Poly (oxy-1,2-ethanediyl), *alpha*-(isononylphenyl)-*omega*-hydroxy-
68412-54-4	Poly (oxy-1,2-ethanediyl), *alpha*-(nonylphenyl)-*omega*-hydroxy-, branched
127087-87-0	Poly (oxy-1,2-ethanediyl), *alpha*-(4-nonylphenyl)-*omega*-hydroxy-, branched

Chemical Formula: (C2-H4-O)mult-C15-H24-O

Structural Formula:[1]



[a] The CAS RNs listed for NPE are those that are known to APERC to be commercially relevant.

Select Names and Synonyms:

Names

Nonoxynol-3
Nonoxynol-30
Nonoxynol-4
Nonoxynol-44
PEG-13 Nonyl phenyl ether
PEG-15 Nonyl phenyl ether
PEG-3 Nonyl phenyl ether
PEG-30 Nonyl phenyl ether
PEG-4 Nonyl phenyl ether
PEG-44 Nonyl phenyl ether
Polyethylene glycol (13) nonyl phenyl ether
Polyethylene glycol (15) nonyl phenyl ether
Polyethylene glycol (3) nonyl phenyl ether
Polyethylene glycol (30) nonyl phenyl ether
Polyethylene glycol (44) nonyl phenyl ether
Polyethylene glycol 200 nonyl phenyl ether
Polyethylene glycol nonylphenyl ether
Polyoxyethylene (13) nonyl phenyl ether
Polyoxyethylene (15) nonyl phenyl ether
Polyoxyethylene (3) nonyl phenyl ether
Polyoxyethylene (30) nonyl phenyl ether
Polyoxyethylene (4) nonyl phenyl ether
Polyoxyethylene (44) nonyl phenyl ether

Synonyms

(Nonylphenoxy)polyethylene oxide
A 730
A 730 (surfactant)
Adekatol NP
Adekatol NP 1000
Adekatol NP 1100
Adekatol NP 638
Adekatol NP 650
Adekatol NP 660
Adekatol NP 675
Adekatol NP 683
Adekatol NP 686
Adekatol NP 690
Adekatol NP 700
Adekatol NP 710
Adekatol NP 720
Adekatol NP 760
Adekatol NP 900
Afilan CVH
Agral
Agral 600
Agral 90
Agral LN
Agral Plus
Agral R
Akyporox NP 105
Akyporox NP 95
Alcosist PN
Alfenol
Alfenol 10
Alfenol 18
Alfenol 22
Alfenol 28
Alfenol 710
Alfenol 8
Alfenol N 8
Alkasurf NP
Alkasurf NP 11
Alkasurf NP 15
Alkasurf NP 8
Antarox 897
Antarox CO
Antarox CO 430
Antarox CO 530
Antarox CO 630
Antarox CO 730
Antarox CO 850
Arkopal N-090
Carsonon N-9
Caswell No. 605
Chemax NP series
Conco NI-90
Dowfax 9N20
EPA Pesticide Chemical Code 079005
Emulgen - 913
Ethoxylated nonylphenol
Glycols, polyethylene, monononylphenyl ether
HSDB 6825
Igepal CO-630
Lissapol NX
Neutronyx 600
Nonoxinolum
Nonoxinolum [INN-Latin]
Nonyl phenyl polyethylene glycol
Nonyl phenyl polyethylene glycol ether
Nonylphenol, polyoxyethylene ether

Nonylphenoxypoly(ethyleneoxy)ethanol, branched
Nonylphenoxypolyethoxyethanol
PEG-9 nonyl phenyl ether
Polyethylene glycol 450 nonyl phenyl ether
Polyethylene glycol nonylphenyl ether
Polyoxyethylene (9) nonyl phenyl ether
Polyoxyethylene nonylphenol
Polyoxyethylene(30) nonylphenyl ether
Protachem 630
Rewopol HV-9
Synperonic NX
Tergetol NP
Tergitol NP-10
Tergitol NPX
Tergitol TP-9 (nonionic)
Triton N-100
Trycol NP-1
alpha-(Nonylphenyl)-omega-hydroxypoly(oxy-1,2-ethanediyl)
alpha-(Nonylphenyl)-omega-hydroxypolyoxyethylene
omega-Hydroxy-alpha-(nonylphenyl)poly(oxy-1,2-ethanediyl)

Systematic Name
Agral 90
Glycols, polyethylene mono(nonylphenyl) ether (nonionic)
Glycols, polyethylene, mono(nonylphenyl) ether
Poly(oxy-1,2-ethanediyl), alpha-(nonylphenyl)-omega-hydroxy-
Prevocel #12
Tergitol NP-14
Tergitol NP-27
Tergitol NP-33 (nonionic)
Tergitol NP-35 (nonionic)
Tergitol NP-40 (nonionic)

Superlist Name
Nonyl phenol, ethoxylated
Nonylphenoxypolyethoxyethanol
Poly(oxy-1,2-ethanediyl), alpha-(nonylphenyl)-omega-hydroxy-
Polyoxyethylene nonylphenol

BACKGROUND

Surfactants are substances that lower the surface tension of water. Structurally, surfactants are made up of a hydrophilic "head" and a hydrophobic "tail." This structure allows the chemicals to absorb dirt and keep it emulsified in the cleaning solution. Surfactants may have a positively-charged head (cationic), a negatively-charged head (anionic) or no charge (nonionic).

The most widely-used of the nonionic surfactants are alkylphenols and alkylphenol ethoxylates, with nonylphenol (NP) making up approximately 85% of the alkylphenol market and nonylphenol ethoxylate (NPE) making up more than 80% of the alkylphenol ethoxylate market in North America. [2]

NP is used as a chemical intermediate in the production of nonylphenol ethoxylates and other compounds [i.e., tris(nonylphenyl) phosphite and nonylphenol-formaldehyde condensation resins]. NP is reacted with ethylene oxide to form variety of NPE isomers (compounds with the same molecular formula but different structural formulae) with different chain lengths. The association representing APE manufacturers states that commercially available NPE have essentially the same structure and isomeric mix, due to manufacturers using basically the same starting materials and synthesis process.[3]

NPE surfactants are used as emulsifiers, wetting agents, dispersants, foam control agents and surface tension agents in commercial and household detergents and cleaning products and are used in industrial applications such as paper and textile manufacture, paints, resins, adhesives and coatings and industrial cleaners.[4] NP may also be used as a plastic additive in modified polystyrene and polyvinyl chloride.[5]

One industry website lists at least 13 different NPE commercial mixtures and categorizes them into a number of uses: adhesives/sealants, wetting agents and stabilizers; agricultural emulsifiers, wetting agents and dispersants; antifog and antistat agent for plastic films; asphalt emulsions; defoamer; dust control agent for coal and mining operations; emulsifier; household applications; industrial and institutional cleaners; leather hide soaking, tanning and dyeing operations; metalworking fluids; oil field chemicals; paints/coatings and emulsion polymerization; pulp/paper deinking, felt cleaning and processing aids; and textile processing. The "household applications" category includes the following product types: all purpose cleaners and degreasers; car wash and car care products; laundry detergents; prewash spot removers; and solid toilet bowl cleaners.[6]

The US Department of Human Services Household Product Database lists numerous household products containing NP or NPE, including home maintenance products (e.g., concrete cleaner, joint sealant, floor coating); "inside the home" products (e.g., laundry detergent, floor stripper, spot and stain pre-treatment, tile cleaner); personal care products (e.g., hair color, mousse and conditioner); as well as automotive products and pesticides. Many of the personal care products are listed as "old product," indicating that NPE may not be used in these products at this time.[7]

In the early 2000s, household cleaning products accounted for 15% of the APE market,[8] however, the industry association representing manufacturers of APE indicated in comments to the department that use of NPE in household cleaning products has decreased.[9]

A background report on the industries that manufacture, import, and/or use NP and NPE completed for Canada in 2000 indicated that the cleaning products sector was responsible for approximately 60% of the total Canadian NP/NPE market, and that end-users of these products were responsible for about 75% of total NP/NPE releases to the environment in Canada.[10]

US EPA Inventory Update Reporting 2006 nonconfidential data lists five US producers of NP with an aggregate production volume ranging from 100 to 500 million pounds. The chemical industry reported that US demand for nonylphenol was 235 million pounds in 1999.[11]

HEALTH AND ECOLOGICAL CONCERNS

Alkylphenols, including NPE and NP have been detected in the natural environment, including ambient air, sewage treatment plant effluent, sediment, soil and surface waters, in wildlife, household dust and human tissues. Nonylphenol and nonylphenol ethoxylates are toxic to aquatic organisms, and the breakdown products of nonylphenol ethoxylates (NP and shorter-chained ethoxylates) are more toxic and more persistent than their parent chemicals.

NP has been shown to have estrogenic effects in a number of aquatic organisms,[12, 13] and in human breast tumor cells and rats.[14] The isomer 4-*n*-nonylphenol has demonstrated endocrine disrupting effects in four key cell mechanisms in vitro.[15]

REGULATORY AND VOLUNTARY INTIATIVES TO REDUCE USE OF AND EXPOSURE TO NONYLPHENOL AND NONYLPHENOL ETHOXYLATES

US EPA

As part of an effort to enhance the agency's chemical management plans under the Toxic Substances Control Act (TSCA) the US Environmental Protection Agency is currently developing an Action Plan on NP and NPE.

European Union

The European Union prohibits the sale or use of nonylphenol and nonylphenol ethoxylates in concentrations greater than 0.1% by weight for the following uses:

- industrial and institutional cleaning (except controlled closed dry cleaning systems where the washing liquid is recycled or incinerated and cleaning systems with special treatment where the washing liquid is recycled or incinerate);
- domestic cleaning;
- textiles and leather processing (except processing with no release into waste water and systems with special treatment where the process water is pretreated to remove the organic fraction completely prior to biological waste water treatment);

- emulsifier in agricultural teat dips; metal working (except uses in controlled closed systems where the washing liquid is recycled or incinerated);
- manufacturing of pulp and paper; cosmetic products; other personal care products (except spermicides); and
- co-formulations in pesticides and biocides.[16]

Canada

In 2001, Canada added nonylphenol and its ethoxylates to the list of toxic substances under the Canadian Environmental Protection Act and in 2004 required implementation of pollution prevention plans for NP and NPE contained in products, including a 95% reduction in use of NP and NPE by the end of 2010.[17]

Voluntary

Numerous companies, including chemical manufacturers, product formulators, retailers and distributors and institutional users, have earned recognition through US EPA's Safer Detergent Stewardship Initiative (SDSI) by manufacturing or using only "safer" surfactants in their cleaning products. Under the SDSI program, NPE do not meet the definition of "safer surfactant."[18] In 2006, Wal-Mart announced efforts to encourage product suppliers to find alternatives to three "priority chemicals," including nonylphenol ethoxylates.[19]

ALTERNATIVES

An assessment of alternatives to NP and NPE conducted for Environment Canada found a number of available alternative surfactants currently in use and on the market. The report concluded that the most widely-used alternatives, alcohol ethoxylates (AE), are equivalent in performance to NPE, and in some cases outperform NPE in most sectors including cleaning products, and that AE have a better environmental profile than NPE in that:

- AE are readily and ultimately biodegradable, while NPE are ultimately but not readily biodegradable.
- The biodegradation intermediates of AE are less toxic than the parent surfactants while the biodegradation intermediates of NPE are more toxic than the parent surfactants.
- The predicted chronic no-effect value for AE is 110μg/L; for NP it is 1μg/L.

The report suggests that octylphenol ethoxylates (OPE) are not suitable alternatives to NPE because they exhibit similar toxicological profile and environmental fate characteristics as NPE and because octylphenol (the building block and degradation product of OPE) also shows evidence of estrogenic activity.[20]

PREREQUISITES FOR DESIGNATION OF NONYLPHENOL AND NONYLPHENOL ETHOXYLATES AS A PRIORITY CHEMICAL / FINDINGS OF FACT

CHEMICALS OF HIGH CONCERN LIST

The chemical class **nonylphenol, nonylphenol ethoxylates and related substances** appears on the Chemicals of High Concern list[21] published by the department because this chemical family has been designated as:

- persistent, bioaccumulative and toxic on the OSPAR (Oslo-Paris Convention for the Protection of the Marine Environment of the North-East Atlantic) list of Chemicals for Priority Action; and
- an endocrine disruptor on the OSPAR list of Chemicals for Priority Action.

Phenol, nonyl- (CAS RN 25154-52-3) appears on the Chemicals of High Concern list because it has been designated as a:

- a persistent, bioaccumulative toxin on the OSPAR list of Chemicals of Possible Concern; and
- a category 1 endocrine disruptor, "evidence of endocrine disruption activity" in the European Commission Communication on a Community Strategy for Endocrine Disruptors; and

Phenol, nonyl-4, branched (CAS RN 84852-15-3) appears on the Chemicals of High Concern list because it has been designated as:

- persistent, bioaccumulative and toxic on the OSPAR list of Chemicals of Concern.

Nonylphenolethoxylate (CAS RN 9016-45-9) appears on the Chemicals of High Concern list because it has been designated as:

- persistent, bioaccumulative and toxic on the OSPAR list of Chemicals of Concern.

CRITERIA FOR DESIGNTATION

Biomonitoring. The chemical has been found through biomonitoring to be present in human blood, including umbilical cord blood, breast milk, urine or other bodily tissues or fluids, specifically:

- NP has been detected in the serum of pregnant women in Canada,[22] in the urine of adults in the US,[23] in the breast milk of women in Italy,[24] and in the adipose tissue of women in Spain.[25]

Home Environment. The chemical has been found through sampling and analysis to be present in household dust, indoor air, drinking water or elsewhere in the home environment, specifically:

- Researchers sampling indoor air and dust for endocrine disrupting compounds found alkylphenols and ethoxylates among the most abundant compounds detected, with

4-nonylphenol (a metabolite) detected in 100% of indoor air samples at high concentrations (90th percentile) relative to other compounds in the study.[26]

Ecological Sampling. The chemical has been found through monitoring to be present in fish, wildlife or the natural environment, specifically:

- NPE and their degradation products have been detected in wastewater, ambient air, surface water and sediments.[27] In a study of organic wastewater contaminants in US streams, 4-nonylphenol was one of the most frequently-detected compounds.[28]
- Researchers sampled a variety of species of fish collected from two major regions in Michigan and found detectable concentrations of NP in 41% of samples across all sites and species with a range of 3.3 to 29.1 ng of NP/g.[29]

Consumer Products. The chemical is present in a consumer product used or present in the home, specifically:

- Household detergents, cleaners and degreasers; personal care products and cosmetics; home maintenance products.[30, 31]

HPV. The chemical has been identified as a High Production Volume chemical by the federal Environmental Protection Agency.

- HPV chemicals are classified as those chemicals produced or imported in the United States in quantities of 1 million pounds or more per year. The US Environmental Protection Agency non-confidential IUR Production Volume Information database for 2006 shows production (manufacture and importation) of nonylphenol (CAS RN 84852-15-3) in the 100-500 million pound range and nonylphenol ethoxylates in the 10-50 million pound range (CAS RN 9016-45-9) and the 1-10 million pound range (CAS RN 127087-87-0).[32]

PURPOSE OF DESIGNATION

REQUEST FOR INFORMATION

The department is designating the chemical class nonylphenol and nonylphenol ethoxylates a priority chemical for the purpose of requesting information related to the extent to which nonylphenol and nonylphenol ethoxylates are used in, and the likelihood that children will be exposed to, the chemical as a result of its presence in, the following consumer products:

- Household and commercial cleaning products,
- Cosmetics and personal care products, and
- Home maintenance products sold, marketed to, or intended for use by consumers.

BASIS FOR DEPARTMENT ACTION

DEFINITION OF CHILDREN'S PRODUCTS

The products listed in the department's request for information in the proposed rule meet the definition of "children's products" under 38 MRSA §1691(7) because household and commercial cleaning products, home maintenance product and cosmetics and personal care products are products that when used in a home or commercial setting frequented by children (e.g., a school or daycare center), they "will likely result in a child's or fetus's being exposed" to NP and NPE.

NEED FOR INFORMATION REGARDING NP AND NPE USE IN CHILDREN'S PRODUCTS

Information available to the department indicates that NP and NPE are used in consumer products intended for household use that will likely result in children being exposed to the chemical class, however, there is some indication that these uses have decreased (household cleaning products) or may have been eliminated (personal care products). The department is requesting information to assess how widely this chemical class is used in consumer products sold in Maine.

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