



Alkylphenols (APs)

Common groups of APs: Octylphenols (OPs), mixed isomers
Nonylphenols (NPs), mixed isomers

CAS Number	Substance
140-66-9	4-tert-Octylphenol
1806-26-4	4-Octylphenol
27193-28-8	Octylphenol
104-40-5	P-nonylphenol
11066-49-2	Isononylphenol
25154-52-3	Phenol (2,6-dimethylheptan-4-yl)
84852-15-3	Phenol, 4-nonyl-, branched

May Be Found In:

- Outsole materials of shoes
- Plastic and rubber components of apparel, footwear, and accessories
- Adhesives in plastics such as PVC and polystyrene
- Paints
- Coatings
- As alkylphenol phosphite in UV stabiliser in plastics
- Jelly sandals

In general, Alkylphenols (APs) are chemical compounds that consist of one or more alkyl chains bound to a phenol molecule. The alkyl chain may be of different length resulting in (but not limited to) butyl, octyl, nonyl or dodecylphenol. The most commonly used alkylphenols are octylphenols (OPs) and nonylphenols (NPs), which are listed to the left. These are substances with identical molecular formulas and mass, but different chemical structures (isomers).

Uses in the Supply Chain

APs are intermediates in the manufacture of many derivatives, such as the widely used surfactant class of alkylphenol ethoxylates (APEOs), by a chemical reaction between alkylphenol and oxirane. They have been used in the industry for nearly 50 years, initially in detergents and as additives to fuel.¹ NPs are also intermediates in the production of antioxidants used to protect or stabilise polymers like rubber or polyvinyl chloride (PVC). OPs are also intermediates in the production of phenolic resins used in bonding agents. When released into the environment, APEOs breakdown relatively easily into APs. As a result, the biodegradation of APEOs into more stable APs by loss of the ethoxy group is considered the main source of accumulation and transportation (far from the point of original release) of harmful, very persistent APs in the environment. APs can also be formed during polymer manufacturing from thermal decomposition of intentionally added APEO-based substances, such as antioxidants.

Why Alkylphenols (APs) are Restricted

- Legislation around the world restricts the use of APEOs and APs.
- Leading apparel and footwear brands have banned or set strict limits on APs in their products.
- Some APs are very toxic to aquatic life with long lasting effects.
- They are suspected to negatively impact human fertility and unborn children.²

Sourcing Compliant Materials from Your Suppliers

- Explain that you require materials to be compliant with current AFIRM RSL limits.³
- Pay special attention to suppliers of plastic/rubber footwear materials and plastic/rubber components for apparel and accessories like bags and belts. Ask for additional information, such as proof of source for manufacturing chemicals used and MRSL Conformance Certificates.
- Share this guidance sheet with your material suppliers. Using the guidance in the next section, instruct them to work with their chemical suppliers to source chemical formulations that comply with these requirements. If needed, highlight the existence of harmful substances in materials via chemical management trainings from the ZDHC Academy, existing guidelines, and laws.
- Advise your material suppliers to adjust relevant process parameters, such as time and temperature, for the production of corresponding polymer and rubber materials. This will minimise thermal decomposition of NP-based stabilisers into NPs.
- Request suppliers to submit a confirmation of material compliance and/or a test report from a third-party laboratory. When materials are received, consider performing random, risk-based testing to ensure current AFIRM RSL limits are met.
- Make sure all your suppliers have a solid chemical management system in place.

Sourcing Compliant Formulations from Your Chemical Formulators

- Explain to chemicals suppliers that you require chemical formulations to comply with current ZDHC MRSL limits.
 - Search for formulations on the ZDHC Gateway Chemical Module.⁴ If your preferred formulations are not listed, encourage providers to register their formulations.
 - Ask for a ZDHC ChemCheck report.
- Pay special attention to suppliers providing chemicals used for polymerisation processes and as additives, such as stabilisers commonly used in footwear and polymer/rubber component production.
 - Please note: Poor quality polymer antioxidant and PVC stabilisers Tris (4-nonyl-phenyl) phosphite (TNPP), CAS 26523-78-4, may contain very high residual concentrations of NP and therefore should not be accepted.
- For all formulations, request SDS documentation to ensure none of the CAS Numbers above are listed as ingredients.
- Perform random risk-based checks of your chemical formulators' formulations by submitting samples to a third-party laboratory for testing to ensure APs do not exceed ZDHC MRSL limit values.
- Discuss with your chemical formulators what safer alternatives are available that are suitable substitutes for your production needs.

Safer Alternatives

Several alternatives for APEOs are already available on the market, such as calcium/zinc stabilisers, which do not contain NP-based antioxidants. The ZDHC Gateway Chemical Module is a good place to look for alternatives as it offers several solutions based on special production needs. Any chosen alternative must comply with the limits stated above and any brand specific limits.

Additional Information

US EPA Design for the Environment working group performed an Alternatives Assessment for Nonylphenol Ethoxylates, which may be relevant to alkylphenols.

https://www.epa.gov/sites/production/files/2014-06/documents/npe_final.pdf

References

1 See APEO Guidance Sheet for specific information on phasing out APEOs in apparel and footwear manufacturing.

2 Hazard information per Harmonized Classification and Labelling Approved by the European Union. Source: European Chemicals Agency, <http://echa.europa.eu/>.

3 Apparel and Footwear International RSL Management Group (Ed.). (2018, January 31). Restricted Substances List (Rep.). Retrieved <http://afirm-group.com/afirm-rsl/>.

4 ZDHC Conformance Guidance

https://www.roadmaptozero.com/fileadmin/pdf/Files_2019/MRSL_Conformance_Guidance_022019.pdf.

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