

# ALKYLPHENOLS BULLETIN

An Update from the Alkylphenols & Ethoxylates Research Council

November 30, 2004

*The Alkylphenols Bulletin periodically notifies manufacturers and users of alkylphenols and their derivatives of national and international developments of interest. For further information, please contact the APE Research Council at the address below.*

## ENVIRONMENTAL LEVELS OF ALKYLPHENOLS AND THEIR ETHOXYLATES IN THE UNITED STATES

Alkylphenol (APs) and their ethoxylates have been widely used in many household, institutional and industrial applications for close to 50 years. Since most of their uses involve down-the-drain disposal, it is not surprising that residual levels are found in the aquatic environment near wastewater treatment plants. Numerous studies that report environmental levels of APs and alkylphenol ethoxylates (APEs) have been published and the Alkylphenols & Ethoxylates Research Council (APERC) has developed a database of environmental levels in the United States based on these peer-reviewed reports. The database will be used to develop a statistical understanding of the current concentrations of alkylphenolic compounds in US surface waters and sediments.

In January 2004, the US EPA proposed a Water Quality Criteria (WQC) for nonylphenol (NP).<sup>1</sup> Nonylphenol ethoxylates (NPEs) are by far the most commonly used APE in commerce and NP is their most toxic biodegradation intermediate. The proposed WQC represent the concentrations of NP in water at which aquatic life is protected from acute and chronic adverse effects. EPA has recommended an acute freshwater criterion of 27.9 µg/l and a chronic freshwater criterion of 5.9 µg/l for NP.

Evaluations of APERC's US environmental monitoring database conducted to date indicate that 99% of the detectable levels of APs/APEs and their biodegradation intermediates (APEMs) in US surface waters are below EPA's proposed chronic Water Quality Criteria for NP. For all but four of the samples in the database, fresh water concentrations of NP were below EPA's proposed chronic WQC of 5.9 µg/L (Figure 1). In the majority of samples, which were collected across 43 states, NP was detected in fresh water at levels below 1 µg/L. The average concentration of NP in fresh water was 0.64 µg/L (Table 1). Samples that exceeded the proposed WQC for NP were taken from locations that are known to be effluent dominated and subject to the obvious general problems with pollutants, including natural human hormones, numerous synthetic compounds, dissolved organic matter and pathogens.

Since APEs and their biodegradation intermediates are less toxic than NP, the environmental concentrations of these compounds are evaluated on a Toxicity Equivalence Basis. Toxicity Equivalence Factors (TEFs) have been derived by the Canadian Council of Ministers of the Environment based on the analysis of a broad dataset comprised of acute and chronic studies conducted on a range of aquatic vertebrate and invertebrate species.<sup>2</sup> When these conservative

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<sup>1</sup> US EPA. (2004, January 5). Draft Ambient Aquatic Life Water Quality Criteria for Nonylphenol. 69 Fed. Reg. 340.

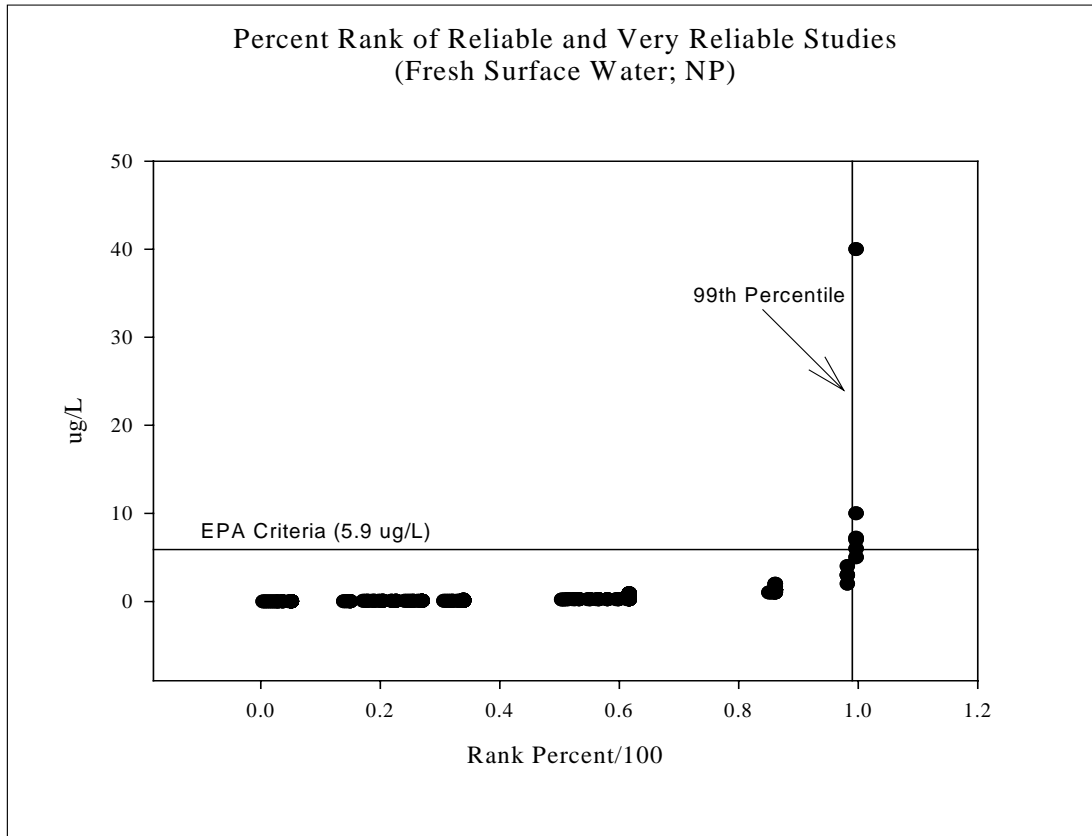
<sup>2</sup> Canadian Council of Ministers of the Environment. (2001). Canadian Water Quality Guidelines for the Protection of Aquatic Life Nonylphenol and Its Ethoxylates.

TEFs are applied to environmental concentrations of APs, APEs and their biodegradation metabolites, their environmental levels, which average 0.57 µg/L (Table 1), are also significantly below the proposed WQC for NP (Figure 2). Given the widespread use of nonylphenol and its derivatives, the low levels found in the environment likely reflect the compound's treatability in well functioning wastewater treatment plants, the use of good disposal practices and the generally high standard of wastewater treatment in the United States.

**Table 1**  
**Surface Fresh Water Concentrations of Alkylphenol Ethoxylates**  
**and Their Biodegradation Metabolites (United States)**

|   | Concentrations in µg/L |                |       |      |                    |
|---|------------------------|----------------|-------|------|--------------------|
|   | Average                | No. of samples | Min.  | Max. | Standard Deviation |
| NP  | 0.64                   | 278            | 0.005 | 40   | 2.60               |
| APEs +APEMs+APs (Adjusted for Toxic Equivalence Factor) | 0.57                   | 1385           | 0.005 | 40   | 1.67               |

**Figure 1**  
**Percent Rank of Samples Containing Nonylphenol in Surface**  
**Fresh Water within the United States**



**Figure 2**  
**Percent Rank of Samples Containing Alkylphenol Ethoxylate Metabolites in Surface Fresh Water within the United States**

