

San Luis Obispo Science & Ecosystem Alliance (SLOSEA)  
Cal Poly State University  
1 Grand Ave  
San Luis Obispo, CA 93407

CA Central Coast Regional Water Resources Quality Control Board  
Attn: Mary Adams  
CC: Jeffery Shu (State Water Resources Control Board)

Re: 2012 California Integrated Report: Petition and Data in Support of Inclusion of Morro Bay and Chorro Creek on the CWA 303(d) List of Impaired Waters for Nonylphenol Contamination

CCRWQCB Members –

The Central Coast Regional Water Quality Control Board has a duty to protect the beneficial uses of Morro Bay and Chorro Creek, and therefore take an important step in this process by listing these waterbodies on the Clean Water Act (CWA) 303(d) list of impaired water bodies for nonylphenol (NP) contamination. Substantial levels of NP have been measured in both Morro Bay and Chorro Creek as well as in marine organisms that live in Morro Bay such as the mud-dwelling arrow goby, *Clevelandia ios*, and the mussel, *Mytilus californianus*<sup>1</sup> As described below, NP is an endocrine – disrupting chemical that has been shown to have effects on the reproductive success of fish populations, as well as effects on human health and lab animals, thus having the strong potential to disrupt many of the beneficial uses of these water bodies.

Of particular concern is the ability of NP to bioaccumulate within organisms. Scientific studies show that aquatic exposure to nonylphenol is detrimental to those organisms' health. Moreover, it is essential to recognize that long-term exposure and bioaccumulation in organs may have greater effects – levels of NP can be found hundreds and sometimes thousands of times higher in an organism's liver than compared with the water in which the organism is living. This indicates a potential pathway for human exposure through consumption of seafood.

With this petition we provide data on both the levels of NP in water samples, and also in organisms living in these water bodies. Due to the toxic properties of NP, the European Union has banned its use in several manufacturing processes. The Board should follow this standard and adopt a precautionary approach in determining that the beneficial uses of Morro Bay and Chorro Creek are disrupted by nonylphenol contamination, and thus list these water bodies on the CWA 303(d) list of impaired waters.

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<sup>1</sup> Scientific research conducted by Cal Poly's Center for Coastal Marine Sciences Tomanek Lab/ San Luis Obispo Science & Ecosystem Alliance (SLOSEA) attached and described below.

## **Background**

As described in the California EPA's recent *Toxicological Profile for Nonylphenol*<sup>2</sup>, this substance is:

... a synthetic organic chemical produced in relatively large quantities in the United States. Primary uses include: (1) a building block of nonionic surfactants (i.e., agents that reduce surface tension of liquids) used in lubrication, defoaming agents, scouring fibers, emulsifiers, wetting and de-wetting agents, dyes, and other products; and (2) a component in a stabilizer used in plastics and vulcanized rubber.

NP-surfactants are the principal source of NP release into the environment. Aquatic and marine life exposure occurs when the substantial quantities of NP-surfactants, discharged into wastewater, biodegrade into several by-products, including NP...

... NP *accumulates and persists in sewage sludge, river sediments, and other environmental compartments*. The occurrence of NP in the environment is *clearly correlated with human activities such as wastewater treatment, land filling and sewage sludge recycling*. (Emphasis added).

## **Detrimental Effects on Aquatic Life, Lab Animals, and Humans**

Laboratory studies demonstrate that NP can “induce a variety of reproductive effects in aquatic life, including fish and shellfish” such as:

- Changes in male and female hormone levels in turbot
- Decreased gamete production and fertilization in medaka and zebrafish
- Reduced hatching of rainbow trout embryos
- Altered sex ratios in offspring of NP-exposed oysters
- Development of intersex trout, bream, and frogs (i.e. offspring with characteristics of both sexes)<sup>3</sup>

Also, NP can also induce a variety of non-reproductive effects, such as “the inability to maintain fluid and electrolyte balance...decreased respiration and increased malformations.”<sup>4</sup>

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<sup>2</sup> *Toxicological Profile for Nonylphenol*: Integrated Risk Assessment Branch  
Office of Environmental Health Hazard Assessment, California Environmental Protection Agency. 2010. *Please note: This report is highlighted in this petition as it was commissioned by the California Ocean Protection Council to summarize the plethora of peer-reviewed manuscripts related to the environmental effects of nonylphenol. For information on specific studies, refer to this toxicological profile available in the appendix to this petition.*

<sup>3</sup> *Id.*

<sup>4</sup> *Id.*

Moreover, this report highlights the results of several peer-reviewed studies that demonstrate link NP exposure to health hazards and toxicity in humans and lab animals. As summarized in *Toxicological Profile of Nonylphenol*<sup>5</sup>:

**Reproductive and Developmental Effects.** NP can act as an estrogen, a group of naturally occurring steroid compounds that function as the primary female sex hormone. *Sufficient evidence was found to show that NP causes reproductive effects in laboratory animals.* (Emphasis added). These effects, ... include:

- Lowered levels of the male sex hormone testosterone
- Effects on the testes, including decreased sperm production
- Increased uterine weight, suggesting that NP may affect female reproduction
- Altered development of the brain region responsible for male and female behavior
- Hyperactivity in juvenile animals and animals exposed before birth due to effects on the development of regions of the brain.

In humans, limited information is available on possible reproductive effects. One study reported early onset puberty in children exposed to NP while *in utero*.

**Immune and Thyroid Effects.** There is some evidence that NP affects the immune system in laboratory animals and limited evidence that it affects thyroid function and obesity. Many if not all of these effects appear to be related to NP's estrogen-like effect and its ability to disrupt the endocrine system.

**Nervous System Effects.** Prenatal exposure of laboratory rodents to NP results in neurobiological alterations, including some sexually dimorphic behaviors. *Studies conducted with cultured cells and tissues suggest that NP could adversely affect brain development and may cause neurodegeneration.* (Emphasis added).

The recently released *Nonylphenol (NP) and Nonylphenol Ethoxylates (NPEs) Action Plan* by US EPA discusses the following in regards to children:

There are potential children's health concerns related to NP and NPEs. NP exposure over several generations has been observed to cause slight changes in the estrous cycle length, timing of vaginal opening, ovarian weight, and sperm/spermatid count in laboratory animals (EU, 2002). NP exposure over several generations has been observed to cause slight but statistically significant changes in the estrous cycle length, timing of vaginal opening, ovarian weight, and sperm/spermatid count in laboratory animals beginning in 30-100 mg/kg/d dose groups (EU, 2002; Chapin et al., 1999).... Data on children's exposure are limited, though children may have greater exposure to NP and NPEs because they consume more food, drink more water, and breathe more air per pound than adults. While

biomonitoring data are also limited, a recent Italian study found maximum exposures from human breast milk of 3.9 µg /kg/day (Ademollo, 2008).

### **Exposure Measurements, US Federal Actions, and Other Significant Regulation**

NP is toxic to a wide variety of marine and freshwater vertebrate and invertebrate species in laboratory settings. Wide ranges of concentrations in water have been found to show effects, ranging from 1 to 1000 ppm . However, there are some reports of effects at environmental concentrations less than ppm.<sup>6</sup>

Unfortunately, most of the environmental concentration data are from fresh water systems. Negative effects are seen at lower concentrations in sea water when compared with fresh water. For example US EPA has set the chronic ambient water quality criteria of saltwater systems four times lower than freshwater (1.7 ppm and 6.6 ppm, respectively.)

With this petition we provide data that is rarely found in research studies – NP levels found in wild saltwater organisms. As you will find below, there are substantial levels of nonylphenol found in the water, sediment and marine organisms of Central Coast.

US EPA has determined NP to be a chemical of concern and on August 18, 2010, and released an “Action Plan” specifically for NP. US EPA specifically states that its concern centers on the following:

NP is persistent in the aquatic environment, moderately bioaccumulative, and *extremely toxic to aquatic organisms*. NP has also been shown to exhibit estrogenic properties in in vitro and in vivo assays.<sup>7</sup> (Emphasis added).

As part of the *NP Action Plan*, US EPA has implemented or plans to implement the following<sup>8</sup>:

1. Support and encourage the ongoing voluntary phase-out of NPEs in industrial laundry detergents
2. Initiate rulemaking to simultaneously propose a significant new use rule (SNUR) under TSCA section 5(a) and a test rule for NP and NPEs under TSCA section 4. The proposed SNUR would designate use of NPEs in detergents and cleaning products a significant new use, which would require submission of a significant new use notice (SNUN) to

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<sup>6</sup> *Id.*

<sup>7</sup> Nonylphenol and Nonylphenol Ethoxylates Action Plan Summary. US EPA. Aug 2010. Available at <http://www.epa.gov/oppt/existingchemicals/pubs/actionplans/np-npe.html>. Last visited Aug 29, 2010.

<sup>8</sup> *Id.*

EPA at least 90 days before beginning that use.

3. Consider initiating rulemaking under TSCA section 5(b)(4) to add NP and NPEs to the Concern List of chemicals that present or may present an unreasonable risk of injury to health or the environment.

4. Initiate rulemaking to add NP and NPEs to the Toxics Release Inventory (TRI), which would require facilities to report releases of these chemicals to the environment.

Due to the toxic effects of nonylphenol, and convincing evidence as to these effects, other countries have also taken steps to regulate nonylphenol. For example, Canada has set sediment concentration levels (Interim sediment quality guidelines- ISQGs) to 1 ppm in saltwater systems.<sup>9</sup> In samples taken and analyzed at Cal Poly, the average sediment level in Morro Bay was 33 ppm. Further, the European Union has banned the use of nonylphenol most of its applications.<sup>10</sup>

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<sup>9</sup> *Nonylphenol (NP) and Nonylphenol Ethoxylates (NPEs) Action Plan*. US EPA. 2010. Available at <http://www.epa.gov/oppt/existingchemicals/pubs/actionplans/np-npe.html>. Last visited Aug 29, 2010.

<sup>10</sup> *4-Nonylphenol (branched) and Nonylphenol Risk Assessment Report*. European Union, Institute for Health and Consumer Protection, European Chemicals Bureau. 2002.

## Central Coast Data

### *Nonylphenol Contamination in Morro Bay, Chorro Creek --- Water, Sediment, and Organism Samples in PPM (u/L or kg/L)*

		Morro Bay	Chorro Creek	No. of Samples
Water Samples				
	High	0.9	3.4	9 MB, 2 CC
	Low	0	1.3	
	Avg	0.31	2.35	
Sediment	High	87	610*#	9 MB
	Low	0	0*#	
	Avg	32.9	305*	
Mussels (whole)	High	390		2 MB
	Low	190		
	Avg	290		
Arrow Goby Livers				2 MB
	High	2700		
	Low	716		
	Avg	1708		
Oysters (whole)	High	265		3 MB
	Low	159		
	Avg	203		
Whole Arrow Goby (minus intestine)	High	550		40 MB
	Low	0		
	Avg	167		
<b>San Francisco</b>	High	420		6 SF
Whole Arrow Goby (minus intestine)^				
	Low	50		
	Avg	161		

\* Dry weight

# The low sediment measurement of 0 ppm was taken above the Men's Colony WWTP outfall, the high sediment measurement of 610 ppm was taken directly below the outfall

^ Included for reference

## **Conclusion**

The CC RWQCB has the opportunity to be a leader in regulating and controlling the discharge of NP into our marine environment, which is essential to both recreation and economic activities, not to mention a source of our food. The ubiquitous presence of this harmful chemical in Morro Bay and Chorro Creek is impacting both marine life and human uses. Placing these water bodies on the 303(d) list will support US EPA's actions to regulate and phase-out NP, and will send a signal to the industry to switch to safer alternatives. More importantly, taking action will protect the human health and our fragile marine ecosystems.

Please contact Melissa Locke at 734-717-9111 or [mlocke@calpoly.edu](mailto:mlocke@calpoly.edu) if you have any questions.

Thank you –

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