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1250 CONNECTICUT AVENUE, NW, SUITE 700, WASHINGTON, DC 20036
TOLL FREE: 866-APERC-NA WWW.APERC.ORG INFO@APERC.ORG

APERC Follow Up Statement on University of Colorado Research on Intersex Fish November 30, 2004

What You Need to Know About Alkylphenols and Intersex Fish

A study, conducted at the University of Colorado about intersex fish in Colorado rivers downstream from wastewater treatment plants, was presented at the Fourth World Conference of the Society of Environmental Toxicology and Chemistry (SETAC).[1] The study previously received newspaper and television media coverage that quoted the researchers as being concerned that the intersex fish, which display characteristics of both males and females, and low numbers of male fish are being caused by exposure to natural human estrogens and "estrogen mimickers" found in wastewater effluent. Unfortunately, based on the monitoring data presented at the meeting, the recent media reports clearly overemphasized the relevance of alkylphenols in their discussion.

The finding that highly potent estrogenic compounds from human waste are present at low levels in treated wastewater effluent is not surprising; neither is the detection of weakly estrogenic compounds such as nonylphenol (NP) given their use patterns. Another recently publicized Minnesota study determined the presence and distribution of 91 organic wastewater compounds (OWCs) at 65 sites.[2] This study, which is one of many similar studies conducted by the US Geological Survey, illustrates just how much is already known about environmental levels of OWCs. In fact, topics related to the presence of human hormones and OWCs in wastewater effluent were the subjects of numerous studies that were presented at the recent SETAC conference. In a session that was devoted to endocrine disrupting chemicals in wastewater treatment plant effluents, the Wisconsin State Hygiene Lab[3] presented the results of a nationwide survey of treatment plants which concluded "the vast majority of the activity is due to three hormones (17β-estradiol, estrone and estriol) rather than phenolic compounds."

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[1] Vajda, A., Lopez, E., Woodling, J., Maldonado, T., and Norris, D. (2004, November). Intersex and reproductive disruption in white suckers (*Catostomus commersoni*) downstream of Colorado wastewater treatment plants. Poster PT217 presented at Fourth World Conference of the Society of Environmental Toxicology and Chemistry, Portland, Oregon.

[2] Lee, K.E., Barber, L.B., Furlong, E.T., Cahill, J.D., Kolpin, D.W., Meyer, M.T., and Zaugg, S.D. (2004, November). Presence and Distribution of Organic Wastewater Compounds in Wastewater, Surface, Ground and Drinking Waters, Minnesota, 2000–02. US Geological Survey Scientific Investigations Report 2004-5138. http://water.usgs.gov/pubs/sir/2004/5138/

[3] Hemming, J.D.C., Drewes, J.E., Ladenburger, S., Mieritz, M., Barman, M.A.E., Schauer, J.J., and Sonzogni, W.C. (2004, November). Removal of Endocrine Disrupting Activity from Water Reclamation Processess I. Comparing Bioassay Results with Chemical Analyses. Paper 708 presented at the Fourth World Conference of the Society of Environmental Toxicology and Chemistry, Portland, Oregon.

Most media coverage focuses on the detection of many different hormones and OWCs in wastewater effluent without discussing what is known about their relevance in risk assessment. For example, alkylphenols and their biodegradation intermediates are typically found at only trace levels (less than a part per billion) in the aquatic environment in the United States. In addition, their estrogenic potency is ten thousand to one million times less than that of natural estrogen. **Indeed numerous studies have already demonstrated that the major estrogenic activity present in effluents of sewage treatment plants is from the hormones in human waste (*e.g.*, human estrogen, birth control pills) not from weakly estrogenic compounds like nonylphenol.**

The monitoring data reported with the University of Colorado study are consistent with this conclusion. In fact, after removing nonylphenol ether carboxylates (NPECs) from the calculation, since they are not estrogenic and not do biodegrade to any estrogenic compounds, the estrogenic contribution of nonylphenol in this waste stream is between four to six orders of magnitude lower than that of the human estrogens.

The Colorado and Minnesota studies add to an already well-founded understanding of the environmental levels of alkylphenols in US surface waters. **APERC recently conducted a statistical analysis of environmental monitoring data taken from over one thousand samples reported in peer-reviewed literature that shows levels of nonylphenol, its ethoxylates and biodegradation intermediates in the United States are with few exceptions well below EPA's proposed Water Quality Criteria (WQC) for nonylphenol.** WQC represent the concentrations of NP in water at which aquatic life is protected from acute and chronic adverse effects.

Given the widespread use of nonylphenol and its derivatives, the low levels found in the environment 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. Recently, a study sponsored by EPA's National Risk Management Research Program on endocrine disrupting chemicals[4] found that the removal rate for nonylphenol ethoxylates in two pilot scale wastewater treatment plants exceeded 96%, while removal rates for some natural estrogens were as low as 50%.

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http://www.aperc.org/docs/bulletin_waterquality012204.pdf

Environmental Levels of Alkylphenols and Their Ethoxylates in the United States
http://www.aperc.org/docs/bulletin_levelsap113004.pdf

[4] Esperanza, M., Suidan, M.T., Nishimura, F., Wang, Z.M., and Sorial, G.A. (2004). Determination of sex hormones and nonylphenol ethoxylates in the aqueous matrixes of two pilot-scale municipal wastewater treatment plants. Environmental Science & Technology, 38 (11), 3028-3035.