

PHARMACEUTICALS IN DRINKING WATER

Testimony of David Pringle

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On Behalf of:

New Jersey Environmental Federation and Clean Water Action

Before the U.S. Senate Environment and Public Works Committee

Subcommittee on Transportation Safety, Infrastructure Security and Water Quality

**“Pharmaceuticals in the Nation’s Water: Assessing Potential Risks and
Actions to Address the Issue”**

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Introduction -- Thank you, Mr. Chairman and Members of the Committee, for the opportunity to testify before you today at your hearing entitled: "Pharmaceuticals in the Nation's Water: Assessing Potential Risks and Actions to Address the Issue."

My name is David Pringle. I am the Campaign Director for the New Jersey Environmental Federation (NJEF), the Garden State Chapter of Clean Water Action (CWA). NJEF has over 100,000 individual members and an additional 100 member groups in the Garden State. CWA has offices in seventeen states and one million members across the nation including in many of the committee members' home states. Since CWA's founding in the early 1970's, NJEF's a decade later, and the launch of my own professional career in the late 1980's, CWA's, NJEF's, and my primary focus have been advancing water protection policies at the local, state and federal level.

While I come before you today representing CWA, NJEF and myself, for the past 5 years I have also served as an appointee of the Speaker of the New Jersey State Assembly to the Drinking Water Quality Institute (DWQI) and currently serve as chair of its Health Subcommittee. Created by New Jersey statute over 20 years ago, DWQI is a professional body of scientists, engineers, government officials and public health experts appointed by the Governor, State Senate President and State Assembly Speaker that must recommend drinking water standards to the NJ Department of Environmental Protection (NJDEP) before NJDEP acts on such standards.

As the most densely populated state, New Jerseyans live most literally on top of and right next to their drinking water, which accordingly is too often in short supply and threatened with contamination. In response, NJDEP, DWQI, CWA, NJEF, et al. have sought to ensure that New Jerseyans, whether tapping their own private individual well or a public water system, benefit from some of the strongest drinking water protections in the nation.

Summary – The presence of hundreds of unregulated pharmaceuticals and other manmade chemicals in the nation's surface, ground, waste and drinking water is becoming increasingly well documented due to increased monitoring, better testing techniques and greater use. While the data to date reveals concentrations at relatively low levels, current conventional treatment does not effectively remove them. This is cause for concern, albeit not panic, and cause for timely action. More research and other common sense measures are needed, and some are well beyond the current regulatory framework process and timeframes.

The recent Associated Press investigation ("AP Probe Finds Drugs in Drinking Water," March 9, 2008) brought to greater light what the scientific literature has been documenting for a decade -- a potential toxic stew of organic pollutants: human and veterinary medicine (steroids, antibiotics, anti-depressants, hormones, et al.), personal care products, and various industrial and commercial products. The primary sources of these pollutants include wastewater due to pharmaceuticals excreted unchanged by the body, industrial discharge, disposal of unused drugs, biosolids and manure used as fertilizer and agricultural runoff.

There are no federal or state standards or monitoring requirements for the vast majority of these pharmaceuticals in drinking water or waste water. While the health effects of these contaminants

at medical doses are relatively well-known, their ecological and public health impacts, especially their side, cumulative, and synergistic effects at lower doses are largely unknown and cannot be dismissed. Pharmaceuticals by their very nature are designed to be biologically active and scientific studies indicate that these chemicals are already harming a wide array of wildlife.

Further, the nation's current regulatory framework is so slow, narrowly focused and costly that it is unfit to address this problem, especially if it grows as anticipated with greater water re-use and new medical breakthroughs, of which this problem is in part an unintended consequence.

Accordingly, while we don't know enough and need to learn more, we do know enough to be concerned and take precautionary action – e.g., more research on health and ecological impacts and occurrence, upgraded treatment for wastewater and drinking water and most importantly pollution prevention through pharmaceutical, agricultural and water industry reforms.

Occurrence of Pharmaceuticals and Other Unregulated Contaminants in the Nation's Waters – As noted above, the presence of hundreds of unregulated pharmaceuticals and other manmade chemicals in the nation's water is increasingly well documented. The primary sources of these pollutants are wastewater excreted unchanged by the body, industrial discharge, disposal of unused drugs, biosolids and manure used as fertilizer and agricultural runoff.

While the data show concentrations at relatively low levels, current conventional treatment does not effectively remove them. More than 100 different pharmaceuticals have been detected in lakes, rivers, reservoirs and streams throughout the world (*Damming the Flow of Drugs in Drinking Water*, Environment Health Perspectives, Volume 113, Number 10, October 2005). It can be anticipated that the concentrations and numbers of pharmaceuticals in the nation's waters will increase given ongoing medical advances and increased reliance on water reuse as demands for water grows and the supply diminishes. Some of the early and most important scientific studies documenting this problem were conducted in New Jersey including:

- NJDEP-Environmental and Occupational Health Sciences Institute, *The Characterization of Tentatively Identified Compounds (TICs) in water samples collected from public water systems in New Jersey*, March 2003 – 600 non-volatile and semi-volatile compounds were detected in samples from 20 sites, primarily community systems using groundwater with known historic organic contamination and near known contaminated sites. 51 compounds were detected in raw and finished water;
- NJDEP-United States Geological Survey (USGS), *Occurrence, Distribution, and Concentration of Pharmaceutical and Other Organic Wastewater-Related Compounds in New Jersey's Surface Water Supplies*, February 2003 – 30 stream sampling locations in New Jersey sites with a range of 0 to 51 municipal wastewater treatment facilities upstream and estimated wastewater contributing to stream flow ranging from 0-70%. Over 90% of samples contained at least 1 and as many as 32 of the 95 targeted compounds with a median of 11. Total concentrations of these compounds ranged from non-detect to 81 ppb (parts per billion) with a median of 1.7 ppb and the most commonly detected compounds included caffeine, the pharmaceuticals carbamazepine and cotinine, flame retardants and plasticizers, a fragrance, steroids and the pesticides prometon, diazinon, and metolachlor; and
- USGS-Centers for Disease Control-NJDEP, *Fate of Organic Wastewater Contaminants in a Drinking Water Treatment Facility*, February 2003 -- 11 organic wastewater contaminants were tracked through the 4 stages of "traditional" treatment (pre-disinfection with chlorine, flocculation/sedimentation, filtration, and post-disinfection with chlorine) at the Passaic Valley Water Supply Commission's Little Falls, NJ plant. All 11 contaminants were detected in raw, settled, filtered and finished water samples with concentrations for each contaminant ranging

from .1 to .4 ppb and reductions not very significant (most reductions ranged from 10-30% and for one contaminant there was actually a 10% increase.)

- USGS, *Pharmaceuticals, Hormones, and Other Organic Wastewater Contaminant in U.S. Streams:1999-2000: A National Reconnaissance* – at least one chemical was detected in 80% of the 139 streams sampled in 30 states, 75% had more than one, 50% 7 or more, and 34% 10 more, while 82 of 95 chemicals sampled for (including steroids, insect repellent, caffeine, triclosan [the anti-microbial disinfectant often used in liquid hand soap], detergent metabolites, and plasticizers) were detected in at least one stream.

Human Health and Ecological Risks – Common sense dictates it's not a good idea to drink somebody else's medicine: "We know we are being exposed to other people's drugs through our drinking water, and that can't be good," says Dr. David Carpenter, who directs the Institute for Health and the Environment of the State University of New York (SUNY) at Albany (AP, 2008).

Pharmaceuticals are designed to be biologically active. Studies indicate that these chemicals are already harming wildlife at levels found in water. While the effects of many of these contaminants at medical doses are relatively well-known, their ecological and human health impacts at lower doses are largely unknown, especially their side, cumulative and synergistic effects.

"These are chemicals that are designed to have very specific effects at very low concentrations. That's what pharmaceuticals do. So when they get out to the environment, it should not be a shock to people that they have effects," says zoologist John Sumpter at Brunel University in London (AP, 2008).

Further, standards, guidelines or criteria are in place for only a fraction of the pharmaceuticals being detected in drinking water. For example, a 2001 USGS study found only 29% of over 50 semi-volatile organic pesticides and 34% of volatile organics compounds (VOC's) detected in New Jersey ground and surface water had drinking water standards or guidelines. Of the 600 TICs from the NJDEP, March 2003 study, "the majority have no standards or guidelines associated with them [and] in fact, there is scant information at all on health effects from most of the [them]" (Mark Robson, et al., NJ School of Public Health, University of Medicine and Dentistry of New Jersey, March 2003).

Ecotoxicity data is even less available -- for less than 1% of human pharmaceuticals according to estimates published in the April 2004 issue of *Regulatory Toxicology and Pharmacology*. However, "while researchers do not yet understand the exact risks from decades of persistent exposure to random combinations of low levels of pharmaceuticals, recent studies ... have found alarming effects on human cells and wildlife. ... "[w]e recognize it is a growing concern and we're taking it very seriously," said Benjamin H. Grumbles, U.S. Environmental Protection Agency (USEPA) Assistant Administrator for Water' (AP, 2008).

Studies that taken together represent a modern Noah's Ark- from algae, zooplankton and earthworms to vultures, mussels and fish- suggest a host of species can be impacted by this contamination. Perhaps the most documented is the feminization of male fish living downstream from wastewater treatment plants. Two prime examples of this phenomenon come from Colorado streams (e.g., *Comparative Biochemistry and Physiology C, Toxicology and Pharmacology* 144: 10-15, 2006) and from striped bass and winter flounder in Jamaica Bay, New York (McElroy, et al., Sea Grant/SUNY-Stony Brook, May, 2007).

“It doesn’t take a lot of estrogen to feminize male fish. If you can measure the estrogen in the water, then that’s enough to cause an effect, and we can measure it at very low parts per trillion,” said Karen A. Kidd, a biology professor at the Canadian Rivers Institute, University of New Brunswick in the February 25, 2008 cover story, “Side Effects”, in *Chemical & Engineering News*, the weekly magazine of the far from radical American Chemical Society.

We also know little about how these compounds degrade and react in the environment, during treatment and inside our bodies, as well as long-term exposure to multiple contaminants at low levels. “Sometimes ... the biodegradation product is more toxic than the parent,” said Diana Aga, an analytical chemist at SUNY, Buffalo (*Chemical & Engineering News*, 2008).

Even some in the pharmaceutical industry are expressing concern: ‘At a conference last summer, Mary Buzby - director of environmental technology for drug maker Merck & Co. Inc. - said: "There's no doubt about it, pharmaceuticals are being detected in the environment and there is genuine concern that these compounds, in the small concentrations that they're at, could be causing impacts to human health or to aquatic organisms".’ (AP, 2008)

Current Regulatory Framework Flaws – The presence of pharmaceuticals in the nation’s waters highlights how severely flawed the nation’s current regulatory framework for water protection is and the challenge we face. “There are thousands upon thousands of chemicals out there” ... even adding one more substance to the regulated list can be a “lengthy, costly and frustrating process” Barker Hamill, NJDEP’s Bureau of Safe Drinking Water Chief, told (Camden, NJ) *Courier Post* (Removal of drugs in water gets test in S.J., Richard Pearsall, March 16, 2008).

That framework is a series of laws and agencies (Resource Conservation and Recovery Act, Superfund, Clean Water Act, Safe Drinking Water Act, Food and Drug Administration and U.S. EPA, et al.) that add up to a process that is costly, time consuming, and unprotective -- each looking at too narrow of a set of contaminants (e.g., Superfund and the Safe Drinking Water Act (SDWA) focus on about 100 each but not the same 100) in too narrow of a setting (chemical by chemical, limited health effects) without enough coordination between programs (clean water staff and don’t communicate enough with drinking water staff even though one might be regulating a discharge just upstream of an intake).

The Toms River NJ, cancer cluster investigation drives this point home. In an effort to explain and address why leukemia, brain and nervous system cancers were elevated among the area’s children, millions of dollars have been spent to identify, develop health data on and treat the local water supply for an organic TIC. The TIC had been picked up in test results from a Superfund site literally feet away from the area’s drinking water supply in the 1980’s but was ignored as it was not a priority pollutant. Ten years ago it was found to have leached into the areas’s water supply. The water is currently being treated using air stripping and a carbon filter, but the health data is too lacking to develop a drinking water standard.

FDA regulates pharmaceuticals for acute health effects but much less for chronic effects: “It takes a lot of 17a-ethinylestradiol [a synthetic estrogen] to kill an aquatic organism, so by current testing standards, the compound would appear to have a very low potential risk. But feminization of male fish – something those short-term tests would have never detected – occurs at very low concentrations of the drug” says Bryan Brooks, an environmental science professor at Baylor University” (*Chemical & Engineering News*, 2008).

The other programs similarly ignore important health effects. Most of these contaminants occur in concert with other contaminants yet cumulative and synergistic effects are not evaluated. Standard

setting is too often focused solely on carcinogenic effects and sometimes teratogenic and mutagenic effects and based on an average adult male at the expense of more vulnerable populations – the young, women of child-bearing age, seniors, and the already sick.

“It could be that the chemical stress that’s put on any organism is the result of minute stresses of a multitude of chemicals,” says Christian G. Daughton, chief of the environmental chemistry branch at the EPA’s National Exposure Research Laboratory (Chemical & Engineering News, 2008).

Finally, traditional wastewater systems are designed to treat microorganisms and nutrients, not pharmaceuticals and other organic compounds found in the studies referenced in this testimony. Making matters worse, loopholes in the Clean Water Act permit industrial discharge into sewers in greater amounts than directly into surface or groundwater even though the sewer plants are not designed to manage such waste.

Advanced treatments such as ozonation, granulated activated carbon, reverse osmosis and nanofiltration membranes can remove significant amounts of pharmaceutical but are expensive (Stackelberg, Gibs, et al., USGS, 2004, 2006, 2007; Black and Veatch Consultants -- NJDEP, January 2007). Black and Veatch, NJDEP and several water utilities are working together on several pilot projects to explore treatment options. More research, as well as federal leadership from U.S.EPA, are needed to build on this and other projects in states and on the information base that USGS and others have begun.

Recommended Actions – As described above, the occurrence of pharmaceuticals in the nation’s waters is a complex problem and requires a comprehensive multi-faceted response by policy makers, industry, scientists and consumers:

- Monitoring of both raw and finished water should be expanded – for starters, Congress needs to restore President Bush’s FY09 \$10 million budget cut for USGS’s National Water Quality Assessment (NAWQA) and other programs which includes monitoring, analysis and research activities that are critical to further understanding of this issue.
- Research is needed into treatment technology upgrades that industrial dischargers, wastewater systems and drinking water utilities can use to remove drugs from water intended for consumption or other use – priority should be placed on pilot projects like New Jersey’s and the consideration of precautionary approach treatment techniques (requiring treatment in some instances even when presence and/or health impacts are not confirmed).
- Programs to discourage flushing of unused drugs into public wastewater systems should be encouraged – it must be emphasized that this is just a piece of a much larger plan.
- Pollution prevention and toxic use reduction must be vigorously pursued, especially in the reformulation of human and veterinary medicines at each stage of their life cycle.
- Waters with evidence of deformed fish and other ecological impacts possibly due to pharmaceutical pollution should be targeted for cleanup activities.

Finally, bottled water is not a solution, because it is less regulated than tap water, more expensive (200-10,000%) and is drawn largely from the same sources as public tap water supplies. Activity should be focused on pollution prevention and on ensuring healthy drinking water, a task which is well within our capacity.

I appreciate the opportunity to provide testimony here today and welcome questions now or in the future from the Committee.