



**U.S. House of Representatives  
Committee on Transportation and Infrastructure**

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September 15, 2008

**SUMMARY OF SUBJECT MATTER**

**TO:** Members of the Subcommittee on Water Resources and Environment  
**FROM:** Subcommittee on Water Resources and Environment Staff  
**SUBJECT:** Hearing on Emerging Contaminants in U.S. Waters

**PURPOSE OF HEARING**

On Thursday, September 18, 2008, at 2:00 p.m., in Room 2167 of the Rayburn House Office Building, the Subcommittee on Water Resources and Environment will hear testimony from representatives from the United States Environmental Protection Agency (EPA), the United States Geological Survey (USGS), the State of Maine, the National Association of Clean Water Agencies, and academic researchers on emerging contaminants in U.S. waters.

**BACKGROUND**

This memorandum provides a summary of both unregulated contaminants and those of growing concern in surface waters, and the effects or potential effects on human health and aquatic ecosystems. The memorandum also discusses the Clean Water Act's framework for addressing contaminants in surface waters.

**Emerging Contaminants**

No single or commonly-accepted definition of emerging contaminants exists. Various agencies<sup>1</sup> and states have different, but related, usages. Emerging contaminants can be characterized

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<sup>1</sup> Federal definitions of emerging contaminants vary. USGS characterizes emerging contaminants as "any synthetic or naturally occurring chemical or any microorganism that is not commonly monitored in the environment but has the potential to enter the environment and cause known or suspected adverse ecological and (or) human health effects." (<http://toxics.usgs.gov/regional/emc/index.html> (accessed 12 September, 2008)). In a draft report, EPA recently characterized emerging contaminants as "chemicals and other substances that have no regulatory standard, have been

as both unregulated contaminants and those of growing concern in surface waters that negatively affect or have the potential to negatively affect human health and/or aquatic ecosystems.

The range of emerging contaminants includes:

- Toxic chemicals, including persistent organic pollutants<sup>2</sup>;
- Pharmaceuticals and personal care products;
- Veterinary medicines;<sup>3</sup>
- Endocrine-disrupting chemicals;<sup>4</sup> and
- Nanomaterials.

### Emerging Contaminants in Surface Waters

USGS has the responsibility for water-quality monitoring of the nation's waters. Through its National Water Quality Assessment (NWQA) and Toxic Substances Hydrology (Toxics) Programs it is a national leader in identifying emerging contaminants in the nation's surface, ground, and drinking waters. USGS program and research activities in the area of emerging contaminants include: analytical methods development, occurrence in the environment, sources and source pathways, transport and fate, and ecological effects. The FY 2008 enacted budgets for the NWQA and Toxics Programs were, respectively, \$63.9 million and \$13.5 million. The President's proposed FY 2009 budget requests approximately \$54.1 million and \$10.7 million for these programs, respectively.

In 2002, USGS researchers released the first nationwide study of the occurrence of pharmaceuticals, hormones, and other organic wastewater contaminants in U.S. streams.<sup>5</sup> Since 2002, USGS has published more than 160 reports that document and demonstrate the existence of these substances in U.S. waters, the sources of these substances, the assimilation of some of these by organisms,<sup>6</sup> and adverse ecological health effects.<sup>7</sup>

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recently "discovered" in natural streams (often because of improved analytical chemistry detection levels), and potentially cause deleterious effects in aquatic life at environmentally relevant concentrations. They are pollutants not currently included in routine monitoring programs and may be candidates for future regulation depending on their (eco)toxicity, potential health effects, public perception, and frequency of occurrence in environmental media." (EPA Draft White Paper. "Aquatic Life Criteria for Contaminants of Emerging Concern." (June 3, 2008))

<sup>2</sup> Persistent organic pollutants are organic chemical compounds that are resistant to environmental degradation through chemical, biological, or photolytic processes. These compounds will persist in the environment and can bioaccumulate in animal tissue – resulting in a biomagnification up the food chain. These substances are often toxic and can therefore negatively impact human and environmental health.

<sup>3</sup> These substances can include antimicrobials, antibiotics, anti-fungals, growth promoters, and hormones.

<sup>4</sup> These substances include synthetic estrogens, androgens, and naturally-occurring estrogens. They have the potential to act as hormones, resulting in changes to the endocrine system and biological changes.

<sup>5</sup> Kolpin, D.W., et al., 2002. "Pharmaceuticals, Hormones, and Other Organic Wastewater Contaminants in U.S. Streams, 1999-2000: A National Reconnaissance." *Environmental Science and Technology*. 36: 1202-1211.

<sup>6</sup> *Amongst the most recent of these is:* Kinney, C.A., et al., 2008. "Bioaccumulation of pharmaceuticals and other anthropogenic waste indicators in earthworms from agricultural soil amended with biosolid or swine manure." *Environmental Science and Technology*. 42: 1863-1870.

<sup>7</sup> *Amongst the most recent of these is:* Vajda, A.M., et al., 2008. "Reproductive Disruption in Fish Downstream of an Estrogenic Wastewater Effluent." *Environmental Science and Technology*. (published on-line March 25, 2008: <http://pubs.acs.org/cgi-bin/abstract.cgi/esthag/2008/42/i09/abs/es0720661.html> (accessed 12 September, 2008)).

The 2002 USGS study involved monitoring for 95 emerging contaminants that are potentially associated with human, industrial, and agricultural waste, including antibiotics, other prescription drugs, steroids, reproductive hormones, personal care products, products of oil use and combustion, insecticides, fire retardants, solvents, and plasticizers, among others. Samples were taken from 139 streams across a wide range of settings in 30 states. Stream sites were chosen on the basis of their being downstream from urban centers and livestock production, and therefore susceptible to contamination. The results of this study are therefore not representative of all streams across the United States.

The study identified one or more emerging contaminants in 80% of the sampled streams. Eighty-six percent of the emerging contaminants were detected at least once. A median of seven emerging contaminants were found in those streams in which the study authors identified a targeted emerging contaminant, with one stream containing 38 of the targeted emerging contaminants. For interpretive purposes, the authors grouped the 95 emerging contaminants into 15 categories, based on their uses or origins. At least six of those categories – steroids, nonprescription drugs, insect repellent, detergent constituents, disinfectants, and plasticizers – showed up in over 60 percent of the streams tested. Three categories – steroids, detergent constituents, and plasticizers – made up almost 80% of the total measured concentration of contaminants.

Measured concentrations of individual compounds were generally low. However, total concentrations of all targeted emerging contaminants were considerably higher. For those substances that have drinking-water guidelines or aquatic-life criteria associated with them, levels were not, for the most part, exceeded. However, the authors noted that “many of the 95 OWCs do not have such guidelines or criteria determined. . . .”<sup>8</sup> Thirty-three of the 95 target emerging contaminants are known, or are suspected, to exhibit at least weak hormonal influence, with the potential to disrupt normal endocrine function. All of these endocrine disruptors were detected in at least one of the stream samples during the study. The study authors note that “measures of concentrations of reproductive hormones may have greater implications for health of aquatic organisms than measured concentrations of nonprescription drugs.”<sup>9</sup>

The 2002 USGS study authors conclude that the implications of this research are that many such compounds survive wastewater treatment and biodegradation.

### Aquatic and Environmental Health Impacts

For many emerging contaminants, the toxicological effects, or potential toxicological effects, of emerging contaminants are not clearly understood. The 2002 USGS study researchers noted that “[f]or many OWCs, acute effects to aquatic biota appear limited because of the low concentrations occurring in the environment.”<sup>10</sup> They go on to note, however, that “chronic effects from low-level environmental exposure to select OWCs appear to be of much greater concern.”<sup>11</sup> The 2002 USGS report cites a number of studies in which long-term, chronic impacts to aquatic and environmental health have been demonstrated, as a result of exposure to emerging contaminants.

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<sup>8</sup> Kolpin, D.W., et al., 2002. p. 1208.

<sup>9</sup> Kolpin, D.W., et al., 2002. p. 1209.

<sup>10</sup> Kolpin, D.W., et al., 2002. p. 1208.

<sup>11</sup> Kolpin, D.W., et al., 2002. p. 1208.

Recent USGS research has identified toxicological and endocrine impacts on aquatic and environmental health. This USGS research has included studies of developing anti-microbial and anti-biotic resistance at beaches and coastal areas,<sup>12</sup> mercury and PCB (polychlorinated biphenyl) contamination of fish in the southeastern U.S.,<sup>13</sup> endocrine disrupting chemicals from wastewater effluent on fish resulting in altered (cancerous, reduced sized, intersex) reproductive organs,<sup>14</sup> and the bioaccumulation of pharmaceuticals and other wastewater effluent contaminants in earthworms from agricultural soil partially comprised with biosolids.<sup>15</sup>

### Human Health Impacts

At levels currently identified in surface water the potential effects of many emerging contaminants on human health is not clearly understood. This includes both acute and chronic effects. As demonstrated above, however, research is developing that shows acute and chronic impacts on other species.

Water contaminants can enter the body through a number of pathways, including ingestion, surface contact, and inhalation of vaporized water. Pregnant women, infants and children, and individuals with suppressed immune systems are understood to be more at risk for negative health consequences from toxic contaminants.

The USGS 2002 study also notes that there is little understanding of the potentially toxic interactive effects of complex mixtures of emerging contaminants in the environment. A 2002 State University of New York-Albany (SUNY-Albany) study highlights the human health effects of chemical mixtures.<sup>16</sup> This research notes that an estimated 80,000 chemicals are currently in use. This is a three-fold increase from 1941 to 1995. Of these 80,000, nearly 10% are understood to be carcinogens. The SUNY-Albany researchers state that many of these compounds have not been adequately tested for human toxicity. Compounding this is even less of an understanding of the human health impacts of chemical mixtures.

Similarly, a number of compounds included among the targeted emerging contaminants in the 2002 USGS study are noted to degrade into other constituents over time. As a result, the 2002 USGS study authors call for increased research into the health effects of the individual emerging contaminants, mixtures of these compounds, and degradates of particular compounds.

In 2008, USGS has released a national reconnaissance study that demonstrates the presence of emerging contaminants in untreated drinking water sources across the United States.<sup>17</sup> Sixty-three of the 100 targeted emerging contaminants were detected in at least one water sample (taken from 74 untreated drinking water locations.) This is consistent with the findings of recent Associated

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<sup>12</sup> Fogarty, L.R., et al., 2003. "Abundance and Characteristics of the Recreational Water Quality Indicator Bacteria *Escherichia coli* and Enterococci in Gull Faeces." *Journal of Applied Microbiology*. 94: 865-78.

<sup>13</sup> Hinck, J.E., et al., 2008. "Chemical Contaminants, Health Indicators, and Reproductive Biomarker Responses in Fish from Rivers in the Southeastern United States." *Science of the Total Environment*. 390: 538-57.

<sup>14</sup> Hinck, J.E., et al., 2008; Vajda, A.M., et al., 2008.

<sup>15</sup> Kinney, C.A., et al., 2008. "Bioaccumulation of Pharmaceuticals and other Anthropogenic Waste Indicators in Earthworms from Agricultural Soil Amended with Biosolid or Swine Manure." *Environmental Science and Technology*. 42: 1863-70.

<sup>16</sup> Carpenter, D.O., et al., 2002. "Understanding the Human Health Effects of Chemical Mixtures." *Environmental Health Perspectives Supplements*. 110: 25-42.

<sup>17</sup> Focazio, M.J., et al., 2008. "A National Reconnaissance for Pharmaceuticals and Other Organic Wastewater Contaminants in the United States – II) Untreated Drinking Water Sources." *Science of the Total Environment*. 402: 201-16.

Press (AP) investigative reports that found that pharmaceuticals are in the drinking water supplies of at least 46 million Americans.<sup>18</sup> In these reports, the AP writers noted that some pharmaceuticals resist drinking water and wastewater treatment processes, and that wastewater treatment facilities are not currently configured to remove these substances. These media accounts do report that levels of contaminants are showing up in drinking water supplies or source water at very low levels. However, concern exists in the research community about the human health consequences of long-term, low-level exposure to these contaminants.<sup>19</sup>

### Clean Water Framework for Addressing Surface Water Pollutants

**Introduction:** The Clean Water Act is the federal government's primary statutory tool for protecting the quality of surface waters. The 1972 CWA identifies two national goals: the discharge of pollutants into navigable waters be eliminated by 1985; and, wherever attainable, an interim goal of water quality which provides for the protection and propagation of fish, shellfish, and wildlife and provides for recreation in and on the water be achieved by July 1, 1983 (also known as "swimmable and fishable waters"). While progress towards these goals has been achieved, neither goal has yet been met.

Protection of surface waters, through the CWA, occurs through two mechanisms: technology standards and water quality standards. Technology standards, through the use of effluent guidelines, were intended to result in the complete elimination of the discharge of pollutants into surface waters by 1985, through a process of increasingly strict technology standards over time. Water quality standards are intended as a backstop that would entail a strengthening of effluent guidelines until a water body is delisted as impaired.

**Effluent Limitation Guidelines:** Effluent limitation guidelines are national standards that are developed by EPA on an industry-by-industry, pollutant-by-pollutant basis. Effluent limitation guidelines are intended to represent the greatest pollutant reductions from a given industry that are economically achievable and technically feasible. Effluent limitation guidelines are not determined by toxicity, or based on any health standard or criteria. This effluent guideline approach was envisioned by the 1972 CWA to be an interim step, with the eventual goal of an elimination of all pollutant discharges.

Since 1972, EPA has established effluent limitation guidelines for 56 industry sectors. EPA has not finalized any new effluent guidelines since 2003.

If a sector has no effluent limitation guideline associated with it, it is up to the permit writer to establish site-specific technology based limits to control the discharge. Under Section 304(b) of the CWA, EPA must identify and generate effluent limitation guidelines for those industry sectors that generate more than trivial amounts of toxic or "nonconventional" pollutants.

Pursuant to Section 307(a) of the CWA, EPA has identified a class of toxic pollutants known as "priority pollutants." EPA must develop effluent limitation guidelines for these substances.

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<sup>18</sup> Donn, J., et al., 2008. "AP Probe Finds Drugs in Drinking Water." *USA Today*. 9 March 2008; Mendoza, M. 2008. "AP Enterprise: Recent Tests Detect Pharmaceuticals in Drinking Water of 46 Million Americans." *Los Angeles Times*. 12 September, 2008.

<sup>19</sup> Rapid Public Health Policy Response Project. 2008. *Pharmaceuticals are in the Drinking Water: What Does it Mean?* George Washington University School of Public Health and Health Services.

Currently, 126 specific toxic substances are listed on the priority pollutant list (this list was generated from 65 pollutants and classes of pollutants.)

***Water Quality Standards:*** In those instances where a technology-based permit (or secondary treatment limits for treatment works) is not sufficiently stringent to meet state-established water quality standards for the water where the discharge is located, the Clean Water Act requires the implementation of more stringent, water-quality based effluent (discharge) limits to ensure that water quality standards for the waterbody are met.

Following implementation of the technology-based controls (developed as part of traditional effluent guidelines), if a water body is still impaired, the Clean Water Act requires the development of water-quality based discharge limits for those chemicals or pollutants that are causing the impairment of the waterbody. However, unlike the technology based effluent limits, water-quality based limits do not require a cost-benefit analysis, but are focused on establishing specific discharge limits for pollutants that are known to cause water quality impairments to receiving waters.

Accordingly, the framework of the Clean Water Act provides a process for the identification of specific waterbodies where the technology-based limits fail to achieve water quality standards for identified pollutants, as well as a mechanism for imposing further discharge limits on those identified pollutants that, if properly, implemented, should result in the waterbody meeting state-established water quality standards.

WITNESSES

Panel I

**Honorable Carolyn McCarthy**  
Congresswoman  
4<sup>th</sup> District of New York

Panel II

**Honorable Benjamin Grumbles**  
Assistant Administrator for Water  
United States Environmental Protection Agency  
Washington, D.C.

**Dr. Matthew Larsen**  
Associate Director for Water  
United States Geological Survey  
Reston Virginia

*Accompanied by:*

**Mr. Herb Buxton**  
Program Coordinator, Toxics Program  
United States Geological Survey  
West Trenton, New Jersey

**Mr. David Littell**  
Commissioner, Department of Environmental Protection  
State of Maine  
Augusta, Maine

**Mr. Keith Linn**  
Environmental Specialist  
Northeast Ohio Regional Sewer District  
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*Testifying on behalf of:*

The National Association of Clean Water Agencies

**Dr. Tee Guidotti**  
Chair, Department of Environmental and Occupational Health  
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**Dr. Peter DeFur**  
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