New Generation Toxics in Lake Champlain

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1) What are they? Endocrine disruptors
   a) Have been found in drinking water of at least 41 million Americans
   b) Brought to attention by a 2002 study completed by the USGS
      i) 80% of waterbodies studied had some form of contamination
      ii) Most are unregulated by EPA
   c) Sources
      i) Pills – both processed by body and directly dumped into waste stream
      ii) Plastics (phthalates including Bisphenol A)
      iii) Fragrances – perfumes, soaps, shampoos (another group of phthalates)
      iv) Stormwater runoff (e.g. caffeine)
   d) Why now? Hypotheses:
      i) More drugs being used
      ii) Better detection limits on analytical techniques

2) What might be the effects?
   a) Ecological
      i) Fish
         (1) Lowered sperm counts and damaged sperm– razorback sucker and fathead minnows and rainbow trout
         (2) Males feminized (i.e. - Produce egg yolk proteins)– walleye and carp and smallmouth bass
         (3) Females with male genetalia
         (4) Skewed sex ratios – white suckers, Boulder, CO
         (5) Production of both male and female gametes – bass and three spine stickleback
         (6) (Fish as broadcast spawners perhaps more susceptible)
      ii) Frogs –
         (1) metamorphosis slowed upon lab exposure to Prozac
         (2) All tadpoles developed as female after exposure to estrogen from contraceptive pills
      iii) Mussels – impaired immune response after lab exposure to synthetic musks
   b) Human
      i) Adverse male genital development in humans linked to phthalates (smaller scrotum and penis size and a smaller measurement known as the anogenital distance)
      ii) Childhood Obesity linked to higher urine concentrations of phthalates in East Harlem
      iii) Antibiotic resistant bacteria

3) Bisphenol-A – a case study

a) Used in production of plastics and resins including food and drink packaging – particularly in #7 plastics and to a lesser degree #3 plastics. Widespread human exposure (in 93% of 2,517 urine samples in one study).
b) September 2008 – National Toxicology Program Center for the Evaluation of Risks to Human Reproduction identified evidence from experimental animal studies that raised "some concern" that current levels of exposure may result in some developmental changes. "Some concern" represents the mid-point of a five-level scale ranging from "negligible" to "serious" concern. Many areas of uncertainty and data gaps.
c) How was report received?
    i) "Bisphenol A safety confirmed in final national toxicology program report" bisphenol-a.org – an industry group
    ii) NRDC called on the FDA to "ban this toxic chemical from our food packaging".
    iii) A number of retailers voluntarily stopped using Bisphenol A in some products including drinking water bottles, baby bottles, sippy cups.

4) What's in Lake Champlain?
    a) USGS report –Pat Phillips and Ann Chalmers – February 2009 publication in Journal of the American Water Resources Association
    b) Looked for 62 chemicals, found all but 8 in one or more samples. Max # per sample was 35. Chemicals found included pesticides, fire retardants, fragrances, detergent degradates, and caffeine. PAHs found routinely in stormwater.
    c) 30 locations sampled in 2006 – Winooski R, Missisquoi R, Potash Brook, Englesby Brook, Stevens Brook (St. Albans) Burlington Bay, Cumberland Bay, Missisquoi Bay, St. Albans Bay, Burlington WWTF, St. Albans WWTF, Plattsburgh WWTF
    d) Concentrations highest in waters released by wastewater treatment plants, combined sewer overflows, and small urban streams.
    e) Concentrations lowest in large rivers, an undeveloped stream in Stowe (nothing found), and Lake Champlain
    f) Three most common contaminants in Lake Champlain – caffeine, HHCB (a musk fragrance), and metolachlor (an herbicide)\
    g) Three compounds found in every WWTF sample – codeine, Benadryl, carbamazapine (an anti-convulsant)
    h) Five of eight anti-microbial compounds found at Burlington Riverside WWTF

5) What's it mean here?
    a) Who knows? Concentrations low for chemicals we've looked for. Ecological or physiological effects at these concentrations thought to be non-existent or minimal
    b) Proper role of the precautionary principle?
        i) What does it mean? (based on Stewart 2002):
            (1) Scientific uncertainty should not automatically preclude regulation of activities that pose a potential risk of significant harm (Non-Preclusion PP).

(2) Regulatory controls should incorporate a margin of safety; activities should be limited below the level at which no adverse effect has been observed or predicted (Margin of Safety PP).
(3) Activities that present an uncertain potential for significant harm should be subject to best technology available requirements to minimize the risk of harm unless the proponent of the activity shows that they present no appreciable risk of harm (BAT PP).
(4) Activities that present an uncertain potential for significant harm should be prohibited unless the proponent of the activity shows that it presents no appreciable risk of harm (Prohibitory PP).

ii) Uncertainty of terms like risk, consensus, harm, degree of preventive measures (e.g. Bisphenol A – limited uses or wholesale ban?)

6) What can you do?
   a) Pharmaceutical take-backs (the first local one took place at Kinney Drugs in Burlington April 4)
   b) Proper disposal
   c) Seek alternatives
   d) Lake Champlain pledge