



American Water Works
Association

AWWA Webcast: May 4, 2005

**Down the Drain and Into the Water Supply:
The Facts About Endocrine Disruptors,
Pharmaceuticals and Personal Care Products.**

Questions Submitted
Answers in Italics

Alan Roberson: Regulatory Implications

Q: For the perchlorate reference dose, is inhibition of iodine uptake in the thyroid an example of agonist or antagonist effect?

Based on my interpretation of the definitions of these two words from Merriam-Webster Online, inhibition of the iodine uptake in the thyroid would more fit the definition of antagonist. Perchlorate doesn't combine with a cell receptor and initiate a reaction (agonist). As an antagonist, hormone production can be changed (but not always) with inhibition of iodine uptake by perchlorate.

Q: Is there evidence of endocrine disruptors, pharmaceuticals, or personal care products having an adverse effect on human gender (male/female) ratios as has been noted for animal species worldwide?

I am not aware of any proven adverse effect on human male/female ratios.

Q: What does altered pregnancy maintenance mean?

The quote below is from EPA's March 2002 report, "The Grouping of a Series of Triazine Pesticides Based on a Common Mechanism of Toxicity":

It is well known that the hormonal requirements of the corpus luteum (CL) change as the rat progresses through different stages of gestation. After the first week of gestation, the CL no longer requires prolactin for support and becomes dependent on the luteinizing hormone (LH) during gestation days (GD) 7-16. During this time as little as 2-4 hours deprivation of LH may be sufficient to terminate pregnancy. Atrazine and the metabolites 2-hydroxyatrazine, diaminochloratrazine (DACT), desethyl s-atrazine (DEA), and desisopropyl s-atrazine (DIA) have been reported to alter pregnancy maintenance. These compounds have been found to induce full litter resorption, induce pseudopregnancy, prevent pre or post-implantation, and/or delay parturition. Although 2-hydroxyatrazine has been shown to alter pregnancy and delay puberty in males, it has not been found to induce mammary gland tumors. Therefore, based on the absence of mammary gland tumor induction by 2-hydroxyatrazine and inconclusive data that show 2-hydroxyatrazine's effect on the luteinizing hormone (LH) surge and/or LH-dependent events, the weight-of-evidence (WOE) does not support including it in the common mechanism group at this time.

*This full text of this report can be found on EPA's website at:
<http://www.epa.gov/oppsrrd1/cumulative/triazines/triazinescommonmech.pdf>.*

Q: What disinfection by-products (DBP's) are in soft drinks & bottled water? Are they regulated? Or a concern?

DBP levels in soft drinks and bottled water vary considerably based on source water and the additional treatment used in production. The Food and Drug Administration develops parallel standards for bottled water after EPA has developed national drinking water standards. So, at this point, based on the Stage 1 Disinfectant/Disinfection By-Products Rule (D/DBPR), bottled water has the same DBP standards as drinking water—80 ppb for Total Trihalomethanes (TTHM) and 60 ppb for 5 Haloacetic Acids (HAA5).

Q: Is there any plan to use biological screening tests and endpoints developed by the Endocrine Disruptor Methods Validation Advisory Committee (EDMVAC) in the National Pollutant Discharge Elimination System (NPDES) Permitting Program? If so, when would this be expected to show up as proposed national regulation?

EPA is struggling to find robust and reliable screening assays, and is looking for EDMVAC for advice. EPA is currently evaluating an amphibian metamorphosis assay, a fish screen assay, a steroidogenesis assay, and an uterotrophic assay. Based on the difficulties with these screening assays, it is not likely that any of them would be used in the NPDES program in the foreseeable future.

Q: Could you elaborate on the possible role the Clean Water Act could play in reducing inputs of endocrine disruptors into source waters?

EPA, under its Clean Water Act (CWA) authority, could develop national water quality criteria for these compounds. States could adopt these water quality criteria and then incorporate these new criteria into new or revised NPDES permits. However, this is not very likely in the foreseeable future. Again, based on the difficulties with these screening assays, it is not likely that any of them would be used in the NPDES program in the foreseeable future.

Q: Was the chemical screening approach mentioned in your presentation ready by April 2005? Could you summarize the approach?

EPA appears to have missed the April 2005 deadline for the final chemical screening approach. This is likely due to the previously mentioned difficulties with the screening assays. The basic approach is to use screening assays (Tier 1) for the broad universe of potential chemicals, and then use more detailed testing (Tier 2) for chemicals that have a positive response from the screening assays.

Dana Kolpin: Source and Occurrence

Q: Is the biosolids monitoring study published?

No, the biosolid study is not yet published. Available information on our biosolid research can be found at: http://toxics.usgs.gov/regional/emc/municipal_biosolids.html.

Q: How does the alleged health benefit on phytoestrogens in soy play into this research?

Right now phytoestrogens have not been a part of our research. As such phytoestrogens have been shown to be another source of EDCs. Adding major phytoestrogens into our analytical capabilities is one of our long-term goals for our study.

Q: We are sampling water in some agricultural watersheds in Alberta for livestock pharmaceuticals - a survey study (e.g. tetracyclines, macrolides, sulfas, coccidiostats). Is there a sampling protocol for pharmaceuticals or veterinary pharmaceuticals? I am specifically wondering about rinsing and field quality assurance/quality control (QA/QC)? Usually we rinse the bottles 3 times and then take a sample. Obviously the bottles will be cleaned before hand (I think with hexane acetone) but I have heard no rinse and one rinse to saturate any binding sites on the glass?

I'll refer you to our National Field Manual (<http://water.usgs.gov/owq/FieldManual/>). See chapter 5.6.1.F for emerging contaminants.

Q: The 2 background sites in Montana chosen for the 2002 wastewater treatment plant (WWTP) sampling had 2 emergent contaminants (EC) detected. What were those two contaminants? I know Pat Phillips, USGS Troy, has been the project manager for 3 organic studies in the past 5 or so years in the NY City watershed and collected a sludge sample last year at the Yorktown WWTP.

For our background sites, three compounds were detected in Michigan (acetaminophen, caffeine, and methyl salicylate) and none were found in Montana. This led to a median of 2 compounds detected for this group. Yes, Pat Phillips is doing excellent EC research in NY and we have been collaborating with Pat on a number of such projects.

Q: Have you performed any studies on precipitation? I was wondering about the persistence of PPCPs and endocrine disruptors transport behaviors through dry deposition. In Upstate NY (i.e., Adirondacks), there is more mercury (Hg) being deposited through air per trillion from prevailing winds than is coming from other parts of the hydrologic cycle. Do you know if the contaminants seen in the more remote location in Montana are commonly detected in precipitation?

We haven't done any EC research to date on precipitation. It certainly is possible that there could be some atmosphere transport of some of these compounds (depending on their chemical and physical properties).

Q: In the Drinking Water Treatment Research by Paul Stackelberg, what overall percent of contaminant removal was due to Government Advisory Committee (GAC)?

Please reference:

Stackelberg, P.E., Furlong, E.T., Meyer, M.T., Zaugg, S.D., Henderson, A.K., and Reissman, D.B., 2004b, Persistence of pharmaceutical compounds and other organic wastewater contaminants in a conventional drinking-water-treatment plant: Science of the Total Environment, v. 329, no. 1-3, p. 99-113.

Q: Have you begun to collect macroinvertebrates for tissue analysis and detection of the PPCPs and endocrine disruptors? When do you expect the USGS to have methods such as O-1433-01 ready for the detection of the 67 organic compounds in a tissue matrix? I know Pat has been doing a parallel study for pesticides with the NYSDEC Division of Water Stream Biomonitoring unit for the past few years. I think it would be worthwhile to see what PPCPs and endocrine disruptors collect in macroinvertebrate tissues. If not macroinvertebrates, how about freshwater mussels which provide a longer recorded history?

Yes, we are working on methods to measure ECs in macroinvertebrates. In fact, we have some research going on this summer to determine if ECs are present in such tissue. It would likely be a couple years before it would become an official USGS method like SH1433.

Q: Has anyone compared use and detections of these compounds among different countries? Are your results from the US typical of most modern countries, or should we expect some drugs, etc. to be more frequently used in the US?

I'm not aware of a publication that compares use and detections among different countries. I suspect that there are some differences in use among specific chemicals. However, the presence of EDCs and PPCPs are going to be present in municipal discharge globally.

Q: The reporting limit for bisphenol A in the Stackelberg, et. al paper was 1 ug/L, and it showed no values above the reporting limit (RL). However the graph that you presented entitled "Occurrence in Raw & Finished Waters" shows 100% frequency of detection. Assuming that the data you presented is from Stackelberg, et. al, can you explain the difference between the raw data in the Stackelberg, et. al. paper and the graph? The raw data in the paper would appear to show that no bisphenol A was found above method reporting limits. This observation was also noted for several other compounds.

It is important to note that any RL (however calculated) represents a statistically determined reference value above which data values are reported without qualification by the laboratory. The calculation of an RL, however, does not preclude reporting detections and concentrations below the RL as long as these results are properly qualified. Our research was designed to identify the range of potential concentrations in ambient water samples, and therefore we chose to maximize the useful scientific information in our dataset by evaluating our laboratory data above, as well as below, the RL.

Q: What is Fluoxetine? What it is generally found in? What sort of hazards can this cause when found at a higher contamination level?

Fluoxetine (commonly referred to as Prozac) is a pharmaceutical used as an anti-depressant. We have found this commonly in only a small number of water samples, but have found this compound to be more frequently detected in streambed sediment. Researchers at Baylor University have also found fluoxetine in fish tissue collected from a waste-dominated stream. Little is known about the potential ecologic effects from long-term, low-level exposure to this compound. I have seen papers that suggest that high levels of fluoxetine can induce spawning in mussels.

Q: What was the reporting limit for the sediment data for Fluoxetine and has this data been published?

You can find our complete list of compounds (are their respective reporting levels) at: http://toxics.usgs.gov/regional/emc/methods_devel.html.

Q: On one slide (Sources and Source Pathway), you site a reference, Halling-Sorenson 1998, could I please get the full reference?

The full reference is:

Halling-Sørensen B, Nielsen SN, Lanzky PF, Ingerslev F, Luthoft HC, Jorgensen SE. 1998. Occurrence, fate and effects of pharmaceutical substances in the environment - a review. Chemosphere 36: 357-393.

Q: In the study design (Drinking Water Treatment), did you find that the sludge decant contributed to the contaminant results in the finished water?

See this reference for more information:

Stackelberg, P.E., Furlong, E.T., Meyer, M.T., Zaugg, S.D., Henderson, A.K., and Reissman, D.B., 2004b, Persistence of pharmaceutical compounds and other organic wastewater contaminants in a conventional drinking-water-treatment plant: Science of the Total Environment, v. 329, no. 1-3, p. 99-113.

Q: EDCs and PPCPs may accumulate in wastewater biosolids. When biosolids are applied to land, do we know their fate? Are they refractory, or can they be degraded either in aerobic or anoxic environments? If so, over what time period?

Currently we don't know a lot about what happens to EDCs and PPCPs that may be in biosolids after their land application. That certainly is an area that we will be researching further. A nice review paper is following.

Xia, K., and others. 2005. Occurrence and fate of pharmaceuticals and personal care products (PPCPs) in biosolids. Journal of Environmental Quality, v. 34, p. 91-104.

Shane Snyder: Analysis and Treatment

Q: How did you ultimately choose the compounds to test? Was it because they fit into the endocrine disruptor category and they had analytical standards for testing? I assume the SNWA provided the lab testing. Was the final list of compounds driven also by testing cost? Likelihood of occurrence?

As far as your questions, the first is a rather long discussion, but we mainly sought to include compounds that represented a wide variety of physico-chemical parameters. We have a paper on the gas chromatography/mass spectrometry (GC/MS) compounds in press. Yes, we did the analyses at SNWA.

Q: I saw the removal efficiency of free chlorine and ozone in the presentation. Has there been testing of combined effects of oxidants beyond what you presented that include the combined removal efficiency of ozone and free chlorine similar to what SNWA is using? Obviously plants with UV or ozone still have to provide a chlorine residual. This would be more representative of actual conditions.

For example, the free chlorine slide shows poor removal of musk ketone in ozone but high removal efficiency in chlorine. Any thoughts of the combined removal efficiency of musk ketone at your plant (ozone and chlorine)?

The opposite is true of TCEP. TCEP shows poor removal efficiency in both ozone and chlorine according to your presentation. Any thoughts on the combined removal efficiency of TCEP at your plant (ozone and chlorine)?

You are correct in the multi-treatment train approach, however, most of these compounds were not detected at full-scale, so we can only assume the multibarrier approach is preferable. However, in the case of chlorine following ozone, the bulk of chlorine reactive compounds are already removed by the ozone, so it is hard to differentiate. Musk ketone has somewhat erratic behavior in the analytical method due to its volatility, so I would need to verify the data. However, we did not detect it at the full-scale plants. We have seen that TCEP is difficult to remove regardless of treatment train, other than carbon and RO. That said, TCEP is in all blanks. We had to raise our reporting limit accordingly, but, it is still difficult to assess below approximately 20 ng/L.

The full AwwaRF report should answer these questions in more detail. It is targeted to be available summer 2005.