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Goal 4. Endocrine Disruptors

Title:

Assessing waste water treatment plant effluent for thyroid hormone disruption.

Emily M. Burgess¹, Marc A. Mills², Michael W. Hornung³

¹Student Services Contractor, Duluth, MN

²US EPA, ORD, NRMRL, Cincinnati, OH

³US EPA, ORD, NHEERL, Mid-Continent Ecology Division, Duluth, MN

Abstract:

Much information has been coming to light on the estrogenic and androgenic activity of chemicals present in the waste water stream and in surface waters, but much less is known about the presence of chemicals with thyroid activity. To address this issue, we have utilized two assays to assess disruption of thyroid hormone (TH) synthesis and secretion by waste water treatment plant effluents. The first is an in vitro assay that measures the activity of thyroid peroxidase which is the enzyme involved in thyroid hormone synthesis, and the second uses a *Xenopus laevis* thyroid gland explant culture system that assesses the release of TH from thyroid glands in response to treatment with thyroid stimulating hormone (TSH). Effluent samples collected from two waste water treatment plants, one with primarily industrial inputs and one with primarily domestic and residential use inputs, were freeze dried and the resultant powder was reconstituted for testing in these assays. The enzyme inhibition assay and explant culture assays were shown to be adaptable to testing environmental samples. While the reconstituted effluent did not inhibit thyroid peroxidase activity in vitro, it did decrease the TSH-stimulated TH release from the thyroid glands. Analysis of the effluents for nitrate and ammonia showed high parts per billion to low parts per million concentrations of each, which may contribute to the reduced thyroid hormone release. Nitrate is a known inhibitor of iodide uptake into thyroid glands which would lead to decreased TH synthesis and release. Whether the concentration of nitrate, ammonia, or some other as yet unknown factor in these samples is sufficient to explain the decreased thyroid hormone release will need to be determined. These in vitro assays are promising tools to be further developed to identify the presence of thyroid disrupting activity in environmental samples and can be integrated with analytical chemistry methods for identification of any thyroid disrupting chemicals.

Impact Statement: This abstract presents research to use in vitro assays to detect thyroid hormone disrupting activity in environmental samples, specifically waste water treatment plant effluent. The work shows a promising beginning to the development of methods to detect thyroid hormone disrupting activity in chemicals in water samples from the environment. Further research to integrate methods to analyses and identify specific chemicals present in these samples that might have thyroid disrupting activity is needed.