Virginia Institute of Marine Science
School of Marine Science

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Subject: Analysis of organic contaminants in San Francisco compost

To: John Stauber

A sewage sludge-derived compost from the Synagro CVC plant, distributed by the San Francisco Public Utilities Commission in their "compost give away" program, was analyzed for synthetic pollutants. Several classes of emerging contaminants with endocrine disruptive properties were detected in appreciable concentrations, including polybrominated diphenyl ether (PBDE) flame retardants, nonylphenols (NPs) detergent breakdown products and the antibacterial agent triclosan.

The compost contained 22.7% water by weight. Two aliquots were extracted and analyzed separately by gas chromatography/mass spectrometry.

Priority pollutants detected included the chlorinated pesticide degradate DDE and polycyclic aromatic hydrocarbons (PAHs). DDE was present at an average concentration of 41.8 ng/g (dry weight). The average for total PAHs in the two aliquots extracted was 1010 ng/g. Constituents included alkylated and non-alkylated PAHs. The former are generally petroleum in origin, while the latter may be combustion-related and included compounds such as benzo(a)pyrene, pyrene, fluoranthene and phenanthrene.

PBDEs are persistent and bioaccumulative in the environment. Elevated levels have recently been reported in California citizens (1). The average total of these PBDE congeners in the compost was 731 ng/g (dry weight basis). The constituents examined here possessed between 3 and 7 bromines and the pattern of congeners matched the PentaBDE formulation. Major congeners detected were BDE47, 99, 100, 153 and 154. At this time the samples have not been analyzed for the major constituents of the DecaBDE product. DecaBDE is used in greater amounts than PentaBDE or OctaBDE, but is believed to be less bioavailable and toxic than the former two products. However, DecaBDE (BDE209) has been observed to breakdown to less brominated congeners and has been detected in humans and birds of prey (2). The constituents of PentaBDE are the congeners most commonly reported in human tissues and wildlife (3). The major constituent of OctaBDE is BDE183 and this congener was not detected.

Manufacture of PentaBDE (and a more brominated, but less widely used product known as OctaBDE) was voluntarily ended in North America by its producer (Chemtura Corp.) in December 2004 after deliberations with the EPA over environmental and human health effects. PentaBDE and OctaBDE also have been banned by the European Union. California passed AB302 banning products containing greater than 0.1% of PentaBDE and OctaBDE effective in January 2008. However, large amounts of PBDEs remain in in-use and discarded polymer products. Therefore, releases to sewage sludge and the environment will continue.

The anti-bacterial additive Triclosan was also detected in the compost (average 1312 ng/g). Methyltriclosan, a degradate generated from the Triclosan in the environment, was also detected in the compost (average 145 ng/g). It is more bioaccumulative than triclosan itself. The US FDA is currently re-evaluating the safety of triclosan (4,5). Triclosan is also toxic to algae at the low µg/L level (6). Uptake of triclosan and pharmaceuticals from biosolids-amended soils has recently been demonstrated in lab exposures (7).

NPs and related compounds, including octylphenol and NP-mono and di-ethoxylates were also detected in the compost (total average 10,500 ng/g). These are breakdown products of alkylphenol ethoxylate detergents. They have been found to be weakly estrogenic to exposed organisms. NPs have been found to be toxic to aquatic organisms and the US EPA has developed aquatic life criteria (8). The criterion for marine life is 1.7 µg/L (ppb) and that for freshwater is 6.6 µg/L. The average concentration of NP itself in the compost was 7065 ng/g (dw).

Sincerely,

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References

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