Austin/Travis County Health and Human Services Department

Office of the Health Authority
Epidemiology Program
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Internal Memorandum

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Subject: Toxicological Evaluation of Compost and Digested Sludge Samples from the Hornsby Bend Biosolids Processing Facility, March 10 and April, 2003

Background

The City of Austin Water and Wastewater Department conducted sampling of compost and digested sludge from the Hornsby Bend Biosolids Treatment Plant. The purpose of this sampling was to characterize the potential influence of organic compounds from household products and non-point source pollution entering the stormwater sewage system. Specifically, samples were collected to characterize digested sludge and compost at various stages of the composting process, and to assess the potential health risk associated with the land application of digested sludge, or the use of compost by residential consumers.

Compost and sludge samples collected on March 10 and April 17, 2003 were analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs) and organochlorinated pesticides. Expanded analysis for organophosphorous pesticides were also included for compost and sludge samples collected on April 17th. These classes of chemical were selected to assess the broad array of chemicals that could enter into the stormwater sewage system and could potentially be harmful to human health. VOCs (organic compounds that evaporate easily in ambient conditions) and SVOCs (organic compounds that evaporate slowly in ambient conditions) were selected since they are present in many household, automotive and lawn products or come from vehicle emissions that deposit in soil and become part of surface water runoff. Samples were also analyzed for pesticides since they may be present in household products or yard trimmings used for composting. Samples were analyzed for 142 compounds. Compost and digested sludge samples collected on April 17th included analyses of 29 organophosphorous pesticides.

Methods

To determine the potential for adverse health effects, the measured concentration of a compound was compared to the Texas Commission on Environmental Quality's (TCEQs) Protective Contaminant Levels (PCLs). The PCL is the concentration of a chemical of concern that can remain in soil and is protective of human health. For most compounds, the minimum analytical levels (MALs) were below their respective TCEQ PCL and were adequate to evaluate compounds from a health perspective. However, several compounds had MALs greater than their corresponding PCLs. For those compounds, a concentration could be higher than a PCL even if it were reported as non-detected. Unless the MAL is greater than the PCL, the compound cannot be evaluated from a health perspective.

Compost

For compost, the residential total combined exposure to soil ($^{Tot}Soil_{comb}$) PCL was used as a comparison value. The residential $^{Tot}Soil_{comb}$ PCL considers combined exposures of a compound in soil from ingestion, dermal contact, inhalation of volatiles and particulates, and ingestion of above-ground and below-ground vegetables. For organophosphorous pesticides without a $^{Tot}Soil_{comb}$ PCL, the parathion $^{Tot}Soil_{comb}$ PCL was used as a surrogate measure to evaluate compost results. For the purpose of this review, we assumed a person's exposure to compost through use in a residential garden as the most likely exposure scenario. This scenario is conservative since it assumes total exposure compost. In reality, actual exposure to compost will be diluted with other garden/yard soil.

Compost samples were analyzed using the appropriate EPA analytical methods for VOCs, SVOCs and pesticides. For most compounds, the minimum analytical levels (MALs) were below their respective TCEQ PCL and were adequate to evaluate compounds from a health perspective. However, the MALs for acrolein, 4-chlorophenyl phenyl ether, N-nitrosodimethylamine, and benzidine were higher than their respective PCLs and were not adequate to evaluate the results in both compost samples. In addition, the MAL for aldrin was not adequate to evaluate the results for the sample collected April 17th.

Digested Sludge

For digested sludge, a commercial/ industrial $^{Tot}Soil_{comb}$ PCL was used to assess exposure occurring during or after land application of digested sludge. Because of the restricted access and the larger source area of application, a commercial/industrial scenario for a 30-acre source area was used to evaluate this exposure scenario. The commercial/industrial $^{Tot}Soil_{comb}$ PCL considers combined total exposure from ingestion, dermal contact, inhalation of volatile and particulates and ingestion of above-ground and below-ground vegetables. Because digested sludge is liquid rather than a solid like compost or soil, a person exposed during land application is likely to only have exposure from dermal contact and inhalation of volatile and particulates. Assuming a total combined exposure as for compost makes this exposure scenario conservative. For organophosphorous pesticides without a $^{Tot}Soil_{comb}$ PCL, the parathion $^{Tot}Soil_{comb}$ PCL was used as a surrogate measure to evaluate sludge results.

Analyses of digested sludge samples were conducted using the appropriate EPA analytical methods for VOCs, SVOCs and pesticides, and the MALs were set below their respective PCLs and adequate to evaluate compounds from a health perspective. However, the MALs for acrolein, N-nitrosodimethylamine, and benzidine were not adequate to evaluate these compounds in both digested sludge samples. The MALs for 4-bromophenyl phenyl ether, 2-chlorophenyl phenyl ether, hexachlorocyclopentadiene, and N-nitrosodi-n-propylamine, were above their respective PCLS and the sludge sample collected April 17th and could not be evaluated from a health perspective.

Results

Compost

Of 142 compounds analyzed on March 11th and the 171 compounds analyzed for on April 17th, 132 and 169 compounds were reported below their MAL, respectively. Table 1 summarizes concentration of these compounds in compost reported above their MAL. All compounds detected above their MAL were less than their respective $^{Tot}Soil_{comb}$ PCL. Exposure to compounds measured at these concentrations is not expected to result in any adverse human health effects. Compounds with MALs greater than their $^{Tot}Soil_{comb}$ PCL could not be evaluated from a health perspective.

Digested Sludge

Table 2 summarizes the concentration of compounds in digested sludge detected above their respective MAL. Of 142 compounds analyzed in sludge on March 11th and the 171 compounds analyzed for on April 17th,, most compounds were not detected. Of the 18 compounds detected above the MAL, all concentrations were measured at levels below their respective $^{Tot}Soil_{comb}$ PCL and do not present a human health risk. Compounds with MAL greater than their $^{Tot}Soil_{comb}$ PCL could not be evaluated from a health perspective.

Conclusions and Recommendations

In summary, measured concentrations of compounds in these compost and digested sludge samples were below acceptable PCL values and do not pose a risk to human health.

The following recommendations are suggested to evaluate the characterization of compost in the future.

- The contract laboratory conducting sample analyses should ensure that compound-specific minimum analytical limits are less than health comparison values to ensure they are adequate for evaluating.
- The City of Austin should consider sampling a variety of similar compost products to determine how they vary in chemical composition.

- Because the compost material is made up of yard trimmings, the City of Austin should consider resampling these products at various times of the year to characterize seasonal influences (leaves in the fall, grass clippings during the spring and Christmas trees in the winter) on the final product. Sample analyses should focus on semi-volatile organic compounds and organochlorine pesticides, which seem to persist in the environmental media.

If you have any additional questions, please contact me at 972-5486.

Table 1.
Concentration of Compounds In Compost
Reported over their Minimum Analytical Level
(micrograms/kilograms)

Compound	**Compost Result #596264 – 3/11/03 (µg/kg)**	**Compost Result #603554 – 4/17/03 (µg/kg)**	**$^{Tot}Soil_{comb}$* (µg/kg)**
Beta-BHC (hexachlorocyclohexane)	8.53	ND	928
4,4-DDE	31.8	ND	10177
Dieldrin	26	ND	146
Endrin aldehyde	19.4	ND	19373
Benzo(b)fluoranthene	507	ND	5713
Dibenz(a,h)anthracene	102	ND	550
Benzo(a)anthracene	311	401	5653
Benzo(a)pyrene	357	ND	564
Indeno(1,2,3-cd)pyrene	205	ND	5722
Bis(2-ethylhexyl)phthalate	3180	6300	43157

* TCEQ Total Soil Combined PCL for residential exposure, 0.5 acre source area
ND – Not Detected

Table 2.
Concentration of Compounds in Digested Sludge
Reported over their Minimum Analytical Level
(micrograms/kilograms)

Compound	**Sludge Result #596265 – 3/11/03 (µg/kg)**	**Sludge Result #603555 – 4/17/03 (µg/kg)**	**$^{Tot}Soil_{comb}$* (µg/kg)**
Delta-BHC (hexachlorocyclohexane)	90.9	ND	11,506
4,4-DDE	39	ND	73,187
Dieldrin	27.3	ND	1,142
Endrin Aldehyde	35.8	ND	204,400
Hepatochlor	535	ND	2,755
Hepatochlor Epoxide	43.9	ND	1,902
p-Isopropyltoluene	3380	2210	4,713,423
Toluene	14700	9830	4,327,706
Benzo(b)fluoranthene	1410	ND	23,649
Dibenz(a,h)anthracene	373	ND	2,372
Benzo(a)anthracene	1070	ND	23,582
Benzo(a)pyrene	1290	ND	2,368
Fluoranthene	2330	ND	24,775,758
Phenanthrene	1510	ND	18,581,818
Phenol	3430	ND	2,384,114
Indeno(1,2,3-cd)pyrene	610	ND	23,729
Bis(2-ethylhexyl)phthalate	32200	42300	562,841
Di-n-octylphthalate	2940	ND	13,626,667

* TCEQ Total Soil Combined PCL for commercial industrial exposure, 30 acre source area
ND – Not Detected