

## Engineering And Marketing Data Sheet

5330

### Fate And Effects Of Heavy Metals In OAT™ Process Biomass-To-Renewable Energy Program

#### Heavy Metals Are Found In:

1. Municipal solid wastes (MSW).
2. Municipal treatment plant sludge.
3. Stormwater runoff.

#### OAT™ Process Biomass-To-Renewable Energy Program Consists Of:

1. Accepting and processing MSW.
2. Accepting and processing municipal sanitary wastewaters.
3. Accepting and processing stormwaters.
4. Accepting and processing sludges.
5. Accepting and processing green wastes.
6. Accepting and processing food wastes.
7. Accepting and processing storm related wastes.
8. Accepting and processing computer related wastes.
9. Accepting and processing animal deads.
10. To the extent that medical wastes are unlawfully included in MSW shipments they too will be processed as though they were authorized wastes without adverse impact on total waste processing activities.

#### In the Processing Of MSW:

1. Ferrous and non-ferrous metals are mechanically ground along with MSW and all other wastes.
2. Resulting ground wastes are slurry mixed with sanitary wastewaters and stormwaters.
3. Slurried wastes are continuously transferred to the anaerobic digester.
4. All heavy metals end up in digester solids discharge (digestate).
5. Digestate qualifies as **Class A Biosolids** (40 CFR Part 503 Pathogen Standards). The digestate also qualifies as an organic fertilizer. Because of its low macro (NPK) nutrient content the digestate also qualifies as a soil amendment.

#### The Digestate Class A Biosolids Soil Amendment:

1. May be dried to 30% moisture content, bag packaged, and sold to farmers and landscape markets as well as businesses and residential users. The soil amendment in each instance becomes the ultimate fate of the heavy metals.

2. May be used as the soil amendment in greenhouses to grow vegetable oil crops for subsequent conversion of the vegetable oil to biodiesel fuel through transesterification. The soil amendment becomes the ultimate fate of the heavy metals.
3. May be used as the soil amendment in greenhouses to grow both food crops and flowers. The soil amendment becomes the ultimate fate of the heavy metals.

#### Background Information:

1. For more than 20 years the United States Environmental Protection Agency (USEPA) has permitted the land application of **Class B Biosolids**. *The Centers For Disease Control And Prevention, The Occupational Health And Safety Administration (OSHA)*, and several additional private groups have recommended against this continuing practice.
2. When Class A or Class B Biosolids that contain heavy metals are applied to cropland, heavy metals uptake occurs mostly within the root system with progressively lesser uptake occurring throughout the entire plant pathway to the food product itself. The uptake occurs at acidic, neutral, and basic (alkaline) pH values as well as other growing conditions such as moisture adjustments and macro nutrient applications.
3. Using the **Class A Biosolids Digestate** as a soil amendment for use in landscaping activities is specifically permitted by the USEPA because of its Class A Biosolids Status<sup>1</sup>. The soil amendment therefore becomes the ultimate fate of the heavy metals.
4. When Using The **Class A Biosolids Digestate** as a soil amendment in the greenhouse growing of vegetable oil crops, the vegetable oil is subsequently refined into biodiesel through transesterification. Heavy metals do not participate in the transesterification process and are therefore left over in the associated wastes. The transesterification process results in soapstock and glycerin wastes. All wastes associated with biodiesel refining are routinely returned to the digester to produce additional renewable energy.

The associated vegetable oil crop residues are also routinely returned to the digester to produce additional renewable energy. The soil amendment therefore becomes the ultimate fate of the heavy metals.

5. When using the **Class A Biosolids Digestate** as a soil amendment in the greenhouse growing of food crops, the food will be marketed at a discount from retail. Evidence that food products produced on sewage sludge applied land are harmful to human health does not exist.<sup>2,3</sup> Using the digestate soil amendment regardless of the heavy metals content (pollutant load) is specifically permitted by the USEPA because of its **Class A Biosolids Status**<sup>1</sup>. The soil amendment therefore becomes the ultimate fate of the heavy metals.

#### Heavy Metal Effects:

1. When **Class A Biosolids Digestate** are used for landscaping type activities the heavy metals act as beneficial micronutrients.
2. When **Class A Biosolids Digestate** are used as a greenhouse soil amendment the heavy metals act as beneficial micronutrients.
3. When **Class A Biosolids Digestate** are used as a soil amendment in any and all agricultural activities, the heavy metals act as beneficial micronutrients.

The Engineers, Chemists, Scientists, and Agronomists at **WaterSmart Environmental, Inc.** welcome your inquiries with enthusiasm.

Editor's Note: It has just been learned that Beethoven (Ludwig van Beethoven) of Symphony No. 5 fame (Opus

67 In C Minor) died (March 26, 1827) of lead poisoning resulting from his music composing habit of drinking wine from a pewter goblet. Lead is one of the heavy metals. The medical science of determining the harmful effects of heavy metals has been around for well over 50 years. The continuing public debate that **All Heavy Metals** are automatically harmful to human health appears to be based on rather simplistic non-technical concerns over the general use of chemicals in the agricultural marketplace rather than the systematic application of sound science. For example, the quite popular human vitamin *Centrum* contains Boron (B), Calcium (Ca), **Chromium (Cr)**, **Copper (Cu)**, Iodine (I), **Iron (Fe)**, Magnesium (Mg), **Manganese (Mn)**, Molybdenum (Mo), **Nickel (Ni)**, Potassium (K), Phosphorus (P), **Selenium (Se)**, Silicon (Si), **Tin (Sn)**, **Vanadium (V)**, and **Zinc (Zn)** chemicals. There are some 23 heavy metals including Cr, Cu, Fe, Mn, Ni, Se, Sn, V, and Zn<sup>4</sup>. The environmental and medical communities appear out of sync on the subject of heavy metals. The few heavy metals of Arsenic (As), Mercury (Hg), and Lead (Pb) have indeed caused death under special circumstances. Many other heavy metals, however, are beneficial micronutrients within the agricultural marketplace.

<sup>1</sup> Section Three, Par. 3.1 EPA/831-B-93-0026, Land Application of Sewage Sludge, December, 1991.

<sup>2</sup> Nutrition for Health and Development, World Health Organization, WHO/NHD/00.6, Progress Report, 2000.

<sup>3</sup> Food Standards Agency, Research Programme Annual Report 2001.

<sup>4</sup> Glanze, 1996.

