SL 205

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The Basics of Biosolids Application to Land in Florida[1]

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What are biosolids?

Biosolids are nutrient-rich, predominantly organic materials. Although classified as a waste material, biosolids can be a beneficial agricultural or horticultural resource because they contain many essential plant nutrients and organic matter. Following proper treatment and processing, biosolids can be recycled as fertilizers or soil amendments to improve and maintain productive soils and stimulate plant growth, with negligible human health or environmental impacts.

How are biosolids generated and processed?

Biosolids are generated when solids accumulated during domestic sewage processing are treated further to meet regulatory requirements. **Wastewater residuals** are produced wherever the population is concentrated enough to require a centralized domestic wastewater treatment facility. These treatment plants continuously generate **sewage sludge** that must be disposed of by one of several means, including the production of **biosolids**. Sewage sludge becomes biosolids when it undergoes pathogen control treatment that meets federal and state sewage sludge regulatory requirements, followed by land application to beneficially recycle it. Sewage sludge that is disposed of by landfilling or incineration is not biosolids.

Wastewater treatment sometimes begins before the wastewater reaches the general treatment facility. In many larger wastewater treatment systems, regulations require that industrial facilities pre-treat their wastewater to remove many hazardous contaminants (metals like lead and cadmium, for example) before sending it to the main system. Wastewater treatment facilities monitor their incoming wastewater stream to ensure that the water and the accompanying organic material are safe to recycle and are compatible with the treatment plant process. This pre-treatment has resulted in dramatic decreases in metal concentrations of biosolids nationwide, so the biosolids of today are substantially different from the metal-laden sewage sludges that were produced before 1980.

Once wastewater reaches the treatment plant, domestic sewage is subjected to physical, chemical, and biological processes that kill pathogens and remove solids. The overall mass of solids is reduced as the organic matter is degraded by microorganisms, not unlike the process that goes on in a septic tank, but much faster. At some treatment plants, the solids

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are further treated with lime (calcium oxide or calcium hydroxide) to raise the pH, which helps to eliminate objectionable odors. Lime treatment also reduces the amount of pathogens (disease-causing organisms, including various bacteria, viruses, and parasites) and the attractiveness of the material to other organisms capable of transporting disease ("vectors").

How, where and why are biosolids used?

After treatment and processing, biosolids can be recycled and applied as fertilizer to improve and maintain productive soils and stimulate plant growth. The controlled land application of biosolids completes a natural cycle in the environment. By treating sewage sludge, the material becomes biosolids that can be used as valuable fertilizer instead of occupying dwindling landfill space. When regulations (Federal: 40 CFR Part 503; State: Chapter 62-640, FAC) and guidelines (USEPA Process Design Manual) are followed, the protection of food, animals, human, and environmental health is assured. Farmers and gardeners have been recycling biosolids, or their equivalent, for many years. Land application of biosolids takes place in all fifty states, and includes use on farms, ranches, gardens, parks, forests, and reclaimed mining sites.

Agricultural uses of biosolids that meet strict quality criteria have been shown to produce significant improvements in crop growth and yield when applied at recommended rates. Nutrients found in biosolids, including nitrogen, phosphorus, sulfur, calcium, magnesium and numerous micronutrients, are necessary for crop growth and production. The fertilizer value of biosolids is estimated to be $60 to $160 per acre at normal application rates. Thus, the use of biosolids reduces farmer's production costs and replenishes soil organic matter that is depleted with time. The organic matter in biosolids improves the capacity of the soil to store nutrients and water. Crops use nutrients from biosolids efficiently because they are released slowly throughout the growing season as the biosolids break down. The slow-release nature of biosolids nutrients also decreases the likelihood of water quality impairment by the leaching and/or runoff of nitrogen and phosphorus.

The fertilizer value of biosolids is well documented both nationally and in Florida. Research in Florida has focused on both the nutritional value of biosolids and on the environmental impact of biosolids-associated nutrients and contaminants. For example, researchers have shown that biosolids application to pasture can improve bahiagrass growth due to improved nitrogen and sulfur availability, and that turfgrass performance can be improved by applying a slow-release nitrogen source like biosolids.

Because the fertilizer value of biosolids is so well established, most recent investigations in Florida have focused on various environmental or health risk evaluations. Research has addressed "heavy metal" (cadmium) availability to plants, toxic organic behavior, and possible molybdenosis risk to cattle grazing biosolids-amended pastureland. A major current interest in Florida is the biosolids-phosphorus relationship because many states, including Florida, are moving to restrict biosolids application rates based on phosphorus concerns associated with water quality impairment (leaching and runoff). Researchers are studying phosphorus forms, solubility, leachability, and availability to plants.

Are biosolids safe?

Decades of worldwide research have demonstrated that biosolids can be safely used on food crops. In 1996, the National Academy of Sciences (NRC 1996) reviewed current practices, public health concerns, and regulatory standards, and concluded that

the use of these materials in the production of crops for human consumption when practiced in accordance with existing federal guidelines and regulations, present negligible risk to the consumer, to crop production, and to the environment.

In addition, an epidemiological study of the health of farm families using biosolids showed that the use of biosolids was safe.

A report issued by the National Academy of Sciences (NRC 2002) in 2002 found that

There is no documented scientific evidence that the Part 503 rule has failed to protect public health. However, additional scientific work is needed to reduce persistent uncertainty about the potential for adverse human health effects form exposure to biosolids.

The Academy report also recommended that the US Environmental Protection Agency (USEPA) conduct another national sewage sludge survey to confirm the continuing reduction in biosolids metal concentrations, the negligible concentration of toxic organics previously identified as problematic, and to expand biosolids analysis to include compounds recently suggested as potentially troublesome (e.g., antibiotics, flame retardants, and endocrine-disruptors). Such a survey is welcomed by most people familiar with biosolids, as it will replace unbridled speculation with fact.

What is the current atmosphere surrounding biosolids land application in Florida?

Lime-stabilized vs. non-lime-stabilized biosolids

As previously mentioned, some biosolids are treated with lime to reduce pathogen concentrations. These **lime-stabilized biosolids** have an alkaline pH and can increase soil pH the same way agricultural lime does following application to soil. A major land application issue in Florida is the use of lime-stabilized biosolids on pastures where “acid-loving” grasses like bahiagrass grow. Addition of an alkaline material can result in elevated soil pH which in turn leads to poor grass growth caused by micronutrient deficiencies. Florida's sandy soils have low capacity to resist changes in pH. Thus, soil pH can increase quickly and substantially in fields where lime-stabilized biosolids have been land applied. Land managers using biosolids soil amendments should be aware that biosolids may contain lime, and should apply biosolids stabilized by other means where acid-loving plants are growing.

Additional application restrictions and concerns

Biosolids are land-applied across most of the state of Florida without restriction beyond the basic federal and state guidelines. However, since biosolids contain considerable amounts of phosphorus, application has recently been limited or banned outright in phosphorus-sensitive regions (e.g. the area adjacent to Lake Okeechobee) due to water quality concerns. In other regions, decisions dealing with the land application of biosolids are not being made solely on a scientific basis. Rulemaking at the county level has been influenced by factors peripheral to the core scientific issue, such as odors associated with land application of wastes (biosolids, manures, etc.) and unfounded reports of vague “toxics” in human wastes being indiscriminately spread on nearby land. Some counties have gone as far as banning all land application of biosolids, even those that can be sold as commercial fertilizer (such as the material produced for many years in Milwaukee, WI known as “Milorganite”).

Some of the opposition to land application is associated with the "NIMBY" (Not In My Back Yard) syndrome, which may have some credence if biosolids haulers and land applicators do not strictly follow the language of permits issued by the Florida Dept. of Environmental Protection (FDEP) when carrying out their duties. However, adherence to these rules assures proper hauling and application of biosolids, which should prevent noticeable “incidents” and should satisfy the concerns of most citizens about biosolids safety.

It is telling that FDEP and the USEPA continue to support land application of biosolids and insist that, when conducted correctly, the practice is safe. USEPA continues to support research to improve testing and verification procedures confirming that treatment practices accomplish intended pathogen reductions and additional analysis for the latest “toxics of concern.” Biosolids land application continues across the country, as it has for decades. There have never been any documented cases of public health endangerment, deaths, serious illnesses, or malformed animals attributed to biosolids land application worldwide.

Further Reading

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