

Arcata Marsh composting

From Appropedia

What Are Biosolids?



Fig 1: Biosolids in drying beds.
Photo by
Woodland
Schultze 2008

During the process of waste water treatment, solids and semisolids composed mainly

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of organic material are collected from the waste water, digested, and poured into drying beds (**Figure 1**). These solids are defined as biosolids (<http://www.epa.gov/region8/water/biosolids/>) by the Environmental Protection Agency^[1]. Biosolids can be recycled as soil amendment and or fertilizer due to having nutrients and metals that soils tend to lack.^[2]

Categories of Biosolids

Biosolids can be categorized into either Class A Unrestricted (exceptional quality), Class A restricted, or Class B restricted. Both Class A biosolids, unrestricted and restricted, are sold to the public for home use. When sold, Class B biosolids are used for agriculture and landscaping, in areas of limited public contact. The reason that only Class A biosolids are sold to and used by the public is because they have fewer pathogens which lead to potential harm. For more information regarding the technical differences between Class A and Class B biosolids refer to page six of the 503 regulations (<http://www.epa.gov/region8/water/biosolids/biosolidsdown/Biosolids%20Inspection.pdf>) .

How Biosolids are Categorized at Arcata Marsh

Seven samples of the biosolids are taken at two different times to be tested for heavy metals and pathogens^[3]. The biosolids are tested first when they are poured into the drying beds, and again after they have been composted. Each time a test is run, seven samples of the biosolids are taken by the City of Arcata

(http://www.arcatacityhall.org/index.php?option=com_content&task=view&id=25&Itemid=52#green) to North Coast Labs (<http://www.northcoastlabs.com/index.asp>) .[4]

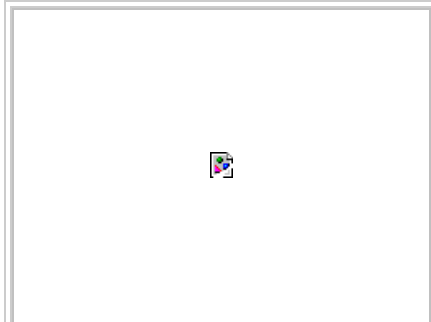


Fig 2: Drying beds at Artaca Marsh. Photo by Woodland Schultze 2008

Heavy Metals Tested for	
Arsenic	Mercury
Cadmium	Molybdenum
Chromium	Nickel
Copper	Selenium
Lead	Zinc

Pathogens Tested for
Fecal Coliform
Salmonella

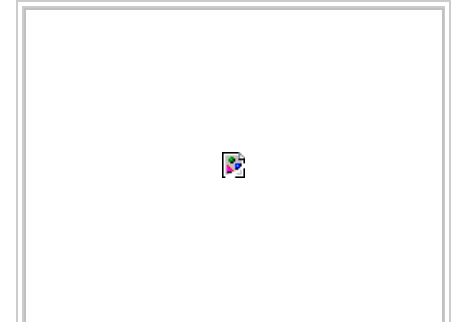


Fig 3: Side view of drying beds. Photo by Woodland Schultze 2008

To meet Class A standards for exceptional quality, fecal coliform (<http://www.epa.gov/OWOW/monitoring/volunteer/stream/vms511.html>) counts must be less than 1000 MPN (Most Probable Number (<http://www.jlindquist.net/generalmicro/102dil3.html>)) per gram of dried biosolids^[5].

Also the salmonella levels must be less than three MPN per gram of biosolids, according to the EPA^[2]. The criteria differentiating Class A and Class B biosolids in relation to heavy metals can be found in the 503 regulations (<http://www.epa.gov/region8/water/biosolids/biosolidsdown/Biosolids%20Inspection.pdf>) on page seven.

Where and How Biosolids are Dried

Biosolids are poured into drying beds which are a set of two rectangular cement floored holding areas that have drains. To get an idea of how large they are, look at (**Figure 1**) and compare the bed to the Ford truck in the background. It is in the drying beds that evaporation and transpiration (evapotranspiration) act as the drying mechanism of the biosolids^[6]. The hotter and sunnier the year is, the faster the biosolids harden into a dirt-like consistency. Built above the drying beds is a metal roof with air vents and skylights, viewable in (**Figure 3**). Because Arcata gets rain for a majority of the year, this roof helps the biosolids from getting watered down or inundated. Drying can take anywhere between six months to one year. Each year at Arcata Waste Water Treatment Plant two dry beds of biosolids are generated (**Figure 2**).

Purpose of Composting

Waste water treatment plants such as Arcata Marsh produce large amounts of biosolids. The biosolids initially have high pathogen counts, for example: more than 1,000 MPN fecal coliform per gram biosolids. Composting is used to kill human and plant pathogens as well

as balance out the pH to roughly 7. To make the biosolids meet Class A exceptional quality they are composted.

How the Compost is Made



Fig 4: Mixing machine. Photo by Woodland Schultze 2008

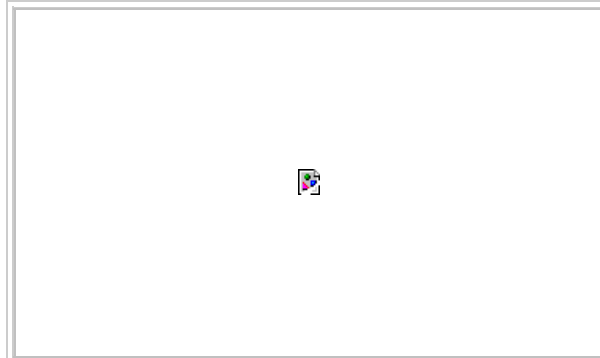


Fig 6: Diagram of static pile composting.(Photo taken from "Principles of Solid Integrated Waste Management" by h. Hickman. <http://www.epa.gov/owm/mtb/combio>

After
the



Fig 5: Blades of mixing machine. Photo by Woodland Schultze 2008

biosolids are done drying, one part biosolids is mixed with three parts [1]

(<http://www.ciwmb.ca.gov/organics/Definition.htm>) and two parts [2] (<http://www.ciwmb.ca.gov/organics/Definition.htm>) inside the mixing machine (**Figures 4 and 5**)^[7]. This mixture of 3 parts wood wate, 2 parts green waste, 1 part biosolids

provides the correct carbon to nitrogen ratio

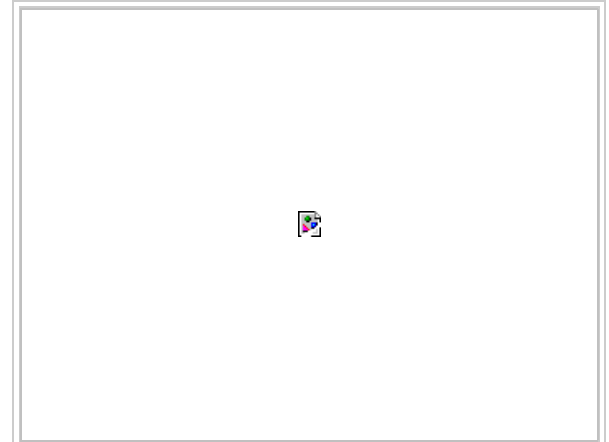


Fig 7: Static compost pile at Arcata Marsh. Photo by Woodland Schultze 2008

(<http://www.digitalseed.com/composter/science/cnratio.html>)
(around 30:1), helping promote optimal decomposition^[8].

Method of Composting Used

The mixture is dumped into a series of long piles. Each pile sits on top of a large air vent pipe (**Figures 7 and 8**). This air vent pipe can

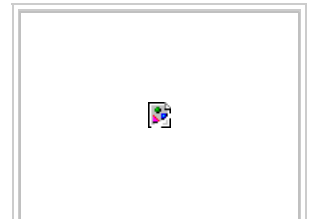


Fig 8: Side view of static compost

either feed oxygen to the microorganisms or take it away. Adding oxygen to the pile will raise the piles temperature due to increased microorganism activity. This method of composting is known as aerated static pile composting (<http://www.epa.gov/epawaste/conserves/rrr/composting/static.htm>) [1]. A diagram of aerated static pile composting can be seen in (**Figure 6**).^[9]

pile at Arcata Marsh. Photo by Woodland Schultze 2008

Temperature Phases of Composting at Arcata Marsh

To make sure harmful human and plant pathogens are killed, compost must be held at high temperatures for designated time periods (**Figure 9**). A pile with a high temperature reflects an abundance of microbial digestion. By pumping oxygen into the compost piles, site workers are able to keep the piles at a maintained high temperature of 46.1 degrees Celsius for 14 days and 55 degrees Celsius for three days^[3]. After the compost piles have been through the highest of temperature phases (55 degrees Celsius for three days) they are once again tested, and each year qualify as Class A.

Microorganisms of Composting

Each pile of compost has within it a number of different microorganisms. Each type of microorganism takes part in the decomposing process, some during certain temperature phases only. While the aerated static compost pile sits, mesophilic bacteria (<http://www.css.cornell.edu/compost/microorg.html>) and fungi



Fig 9: Temperature graph of composting. Photo taken from "Compost Microorganisms" by Nancy Trautmann and Elaina Olynciw <http://www.css.cornell.edu/compost/m>

(<http://www.digitalseed.com/composter/biology/fungi.html>) start decomposing organic material (<http://www.ext.colostate.edu/pubs/crops/00546.html>) . Mesophilic bacteria decompose organic material only in the first and last phase of composting, when the temperature of the compost pile is less than 40 degrees Celsius. A large population of invertebrates (<http://www.bumblebee.org/invertebrates/Inverts.htm>) aid in this phase of decomposition as well^[10]. Some examples of invertebrates include: Ants, beetles, worms, and mites. Invertebrates decompose the larger particles in the compost, making work for the bacteria and fungi easier. As the temperature of the compost exceeds 40 degrees Celsius thermophilic bacteria (<http://www.css.cornell.edu/compost/microorg.html>) take

over decomposing for the mesophilic bacteria and invertebrates. Actinomycetes (<http://www.bacteriamuseum.org/species/actinomycetes.shtml>) are another decomposer of the pile^[11]. These are a major contributing factor to the smell of compost and can be seen on the surface of the pile appearing as a spider's web. It is the combination of microorganisms that makes composting possible.^[8] ^[12]

Potential Dangers of Biosolids and Compost

When handling biosolids and or compost, people are exposing themselves to a number of potential dangers. If ingested, both biosolids and compost contain a large number of pathogens, which could cause disease and possibly death. Skin, eye, and respiratory protection in many situations are required, especially when handling Class B biosolids. One disease known to be caused by the bacteria in compost is legionnaires `disease

(<http://www.dailymail.co.uk/news/article-1021542/How-catch-deadly-legionnaires-disease-garden-compost.html>) . Another

potential danger is actinomycosis

(<http://gsbs.utmb.edu/microbook/ch034.htm>) , a disease caused by

Actinomyces israelii. These two types of diseases are related to

human inhalation and or ingestion of compost. Keeping that in mind, the people who handle biosolids and compost at Arcata Marsh wear protective gear, masks, and wash up after working. As long as one doesn't ingest/inhale compost or biosolids, chances of getting sick are minimal. Another danger involved with composting on such a



Fig 10: Compost being piled. Photo by Woodland Schultze 2008

large scale is the operation of heavy machinery (**Figure 10**). OSHA (<http://www.osha.gov/>) has set safety standards for facilities such as Arcata Marsh.^{[13][14]}

Current Uses

Each year Arcata Waste Water Treatment Plant generates only a few piles of compost. Instead of selling it to the public, the City of Arcata gives the compost to the Park and Recreation Department. There the compost is spread about in the local parks and or recreation areas.

References

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See Help:Footnotes for more.

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