Submitted by Joshua Klyber, ReCode Oregon 5/11/11

# Moving Beyond the NSF: Composting Toilet Systems

"Oregon is 1 of only 7 jurisdictions in North America that requires treatment systems be certified by NSF. NSF's certification protocol does not physically monitor effluent characteristics in order to verify system performance in the field."

*-Final Report of Recommended Rules Governing Onsite Systems, Oregon DEQ Onsite Advisory Committee*

Oregon has relied on NSF standard 41 for composting toilets since 1983, but the NSF no longer serves the purpose of encouraging innovation and protecting health. Relying on NSF guidance prevents economical, high performance systems from being installed, and it is time to move on to performance-based guidelines that allow Oregonians to chose the best technologies.

For example, the Vira Miljø Carousel, developed in Norway and with over 20,000 installations worldwide, is also manufactured in California by Ecotech. Ecotech is owned by David Del Porto, lead author of the composting toilet section of NSF 41. The Carousel is no longer NSF certified, owing to the expense. CTS Inc. has also dropped their NSF certification for the same reason.

Since 1978 four Oregon manufacturers have made composting toilet systems in-state: The Green Earth Compost Toilet Company, Toa-Throne Compost Toilets, Mullbank of Oregon, and most recently Romtec, which ceased production due to lack of demand. The owner of Green Earth Compost Toilet Company says that difficulties with permitting, especially following NSF 41 adoption, were the most important factors in putting his company out of business.

Additionally, not all systems tested in NSF-certified laboratories and bearing the NSF-approved mark are NSF-listed, confusing consumers. ACS LLC, Montana manufacturer of toilets popular at parks including Smith Rock- is not NSF listed, although it bears the NSF-approved seal because of testing through the Canadian Standards Association (CSA).

**The NSF, Composting Toilet Availability and Manufacturing in Oregon**

Certifying a composting toilet to NSF standard 41 costs $15,000- 20,000 / year. Despite four attempts, there is currently no Oregon manufacturer.

| Manufacturer | Country | State | |
|---|---|---|---|
| Clivus Multrum | Sweden, USA | MA | NSF-listed — permited to install in OR (all tested to NSF standards) |
| Sun-Mar | Canada | | NSF-listed — permited to install in OR (all tested to NSF standards) |
| ACS | USA | MT | CSA-listed — permited to install in OR (all tested to NSF standards) |
| Sancor | Canada | | CSA-listed — permited to install in OR (all tested to NSF standards) |
| CTS | USA | WA | NSF lapsed, installed in OR (NSF dropped owing to excessive cost) |
| Vera Miljø/Ecotech | Norway, USA | CA | NSF lapsed, installed in OR (NSF dropped owing to excessive cost) |
| Romtec | USA | OR | discontinued, cites lack of demand |
| AlasCan | USA | AK | US distribution, not permitted in OR |
| Biosun | USA | PA | US distribution, not permitted in OR |
| Cotuit | USA | MA | US distribution, not permitted in OR |
| Aquatron | Sweden | | US distribution, not permitted in OR |
| Ekologen | Sweden | | US distribution, not permitted in OR |
| Separett | Sweden | | US distribution, not permitted in OR |
| Berger Bioteknik | Germany | | no US distribution |
| Biolan | Finland | | no US distribution |
| Biolytix | New Zealand | | no US distribution |
| Ekolet | Finland | | no US distribution |
| Enviroloo | South Africa | | no US distribution |
| Rotaloo | Australia | | no US distribution |

Quotations from the *Final Report of Recommended Rules Governing Onsite Systems*, DEQ Onsite Advisory Committee, 2010.


Toilet manufacturers found with the assistance of:
*The Composting Toilet Systems book v.2*, Del Porto & Steinfeld, 2000
*The Lane County Office of Appropriate Technology's guide to Composting Toilets*, 1979.



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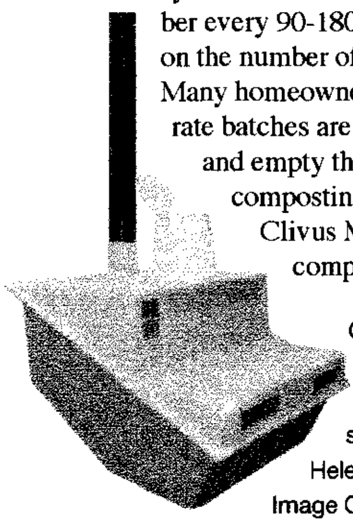
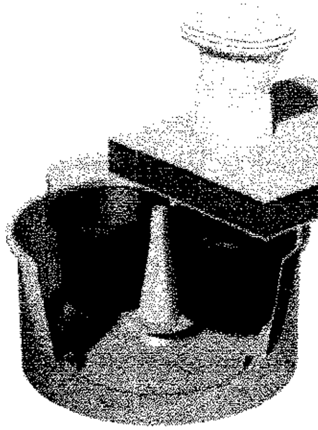
## Manufactured Composting Toilets

The first composting toilet to be manufactured was the Clivus Mulrum, a conjunction of clivus, Latin for "sloped" and multrum, Swedish for "mulching chamber." It is a sloped composting chamber where compost is added up top and removed at the bottom, known as a continuous composter. Since its patents expired in the late 1970's, the design has been imitated and improved upon in by several site-built and manufactured composting toilet systems. Currently only Clivus Multrum-branded clivus multrums, as well as Sunmar, Sancor, and ACS systems are licensed by the NSF, and therefore permitted in Oregon. Composting Toilet Systems Inc. of Newport, WA went into business in 1978, after patents expired on the Clivus Multrum, and their design is very similar. CTS Inc. systems are installed at Sand Island park in St. Helens and five other sites in Oregon. CTS Inc. used to be listed by the NSF, but found it uneconomical and dropped the listing.

The Vira Miljø Snuredass, Norway's most popular composting toilet, is now manufactured by Ecotech in California as the Carousel. Vira Miljø pioneered a variety of batch composting systems that rotate to a new chamber every 90-180 days, depending on the number of residential users. Many homeowners find that separate batches are easier to maintain and empty than continuous composting systems like the Clivus Multrum. No batch composters are currently permitted in Oregon, but at least one Carousel is installed.



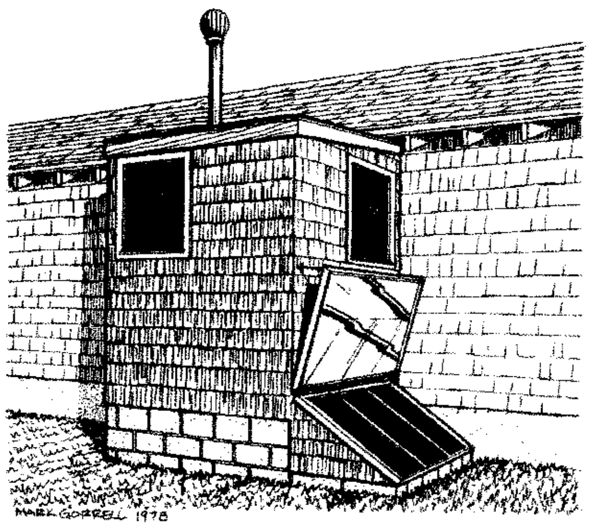
CTS Inc. composting toilet for trailhead use, similar to the system installed in St. Helens, Oregon. Image Credit: CTS Inc.



Ecotech Carousel pictured with a cutaway showing the interior chambers of a rotating unit situated below the floor of a bathroom. Image Credit: Vira Miljø

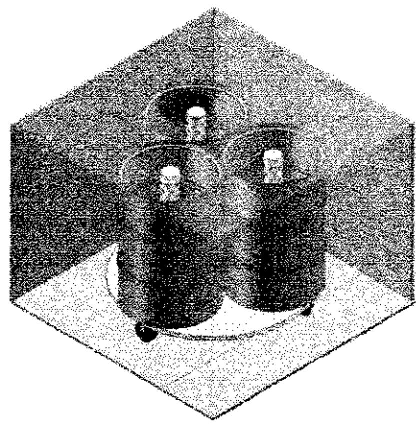
## Site-Built Composting Toilets

In cases of new construction and home renovation, it is often economical to build the composting toilet system into the structure. Many homes are not built to accomodate a composting toilet within their current plan, but can add one as a small addition. In New South Wales, Australia, where water shortages are acute, these systems are often of the "Clivus Minimus" continuous composter design, similar to the clivus multrum, but cast in place out of multiple layers of insulated concrete. The Clivus Minimus system was originally published by Ron Davis of Cottage Grove. Despite many attempts, Davis's home is, to ReCode's knowledge, the only site-built system to recieve a permit in Oregon.




A bathroom with composting toilet added on to a house, with a solar collector to heat the compost chamber and speed decomposition. Image Credit: Mark Gorrell, the Lane County Office of Appropriate Technology's Guide to Composting Toilet Systems, 1978.

In Alaska, where soils are often inappropriate for septic systems, and there is an alternative waste treatment industry. Biorealis Systems is one such company, lead by Ecological Engineer Robert L. Crosby, Jr., recipient of the US Department of Energy Award for Energy Innovation. Biorealis focusess on containerized waste treatment systems, and his barrel batch composting toilet system is an affordable alternative to commercial batch composters. His designs are installed extensively in public and private buildings throughout Alaska, and he has licensed his plans so that anyone may re-use them without fees. As site-built systems, they are not permitted in Oregon.



A Biorealis site-built composting toilet system built out of plastic 55-gallon barrels modified with aeration piping, and a rotating chamber like the Ecotech Carousel. Image Credit: Biorealis Systems Inc.

ENVIRONMENTAL
Fact Sheet

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

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# Fecal Coliform as an Indicator Organism

**What is an indicator organism?**

Fecal coliform bacteria are indicators of fecal contamination and of the potential presence of pathogens associated with wastewater or sewage sludge. Indicator organisms are typically used to demonstrate the potential presence or absence of groups of pathogens. The use of indicators is attractive because it reduces the complexity and cost of analyzing sludges or environmental media (soil, water, air) for individual pathogens. Indicator microbes are generally selected for the following reasons:

1) They are initially abundant in the matrix to be assayed.

2) A relatively rapid, accurate, and cost effective analytical method for enumerating the indicator exists or can be readily developed.

3) A reasonably strong correlation exists between the presence/absence of the indicator and a particular pathogen or group of pathogens. The strength of the correlation will determine the effectiveness and accuracy of the indicator as a measure of pathogen occurrence.

**What are fecal coliform bacteria?**

Fecal coliform bacteria are bacteria found in feces. Fecal coliforms are a subset of a larger group of organisms known as coliform bacteria. Coliform bacteria are described in *Standard Methods for the Examination of Water and Wastewater, 19th edition*, as facultative anaerobes (organisms which can survive in the absence of oxygen), gram-negative, non-spore forming, rod-shaped bacteria that ferment lactose (a type of sugar), producing gas and acid within 48 hours when cultured at 35°C. Their lack of ability to form spores makes them more susceptible to destruction by environmental conditions.

Fecal coliforms normally reside in the intestinal tract of warm-blooded animals. Outside of a warm-blooded host, fecal coliforms are short-lived compared to the coliform bacteria that are free-living and not associated with the digestive tract of man or animals. The fecal category contains both pathogen (disease-causing) and nonpathogenic bacteria. An example of one group of fecal coliform bacteria is *Escherichia coli* or *E. coli*. The presence of fecal coliforms is indicative of fecal contamination and of the potential presence of enteric pathogens (disease-causing organisms which originate in the digestive system), especially bacterial pathogens.

**How is the fecal coliform test used?**

The N.H. Department of Environmental Services (DES) uses the fecal coliform analysis as an indicator in several situations in the administration of both the Sludge Management Rules (Env-Ws 800) and the Septage Management Rules (Env-Ws 1600). In particular:

1) The U.S. Environmental Protection Agency (EPA) has promulgated rules that require that certain treated sludges (biosolids) be tested for fecal coliforms or *Salmonella sp.* For class A biosolids, fecal coliform results must be less than 1000 MPN/gram dry weight ("MPN" stands for Most Probable Number and is a way of statistically enumerating organisms) of biosolids to demonstrate that the treatment process has been effective in reducing pathogen populations to below detectable levels or to assess the potential for pathogen regrowth after treatment.

2) In some situations, DES will test for fecal coliforms to determine if an area has been contaminated with wastes of fecal origin, regardless of whether it is domestic septage or municipal sewage sludge.

3) In the event of a sludge, biosolids or septage spill or where contamination is evident, fecal coliform analysis is used to assess the likelihood that pathogens are present, their persistence, and the potential for negative impacts to public health or the environment.

**Are fecal coliform bacteria a reliable indicator of the presence or absence of pathogenic organisms?**

The presence of fecal coliforms is a reliable indicator of fecal contamination. However, the absence of fecal coliforms does not equate to the absence of fecal contamination, which is one of the shortcomings of using fecal coliforms. The source of the contamination could be animal excreta, wastewater, sludge, septage, or biosolids. Each of these wastes is derived entirely or at least in part from the feces and urine of warm-blooded animals. Since enteric pathogens and fecal coliforms are also excreted by warm-blooded animals, detection of fecal coliforms indicates the potential presence of pathogens.

However, fecal coliform bacteria are not always a reliable indicator of the destruction of individual species or groups of pathogens during wastewater treatment processes. For example, during anaerobic digestion, viral pathogens appear to have a greater survivability than fecal coliforms. The rate of inactivation for viruses and fecal coliforms seems to be more comparable for lime stabilization and high heat processes such as composting. In contrast, helminth ova (eggs of parasitic worms such as *Ascaris lumbricoides*, the large intestinal roundworm) are extremely resistant to chemical treatments such as lime stabilization but can be inactivated by high temperatures. Consequently, the fecal coliform test may be an inadequate indicator of viruses and helminthes in anaerobically digested biosolids, but a good indicator of treatment efficiency during composting. According to the literature, fecal coliform enumeration is most reliable as an indicator of the presence of bacterial pathogens, especially *Salmonella sp.*

Regarding persistence in the environment, caution should be exercised when interpreting fecal coliform results. Fecal coliforms are a reliable indicator of the survival of most bacterial pathogens, but are less reliable as an indicator for the presence of viruses and parasites. Fecal coliform analysis is less relevant when pathogens are incorporated into the soil where viruses and helminth ova are less susceptible to the destructive forces of heat and desiccation.

Fecal coliform testing does appear to be a good indicator of pathogen regrowth. This results from the fact that viruses and parasites are unable to reproduce without a warm-blooded host. The only pathogenic group capable of multiplying in the environment is bacteria. Given that fecal coliforms are a reasonably good indicator of pathogenic bacteria, conditions that would favor an increase in fecal coliform density may also be conducive to bacterial pathogen regrowth.

With potential limitations in mind, DES continues to use fecal coliform analysis as the best practical indicator of the presence and/or absence of pathogenic organisms. Given relative ease and low cost of the testing, fecal coliform analysis remains an effective tool for evaluating potential public health or environmental impacts.