

Making and Using a Composting Toilet

Living Web Farms Workshop Series 2016

Why compost human manure?

- Capture and conserve valuable calcium and iron phosphates
- Recycle nutrients back into the soil
- Save water typically used for flushing
- Save energy that would have been used for pumping and processing raw sewage
- Reduce surface and ground water pollution
- Redirect kitchen and household scraps into composting process

Key goals of a composting toilet

- Collect feces and urine in a leak-free and odorless environment
- Inhibit flies and insects from being attracted to composting materials
- Encourage naturally occurring microbes to turn wastes into nutrient-rich humus in a workable timeframe
- Assure that moisture from solid and liquid wastes is properly evaporated to reduce odors
- Maintain temperatures adequate to encourage a complete decomposition process
- Destroy pathogens (viruses, bacteria, parasite, harmful fungi) present in human waste

Sawdust toilets

- Simple and effective collection and composting method
- Inexpensive and requires minimal materials—bucket, seat, plywood, and lumber scrap
- Uses sawdust or other organic cover material—pine pellets, chopped straw, leaf waste, coconut hull (avoid redwood, cedar, and pressure-treated sawdust)
- Cover material contains odors and keeps flies and insects at bay
- Require an outdoor compost pile that is properly maintained
- Must be emptied regularly to compost pile to prevent excess buildup or overflow
- Useful for campsite, worksite, remote housing, low-impact living, emergency disaster prep

Stand-Alone composting toilet

- Uses a “direct deposit” collection chamber made of plastic or some easily cleaned material. The chamber ideally has a lid for when it is transported
- Deposits are periodically emptied into an outdoor compost pile set up for humanure
- Collection chamber is watertight and includes a drain fitting. If urine and feces go into the same container, a screen or baffle should be installed a few inches above the bottom to separate the two materials and allow for liquid leachate to drain
- A separate urine diverter can be used to direct liquids to a separate container for handling

LWF Composting Toilet budget

| | |
|---------------------------|-----|
| Plywood | 160 |
| Studs framing | 90 |
| Plywood roof sheathing | 56 |
| Roll roofing | 35 |
| Ridge cap | 24 |
| (2) Compost Chambers | 110 |
| (2) Toilet seats | 32 |
| Misc. seals | 12 |
| 8-in flex pipe | 25 |
| 4-in flex pipe | 22 |
| 4-in turbine | 38 |
| 4-in base | 35 |
| 4-inch duct | 9 |
| 2-in EPS rigid insulation | 72 |
| 1-in EPS rigid insulation | 36 |
| Rocket hand pump | 35 |
| Stainless sink bowl | 8 |
| Misc plumbing fittings | 35 |
| Roofing screws | 15 |
| 9 x 2-1/2 deck screws | 29 |
| EPS PL300 adhesive | 7 |
| Liquid nails EHD adhesive | 11 |

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Recommended reading:

The Humanure Handbook, Joseph Jenkins, Chelsea Green Publishing, 2005. The Third Edition contains updated information but earlier editions are equally valuable. Jenkins' work is considered the major source on backyard human waste composting and the author champions the use of the "sawdust toilet" with subsequent bin composting.

The Scoop on Poop, Dan Chiras, New Society Publishers, 2016. A very complete and well-structured overview of various types of composting toilets both commercial and home-built. Includes information on outdoor and indoor units, composting regimen, and bacteria. The author also includes a chapter on greywater recycling.

Recode Now:

<http://www.recodenow.org/wp-content/uploads/2015/05/composting-toilet-code-Recode-December-2014.pdf>

A collaborate effort to define and structure code and regulations for composting toilet systems. Includes examples and illustrations, current code conflicts, and an overview of typical pathogen survival times.

North Carolina Division of Public Health:

A state memorandum compiled for local environmental health specialists which describes the circumstances and conditions for the use of composting toilets in North Carolina.

<http://ehs.ncpublichealth.com/oswp/docs/design/CompostingToilets-4-30-2015-OSWP.pdf>

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|----------------------------------|------|
| Door hardware | 26 |
| Solar PV panel Vikram 150 W | 150 |
| Battery Deka 12VDC 92 AH | 228 |
| Morningstar PS-15 charge control | 99 |
| ShurFlow yellowtail 12VDC fan | 32 |
| Misc. breaker/box/conductor | 60 |
| Total | 1491 |

- Toilet seat, lid and enclosure should be airtight to the rest of the structure to isolate any odors and keep flies and insects from being attracted
- Ventilation is critical to aerobic decomposition and odor control. A 4-inch vent pipe with a turbine cap extends from the composting enclosure through the structure roof. A small additional solar-powered bilge blower has been installed for use as needed
- A small fan with flexible aerating pipe is used in the chambers for direct aeration during heavy/continuous use
- Aerobic conditions support the activity of heat-producing mesophilic and thermophilic bacteria which break down the waste and destroy any pathogens it contains. Mesophilic bacteria from within our feces work at temperatures between 68 and 112 degrees F. Thermophilics work in the range of 113 to over 162 degrees F. A consistent temperature of 122 degrees will kill pathogens within 24 hours, but because consistency is not guaranteed, waste material must be allowed to safely cure in an outdoor pile for at least one year
- Ambient temperatures above 60 degrees F will keep heat working within the composting materials. Some composting takes place in the chamber and the remainder occurs over time as the contents are removed to the pile. If temperatures fall below 60 degrees F, aerobic activity comes to a halt but the bacteria do not die; they will reactivate when temperatures rise. Stand-Alone or outdoor composting toilets will benefit from insulation in colder climates.
- Cleanout and transfer of material from the chamber to the pile should be done before the chamber reaches overflow. Transport is safer and less unpleasant if the containers are lidded. The chambers can be rinsed with a quick hose spray at the outdoor pile and the waste water added to the pile

Outdoor compost pile

- Can be constructed from scrap lumber, fencing, or pallets
- Should contain more than one compartment to maintain active and staged decomposition
- Must be protected from scavenging animals. A framed top covered with galvanized hardware cloth works well; If the sides have gaps these should be covered as well
- Maintain diversity in your composting materials with kitchen scraps, paper towels, leaves, weeds, clippings, straw, and poultry litter. Used toilet paper is composted with human waste
- In wet climates, provide rain protection with a tarp as needed. Don't use a permanent solid cover
- In dry times, moisture from urine and food wastes may not be adequate. Dishwater or hose spray and rinse from humanure chamber can supplement
- Assure that runoff of fresh material cannot occur by using berms or base framing if needed
- Keep a supply of cover material and bulk nearby to cover fresh material. This can be straw, soil, poultry litter, cotton fabric shreds, old manure, etc. that can be spread easily
- Spread materials evenly with a fork or rake to avoid high-piling

Composting humanure safely

- Human wastes contain abundant bacteria and microorganisms but only a small percentage are harmful
- Healthy humans do not carry infectious diseases but may harbor parasites such as tapeworms, roundworms, and pin worms
- Unhealthy humans can carry diseases such as malaria, ebola, cholera, hepatitis and other infections but these are rare in developed countries. Family members supplying humanure compost should not normally contribute risk
- Handle liquid and solid waste with care when moving them to the compost pile and avoid splashing or dripping the contents. Wear rubber gloves and wash thoroughly afterwards
- Cover freshly deposited materials completely, in the toilet and in the pile
- Since mesophilic and thermophilic bacteria vary in their working timeframes depending upon environment and materials, allow a minimum of one year—and possibly longer—before applying composted materials to soil
- Avoid turning a working compost pile since that may cool and slow working bacteria
- Be sure to mix coarse material such as straw or yard trimmings regularly to make air pockets and encourage aerobic digestion
- We do not advocate using composted humanure directly on vegetable gardens although many practitioners do just that. The safest applications are in flower gardens and orchards