City of Portland, Oregon
Bureau of Development Services
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Alternative Technology Advisory Committee Application Form

For information about the Alternative Technology Advisory Committee, instructions for filling out this application form and a list of submittal requirements please see our web site at www.portlandonline.com/bds/atac

Applicant Information:

Name: Angel York & Darin Wick **Company Name: N/A**
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Address: 4846 N Vanderbilt St
City: Portland **State: OR** **Zip Code: 97203**
Phone No.: (503) 765-8444 **FAX No.: (---) --------**

Project Information:

This application involves (check one):

☐ **A technology not associated with a specific project**
☒ **A specific project currently under review**
Project Address: 4846 N Vanderbilt St.
Tax Account number: R614556
Building Permit No.: 15-149959 RS
LU Case No (if applicable):
☐ **Other (specify):**

I. Overview of Technology

A. Proposed Technology: Please describe the material/product/construction method you would like to have reviewed by the committee.

Home-built composting toilet system, per the 2017 ANSI/IAPMO Water Efficiency & Sanitation Standard (WE·Stand) 403.3-403.9 (see **Attachment B**).

The **compost processors** will be water-tight and rodent-proof. They will have perforated ABS vent pipes for aeration. We will test water-tightness by filling the empty processors with water and letting them sit for 24 hours to confirm that they hold water.

The **commode** part where we sit will be bolted securely to the floor with corrosion-resistant fasteners. The 5-gallon commode bucket will sit inside that, and carbon matter will also be located inside the bathroom for "flushing."

We have attached an **owner's manual** for the system that meets standards from the 2011 Oregon Reach Code as well as the more recent and more detailed WE·Stand. See **Attachment A.**

B. Application of Technology: Please describe the specific application of the technology. How, when and where will this technology be used?

The commode part will be used whenever someone in the house needs somewhere to urinate, defecate, regurgitate, and/or menstruate. We will sit on the commode, possibly read a book, pee, poop, vomit and/or bleed, then cover any bodily waste product with carbon matter to prevent odors and protect against flies. When full, the commode bucket will be emptied into the compost processor. Microbes in the compost processors will be chowing down on our excreta; this is the act of composting. When, one year after it has been filled, the contents of a full composting processor are a nice, healthy manure, the manure will be applied to the landscaping per WE·Stand section 403.8.6.

C. Code Conflicts: Please describe any known building code issues related to this technology.

Relevant Standards: A History

Composting toilet systems have been allowed by Oregon code since 1978[1]. It is only with the recent release of WE·Stand that there is prescriptive code for a composting toilet system in which the commode and compost processor are not directly connected. Below is a brief chronological overview of codes and standards regualting composting toilets in the state of Oregon.

- **NSF 41 (1983)**[2]
  - Standard for certifying commercial composting toilets

1 "Since 1978 composting toilets have been allowed as part of the Oregon state residential plumbing code (Oregon Revised Statues 918 770-0080)" per http://www.recodenow.org/composting-toilets-in-oregon/

2 http://www.nsf.org/newsroom/resources/category/non-liquid-saturated-treatment-systems

- Primarily based on product testing; not intended for or easily applicable to site-built systems

- **Oregon Administrative Rule 918-770 (1997, though other sources indicate some language to this effect was present as early as 1978)**[3][4]
  - Specifies that evaluation criteria for composting toilet systems includes but is not limited to NSF 41
  - Seems to be a standard for evaluating products offered for sale ("No plumbing product may be sold or offered for sale in the state of Oregon unless...")

- **2011 Oregon Reach Code, Section 1307.4**[5]
  - Site-built composting toilet systems may be installed "pending laboratory verification" of humus safety after the first period of composting is complete.
  - There's a newer version of the Reach Code out that makes no reference to composting toilet systems, but when we inquired with Mark Heizer at the state's Reach program he said "the use of the 2011 reach code alternate method for composting toilet systems is still accepted by building departments for residential structures."
  - "**1307.4.2.2.4.1** The *collection method* shall connect *commode* directly to *composting chamber* or present water-tight barriers to user contact with human wastes during normal operation or in event of failure." Andrew Skinner, state plumbing program chief, said during a phone conversation in the summer of 2017 that he would consider this inconsistent with a bucket-based system that requires the commode to be emptied into the composting processor by hand. The more recent 2017 ANSI/IAPMO WE·Stand does not include this requirement.
  - Standards in this document mostly concern management plan, since all composting toilet systems need some level of active management.

- **ORS 447.118 Standards for composting toilet systems (2015)**[6]
  - "Nothing in ORS 447.010 (Definitions for ORS 447.010 to 447.156 and 447.992) to 447.156 (Sale of uncertified plumbing products prohibited) and 447.992 (Civil penalties) shall prohibit the installation of a compost toilet for a dwelling by the occupant of the dwelling if the compost toilet complies with the minimum requirements established under this section."
  - "As used in ORS 447.118 (Standards for compost toilets) and 447.124 (Inspection of compost toilets), 'compost toilet' means a permanent, sealed, water-impervious toilet receptacle screened from insects, used to receive and store only human wastes, urine and feces, toilet paper and biodegradable garbage, and ventilated to utilize aerobic composting for waste treatment. [1977 c.523 §2]"

- **2017 IAPMO Water Efficiency and Sanitation Standard, aka "WE·Stand"** [7]

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3 https://secure.sos.state.or.us/oard/displayDivisionRules.action;JSESSIONID_OARD=elmdqcYAwhL1MeoNzHJlE32nWmHjNIVWbGMOZ2jqyJObvf6FhYoO!-348175955?selectedDivision=4192

4 "Since 1978 composting toilets have been allowed as part of the Oregon state residential plumbing code (Oregon Revised Statues 918 770-0080)" per http://www.recodenow.org/composting-toilets-in-oregon/

5 http://ecodes.biz/ecodes_support/free_resources/Oregon/11_Reach/PDFs/Chapter%2013%20-%20Residential%20Provisions.pdf

6 https://www.oregonlegislature.gov/bills_laws/ors/ors447.html

7 Relevant code is attached, see Attachment B. Also available for sale at http://www.iapmo.org/WEStand/Pages/default.aspx

- Replaces the Uniform Plumbing and Mechanical Code Green Supplement
- **"403.8.4.3 Transfer.** Where unfinished excreta or diverted urine is transferred between processors or from commode to processor, transfer and cleaning of containers and provisions for limiting user exposure shall be according to the owner's manual." - *explicitly* allows for transfer of un-composted excreta between the commode and the compost processor.
- While this internationally-recognized standard has not been adopted by the State of Oregon, it is the most recent, up-to-date code we know of that covers composting toilet system design.

II. Sustainability

A. Sustainable Elements: Describe how this alternative substantially reduces the environmental impact on the planet over similar technologies currently allowed by the code? ***Please attach any documentation that supports your answer.***

Shall I compare this to a flush toilet? This is more eco-friendly and more temperate.

SAVING WATER

> We've adopted the policy of defecating in our drinking water and then piping it off somewhere to let someone else deal with it. So now we're finding our drinking water sources dwindling and becoming increasingly contaminated.[8]

And, on a different scale, the United Nations:

> Good water quality is essential to human health, social and economic development, and the ecosystem. However, as populations grow and natural environments become degraded, ensuring there are sufficient and safe water supplies for everyone is becoming increasingly challenging. A major part of the solution is to produce less pollution and improve the way we manage wastewater.[9]

Each Portland sewer customer generates an average of 100 gallons of wastewater per day.[10] Based on a 2016 report from the Water Research Foundation, for residential customers the single appliance that uses the most water – 24% of the average household total – is the toilet.[11]

NUTRIENT CYCLE

Plants grown in soil amended with humus from composting toilet systems are noticeably healthier and more vigorous than those grown in unamended soil. While we wouldn't be using humus on vegetables, it's reasonable to expect trees and ornamental plants to have similar results to Peter Morgan's 2003 experiments with humus from "Fossa alterna" composting toilets, below[12]:

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8 Humanure Handbook, Chapter 10
9 http://www.unwater.org/water-facts/quality-and-wastewater/, accessed February 2018
10 https://www.portlandoregon.gov/bes/article/40675, accessed February 2018
11 http://www.waterrf.org/PublicReportLibrary/4309A.pdf, accessed February 2018
12 http://aquamor.tripod.com/KYOTO.htm, accessed February 2018

Spinach growing on poor sandy soil (left) and the same soil enhanced with an equal volume of humus taken from a Fossa alterna pit (right).

Lettuce growing on poor sandy soil (left) and the same soil enhanced with an equal volume of humus taken from a Fossa alterna pit (right).

Onion growing on poor sandy soil (left) and the same soil enhanced with an equal volume of humus taken from a Fossa alterna pit (right).

CLIMATE CHANGE

Here's an overview from the folks at Turning Earth on how compost relates to climate change:[13]

> Consumption of fossil fuels is far from the only cause of [greenhouse gas] emissions. Carbon released from soil exploitation has been a significant contributor to climate change. Recognizing the connection between soil and climate is key to reestablishing sustainable soil management practices.
>
> **Impact of Soil Exploitation**
>
> - More than twice as much carbon is stored in the Earth's soil as is stored in all living vegetation and the atmosphere combined
> - Over approximately 20 years, most agricultural soils loose 50% of their organic carbon because of the reliance of industrial agriculture on chemical fertilizers and intensive farming practices
> - Soil exploitation has been responsible for approximately one-third of the increase in atmospheric CO2 over the last 150 years, mainly through the loss of soil organic carbon
> - More carbon entered the atmosphere from soils than from fossil fuel consumption from the 1860s until the 1970s
>
> **Compost and Carbon Sequestration**
>
> - Harvesting crops removes carbon from the soil that would otherwise return to the soil when the plant dies and decomposes

13 http://turningearthllc.com/what-we-do-2/compost-and-soil-amendments/composting-and-climate-change/ accessed February 2018

- Compost returns organic matter to the soil
- The nitrogen in compost can increase soil productivity, which can lead to increased crop residues and an increased return of carbon to the soil
- Composting increases the formation of stable carbon that remains bound in the soil for long periods of time
- Applying organic matter to soils is one of the most effective ways to divert CO2 from the atmosphere and convert it into organic carbon in soils

The connection between composting and climate change is known. For example:

> The Bill and Melinda Gates Foundation, with their Reinvent the Toilet Challenge specifically recognised the need for a solution that is 'off-grid' relying on neither water nor electricity to function — a toilet that is resilient and adaptable for climate change. [14]

The City of Portland is on the record as caring about climate change; that's why we have a Climate Change Action Plan:

> In 1993, Portland was the first U.S. city to create a local action plan for cutting carbon. Portland's Climate Action Plan (CAP) is a strategy to put Portland and Multnomah County on a path to achieve a 40 percent reduction in carbon emissions by 2030 and an 80 percent reduction by 2050 (compared to 1990 levels). The plan builds upon a legacy of forward-thinking climate protection initiatives by the City of Portland and Multnomah County that have resulted in significant total and per person reductions in local carbon emissions.[15]

CONCLUSION

Flush toilets – the current standard – account for nearly a quarter of our residential potable water usage. The water they consume is contaminated with raw sewage. That effluent is transported across the city to treatment plants, which expend energy to make the water safe enough for release into rivers, while reclaiming some of the nutrients in the form of biosolids.

Batch composting toilet systems, on the other hand, use almost no potable water – only a few liters per emptying to clean the commode. They do not require transportation of excrement or blackwater. The treatment process is biological, so it requires no energy input. The resulting compost can be used as a soil amendment, maintaining the nutrient cycle. Unlike flush toilets, this is in line with the city's priorities regarding climate change.

B. Reason for Alternative: Describe why this alternative is desired?

"Use of large volumes of potable water to move human excreta over large distances is not only a poor use of water resources but is also inefficient, expensive, and energy intensive."[16]

14 https://www.huffingtonpost.com/catarina-de-albuquerque/sanitation-and-climate-ch_b_8749650.html accessed 02/2018

15 https://www.portlandoregon.gov/bps/49989 accessed February 2018

16 "Economic and Environmental Analysis of Standard, High Efficiency, Rainwater Flushed, and Composting Toilets" by C. Anand and D.S. Apul (see attached copy)

The paper that quote comes from concludes, based on modeling of economic and environmental impacts, that composting toilet systems are preferable in all regards: water conservation, energy conservation, and economic benefit.

Some of the environmental advantages are described in section IIA; here we will discuss two other reasons to use composting toilet systems - economic benefits and resiliency in the face of natural disaster.

ECONOMIC BENEFIT

On the level of personal economics: We're low income and can't afford to flush drinking water down the drain all the time. Commercial compost toilet systems are expensive, and we're not convinced they work any better than site-built models, so we would prefer to build our own. Other people who live in Portland also have low or no income and may have these same preferences. Of course, composting toilet systems also have benefits on a societal scale….

Around 2011, Matthew Lippincott and Molly Danielsson put together an overview of the state of sanitation in Portland to introduce "An Unsolicited Design Review of Composting Toilets & Composting Methods." At the time, 88% of sewer operations and maintenance costs were dedicated to moving sewage. Only 22% went to actual sewage treatment. High sewer bills were the third most common complaint called in to the mayor's office. Ten percent of BES's service district was at risk of sewage flooding. [17]

Since then, the Big Pipe project (a substantial contributor to Portland's high sewer bills) has eliminated the vast majority of Combined Sewer Overflows – but it means more infrastructure to maintain, and came at a cost of $1.4 billion. [18]

Portland's Bureau of Environmental Services operates on a budget of around one billion dollars per year – and as of 2011, 88% of the operations and maintenance costs were dedicated to moving sewage across the city, something not required by the proposed composting toilet system.

RESILIENCE

Natural disasters (e.g. a major Cascadia Subduction Zone quake) are likely to damage water and sewer lines. Composting toilet systems are unaffected by this infrastructure damage – which is why Portland's Bureau of Emergency Management adopted the Sewer Catastrophe Companion by Molly Danielsson and Matthew Lippincott, a guide to composting toilet systems for emergencies.[19] PBEM recommends a bucket-and-bin system very similar to the one we are proposing here.

INSPECTED BUCKETS: FILLING THE GAP IN REGULATION

We have been told countless times – including by multiple professionals – that it would be easier to install a flush toilet and then, once we have an occupancy permit, put a home-built composting toilet systems in under the radar. We've also heard that there are households in Portland already using this type of composting toilet system without having them reviewed or inspected. The City of Portland can continue to look the other way while people build bucket toilet systems without inspections or safety standards, or it can ensure that these compost toilets are designed and operated safely by establishing clear guidelines and procedures for permitting and inspecting them.

17 https://greywateraction.org/wp-content/uploads/2014/11/an-unsolicited-design-review-sm.pdf
18 http://www.oregonlive.com/portland/index.ssf/2011/11/portlands_14_billion_big_pipe.html
19 https://www.portlandoregon.gov/pbem/article/447707

C. Comparison to Other Technologies: How does this technology provide equivalent life safety and/or fire protection than the current technologies allowed by the code?

LIFE SAFETY: Comparison to Flush Toilets & Microbial Exposure Concerns

One of the most common concerns raised about composting toilet systems is exposure to harmful microbes in feces. A properly designed and maintained bucket toilet system, however, is as safe as a properly installed and maintained flush toilet. Below is a quick overview of potential points of contamination and how they compare to conventional plumbing.

1) Life Safety at the Commode
"*But there will be a bucket full of poop in your bathroom!*" people say. That's not quite accurate, though - commode buckets are primed with carbon matter and each deposit is thoroughly covered with more of the same, blocking smells, flies, and direct human contact with feces.

You never need to plunge or snake a clogged bucket, or worry about it suddenly and unexpectedly overflowing.

The only toilet I can ever think of anyone ever putting their hands into in my entire life was that time I accidentally put my dirty laundry in one instead of the laundry basket when I was a small child. I am confident that my mother washed her hands and my clothing afterwards. Accidentally handling the contents of the commode bucket is a non-issue, which is anyway easily addressed by the bathroom handwash sink requirement.

2) Life Safety During Transfer
"*Do you really want to carry a bucket full of… well… and then dump it out and clean it?*" Sure thing! People transport things in five-gallon buckets with lids all the time; that's why they invented secure lids for them. Our buckets will have secure, watertight lids for transfer, as per 2017 IAPMO WE·Stand requirements.

We would have to wash a flush toilet with cleaner, water, and toilet brushes. As demonstrated in the "Emptying toilet materials into a compost bin" video,[20] washing out a bucket is effectively the same process.

3) Life Safety and the Compost Processor
"*I don't want this in the groundwater! And what about rats?*" These are excellent concerns that are addressed by IAPMO requirements. The compost processor, as described in greater detail in section 1a, will be watertight except for vector-proofed venting.

4) Life Safety and Finished Humus
Composting is already well-established as a processing method for human excrement. Research indicates that sixty-gallon containers stored outdoors can achieve thermophilic conditions.[21] When combined with a

20 https://youtu.be/CZTZTVv6kYs

one-year minimum aging period as required under WE·Stand that should be more than sufficient to destroy any harmful pathogens. Required lab testing can confirm that the system is working as expected.

Anecdotally, Joseph Jenkins of the Humanure Handbook has been operating a composting toilet system used by hundreds of guests over a period of decades, and tests indicated no parasites. (See Section IIIA for details.)

5) Life Safety of Proposed System
As for the big picture, IAPMO thinks it's hygienic: their new international standard was put together by professionals who think about sanitation for a living, and who also provide internationally-recognized code for flush toilets – in addition to the Uniform Plumbing code, which is the basis for the Oregon Plumbing Specialty Code.

> The International Association of Plumbing and Mechanical Officials has been protecting the public's health and safety for ninety years by working in concert with government and industry to implement comprehensive plumbing and mechanical systems around the world.[22]

COMPOSTING SYSTEM COMPARISON

There are three main types of composting toilet systems well-suited to individual residential use:

1) Self-contained composting toilets
These are small enough to fit in place of most flush toilets. They usually have vented fans and heating systems to dehydrate excreta and evaporate leachate, along with mechanical aeration or pile-leveling mechanisms. There are at least three NSF-certified models, but all have a reputation for finicky maintenance – keeping such a small amount of compost at an appropriate temperature and humidity is challenging, since it doesn't have enough mass to build up the heat of a larger aerobic composting pile. They're also known for mechanical failures that leave owners scooping humus out with a trowel, and some models have opportunities for finished humus to come in contact with raw feces. The Sun-Mar Excel is generally considered the most reliable, with many happy owners who give good reports, but it's also prone to broken plastic crank handles and occasionally the leachate tube can clog and cause overflows. They also require the installation of extra vents to carry away any smells from the built-in compost processor. The other notable disadvantage to self-contained units is the limited size of their compost processor, which in turn limits the number of people who can safely use the system.[23]

2) Remote composting systems
A large (usually 50+ gallon) compost processor is located somewhere below the toilet, often directly underneath. They require ventilation for the compost processor and some also use electric heating elements and fans to accelerate composting and leachate evaporation. While they can be simple and effective, these systems require adequate space below the toilet room and good access for removing finished compost, which is unavailable in many homes.

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21 "Microbiological assessments of compost toilets: In situ measurements and laboratory studies on the survival of fecal microbial indicators using sentinel chambers" by L.Tønner-Klank et al. (see attached copy, or https://doi.org/10.1016/j.wasman.2006.04.021)
22 http://www.iapmo.org/pages/default.aspx
23 https://letterstocreationists.wordpress.com/2015/03/14/comparison-of-composting-toilets-towards-a-global-commode/

3) Bucket-and-bin systems
This is the type of system we are proposing, based on the requirements of the 2017 IAPMO WE·Stand.

They can accommodate an arbitrary number of users and an arbitrarily-long compost processing time, since additional compost processors can easily be added to the system. They are more versatile than remote composting systems and they have fewer potential points of failure than self-contained systems, and the points of failure are addressed by the requirements of the 2017 IAPMO WE·Stand (such as bolting the commode down, using the lid during transfer, etc.) We believe it is the system best suited to individual residential applications because it requires no modifications to the structure it is installed in, it is affordable and easy to construct, and it is mechanically and conceptually simple.

FIRE PROTECTION AND COMPOSTING

At an industrial scale (e.g., 2000 tons), compost piles can reach temperatures above 180 degrees Fahrenheit and spontaneously combust.[24] However, our bins will be so small that they will never reach that temperature. Jenkins of the Humanure Handbook said that in 26 years of composting by this method, the temperature of his compost processors has never exceeded 149 degrees Fahrenheit.[25]

The following section of the Humanure Handbook can be used to explain the technical reasons for why commercial composters (composting on a much larger scale) need to worry about spontaneous combustion:

> This is especially true for "continuous compost," which is different from "batch compost." Batch compost is made from a batch of material that is composted all at once. This is what commercial composters do — they get a dump truck load of garbage or sewage sludge from the municipality and compost it in one big pile. Backyard composters, especially humanure composters, produce organic residues daily, a little at a time and rarely, if ever, in big batches. Therefore, continuous composters add material continuously to a compost pile usually by putting the fresh material into the top. This causes the thermophilic activity to be in the upper part of the pile while the thermophilically "spent" part of the compost sinks lower and lower, to be worked on by fungi, actinomycetes, earthworms and lots of other things. Turning continuous compost dilutes the thermophilic layer with the spent layers and can quite abruptly stop all thermophilic activity.[26]

Basically, we will be adding small amounts, a little bit at a time, to a small pile. This means most of the heat will be at the top of the pile. The bins will be five feet or less in height (per the recommendation of University of Nebraska bioenvironmental engineer Rick Koelsch) to further discourage any over-accumulation of mass.[27]

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24 https://www.wired.com/2016/08/manure-fire-new-york/
25 http://humanurehandbook.com/downloads/Chapter_8.pdf
26 http://humanurehandbook.com/downloads/Chapter_3.pdf
27 https://www.wired.com/2016/08/manure-fire-new-york/

III. Supporting Documentation

A. Testing Data: Describe any testing that has been performed on this technology to show how it may be able to meet code requirements**.** ***Please attach all available testing data.***

Most people using composting toilet systems are doing so without permits and don't seem to bother testing the resultant humus – or if they have, they haven't published it – so data is limited. What we found ourselves is below.

The most extensive testing data we found on bucket toilet systems is provided by Joseph Jenkins in *The Humanure Handbook*. Rather than testing the finished humus, he submitted his own stool samples for analysis, reasoning "I had been exposed to the compost system and the garden soil longer than anyone else in my family by a number of years. I had freely handled the compost, with bare hands, year after year, with no reservations." Tests after 11, 15, and 26 years were consistently negative for "indicator parasitic ova and worms." Jenkins also tested his finished compost, humanure-amended garden soil, and unamended yard soil for Nitrogen, Phosphorus, and Potassium. Unsurprisingly, the finished compost tested highest, with the amended garden soil substantially more NPK-dense than unamended yard soil.[28]

As described in section 3B, Tony Davidson of Tonasket, Washington submitted finished compost from a Humanure Handbook-style bucket toilet system and it was found to have 21 fecal coliforms/gram – substantially better than what is required by IAPMO's WE Stand.[29]

B. History of Use: Describe all known instances where this technology has been applied to a constructed building, including approximate date, location and building type. ***Please attach any documentation that supports your answer.***

There are so many bucket toilet systems that there's already an internationally-recognized plumbing standard covering it (see Attachment B). There are far too many to list them all here.[30] Some of you may even know people who use this system here in Portland already. Below are some documented examples listed in approximate chronological order, mostly collected from the permies.com forums and a survey we sent out.[31] A few that we consider especially noteworthy are boxed.

Bucket toilet systems described on the permies.com forums include one in **Minnesota** that has been in use for over 30 years[32] and one in **Southern Oregon** that has been used for "years"[33] – both on properties that seem to combine residential with small-scale agricultural use.
Greene, Maine: A bucket toilet system in a house and outhouse has been in use a this location since 2001, with humus buried around the base of fruit trees in a 145-tree orchard.[34]

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28 Humanure Handbook, Chapter 8
29 https://permies.com/t/55070/Public-Domain-Composting-Toilets-Legal
30 Screenshot of several pages of examples, just from one search result: https://poopoccurs.wordpress.com/2018/02/03/screenshot-of-bucket-toilet-videos/
31 https://permies.com/f/77/composting-toilet & https://goo.gl/forms/JDHjoZbpzdHoger62
32 https://permies.com/t/53604/Humanure-Carbon-Stock#440575
33 https://permies.com/t/53182/compost-toilet-heap-designs#434705

Maine: From 2005-2010 eight people used a bucket toilet system in a shed/garage with an open outdoor compost pile.[35]

Sebastopol, CA: A bucket toilet system using 55-gallon pits dug into the ground as compost processors has been operating since 2008, and can maintain a temperature of 140°F for months.[36]

Portland, OR: A bucket toilet in a shed/garage has been emptied into an outdoor compost pile for 8 years with the operator reporting "complete success." This respondent also reported using "dozens" of other bucket toilet systems, at least some of which we believe are located in Portland.[37]

Portugal: A bucket toilet and open pile system that has been operating for 8 years. Even without turning, the 5' x 5' compost pile breaks down everything except bones.[38]

Arizona and Oregon: A 2011 page on Omick.net describes a bucket-and-bin system with urine diversion that uses 55 gallon plastic drums as compost processors. The drums are vented and turned with a compost crank, and leachate evaporates from the drums.[39]

Rural Hawaii: A bucket toilet system with urine diversion located in a shed that has been in use for 7 years with a 1 cubic yard closed compost processors maintains a temperature of 150-170°F for six months with addition of water and livestock manure as needed. [40]

Victoria, BC: In October 2012, Gord Baird posted a description of a bucket toilet system that had been in use by a family of six for seven years, along with a video of dumping the buckets into their open compost pile.[41] The system was approved by local authorities, and they also maintained a system at a nearby regional park. [42] Baird's system was one of about eight different bucket-based systems described throughout the course of the online discussion, most of them in private residences. Locations listed include **Maine, Colorado, and Portugal**.[43]

Auckland, NZ: In April 2015 Shaye Boddington reported on her family's experience using a bucket-and-bin system in their trailer-based tiny house. They do not appear to mix or aerate their compost processors, and they don't publish temperature or testing data, but based on visual inspection they believe composting proceeds well when using wood chips as cover/carbon material.[44]

Tonasket, WA: In April 2016, Tony Davidson described the approval process for a bucket toilet system. In

34 https://docs.google.com/spreadsheets/d/1dNDRIzK6BrOvULhbnIRweR8XQcGh2RtyZPNDClyLFTk
35 Ibid.
36 Ibid.
37 Ibid.
38 Ibid.
39 http://www.omick.net/composting_toilets/bucket_barrel_toilet.htm
40 https://docs.google.com/spreadsheets/d/1dNDRIzK6BrOvULhbnIRweR8XQcGh2RtyZPNDClyLFTk
41 https://www.youtube-nocookie.com/embed/JuKyhUVbKwM
42 https://permies.com/t/16231/bucket-toilet#154997
43 https://permies.com/t/16231/bucket-toilet
44 http://www.diyhousebuilding.com/bucket-toilets.html

Washington (or at least in Okanogan County) the humus produced by a composting toilet is considered biosolids, and as such must undergo lab tests. To qualify as Class A biosolids the humus must contain less then 1000 fecal coliforms/gram. Even though this is less stringent than the 200 fecal coliforms/gram standard required by the 2011 Oregon Reach code and the new IAPMO/ANSI WE·Stand draft, Davidson's toilet system surpassed all these requirements (by orders of magnitude!) when tested, reporting only 21 fecal coliforms/gram.[45]

Stevensville, MT: In Feburary 2017, Daniel Ray posted that the county DEQ had instructed him to stop using the bucket toilet system in his and his wife's straw bale home, which was "a few years" old. When Daniel contacted the DEQ to inquire what laws prohibited the system, they responded that the system did not actually meet their definition of a composting toilet, and would instead be regulated as above-ground composting of "solid waste" - and the system was approved.[46]

Oakland, CA: Greywater Action profiles two residential bucket toilet systems with urine diversion. At least one of them uses 55 gallon drums with nets hung inside to improve aeration and reports that the drums with nets compost faster than the same containers aerated using a compost crank.[47][48]

San Francisco, CA: Another Greywater Action profile describes a San Francisco home with a Humanure Handbook-style bucket toilet system. It does not have urine diversion, and compost is processed in an open cage in the yard. They use their compost in garden beds.[49]

As a final note, we have used numerous composting toilet systems between the two of us, including in the US, Thailand, Nepal, Nicaragua, the Republic of Georgia, and New Zealand.

Responsibility Statement:

As the applicant submitting this application I am responsible for the accuracy of the information submitted. I have submitted all the relevant information available about the technology I am requesting the Alternative Technology Advisory Committee to review. I believe the information submitted to be a compete and accurate representation of the proposed technology and I am aware that any omission (either voluntary of accidental) could cause the application to be denied. I understand that more information may be requested before the committee can make a recommendation on my application.

45 https://permies.com/t/55070/Public-Domain-Composting-Toilets-Legal
46 https://permies.com/t/63278/Montana-sawdust-toilet-approval
47 https://greywateraction.org/composting-toilet-on-cement-slab/
48 https://greywateraction.org/prettiest-composting-toilet-in-oakland/
49 https://greywateraction.org/composting-toilet-in-a-san-francisco-home/

I understand that the recommendation from the committee is not binding. In addition a favorable recommendation from the committee is not a guarantee that the Administrative Appeals Board will approve a subsequent building code appeal. The City of Portland and the committee members have no implied or expressed liability associated with the conclusions of the Alternative Technology Advisory Committee. By my signature, I indicate my understanding and agreement to the Responsibility Statement.

Applicant's signature: _____ **Date:**

Property owner's signature (if applicable): _____ **Date:** _____

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Glossary

Italicized definitions are quoted from the 2017 ANSI/IAPMO Water Efficiency & Sanitation Standard (WE·Stand), chapter 2.

Bucket-and-Bin System
: A composting toilet systems that combines a bucket toilet with a closed compost processor.

Bucket Toilet
: A commode in which a 5-gallon HDPE bucket or similar container is used to collect excreta.

Bucket Toilet System
: A composting toilet system in which the commode contains a bucket or other container too small to allow composting, which is used to transfer excreta and compost additives to the compost processor. Probably the best-known such design is the "Lovable Loo" described in the Humanure Handbook.

Closed Compost Processor
: A compost processor in which the compost is contained by some sort of watertight container. May be located indoors or outdoors.

Commode
: *The composting toilet fixture for collecting, containing, or transporting excreta to the compost processor.*

Commode Bucket
: The part of the commode where excreta is collected, and which contains it during transfer to the compost processor. In the proposed design, a 5-gallon HDPE bucket.

Compost Additives
: *Any material such as sawdust, wood shavings, and other compostable material added to the commode or compost processor to maintain operational conditions within the composting toilet system.*

Composting Toilet System
: *A system designed to safely collect and process excreta and compost additives into humus through aerobic decomposition.*

Compost Processor
: *The site of aerobic decomposition transforming excreta and compost additives into humus.*

Dessication
: *The process of dehydrating excreta or leachate.*

Excreta
: *Includes but is not limited to urine, feces, menses, toilet paper, and other human body emissions and biodegradable cleaning products.*

Humus
: *The biologically decomposed, soil-like output of the compost processor.*

Leachate
: *Liquid draining from the compost processor.*

Open Pile / Open Compost Processor

A compost processor consisting of a pile not enclosed in a watertight container. Often it is contained in a rough wooden or wire structure to maintain a size and shape that is convenient and suitable for aerobic decomposition.

Transfer

The controlled transfer of excreta or partially processed humus between commode and composting processor or between multi-stage composting processors.