

Sanitation Without Waste




Protecting the Environment Using
a Revolutionary Toilet System:
The Humanure Toilet




Sanitation is a Global Problem

- An estimated 2.6 billion people worldwide do not have proper toilet facilities.
- Poor sanitation and unsafe water claim the lives of over 1.5 million children every year.
- If current trends continue, there will still be 2.4 billion people without basic sanitation in 2015.



The U.S. Suffers from Sanitation Issues Too

- The U.S. produces enough sewage to fill the Great Lakes every four months, according to the NRDC.
- In 2009, for the third consecutive year, there were more than 22,000 closings and advisory days at ocean, bay and Great Lakes beaches.
- The number of beach closing and advisories in the Great Lakes due to sewage spills and overflows more than tripled to 4,097 from 2006 to 2007.



Pennsylvania Also Has Its Problems

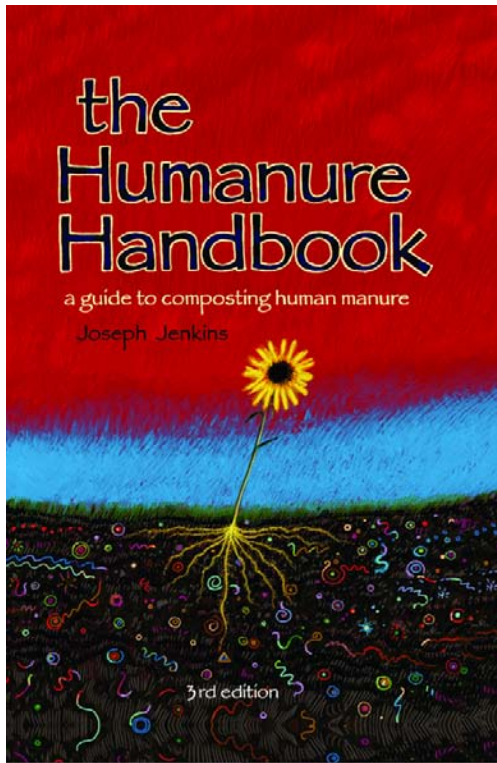
- In 2002, Pennsylvania's 123 "significant" sewage treatment plants (STPs) dumped 11.7 million pounds of nitrogen pollution into the Chesapeake Bay.
- One-fifth of our DEP surveyed streams and half of our surveyed lakes (13 percent of the total) are impaired or polluted.
- Gov. Rendell announced Feb. 20 the investment of more than \$21.5 million in 144 Growing Greener projects to reduce water pollution.



Sewers Create Pollution

- Conventional sewer systems are not the right answer according to the Swedish International Development Agency. "They are very expensive; they pollute rivers; they use a lot of water for flushing that could be set aside for drinking; and they deprive farm soils of the nutrients in sewage."
- The UN Environment Program states that "Nobody planning these sewers is thinking about the pollution."
- Experts agree that the solution is "ecological sanitation" involving composting human excrement, which is cheap, water efficient and non-polluting.

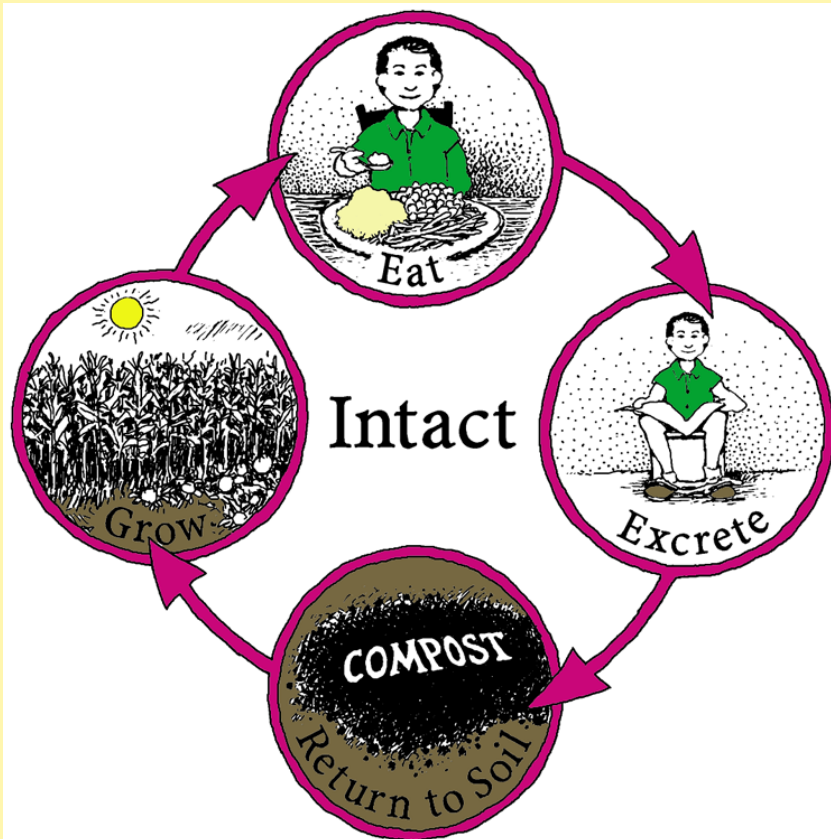
What is a “Humanure Toilet”?



- The Humanure Toilet system is the result of over 30 years of practical experimentation here in Pennsylvania and elsewhere.
- The award-winning book on the subject has been translated into several languages and has been circulated around the world.



The Concept is Simple



HUMAN NUTRIENT CYCLE

- Human excrement is collected before it comes into contact with the environment.
- It is subjected to thermophilic composting.
- The resulting humus is returned to the soil for agricultural use.



Benefits of Composting

- Composting destroys human pathogens, converting human excrement into a hygienically safe and valuable material.

Table 7.14
PATHOGEN SURVIVAL BY COMPOSTING OR SOIL APPLICATION

<u>Pathogen</u>	<u>Soil Application</u>	<u>Unheated Anaerobic Digestion</u>	<u>Composting Toilet (Three mo. min. retention time)</u>	<u>Thermophilic Composting</u>
Enteric viruses	May survive 5 mo.	Over 3 mo.	Probably elim.	Killed rapidly at 60C
Salmonellae	3 mo. to 1 yr.	Several wks.	Few may surv.	Dead in 20 hrs. at 60C
Shigellae	Up to 3 mo.	A few days	Prob. elim.	Killed in 1 hr. at 55C or in 10 days at 40C
E. coli	Several mo.	Several wks.	Prob. elim.	Killed rapidly above 60C
Cholera vibrio	1 wk. or less	1 or 2 wks.	Prob. elim.	Killed rapidly above 55C
Leptospire	Up to 15 days	2 days or less	Eliminated	Killed in 10 min. at 55C
Entamoeba histolytica cysts	1 wk. or less	3 wks or less	Eliminated	Killed in 5 min. at 50C or 1 day at 40° C
Hookworm eggs	20 weeks	Will survive	May survive	Killed in 5 min. at 50C or 1 hr. at 45C
Roundworm (Ascaris) eggs	Several yrs.	Many mo.	Survive well	Killed in 2 hrs. at 55C, 20 hrs. at 50C, 200 hrs. at 45° C
Schistosome eggs	One mo.	One mo.	Eliminated	Killed in 1 hr. at 50° C
Taenia eggs	Over 1 year	A few mo.	May survive	Killed in 10 min. at 59° C, over 4 hrs. at 45° C

Source: Feachem et al., 1980

Table 7.15
THERMAL DEATH POINTS FOR COMMON PARASITES AND PATHOGENS

<u>PATHOGEN</u>	<u>THERMAL DEATH</u>
<i>Ascaris lumbricoides</i> eggs	Within 1 hour at temps over 50°C
<i>Brucella abortus</i> or <i>B. suis</i>	Within 1 hour at 55°C
<i>Corynebacterium diphtheriae</i>	Within 45 minutes at 55°C
<i>Entamoeba histolytica</i> cysts	Within a few minutes at 45°C
<i>Escherichia coli</i>	One hr at 55°C or 15-20 min. at 60°C
<i>Micrococcus pyogenes</i> var. <i>aureus</i>	Within 10 minutes at 50°C
<i>Mycobacterium tuberculosis</i> var. <i>hominis</i>	Within 15 to 20 minutes at 66°C
<i>Necator americanus</i>	Within 50 minutes at 45°C
<i>Salmonella</i> spp.	Within 1 hr at 55°C; 15-20 min. at 60°C
<i>Salmonella typhosa</i>	No growth past 46°C; death in 30 min. 55C
<i>Shigella</i> spp.	Within one hour at 55°C
<i>Streptococcus pyogenes</i>	Within 10 minutes at 54°C
<i>Taenia saginata</i>	Within a few minutes at 55°C
<i>Trichinella spiralis</i> larvae	Quickly killed at 55°C

Source: Gotaas, Harold B. (1956). *Composting - Sanitary Disposal and Reclamation of Organic Wastes*. p.81. World Health Organization, Monograph Series Number 31. Geneva.

Benefits of Composting



- Composting yields a valuable end product: humus.
- Composting prevents environmental pollution and creates fertile soil.

A New Type of Toilet



- A “humanure toilet,” therefore, is a “collection toilet.”
- Excrement, or “humanure,” is collected prior to coming into contact with the environment.
- It is covered with a carbon-based material, such as Pennsylvania sawdust.
- The collected toilet material is then subjected to thermophilic composting.

Small-Scale Units




- Small-scale units have gained popularity around the world.
- However, larger-scale applications must be developed.
- Research and development is necessary for larger scale systems.




Benefits of a Humanure Toilet

- No Waste
- No Pollution
- Low Cost
- No Odor
- Electricity Not Needed
- No Flies
- Not Water Based
- Pleasant to Use
- Urine Separation Not Required
- Creates a Valuable Resource



Requirements of a Humanure Toilet

- A carbon-based “cover material” is required.
- “Humanure” must be collected and composted.
- A compost site is needed.
- “Collection toilets” must be utilized.



We are in the process of researching large-scale applications.

- Music festivals, conferences, environmental centers, campgrounds, any place where flush toilets are impractical or impossible, are perfect places to install and utilize humanure toilets.



Humanure Toilets Need to be Developed for Large-Scale Needs



- Such toilets can be portable or permanent.
- They can be built with Pennsylvania lumber.
- People prefer them to chemical toilets.
- They have no odor or flies.
- They produce no waste or pollution.

California Music Festival



- These simple compost bins shown here collected humanure and food scraps from 500 people over a 10 day period.
- The compost averaged 68 C seven weeks later and over 57 C four months later.
- The EPA requires 55 C or higher for 3 days for static aerated piles.



- Our humanure compost model requires no turning, stirring or digging of the compost once the pile is constructed.
- Static aeration occurs from interstitial air.
- Therefore no odors, spores, or vapors are released into the air.



PA is a Perfect Place to Research and Develop Humanure Toilets



- “Penns Woods” has ample forest products and an abundant supply of sawdust.
- Pennsylvania has strip-mined land that would benefit from compost.
- Our 143 acre site is largely old strip mine.
- We can make compost on our site and use it on our site while we refine the processes.



Humanure Compost

- In 2008, we conducted a planting trial as an internship for a student at Prescott College (AZ). The trial illustrated the agricultural value of humanure compost made with Pennsylvania sawdust.

The Benefits of the Compost Are Obvious





Public Acceptance

- Humanure toilets have begun to be utilized at music festivals, conferences and other gatherings throughout the U.S.
- Public acceptance has been remarkable.

Humanure Toilets Have Been Well-Received by the Public





Humanure Toilets Have Gained International Recognition

- Film crews from Korea and the UK have visited us to document this toilet system.
- Visitors from around the world have stopped to see the system in use.
- Public TV and radio have broadcast segments about the toilet system.

Humanure in the News



Public Humanure Toilets are in Use in Australia and Europe



- These toilets are in use primarily at music festivals.
- However, the humanure is not thermophically composted.
- Urine is separated.
- Non-recyclable plastic toilet receptacles are used.
- With modifications, the Australian system can be greatly improved.



We are designing a steel drum humanure toilet system.



- The drums are recyclable.
- Drum handling equipment enables the drum's contents to be deposited into compost bins.
- The humanure can be thermophilically composted.
- Such a system would be easily replicable throughout the world.
- Applications include any place where people gather, including refugee camps, FEMA, festivals, conferences, camp grounds, even residences.
- Filled drums can collect at a site and be removed later.



Humanure Recycling Would Create Jobs

- The potential market for humanure recycling is immense.
- Potential revenue streams include toilet use fees (similar to porta-potty fees), construction and sale or rental of toilet structures, and sales of finished compost.
- Future development could include large-scale production of “cover material” that includes blends of sawdust and other carbon-based materials such as ground paper products.
- Tipping fees for other organic materials, such as food scraps, newspaper, junk mail and cardboard, may also add to the revenue stream.



Humans Without Sewage

- It is feasible today for humans to gather in large numbers for large periods of time and produce no sewage.
- They would instead produce soil fertility.
- We can achieve this through the humanure toilet system.



We Need Your Help

- We are pioneering into uncharted territory that has not been specifically addressed by legislation or regulation.
- Yet, additional research and development requires us to be able to collect humanure.
- We need to be able to legally set up humanure toilets at gatherings, festivals and other sites.
- Festival organizers need to feel confident that the toilets will be legal.
- We would like to base our research and development in Pennsylvania.
- This is where the DEP comes in.
- We need your support, encouragement and expertise.
- How can we get it?



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