

# Emergency Sanitation:

Dealing responsibly with pathogenic waste in a post-Cascadia earthquake scenario



# **DISCLAIMER**

This presentation is a result of my own ideas, research and personal experience. It does not reflect a locally approved emergency management plan. Although I am an Oregon State University Extension Master Composter, OSU provides no training in composting human manure.

# Post-Cascadia Earthquake Scenario

According to the Oregon Resilience Plan, the coast can expect to be without water and sewer services for 1-3 years after a Cascadia Subduction Zone Earthquake.

# Pathogenic Waste:

Any organic refuse that either contains pathogens or could provide a breeding ground for pathogens.

## Examples:

- human or animal urine and fecal matter
- food scraps from daily cooking
- spoiled food from freezers and refrigerators

# Criteria for Responsible Disposal:

- Won't allow pathogens or toxins to enter soil or water.
- Won't allow access to flying insects or rodents.
- Won't endanger persons performing duty.
- Won't damage public infrastructure, resulting in delays in return to operations.
- Can be maintained for 1-3 years.

# Overview of Potential Disposal Methods:

Dumping

Burying

Burning

Containing in Raw Form

Composting

# Dumping (land or water)

- contaminates dumpsite and anywhere it spreads
- waste remains pathogenic
- allows access by flying insects and rodents for even wider dispersal
- disrupts local ecosystem
- constitutes a hazard to anyone visiting site
- requires ever increasing amounts of land
- requires labor to move waste to dumpsite

# Burying – Cat Hole

- the most common low-tech method
- contaminates soil and groundwater
- requires repetitive labor to dig and cover for each deposit
- waste remains pathogenic
- requires substantial land area and ever increasing travel distances
- must either carry waste to pit or walk to location (adverse weather concerns)



# Burying – Large Pit

- the most common low-tech method
- contaminates soil and groundwater
- requires substantial labor by fit individuals to dig
- waste remains pathogenic
- allows access by flying insects
- must travel to smelly central location

# Burning

- requires large amounts of petroleum products to facilitate burn (not sustainable)
- produces dangerous smoke and horrible smells
- must be tended creating extended exposure (a VERY disagreeable job)
- waste must be carried to a distant location
- produces toxic ash

# Containing in Raw Form (Using bags, bins and manholes)

- waste remains pathogenic
- requires ever increasing durable, covered container space which must exist prior to disaster
- manholes require special tools to seal
- filled manholes may hamper future sewer operation and overwhelm facilities
- waste must be carried to location
- eventually, waste must be dealt with

# Composting

- can be done on a community or household scale
- neutralizes pathogens without producing toxic waste
- requires minimal tools and uses supplies sustainably found outside
- requires minimal land, labor and skills
- can be done by anyone (if you can carry 3 lbs.)
- pathogenic material is handled only once

# Composting Overview

The biological process of decaying organic waste into humus by various micro-organisms including bacteria, fungi and actinomycetes in the presence of oxygen.

Needed:

- carbon-rich organic material (carbon)
- nitrogen-rich organic material (nitrogen)
- oxygen
- moisture
- temperatures above freezing

# Composting

- No way to fail, organic material will eventually rot.
- Examples of carbon-rich material: dried grass and weeds, straw, shredded paper, sawdust.
- Examples of nitrogen-rich material: green grass clippings, manure, carcasses, legumes.
- Optimizing carbon/ nitrogen ratio (20-35/1) in the presence of adequate moisture and oxygen will result in thermophilic (hot) compost.
- Composted organic material will be roughly one third of the original mass.

# Composting Human Waste

## Minimum Needed:

- Bin to optimize heat, contain organic matter and cover materials, and preclude animals.
- Fine carbon material (sawdust, peat moss, shredded paper, needles, crushed leaves)
- Course carbon material (straw, weeds, intact leaves)
- Bucket

# Composting Human Waste

## Optional Tools:

- Extra buckets
- Lids for buckets
- Toilet seat (can modify home seat, make a makeshift seat or buy a bucket seat)
- Shovel or pitchfork
- Long handled cleaning brush
- Soap (preferably biodegradable)
- Compost thermometer
- Tarps (to cover curing piles)
- Extra covered bins to collect carbon material



# Composting Human Waste

## The System

1. Construct a bin (at least one cubic yard) using wood, pallets, cinderblocks, or other found materials. It should be covered to shed excess water and preclude animals and close to the home (there will be no odor).
2. Fill the bottom of the bin with 18-24 inches coarse carbon material and forest duff to act as a sponge.
3. Put several inches of fine carbon material in the bottom of the bucket. Use the bucket as a toilet indoors. After each deposit, cover with fine carbon material.
4. When full (about 1 week) or at the maximum comfortable carrying weight, take bucket to bin. Empty bucket and cover with coarse carbon material. Clean bucket and dump water into compost bin.

# Composting Human Waste

## The System Continued

5. For subsequent deposits into the bin, open a hole in the covering material and dump the bucket into the center. Add more cover material (coarse carbon material). You are striving to layer coarse carbon material between bucket contents. Add kitchen scraps and food waste, too.
6. Before the bin fills, construct a second bin.
7. When the first bin is full, add a thicker layer of cover material and allow to sit (ideally for a year). Repeat previous steps for the second bin.
8. When second bin fills, empty first bin into a pile and cover with a tarp (or additional curing) or spread contents.

# Composting Human Waste

## Sanitizing Waste Material

- Pathogens are neutralized by time and temperature. At low temperatures, more time is required.
- A temperature of 122 degrees (F) for 24 hours will kill human pathogens in human waste. Holding compost from 1-2 years will kill pathogens without heat.
- Composted waste will be sanitized, not sterilized. It will be safe to add to the environment.

# Notes:

- Adding soil to compost will slow down microbial action and lower temperatures.
- The system, as described, produces no odors (if it does, add more carbon material), and has no flies.
- Adding human manure will ensure a concentrated nitrogen source for thermophilic composting. It really will get hot!
- With this system, it is not necessary (or desired) to turn the pile.

# Composting Human Waste

## Can Anyone Do This?

The minimum requirements are to be able to lift one five gallon bucket (1.8 lbs) filled with as many toilet deposits as can be comfortably carried, and dumping the bucket in the bin. The average human produces 2.5 pounds of waste a day, so each day's bucket would weigh about 7 lbs, depending on the fine carbon material used.

Neighbors can help each other construct bins and gather course and fine carbon materials.



Example of emptying the buckets. Notice green cover material.



Permanent Year Round Compost Bins

It's helpful to have water at the bin so buckets can be dumped, washed and the wastewater dumped on the same trip.



# Suggestions:

- Add buckets with lids (with optional items, if desired) and The Humanure Handbook to your emergency supplies.
- Read The Humanure Handbook. It's available online free as PDF's by chapter, or as an e-book for \$10 (both at [humanurehandbook.com](http://humanurehandbook.com)) or as a paperback for \$18.52 on Amazon.
- Watch "Humanure Compost Training in Haiti - Part 1 of 3" under videos at [humanurehandbook.com](http://humanurehandbook.com) to see how this system can be applied in a disaster scenario.

# Closing Thoughts

- We've been culturally conditioned to have irrational feelings toward human urine and fecal material. It takes time to overcome this.
- Humans are extremely adaptable; it's one of our greatest evolutionary strengths. What seems impossible today, will change when necessity dictates.
- Don't underestimate the need for safe disposal of pathogenic wastes. Help educate your neighbors on how to do it properly.