

# out think the box

## Community Compost Dry Toilet System (IAPMO WE·Stand Model)

*Prepared for the EBMUD (East Bay Municipal Utility District)*

8 May 2018



Kimberly King  
Renewable Energy Engineer  
Email: [kimgerly@outthinkthebox.net](mailto:kimgerly@outthinkthebox.net)  
Mobile: +1 415 832 9084  
Skype: kimgerly

---

Recommended Citation

“Community compost toilet and urine diversion system modeled after the International Association of Plumbing and Mechanical Officials (IAPMO) Water Efficiency and Sanitation Standard (WE·Stand)” (2018). <https://bit.ly/3Njo0ul>

# out think the box

Contact: Kimberly King, Renewable Energy Engineer  
+1 415 832-9084  
kimgerly@outthinkthebox.net

Presentation number :  
01-2018 Oakland, CA USA  
Copyright © 2018 Kimberly King

The information contained in this document is the exclusive, confidential and proprietary property of Kimberly King, and is protected under the trade secret and copyright laws of the U.S. and other international laws, treaties and conventions. No part of this work may be disclosed to any third party or used, reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying and recording, or by any information storage or retrieval system, without first receiving expressed written permission of Kimberly King. Except as otherwise noted, all trademarks appearing here are herein proprietary Kimberly King.

# introduction

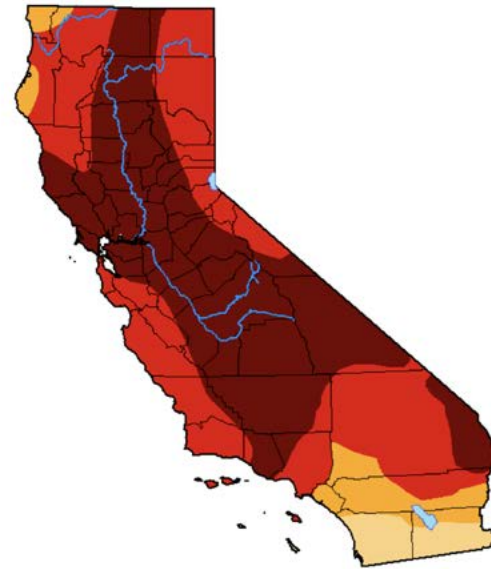
3

## THE CALIFORNIA DROUGHT

*17 August 2021 drought conditions* (percent area)

- D1-D4 100%
  - D2-D4 95.58%
  - D3-D4 88.37%
  - D4 48.97%
- 
- D1 - Moderate
  - D2 - Severe
  - D3 - Extreme
  - D4 - Exceptional

### U.S. Drought Monitor California



August 17, 2021  
(Released Thursday, Aug. 19, 2021)  
Valid 8 a.m. EDT

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	0.00	100.00	100.00	95.58	88.37	48.97
Last Week 08-10-2021	0.00	100.00	100.00	95.07	88.37	47.10
3 Months Ago 05-16-2021	0.00	100.00	100.00	94.31	73.33	15.91
Start of Calendar Year 12-29-2020	0.00	100.00	95.17	74.34	33.75	1.19
Start of Water Year 09-29-2020	15.35	84.65	67.65	35.62	12.74	0.00
One Year Ago 08-18-2020	20.55	79.45	54.22	21.72	3.04	0.00

#### Intensity

None	D2 Severe Drought
D0 Abnormally Dry	D3 Extreme Drought
D1 Moderate Drought	D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. For more information on the Drought Monitor, go to <https://droughtmonitor.unl.edu/About.aspx>

#### Author

Curtis Riganti  
National Drought Mitigation Center



[droughtmonitor.unl.edu](https://droughtmonitor.unl.edu)

The U.S. Drought Monitor is produced through a partnership between the National Drought Mitigation Center (University of Nebraska-Lincoln), USDA, and NOAA.

Citation: <https://bit.ly/3lru6Wo>

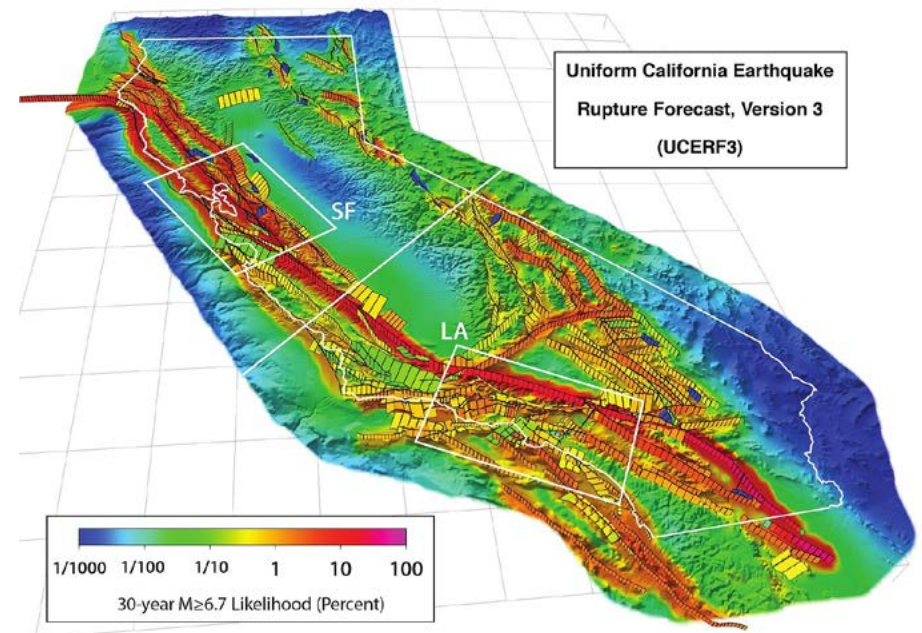
# introduction

4

## THE OTHER 'DROUGHT'

*Pacific Rim (USA West Coast) mega-quakes predicted*

- California's 'other drought'
  - San Andreas Fault (Southern California)
  - Hayward Fault (highly urbanized SF East Bay)
- 23Jan18 7.9 magnitude earthquake AK Kodiak Island
- Cascade subduction zone (Pacific NW)



California's major faults. The 3rd Uniform California Earthquake Rupture Forecast (UCERF3) estimated probabilities. The San Andreas Fault and Hayward Fault systems are red on the likelihood scale.

Citation: USGS, <https://on.doi.gov/2qVm5n0>

---

# the opportunity

5

## WHY DISASTER SANITATION?

Out think the box.  
Prepare. Respond. Adapt.

*Culturally the USA West Coast is attuned to earthquake readiness, but lacks:*

- A long-term strategy
- A holistic, redundant, robust response
- Everyday brilliance for disaster resilience

*So what are the consequences?*



## PHLUSH (Public Hygiene Lets Us Stay Human)

- What happens when the toilets don't work?
- What will happen to the sewer infrastructure?
- Do we have the knowledge and materials to build safe, functional toilet systems?
- Shouldn't we plan for more resilient sanitation systems?



# resilient sanitation system 7

## THE ANSWER

*Community composting  
dry toilet system*

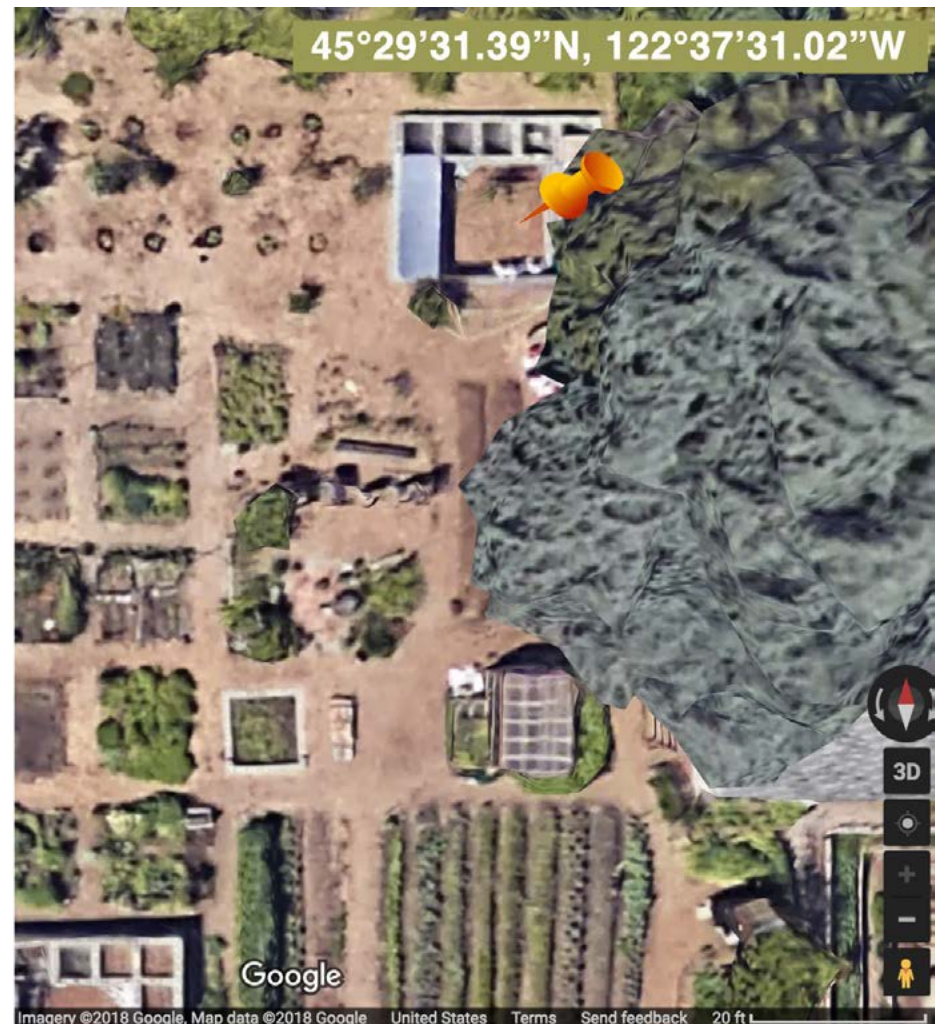
EcoVillage Eco-san

1.75 acre (0.7 hectares)

Portland, OR, USA

- Latitude: 45°29'31.39"N
- Longitude: 122°37'31.02"W

*We don't have to pan for gold anymore!*



---

# what is iapmo we•stand\*? 8

## INT'L ASSOC. OF PLUMBING AND MECHANICAL OFFICIALS (IAPMO)

*1st comprehensive  
codified requirements for  
compost & urine diversion  
toilet fixtures*



### Requirements:

- Separate collecting devices (commodes) and compost processor
- Material construction (durable, non-corrosive)
- No composting leachate discharge into the environment
- Compost processor must be:
  - covered (rain prevention)
  - enclosed, ventilated (vermin prevention)

*\*Water Efficiency and Sanitation Standard*



---

# 2018 iapmo we-stand commode materials list

9

Commode	Design inspired by the Joseph Jenkins Loveable Loo™
Cabinet	Sealed fir, pine, or other untreated wood capable of holding a 5-gallon container
Lid	Plywood
Toilet Seat	Standard, compression molded plastic
Container	5-gallon with lid (humanure collection device)
Features and recommendations	<ul style="list-style-type: none"><li>• Waterproof, sealed wood</li><li>• Easy to install</li><li>• No electricity, water, plumbing connections required</li></ul>

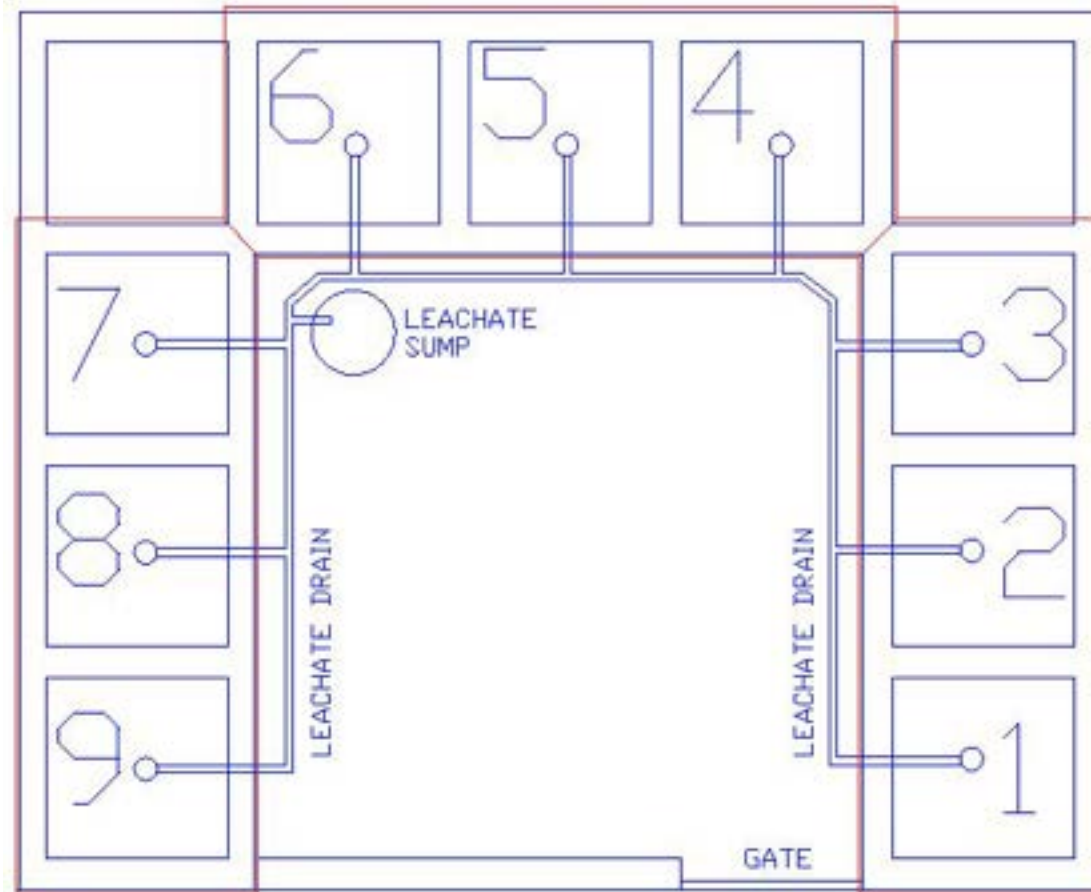
# 2018 iapmo we-stand composting processor (1)

10

Composting Processor	Features
<p><b>Bins (9 count, 3 modules)</b></p>	<p><b>DIMENSIONS</b></p> <ul style="list-style-type: none"> <li>• Exterior (~25' x 19')</li> <li>• Interior (48" x 48" x 48" ~2.4 yards<sup>3</sup>)</li> </ul> <p><b>WALLS</b></p> <ul style="list-style-type: none"> <li>• Durable, low-cost, 8" x 8" x 16" concrete blocks (insulation)</li> <li>• Vermin proof</li> <li>• Wooden sill plate for roof support (located on top of walls)</li> </ul> <p><b>BOTTOM</b></p> <ul style="list-style-type: none"> <li>• Sloped concrete pad (4" above pad perimeter lip)</li> <li>• Waterproof</li> <li>• Center drain grate (leachate collection)</li> </ul> <p><b>ROOF ASSEMBLY (sloped)</b></p> <ul style="list-style-type: none"> <li>• Corrugated, galvanized steel</li> <li>• Rain accumulation prevention</li> <li>• Vermin mitigation</li> <li>• Hinged</li> <li>• 3-bin module shares a common roof</li> <li>• No electricity, water, plumbing connections required</li> </ul>
<p><b>Sump Area (Plumbing)</b></p>	<p>Leachate collection includes drain grate, sump barrel, sump lid; 2" ABS piping with 1/4" per foot slope, 2" ABS fittings; Contamination prevention of local soil and groundwater</p>
<p><b>Ventilation</b></p>	<p>Wire mesh screen air vent (hardware cloth); Vermin and insect management; ~70 in<sup>2</sup></p>
<p><b>Security</b></p>	<p>Gated courtyard (hinged and latched)</p>

# 2018 iapmo we-stand composting processor (2)

11



# 2018 iapmo we-stand composting processor (3)

12



# 2018 iapmo we-stand 13 composting bin construction



a

b

c

d

**Pad edge:** 4" tall lip, channels all leachate to the center drain (a). **Bin Bottom:** 4" thick, 48"x 48" waterproof concrete pad sloped toward a center drain (b). **Vapor barrier (6 mil):** Placed under each concrete pad (c). **Drain plumbing:** Shown prior to vapor barrier placement and concrete pad poured (d).

# 2018 iapmo we·stand 14 compost leachate collection



**a**



**b**



**c**

Leachate sump area (a). Drains for bins 3, 4, 5, and 6 to sump area (b). Sump area shutoff valve (c).

# 2018 iapmo we-stand urine diversion

15

Two-275 gallon (1041 liter) tote tanks fitted with a capped urine funnel on the top port (a, b, c).

Adding urine from a bottle (d).

Tank's bottom discharge port can be fitted with a convenient adapter (e, f) to facilitate transfer to a distribution container (g).



a

b

c

d



e

f

g

## ON-SITE URINE TREATMENT

- Soak Leach/Pit
- Anaerobic Storage conditions decreasing pathogens
  - 1-2 week storage time
  - Temperature > 68°F (20°C)
  - pH 9+
  - High NH<sub>3</sub> concentration (also kills pathogens)

## REUSE OF URINE

- Stimulate plant growth w/ P, N, K, S, micronutrients
- Safest when applied to fruit trees, most effective:
  - Immediately before sowing
  - During the plants' vegetative growth period



# temperature data

17

## BIN #6

Compost temperatures, weekly log (°F/°C)  
Bin completed 10/25/2015

Week	0	Peak (Day 5)	1	2	3	4	5	6	7	8	9 Final Check
Center	131/55	167/75	160/71	147/64	139/59	135/57	130/54	108/42	97/36	70/21	60/16
4" Inside Perimeter	107/42	133/56	130/54	121/49	113/45	105/41	91/33	73/23	71/22	63/17	56/13
Perimeter	91/33	85/29	84/28	78/26	72/22	65/18	56/13	49/9	49/9	45/7	40/4
Date	25 Oct	29 Oct	1 Nov	8 Nov	15 Nov	22 Nov	29 Nov	6 Nov	13 Nov	20 Dec	27 Dec

### *Thermophilic (high-temperature/heat) composting*

- 122°F (50°C) maintained in the compost pile > 1 week
- >140°F (60°C) maintained for a 24-hrs (complete pathogen die-off)

# pathogen testing

18

**MISSION  
ACCOMPLISHED!**

Out think the box.  
Prepare. Respond. Adapt.

Results exceeds USEPA\* Class A Biosolids standards  
( $<1000$  fecal coliform units (cfu)/g) for compost safety

WE•Stand exceeds NSF/ANSI\*\* Standard 41: Non-liquid  
System

\*United States Environmental Protection Agency

\*\*National Sanitary Foundation/American National Standards Institute



---

# performance based

19

## eco-san

### COMPARED TO FLUSH TOILETS

Out think the box.  
Prepare. Respond. Adapt.

- Destroys pathogens
- Safe and secure
- Odor-free
- Vermin-free
- Retains nutrients
- Conserves water

**Definition:** ecological sanitation (eco-san)  
Safely close the loop between sanitation and  
agriculture.



# closing note - benefits

20

↑ Economic viability & empowerment

↑ Job opportunities

↑ Resiliency

↑ Food security

↑ Healthy, fresh food access

↓ Dependency on social services agencies

↓ Stress on municipal H<sub>2</sub>O infrastructure

↓ GHG emissions e.g. locally grown produce



---

# resources & references

# 21

*Community Dry Toilet and  
Urine Diversion System Using  
IAPMO WE•Stand © 2018*

Out think the box.  
Prepare. Respond. Adapt.

*IAPMO WE•Stand*

Research Article IWA *Blue-  
Green Systems Online Vol 1,  
No 1, 30 July 2019*

Kimberly (Kim) King, Oakland, CA  
[kimgerly@outthinkthebox.net](mailto:kimgerly@outthinkthebox.net)

*Permitted by the City of  
Portland, OR, 18 Sept 2019*

*Everyday brilliance for disaster resilience—Out Think The Box*

