RedHorse Constructor

Waste Water Treatment Design for non-sewered systems

Household Treatment Systems: design, construction, operation, and maintenance with real-time controls

Updated: Friday, Oct 18, 2018

- Overview of major initiatives in the OnSite treatment revolution: 2000
- Where are we, almost twenty years later? See below for new national and international standards, for lists of manufacturers of on-site systems, and for the most recent research.
- RedHorse Constructors is building and testing prototypes, based on designs by UC Davis and Questa Engineering, in Richmond, California

This working document surveys global research and development of non-sewered sanitation systems, or NSSS, surveyed in 2018 in Beijing at the Reinvent Toilet Expo 2018. These systems are also known as "on-site treatment", or "distributed treatment" facilities.

RedHorse implementation in August, 2019

- Assignments for working team:

1. Read ANSI/NSF 350.1, the new US standard for household treatment certification. It lists the test elements and the CBOD5 and TSS values we must reach to pass the test. It also says how, in general, to run the tests.
2. Look at the page Testing for more detail.
3. Review all the competing products listed on the Manufacturers page, and their testing regimes.

There's a short list below.

National and international International Organization for Standardization 30500 standards now exist for NSSS at a household level.

An example of a high-quality product shipping today is the Biomicrobics biomembrane system that satisfies the US NSF/ANSI Standard 350.

A second system is Sedron Technologies (Janicki) Firelight Toilet, which will satisfy Standard 350.1. Here's a diagram of the Janicki Omniprocessor

A third example is the CalTech Solar Powered Toilet

A fourth example is EAWAG Autarky developed by ETH Zurich.

The Center for the Advancement of Water and Wastewater Technologies has formed alliances with dozens of vendors.

Note that these systems use technologies beyond standard biological and settlement systems.

These systems are subcomponents of net-zero self-sustaining systems for life support, once only designed for space stations and planetary exploration. Advances in these communities are now applied to devices for use in slum and rural communities on Earth.

This site surveys the science, engineering, construction, and operation of household-size water and wastewater subsystems, with specific focus on wastewater recovery and reuse.

As an science-fiction example of a net-zero life support system, see "*The Martian*" showing imagined total material reuse for water and wastes on the surface of Mars. All energy derives directly from the Sun; there is no source of new water. Can such a system work? For our focus, can wastewater recovery of potable water and nutrients be made to work inexpensively on Earth?

Hundreds of research groups, companies, and governments have invested hundreds of millions of dollars to develop systems capable of treating household wastes for water recovery and energy conversion at the household level (see list below). Military, maritime and aerospace systems are constantly redesigned with promising new technologies.

- NASA Ames:Water Supply for trip to Mars 2016 list of relevant treatment technologies.
- Soil Science Society
- New Frontiers of Soil and Plant Science
- The Martian: Back of the Envelope Botany: What's really needed for total reuse: Bruce Bugbee

The RedHorse design for water reuse is based on engineered field experiments conducted by the Human Needs Project in Kibera, Nairobi, Kenya and San Rafael, California; RedHorse is currently building a working model, while dozens of existing companies currently are shipping systems of varying capabilities.

Testing of the RedHorse design will follow the same analytical procedures described for the Caltech Toilet

RedHorse, in cooperation with UC Berkeley, is building computational models of systems in design or on the market today, to compare and contrast design models. Then, with field data from operational sites, RedHorse proposes to maintain an on-going comparison of actual field performances world-wide, incorporating realized capital and operating expense data.

Research and development groups

- World Bank, WHO,
- Gates Foundation: Transformative Sanitation Technology
- UC Berkeley: Civil and Environmental Engineering
- King Abdullah University of Science and Technology (KAUST)
- KAUST
- UC Davis: Sanitation Engineering
- EAWAG
- California Institute of Technology
- University of Toronto
- Janicki Laboratories: Peter Janicki, now available through Sedron Technologies
- Environmental Science and Technology
- RedHorse Constructors, San Rafael, California, and Kibera, Nairobi, Kenya

Sources

Original design of the Kibera Town Centre waste water processing plant: UC Davis Sanitary Engineering Laboratory:
Dr. Harold Leverenz;
final technical implementation by Matt Woll: Plavel Water, Questa Engineering, and Norm Hantzsche. Questa Engineering, Richmond CA