DRY SANITATION

STRATEGY

Dry sanitation refers to the collection of excreta or feces without flush water . The low-energy and low-tech requirements of dry systems make them suitable for rural, off-grid settings, and areas with water shortages. In multistory buildings, dry collection of excreta or feces is a challenge, yet has been successfully implemented in buildings of up to three stories with straight-drop pipes to the basement, and in larger housing complexes by means of collection of feces at the toilet level and transport to a treatment site. Aside from significant water savings compared to flush sanitation, dry sanitation facilitates the recovery of nutrients and organics and can be an attractive solution for communities in which inhabitants want to manage their own sanitary system off the grid . Dry sanitation is usually combined with urine diversion and often complemented with on-site greywater treatment .

INPUT STREAMS

- Feces
- Excreta

TARGET OUTPUTS

- Soil amendments

DRY TOILETS

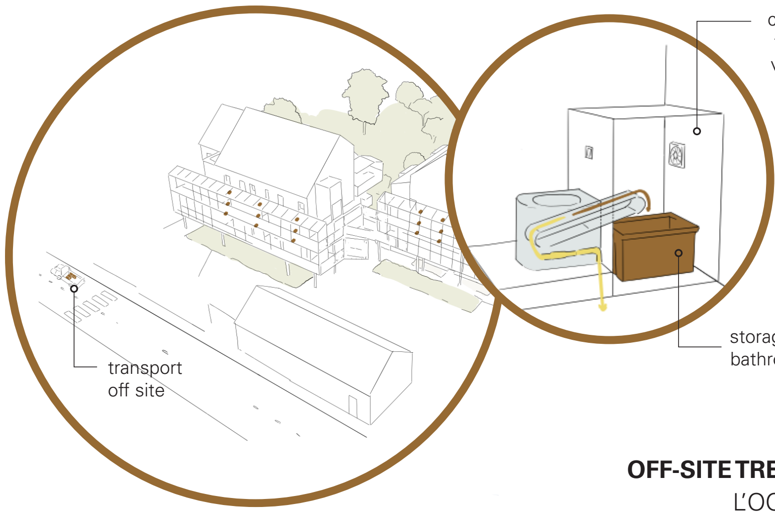
A wide variety of dry toilets are commercially available: from simple models with a "drop hole", to more sophisticated configurations with e.g., conveyor belts. Separation of urine can take place in the toilet itself (e.g., by a separate bowl on the front) or by gravity in the collection and treatment unit. The toilet should be designed to continuously draw air into the toilet bowl, preventing odors.

PIPING

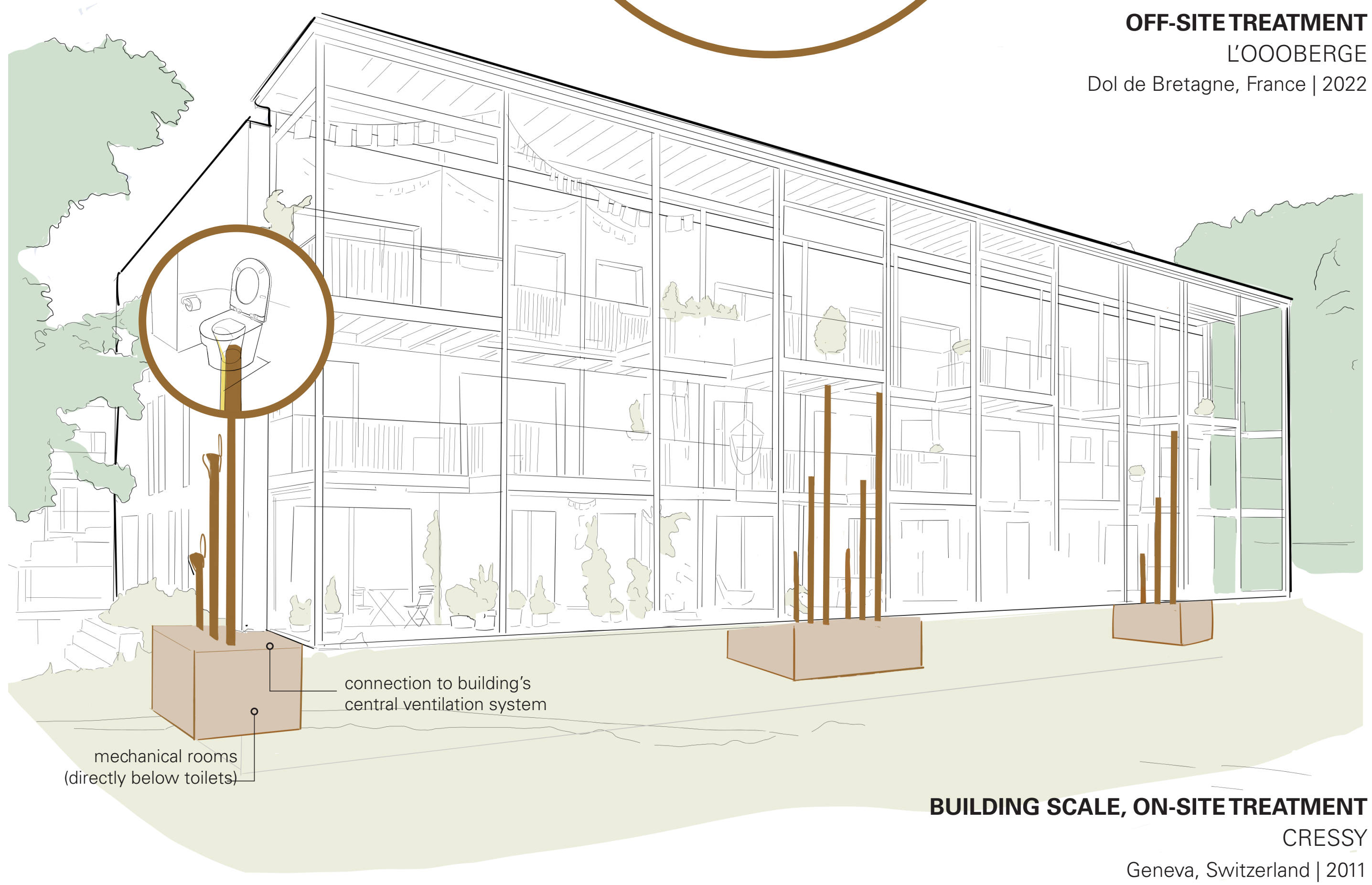
When not collected at the bathroom level (e.g., in containers), feces/excreta can be conveyed one to three stories down via large diameter, straight-drop pipes.

TRANSPORT | TREATMENT

Excreta or feces can be treated on site at building level or can be simply contained/stored on site (at bathroom or toilet level) before transport, often via truck, to an off-site treatment location.



OFF-SITE TREATMENT
L'OOOBERGE
Dol de Bretagne, France | 2022



BUILDING SCALE, ON-SITE TREATMENT
CRESSY
Geneva, Switzerland | 2011

TO CONSIDER

COLLECTED STREAM

Dry toilets collect excreta, or feces with separate collection of urine. When urine and feces are treated together, a bulking agent (e.g., sawdust) is usually added to the stream. Dry sanitation yields relatively small volumes (e.g., 0.15 m³ of fresh feces per person per year, plus toilet paper) with a high solids content of ~25% dry matter. The volume is reduced further during collection and treatment due to evaporation.

SPACE & PLACEMENT

Collection at bathroom level requires space in the bathroom for storage and adequate access for collection. In buildings, straight-drop pipes are needed with collection/mechanical rooms placed directly below the pipes. This poses a limitation on the amount of stories the building can have, and takes up a considerable amount of space in the building. Ventilation is key for dry sanitation: pipes, chambers and mechanical rooms can be connected to the building's central ventilation system.

RESOURCE INTENSITY

Dry sanitation systems are usually low-tech solutions, requiring little energy consumption, and little-to-no water demand. Passive or active ventilation is required. Maintenance of more sophisticated dry toilet models (e.g., conveyor belt dry toilet) should be carried out periodically.

NEW BUILD VS. RETROFIT

Given the architectural considerations imposed by dry sanitation (i.e., piping constraints, ventilation needs, collection space) implementation is easiest in new builds. Collection at toilet and bathroom scale is more accessible for retrofits.

HYBRID VS. DECENTRALIZED

Dry sanitation is usually implemented together with treatment of the remaining streams (i.e., urine and greywater) for holistic and off-grid solutions. Excreta or feces collected in containers (e.g., via dry porta pottys), are often transported to a semi-centralized treatment hub.

USER EXPERIENCE

When designed properly, odor nuisances from dry toilets can be less than for conventional flush toilets, with the added advantage that no aerosols are produced. Bathroom lighting can be adjusted to avoid lighting the inside of the toilet directly. Users may be required to add bulking materials (e.g., sawdust) after toilet use, and to adjust toilet cleaning practices.

TREATMENT OPTIONS

Treatment of feces or excreta is often includes a single treatment step to either stabilize the organic matter, via aerobic decomposition (i.e., composting) or via thermal decomposition (i.e., incineration or pyrolysis).

VALORIZATION OF ORGANICS & NUTRIENTS

Biological treatment, like composting, and thermal treatment, like pyrolysis, converts feces, or excreta, into soil amendments. These soil amendments contribute to long term fertilization, humus reproduction, carbon binding and carbon storage in the soil.

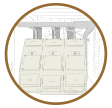
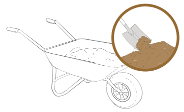
VALORIZATION OF NUTRIENTS

Incineration is a thermal treatment process that combusts organic matter and evaportates water, rendering an inorganic ash rich in nutrients, such as phosphorus and potassium.

SAFE END USE

PATHOGENS & PHARMACEUTICALS

Fecal streams contain human pathogens, posing significant health risks. The collection and handling of feces (e.g., transport for off-site treatment) is the primary disease transmission pathway, with guidelines in place to minimize these risks. Treatment, whether on site or off site, should ensure pathogen inactivation. Pharmaceuticals and other micropollutants will mostly remain in the compost, though health risks from their accumulation in plants using feces-based soil amendments are considered low. The environmental risks from pharmaceuticals or antibiotic resistance genes in soil remain unclear, though are likely lower than those from applying animal manure. Similarly, the risks of heavy metals and micropollutants in feces-based soil amendments are lower compared to sewage sludge because of the exclusion of industrial wastewater and stromwater from the fecal stream.

PROCESS OBJECTIVE		TECHNOLOGY	PRODUCT(S)
Aerobic biological treatment stabilizes the organic matter (and nitrogen), reduces the volume of the stream, and generates heat, which contributes to hygienization.	BIOLOGICAL TREATMENT	 T.21 ON-SITE COMPOSTING	 COMPOST
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