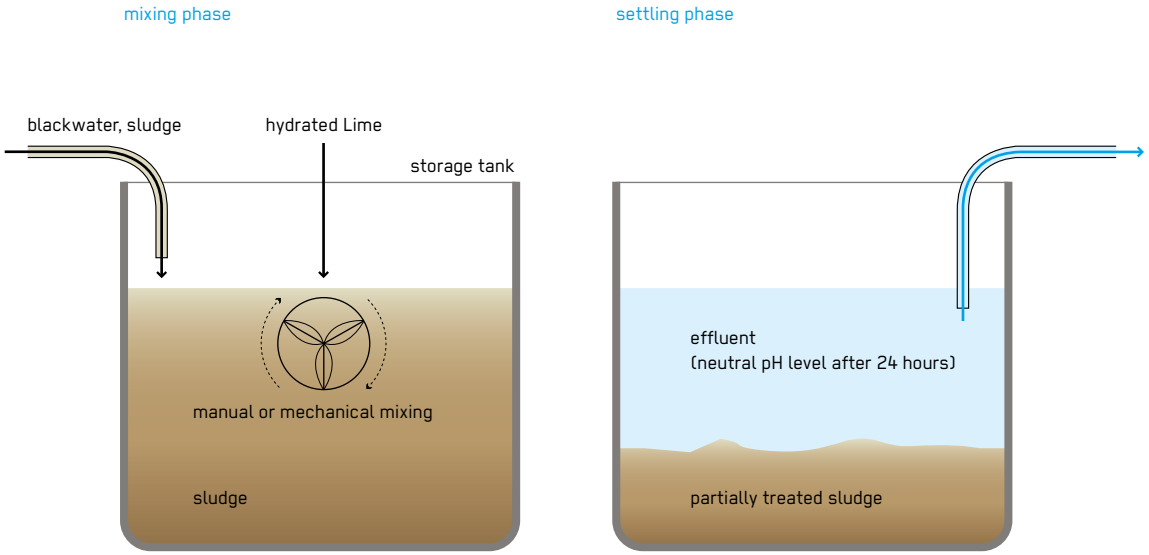
Hydrated Lime Treatment (Emerging Technology)

Phase of Emergency	Application Level / Scale	Management Level	Objectives / Key Features
** Acute Response * Stabilisation Recovery	Household ** Neighbourhood * City	Household Shared ** Public	Pathogen removal, Liquid / solid separation, Minimising immediate public health risks
Space Required	**Technical Complexity**	**Inputs**	**Outputs**
* Little	** Medium	● Blackwater, ● Sludge	● Effluent, ● Sludge



Hydrated Lime Treatment is a cost-effective chemical treatment for faecal sludge from pits and trenches. It uses hydrated or slaked lime (calcium hydroxide: $Ca(OH)_2$) as an additive to create a highly alkaline environment. It significantly reduces the public and environmental health risks of latrine sludge.

Hydrated lime is used to increase pH and create an alkaline environment in blackwater or sludge, making it no longer a viable habitat for pathogens. The optimum dosage to reach a recommended pH of above 12 should be between 10–17 g lime/kg of faecal sludge with a contact time of a at least 2 hours. The exact amount of time required depends on the quality of the lime and the characteristics of the blackwater or sludge. Its effect can be enhanced by increasing the contact time or dosage. The treatment should be undertaken as a batch process. It is a robust technology that can be used to treat both solid and liquid sludge. Above pH 10.4 hydrated lime also acts as a coagulant with precipitation of $Mg(OH)_2$ and allows for separation of sludge and effluent for liquid sludge with < 3 % dry solids. To increase the precipitation of solid particles, and depending on the presence of an excess of magnesium cations in blackwater or sludge, magnesium sulphate can be added. After treatment, the pH falls towards neutral usually within 24 hours and the treated sludge decants. After pH neutralisation, the supernatant can be pumped off and safely infiltrated into the soil (e.g. **D.10**) or used for irrigation or landscaping purposes. However, groundwater pollution may be an issue due to the high nutrient load. The treated solids can be used as a soil amendment or dried and used as cover for landfills.

Design Considerations: Hydrated Lime Treatment should be carried out in a leak-proof cistern or tank, If the tank is located below ground, care should be taken to ensure it is absolutely water tight to avoid the leakage of highly alkaline effluent into the soil. In areas with high groundwater

level or in flood prone areas it is recommended to use above ground tanks. Separate tanks may be needed for preparation of the lime slurry and for post-neutralisation of the treated effluent respectively.

Materials: Hydrated Lime Treatment needs a reactor vessel. A smaller additional container is needed to prepare the lime slurry (e.g. a 200 L plastic drum). For an even distribution of hydrated lime throughout the sludge, constant mixing is required (either manually or with a mixing pump). The type of pump required depends on the consistency of the sludge. A separate pump is needed to remove the treated effluent from the tank and a shovel or vacuum pump to remove the solid material. In addition a water testing kit (particularly for pH, E.coli, total suspended solids and turbidity) is needed as well as personal protective equipment (PPE) including masks, gloves, boots, apron or suit and respective chemicals (hydrated lime, magnesium sulphate if needed).

Applicability: Hydrated Lime Treatment is particularly suitable for the rapid response phase due to its short treatment time, simple process and use of readily available materials. With trained and skilled staff, it allows for safe, cost-effective and rapid treatment of faecal sludge with outputs that can be safely used for irrigation or soil amendment or can be safely infiltrated or disposed of, if the environmental conditions permit.

Operation and Maintenance: Lime is corrosive in nature due to its alkalinity and regular maintenance of the pumps used for mixing will be required. Due to the potential health risks when handling hydrated lime, skilled staff are required who follow appropriate health and safety protocols.

Health and Safety: Hydrated lime is a powder and corrosive to skin, eyes and lungs. Therefore, adequate PPE must be worn when handling hydrated lime to prevent irritation to eyes, skin, respiratory system, and gastrointestinal tract. Protection from fire and moisture must also be ensured. Lime is an alkaline material that reacts strongly with moisture. Staff must be carefully trained to follow health and safety protocols.

Costs: Hydrated Lime Treatment is a relatively cheap treatment option. Costs may vary depending on the availability and costs of local materials and chemicals/lime. As part of an appropriate health risk management, costs for personal protective equipment and staff trainings need to be considered.

Social Considerations: Proper health and safety protocols should be in place and include the provision of PPE and respective trainings for involved staff.

Strengths and Weaknesses:

- ⊕ Short treatment time (6 log removal of E-coli in < 1day i.e. pathogen count is 1 million times smaller)
- ⊕ Simple process which uses commonly available material
- ⊕ For liquid sludge, a sanitised and stabilised effluent is created suitable for soil infiltration

- ⊖ High chemical input
- ⊖ Mixing is essential for the process
- ⊖ Potential health risks if not handled properly

→ **References and further reading material for this technology can be found on page 192**