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TECHNICAL SHEET FOR SLUDGE DRYING

Sludge Drying generally involves the use of low grade (waste) heat, wind, air or solar energy to lower the moisture content of solid wastes. Solar drying in lagoons and drying beds is a low cost option that requires time and space. The performance of these open systems are strongly weather dependent. Vacuum assisted drying beds accelerate drying but are less common. Often combustible waste materials are dried with hot air/emissions from the boiler to drive away excess moisture prior to combustion.

Thermal Drying is used to dry the wastes to a much higher solids content, i.e. with 5-10% moisture content, far beyond what mechanical dewatering can produce), but this is generally high cost because of the high thermal energy input required. The advantages of heat drying include reduced product transportation costs, further pathogen reduction, improved storage capability; increased calorific value and marketability.

There are sludge combustion systems that effectively pre-dry sludge prior to combustion. In some cases these make use of waste heat in a pre-combustion stage while others simply combust sludge with supplemental fuel.

Materials Accepted	• Primary sludge • Secondary sludge • Scrubber sludge • Slurries
Examples in Current Use	*NZ* *Hutt City Council (sewage sludge) – thermal drying (gas)* *New Plymouth District Council (sewage sludge) – thermal drying (gas)* *Christchurch City Council (sewage sludge) – thermal drying (wood waste)* *Pulp mill sludge in drying beds – solar drying* *Overseas* Municipal sludge drying operations Drying recycled paper sludge (Kandant Inc)

Infrastructure and Space Requirements	Drying in lagoons, drying beds requires large areas. Typical area requirements for primary and digested secondary sludge in open sludge drying beds vary from 60 – 100 kg dry solids/m^2.year. Thermal drying systems also require land area and ideally a waste heat source. Space for silos, screw conveyors, mixing vessels, biofilters etc. need to be considered, and depending on the end use of the dried material, additional processes that take up space may be required, such as cooling, granulation, crushing/mixing, bagging .
Capital Cost	Natural drying systems are low cost, especially when land is available. If the soil permeability is high you may need reinforcement with clay liners for leachate management. Thermal drying systems with operational controls for product and process safety are more costly. These are used when the product has a steady market that could cover the costs.
Operating Cost	Lagoons and drying beds have labour and transportation costs, cost for lime (to control odour), excavation costs etc., these costs are comparatively low overall. Thermal drying is energy intensive and is typically high cost. The economics are linked to the heat source. Subsequent processes such as pelletizing, blending etc. would increase cost marginally.
End Product	Thermal drying produces a dried product for beneficial use for : Energy • Dried sludge as fuel alongside coal, wood or other fuels. Calorific value related to water content and combustible matter. Adsorbent or carrier • Kandant Inc. (USA) produces Biodac® granular carrier (for agricultural use) and Gran-sorb® industrial adsorbent from recycled paper waste. • Kitty Litter - cheap to produce, but low price and demand. • Spill absorbents/Hydraulic Barrier materials, Landfill liner materials. Construction products • Sludge (or ash) additives can improve the quality of building products (i.e. board, brick, cement). Long storage times can alter the product. Also require co-location of manufacturers for economics to work. • Particle board and MDF manufacture. The high levels of 'sticky' biological material (i.e. EPS - extracellular polymeric substances) that make secondary sludge difficult to dewater, can be positively used to increase interior bonding. • Road-making –i.e. Fibre additive for Asphalt road pavement. Land application • Soil Conditioner through land spreading or ploughing (adds structure and humic content rather than nutrient value). • Fertiliser delivery - add active ingredients such as Nitrogen. Slow controlled application of nutrients/fertilisers. Manufacturers must prove that there is no risk of contamination.
Operating capacity e.g. viable at low tonnage vs. high tonnage	Viable at nearly any tonnage Linked to availability of cheap heat
Potential consenting issues	• Biological sludge dried in open lagoons are susceptible to disseminate odour and would need a buffer zone from sensitive areas • Thermal drying applications require odour control measures • Underflow (leachate) from drying need management • Land application of product need analysis and prior approvals

Technology Risk	A qualitative assessment of the likelihood of failure of the option or scenario due to issues related to the technological solution e.g. equipment failure, unable to achieve output standards 3 = low risk, technology proven commercially in New Zealand and overseas for biosolids
Commercial Risk	No of suppliers Range of input materials A qualitative assessment of the likelihood of failure of the option or scenario due to issues related to the commercial arrangements e.g. supplier unable to maintain operations, increase in cost of process, transport or ongoing site management exceed those able to be reasonable recovered or those for comparable options. 1 = high risk, suppliers not in place, biosolids drying to high solids content all local authority ru. Difficult to secure cost effective source of heat
Market Risk	A qualitative assessment of the likelihood of failure of the option or scenario due to issues related to the 'market' for the product e.g. a use for the product cannot be found due to concerns about trace contaminants. Market risk depends on the end product. For energy, the risk may be low as pulp mills in NZ have fuel boilers on site and require energy input to their processes. The mills may also have available waste heat for drying. For biosolids with a mix of land application and landfill the risk may be medium.

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