



Flo-Dry Engineering Ltd

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Flo-Dry

THERMAL SLUDGE DRYING

*THERMAL
SLUDGE
DRYING*

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1.0 INTRODUCTION

This booklet is to provide the reader with an overview of Thermal Sludge Drying process offered by Flo-Dry Engineering Ltd.

Flo-Dry Engineering Ltd is a wholly owned New Zealand based process design company and originally developed the Flo-Dry Rotary Drier to satisfy a need for an efficient, cost effective drier to suit Low Temperature Rendering.

Since starting operations over 18 years ago, the company has successfully supplied sophisticated rendering plants and associated equipment around the world and was recently awarded a New Zealand Trade Development Board, Export Commendation Award.

As the name suggests thermal sludge drying is a process where the dewatered sludge from a wastewater treatment plant is dried using external heat to produce a Class A sludge in accordance with USA EPA Rule 503. The dried product is a sterile granular biosolids with a greater than 90% solids content that has a potential for beneficial reuse as an organic fertilizer or soil conditioner.

The Flo-Dry Drier works by directly heating air in a combustion chamber and passing it through a rotation barrel. As the barrel rotates, the wet material is continually lifted and cascaded through the hot air stream as it makes its way towards the discharge. A feature of the Flo-Dry Drier is that a large proportion of the combustion air is recycled thus reducing the volume of exhaust gases.

Thermal drying of sludge has been used in Europe and the USA for some time and is gaining in popularity as one of the technologies available to overcome the increasing problems associated with sludge treatment, disposal and the question of beneficial reuse. The product is promoted and being sold as an organic fertilizer that potentially has a commercial commodity value that is able to provide for operational cost recovery or for full commercialisation.

The advantage of thermal drying is that it very easily satisfies the criteria required for sludge treatment and beneficial reuse as the disposal option. The high drying temperatures sterilize, deodorize and change the nature of the sludge making it acceptable to a wider range of end users and cultural groups. Other benefits include the reduced volume of material to be handled and being able to use existing agricultural equipment such as spreaders or loaders for land disposal options.

In summary this plant will -:

- Produce a sterile and pathogen free product that will comply with a Class A Biosolids.
- Produce no offensive odour
- Dry dewatered sludge to 90-95% solids content
- Produce a biosolids that is granular in nature and has been subjected to temperatures of 500-600°C
- Provide options for a variety of beneficial disposal options such as fertiliser.

2.0 PROCESS DESIGN

Flo-Dry Engineering Ltd are able to offer the Client a complete Mechanical and Electrical process design service and work directly with the client or their Consultants to develop a design to suit their requirements.

Preliminary Information -:

- The average sludge production (DS Tonnes/day)
- The peak sludge production (DS Tonnes/day)
- Dewatered consistency (Dry Solids)
- Operating hours.
- Availability of Gas (Landfill, Digester, Natural)
- Any specific site requirements
- Details of any existing PLC / SCADA system

3.0 PROCESS FLOW & CONTROL OUTLINE

To be read in conjunction with the attached PROCESS FLOW CHART

Raw Material Silo

- A raw material Silo (200) will provide buffer storage of dewatered sludge.
- The silo will be fitted with a level controller to monitor product coming in and that product is available for processing.
- Alarms to be activated for low level and high level be registered
- The silo will be connected to the air extraction and Bio-Filter for control of odors.

RM Discharge Screws

- The silo (200) will be a live bottom hopper.
- The RM Screw (202) feeds to the Mixer (400).

Recycle Material Silo

- Dewatered sludge and the dry biosolids need to be blended to optimise the drying process. The mixing ratios to be manually varied according to the quality of the incoming dewatered sludge.
- The Silo (300) is to allow sufficient dry product storage for recycle. The Discharge Screw (301) will be VSD controlled and manually matched with the RM Screw (202).
- The silo will be fitted with a level controller is provided to control input via the recycle system.
- For safety, an automatic fire suppression system plus manual water backup is fitted to the silo (300).

Primary Mixer / Transfer Screw

- The Primary Mixer (400) blends material from the RM Silo (200) and Recycle Silo (300) to provide the optimum size and solids ratio for drying.
- This blended material is then discharged into the Transfer Screw (401) to control feed to the Drier.
- Both the Mixer and Transfer Screw (400 & 401) will be connected to the air extraction and Biofilter system to control odors.

Flo-Dryer Model

- The Flo-Dry drier operates by cascading the wet product through a flow of hot air. A gas-fired burner, using fresh air for combustion and re-heating the condensed recycled exhaust, produces the hot air. Typically about 50% of the exhaust air is recycled through the drier.
- The drier has independent temperature controllers monitoring the drier operation that will automatically shut down the process.
- Other safety and control measures include
 - A direct cold-water spray into the inlet of the drier.
 - The drier exhaust pressure is monitored and automatically controls an actuated damper on the recycle air.
 - The recycled exhaust gas is continuously measured for oxygen as part of the safety requirements.
 - An automatic fire suppression system is fitted as an additional safety measure. In addition a manual water sprinkler is fitted to the Cyclone and the Condenser.
- Dried product exits via a discharge hood and is taken away by an enclosed Screw conveyor.
- The discharge gases are passed through a Cyclone to drop out any carried over material.
- From the Cyclone the gases are passed through a Condenser this drops out the condensable fraction.
- Approximately 50% of the exhaust gases are recycled to the drier.

Bio-Filter

- The drier exhaust, fugitive gases and extracted building air is collected and blown, by a separate Fan to the Bio-Filter (511).
- The Bio-Filter (511) consists of a network of distribution pipes, covered with a drainage media that also acts to spread the air flow as it moves up for treatment and to allow free drainage around the pipe work. Above this level the multi level organic media treats the odorous gases before being discharged to atmosphere.

Transfer to Screen

- The dried Biosolids are transferred with a water-cooled screw to the Screen (700).
- The Biosolids are discharged from the drier at nominally 100-110 °C and need to be cooled
- Cooling water for the Transfer Screw (600) can be supplied from the WWTP effluent.

Transfer to Recycle Silo

- The over and unders from the Screen (700) are to be used for recycle. The overs are reduced in size through the Crusher (601) while the unders are passed directly to the water-cooled Transfer Screw (602).
- This product is then transferred via the water-cooled Transfer Screw (602) to an Elevator (603) and into the Recycle Silo (300).

701 Screen

- A screen will be used to classify the dried material into
- Accepts will be transported to the Storage Hopper (705).
- Overs and Unders will go to the Recycle Silo (300) after crushing of the Overs.

Transfer to Storage Hopper

- From the Screen (701), the Accepts Biosolids are transported via a Bucket Elevator (702) and water cooled Transfer Screw (703) to the Weigh Belt (704) and then discharged to the Storage Hopper (705).

Storage Hopper

- To monitor and record the loadout product from the Storage Hopper (705), load cells can be fitted.

Cooling Water System

- Cooling water is required to provide cooling water for the condenser and the water-cooled screws. A conventional closed loop system complete with cooling tower would be used.
- Alternatively treated water from the Wastewater Treatment Plant can be pumped through a self cleaning Filter and used for cooling.