WETALLA SOLAR HALL OPERATIONS - 5 YEARS ON

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ABSTRACT

The Wetalla Solar halls were built as part of the plant upgrade that was commissioned in September 2006. They are designed to handle all the sludge produced from the site when the plant reaches maximum capacity of 33 ML/day.

Before the plant upgrade, the Wetalla Stage 4 plant was producing about 1500 tonnes per month which was transported to the Thiess reclamation site at Swan Bank. The biosolids processed from the aerobic digesters had about 12.5% solids concentration and were stored in a clam bottomed silo for loading into semi-trailers and transport from site for beneficial reuse.

The commissioning began well but eventually problems surfaced, not with the actual belt presses but with the associated processes. Over the last 5 years we have made several improvements on the initial design. While the system does run efficiently, there is still room for improvement, and lessons to be applied in the design of future developments.

1.0 INTRODUCTION

The Wetalla Water Reclamation Facility has aerobic digestion for the waste sludge and uses belt presses and covered hall to reduce the moisture content of the biosolids before they are transported of site for beneficial reuse.

The solar hall which has fully automated weather controlled curtains and fans uses air flow and solar radiation to dry the biosolids as they travel through the halls. During the plant upgrade in 2007, two new Sernagiotto presses were installed and a refurbished Tema from the original processing train. The pressed biosolids are placed on the halls and automatically moved down the halls via the operation of the tillers.

After trialling various tiller program combinations it has now been decided that we need to use only two of the five available programs, displacing and clearing. The other three programs turning, loading and accumulating are rarely used. The halls are worked in three sections each day.

- The first program is a displacing program used to remove the dried biosolids to make room for more to be added to the hall.
- The second program moves the biosolids down the hall to prepare a space for the next day's processing.
- The third program then moves the processed biosolids from the belt presses to fill the gap created by the second program.

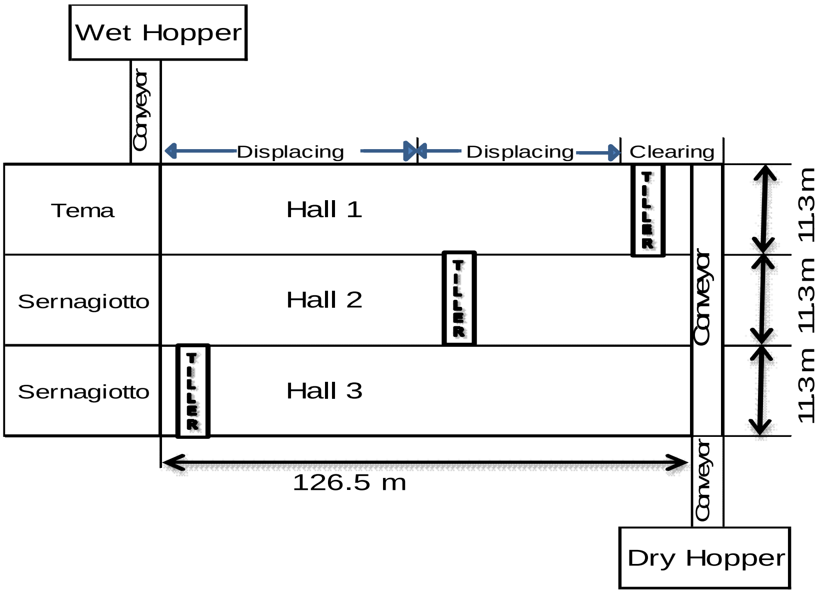

Figure 1: ***Solar Drying Hall Dimensions***

The three programs are used as the tillers have a fixed rate of travel allowing 12 passes per day and if sludge is discharged for approx. two hours into one pile it becomes very hard to move and handle.

The clearing cycle is used at the discharge end of the hall to remove the dried biosolids to the discharge conveyor. Normally we will clear out the last 5 metres of a hall; we then use the displacing cycle to make a space about midway down the hall so that the next day's production can be placed on the hall and moved along as it comes off the press.

The weather conditions influence the amount of biosolids that we can pass through the halls. In the warmer months we manage about 70% of the belt press sludge production down the hall while in winter in can get as low as 30%.

Figure 2: ***Solar Drying Hall***

2.0 DISCUSSION

The fully automated sludge process system came without an overall Operation Manual and it has been the operation staff that have developed an operation regime to best manage the operation of the facility.

There was a detailed operation manual for the tillers but nothing to tie it all together. Our experience with this system over the last several years has led to modifications to the original operation system that have resulted in cost savings and efficiency gains in the operation of the facility .Whilst there may be technical solutions available to these issues, the following operations are all simple and cost effective and have been implemented by the operation staff. Some of the points of improvement identified by operators working with this system since its inception in 2006 and implemented are:

2.1 The Automatic Curtain System

The solar hall has an automated weather protection system using complex technical weather detection (weather station), and automated weather curtains that deploy along both sides of the hall to prevent rain interfering with the drying capabilities. This system has never been effective due to the curtains needing to lift once wind speed is above 20 km/h. Unfortunately the weather conditions in Toowoomba are such that much of our rainfall is storm generated and the curtains are in the raised position when this happens because of the wind speed. For the best use of the side curtains the automatic control system has been disabled and the curtains fixed about a third of the way down.

The automated curtain system is a highly technical response to a very simple problem. A simple extension of the alsynite roof beyond the wall line of the solar hall would be a possible effective substitution. As air flow is critical to the air drying process it is important to not substantially restrict air flow, and equally important to allow solar radiation to facilitate the drying process. This solution would meet both these criteria in a cost effective and maintenance free manner.

Over the last few seasons the downtime of the one hall due to weather conditions has been substantial. The shutdown time of one hall due solely to these weather conditions is estimated to be in the vicinity of six weeks per year.

Figure 3: ***Solar Drying Hall Curtains***

2.2 Dry Out Loading Conveyer

The initial design incorporated a screw conveyer as the primary extraction method from the solar hall. This design was not successful and regularly resulted in blockages requiring manual intervention. Bobcats were equally required to remove biosolids during these outages.

Due to the original design specifications the replacement of the screw conveyor with the horizontal conveyor was restricted in size to the original dimensions of the infrastructure. This has created a large bottleneck in the drying process due to plant outages and maintenance Callouts for tiller outages require prompt attention because any delay can result in the next day's processing being discharged to the 'wet hopper' rather than being placed down the hall. This does not just affect the out loading process itself, but the entire process is slowed due to this bottleneck.

In considering the construction of a solar hall, the capacity of the final discharge conveyor plays a major role in the operation of the solar hall. Currently, due to width restriction, our tiller clearing cycle must be run at least 3 times to reduce the likelihood of overloading the conveyor system, adding considerable time and expense to this process. The replacement belt can only handle a clearing depth of approximately 3 centimetres per clearing cycle, hence the need to cycle at different depths.

More consideration should be given to the volume and weight of biosolids this conveyer must be able to handle in future designs.

Another option would be to have 4 halls. Hall length would be reduced from 126 to 95 meters long. With the same total drying area, better management of tillers would be possible due to shortened travel time.

<u>Figure 4:</u> ***Out loading Conveyor***

2.3 Out Loading Conveyer to Dry Hopper

The primary concern of the initial design is the angle of elevation needed for the transfer of biosolids to the dry hopper. This inclined conveyor was originally a screw lift but do to clogging issues it was replaced with a flat belt conveyor. The flat belt conveyer was then replaced with a ribbed conveyor to enable the dry biosolids to be raised to the dry hopper.

The original design has the dry hopper positioned quite high above and close to the solar hall to allow under pass access for semi-trailers. This has meant the angle of elevation is quite steep and has led to substantial problems with the transfer of biosolids along the conveyor. This change from screw to belt conveyor means we now have problems with belt slippage on the top roller, particularly during moist conditions when belt slippage is common.

A cleated conveyor was needed as a flat conveyor at this angle did not handle the load as rolling back of the biosolids on the incline conveyer belt keep clogging bottom causing conveyor failures.

Maybe the height of the dry hopper in relation to the solar hall is a major design factor that needs attention, reducing the angle of the incline conveyor to the dry hopper would result in substantially fewer failures. Not only would the conveyor system itself be simplified, e.g. non-cleared, but the total product displacement would be substantially increased.

3.0 CONCLUSION

Figure 5: ***Conveyor to dry Hopper***

Figure 6: ***Cleated Conveyor***

It has been said that the only time we experience 20-20 vision is in hindsight. Since 2006 when our solar hall was commissioned we have learnt a lot from our daily usage, maintenance, and down time due to these issues. Many valuable lessons have been learned, and we feel many future problems may be minimised if we take the time to implement these recommendations.

The costs of implementation of these design modifications from the start of a new project would surely be recovered quickly by the increased through put and reduced downtime of the facility.

4.0 ACKNOWLEDGEMENT

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