COMMISSIONING OF UNITED UTILITIES THERMAL HYDROLYSIS DIGESTION PLANT
AT DAVYHULME WASTE WATER TREATMENT WORKS

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Abstract

With an installed throughput capacity of 121,000 tDS/a, Davyhulme’s sludge processing and recovery centre is capable of treating sludge arising from 60% of the North West’s 7 million population. The facility was designed to increase United Utilities’ (UU’s) renewable energy generation significantly whilst maximising the use of existing assets and ensuring the greatest flexibility in sludge re-use throughout the region.

Another key consideration was to increase the potential for new land recycling outlets by producing an enhanced sludge product. The facility is now fully operational, accepting sludge from all seven of UU’s raw sludge cake feeder sites.

This paper describes key commissioning activities, operational experiences and challenges faced whilst discussing theoretical design figures versus actual targets achieved.

Keywords

Thermal Hydrolysis, Digestion Pre-Treatment, Biogas, E.coli, Volatile Solids, dewatering.

Project Background

Since the cessation of sludge disposal to sea in 1998, United Utilities (UU) used their purpose built sludge incineration plant to destroy approximately 20% of their conventionally treated sewage sludge. The majority of the remainder is then recycled to agricultural land. This land bank availability is now decreasing due to an increase in Nitrogen Vulnerable Zones (NVZ’s), tighter Phosphorous and metals restrictions, green field development and unpredictable public perception of the practice. Whilst available outlets are decreasing, the sludge production from each of UU’s 575 wastewater treatment sites is increasing as they achieve ever tighter consents to improve river and coastal water quality throughout the North West. These concerns are the basis of what eventually became the Sludge Balanced Asset Programme (SBAP).
Initially, in AMP5, United Utilities investigated the construction of a second incineration plant based in central Lancashire to take raw sludge from seven of its larger wastewater treatment works. The Lancashire Processing Centre adequately addressed the primary problem of the ever reducing landbank but did not recognise the potential energy which raw sludge inherently embodies. After reviewing emerging technologies, including experience from other water companies, thermal hydrolysis (TH) was the selected solution. Not only did it satisfy the original brief but also allowed UU to harness a higher quantity of renewable energy whilst maintaining and utilising existing assets. The SBAP scheme at Davyhulme allows the whole site to be electrically self-sufficient, meet the enhanced treated sludge standard, gives the best value to our customers and has the lowest Carbon footprint of all the conceptual options, shown on Graph 1.
Process Description

The purpose of the SBAP project was to increase the capacity and improve the quality of sludge at Davyhulme WwTW by providing a central sludge processing facility comprising digestion pre-treatment (DPT) including TH and other associated technologies upstream of the existing mesophilic anaerobic digesters. Figure 2 shows the sludge treatment facility.

Figure 2: Process Flow Diagram of SBAP

The works receive imported raw sludge cake from seven feeder sites; Fazakerley, Preston, Wigan, Rochdale, Hillhouse, Hyndburn and Fleetwood (Figure 1) which previously limed raw sludge prior to recycling to land. Indigenous sludge from Davyhulme WwTW along with liquid imports from satellite sites are received and double screened through 6mm bar screens and 10mm perforated basket screens (PBS) before being stored in odour controlled holding tanks.

The screened sludge is then thickened (it is actually a dewatering process via centrifuges but termed thickening to differentiate from the digested sludge dewatering process prior to export) to 27% DS and held in a storage silo alongside the imported cake. The sludge from all raw cake storage silos is then re-liquefied to 16.5% DS using heated final effluent before passing forward to the four TH streams. Each stream consists of a pre-heated pulper, five reactors and a flash tank. Each batch is heated in the reactor using steam to 160°C and 6 bar pressure. This is then held for 30 minutes before discharging to the flash tank. The hot sludge is then cooled initially using heat exchangers and then with the use of cold final effluent to 40°C and fed to its associated mesophilic digesters (two per stream).

A maximum of 32000tDS/a of enhanced treated sludge is then dewatered to 28% DS by two dedicated centrifuges before being recycled to agricultural land. The remainder of enhanced treated sludge is pumped down the Mersey Valley Sludge Pipeline (MVSP) for incineration at the Mersey Valley Processing Centre (MVPC) shown in blue on Figure 1.

Biogas produced by the eight digesters (7500m³ each) is held in two gas holders (9000m³ each) before passing through a siloxane removal plant and used as fuel for five combined,
heat and power (CHP) engines and three steam boilers with a total generating capacity of 12MW.

**Design and Performance Parameters**

The new installation was designed to take average sludge quantities of 91000tDS/a, with a maximum capacity of 121000tDS/a. During the commissioning period, it became evident that 78000tDS/a was a more realistic amount; however, the plant required proving to the original design parameters to assist with future strategic decisions. This led to each TH stream requiring full throughput of 83.25tDS/d in isolation.

Each cake import stream shall pass 100 wet tonnes per hour.

Raw sludge thickening centrifuges shall achieve 95% solids capture with a polyelectrolyte consumption of 10kg/tDS.

Each DPT and digestion stream shall produce 422Nm³/tDS at 61% methane concentration.

The DPT and digestion plant shall achieve 58% volatile solids destruction.

Digester temperature range should be 40°C (+/- 1°C).

The digesters shall achieve an average of at least 56% COD reduction based on feed volatile solids content greater than 75%.

The design requirement for dewatering digested sludge is 16,000 tDS/a per centrifuge.

The digested sludge cake leaving site must meet the enhanced sludge standard shown before being exported for agricultural use of:

- Average dry solids equal to or greater than 28%
- E.coli < 1000 cfu per gDS
- Salmonella – not detected per 50g wet sludge

Digested sludge dewatering centrifuges shall achieve 98% solids capture with a polyelectrolyte consumption of 10kg/tDS.

**Commissioning Programme**

Due to the scale of the SBAP project it was clear that involvement from each of the feeder sites was key to its success and managing these sludge movements required a team to facilitate it. This team, known internally as the SBAP operational readiness team, ensured communication was maintained throughout the project so commissioning programmes at each of the SBAP feeder sites could be altered and amended in line with the SBAP programme.

Again, due to the size of the project there was a need to divide commissioning in to key deliverable sections. Each section, shown in table 1, had clear reliability and performance test requirements based on the installation and its need to integrate effectively with the whole scheme.
### Table 1: Sectional Commissioning Completion Dates

<table>
<thead>
<tr>
<th>Section</th>
<th>Description</th>
<th>Completion Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Liquid sludge Import and Screening</td>
<td>19th Oct 2012</td>
</tr>
<tr>
<td>2</td>
<td>Biogas storage and cleaning, New CHP Engines 1&amp;2</td>
<td>30th Oct 2012</td>
</tr>
<tr>
<td>3</td>
<td>Existing CHP Engine 3 relocation</td>
<td>4th April 2013</td>
</tr>
<tr>
<td>4</td>
<td>Existing CHP Engine 4 relocation</td>
<td>9th August 2013</td>
</tr>
<tr>
<td>5</td>
<td>Existing CHP Engine 5 relocation</td>
<td>17th Sept 2013</td>
</tr>
<tr>
<td>6</td>
<td>Cake Import, Thickening, TH stream 1, digestion (1&amp;2) &amp; dewatering</td>
<td>3rd April 2013</td>
</tr>
<tr>
<td>7</td>
<td>TH stream 2, digestion 3&amp;4</td>
<td>27th May 2013</td>
</tr>
<tr>
<td>8</td>
<td>TH stream 3, digestion 5&amp;6</td>
<td>25th June 2013</td>
</tr>
<tr>
<td>9</td>
<td>TH stream 4, digestion 7&amp;8</td>
<td>12th July 2013</td>
</tr>
<tr>
<td>10</td>
<td>Odour and ancillaries</td>
<td>To be completed</td>
</tr>
</tbody>
</table>

**Section 1** incorporated existing equipment requiring modifications made to the raw sludge tanks mixing systems, odour control, sludge screening and transfer to the new treatment facility.

**Section 2** required commissioning of two large gas holders, transfer pipework, flare stacks, a biogas siloxane removal plant and connection to existing gas system during commissioning.

**Sections 3 – 5** consisted of refurbishment and programmed relocation of existing CHP engines across the Davyhulme site.

**Section 6** was seen as a key area in the commissioning programme as it held the majority of equipment important to the success of the TH and digestion processes. This included the two cake import facilities, liquid sludge thickening and storage, reliquification of cake sludge, stream 1 of TH, steam boilers, digesters 1&2, digested sludge degassing tank and enhanced sludge dewatering centrifuges.

**Sections 7 – 9** included commissioning of streams 2 to 4 of the TH plant, changing digesters 3 to 8 from conventional mesophillic to accepting TH sludge and commissioning of a dissolved air floatation (DAF) to remove fine solids from dewatering centrate.

**Section 10** covered the odour control, ancillary equipment and control systems.

Although each section had a dedicated take over performance test requirement, there is a final performance test planned for the whole scheme in January 2014 which will clearly demonstrate specific criteria are met as detailed in the original scope.

**Commissioning**

Commissioning of section 1 was completed on 19th October 2012 which allowed indigenous and liquid import sludge to be screened and stored ready for transfer to the DPT plant.
During this time sludge was still being thickened on gravity belt thickeners (GBT) before being fed direct to the digesters.

Section 2 was completed on 30th October 2012. Again, this was an important milestone as without the ability to store, clean and use the increased gas produced by the digestion plant, the subsequent sections could not be commissioned. Due to the existing engines still being in service, the connection between the old system and the new system was maintained until the removal of engine 5 in July 2013. Up until this point the accuracy of inline gas analysers were problematic as differing pressures associated with maintaining the two systems were causing back flows and fluctuations in velocities.

Section 6 was the next to be commissioned and embodied the majority of process plant and equipment essential for the whole scheme. Firstly, enabling work on digesters 1 & 2 had to be completed. This included a full emptying and clean of the two digesters as an enhanced sludge product was required for commissioning of the dewatering centrifuges, silo and centrate handling equipment. The cleaning of the digesters and installation of new gas mixing system was completed by December 2012. Digested sludge cake previously treated by thermal hydrolysis was imported from Anglian Water’s Cotton Valley WwTW at 28% DS and re-liquefied on site at Davyhulme to 6% DS. This sludge was then used to seed digesters 1 & 2. Just over four trucks per day over 29 days were transported to site giving a total of 2460 wet tonnes. Due to alkalinity being lost in the dewatering process at Cotton Valley, sodium bicarbonate was added to provide a buffer of approximately 10000mg/l CaCO₃. For every twenty wet tonnes of cake processed, one dry tonne of sodium bicarbonate was added.

Once the digesters were at the correct level, the recirculation pumps were started and stream 1 of the TH plant was put into operation. This required 25% of the liquid sludge to be thickened and the first feeder site could be brought in via the new import facility shown in Figure 3. The requirement for truck unloading on each import silo was 100 wet tonnes per hour with the actual performance successfully achieving 117 wet tonnes per hour. This amount was not required specifically for stream 1 but would be needed as part of the whole scheme if maximum throughput was required.
Based on laboratory experiments, Jolly et al (2012) it was planned to ramp up the feed through stream 1 over 25 days with a 9 day break over Christmas, however, due to initial difficulties encountered with maintaining a stable 16.5% DS feed to stream 1 TH plant, full throughput was achieved after 70 days. The control system was designed to dilute the stored cake in a small hopper at the base of the silo from 27% DS to 16.5% DS using an inline dry solids instrument as feedback to the cold final effluent control valve. During commissioning, due to poor accuracy of the inline instrument, alterations were made to the control philosophy for dilution based on a manual input of dry solids concentration of the cake controlling the final effluent valve from a look up table developed locally over a range of scenarios. The dilution water was also preheated to provide better mixing in the hopper and through the TH feed pump giving a much more homogenous feed to stream 1. The combined impact of the changes prevented blockages downstream of the dilution point giving consistent dry solids feed to the TH plant.

The TH plant requires steam to heat the sludge and raise pressure in order to rupture the microbial cells. The boilers were commissioned on biogas and required to provide greater than 5700 kg/h (95% of design output) of steam whilst keeping within regulated emission limits. The boilers successfully provided 6337kg/h of steam with NOx, SOx, CO, VOC’s and non-methyl VOC’s all below the required limits at point of emission. The full balance of steam demand was optimised once all TH streams were in operation using heat from CHP emissions and 8% of the total biogas produced.

As there is an increase of suspended solids and ammonia loads returned to the wastewater treatment works as centrate rather than filtrate from GBT’s, considerable emphasis was placed on the quality of centrate from both thickening and dewatering centrifuge operation. Both raw and digested centrifuge operations were at this stage required to meet
95% solids capture rates. Commissioning of the DAF was postponed until section 7 where 98% capture was required across the dewatering centrifuges and the DAF process. Initially, both centrifuge operations were commissioned on a fixed poly dose rate determined by the operator and were meeting the 10 kg/tDS performance criteria for raw sludge but exceeding the performance criteria of 13 kg/tDS on the digested sludge. More recently the automatic control solids proportional mode has been introduced with immediate benefits giving 7.85 kg/tDS on raw thickening and 9.51 kg/tDS on dewatering.

Sections 3, 4 & 5 were commissioned on a stand-alone programme; however, each engine in series needed to be operational to meet the increase in gas production as each TH stream was established. Failure to do this would have resulted in increased biogas wastage through the flare stack and a breach of the Environmental Permit (EPR). Each of the three engines were carefully decommissioned, refurbished and relocated to the new site over a period of six months.

Commissioning of Section 7 included the start-up of stream 2 TH plant and conversion of conventional mesophilic digesters 3&4 to treat TH sludge. As these digesters were not emptied and cleaned out as with digesters 1&2, the ramp up of feed solids required a different methodology. The method was to feed thermally hydrolysed sludge from stream 2 at the same organic loading rate they were accustomed to, 1.25 kg VS/m$^3$/day for the first 14 days and for the remaining 20 days, slowly ramp up the throughput to the design loading rate of 4.16 kg VS/m$^3$/day. To do this the digesters were drained from a sludge level of 16m to 10m to maintain a gas seal. As planned, the digesters were fed at minimum loading for 14 days and steadily ramped up. Three monitoring indicators (pH, VFA:Alkalinity ratio and methane concentration) were used to determine the health of the digesters. After day 25, it became apparent that the digesters became unstable with an immediate drop in methane concentration from 59% to 48%. Surprisingly, there was a lag of roughly 4 days before the remaining parameters showed any change. The pH dropped to below 7 and VFA:Alkalinity ratio increased to 0.77 from 0.3. Prior to this point the VFA:Alkalinity ratio had been the primary monitoring parameter when assessing the ramp up of feed sludge, however it now became clear that methane concentration was the first to be affected and so adopted from then on. It is believed that a batch of septic sludge caused the instability so feed was reduced to minimum and 3000 m$^3$ of seed sludge from digesters 1&2 was transferred by connection into the recirculation system. The effects were immediate and stability regained in just a couple of days. This allowed the continuation of ramp up to full throughput in a total of 55 days.

Running concurrently with the commissioning of stream 2, the DAF used to remove excess solids from dewatering centrate was brought on line and achieved an average of 98% solids capture across the centrifuge and DAF.

Due to the rapid improvement and conversion of digesters 3&4 in section 7, digesters 5&6 in section 8 were seeded with approximately 2000 m$^3$ of acclimatised biomass on start-up of stream 3. The effects were immediate and allowed for a much steadier and quicker ramp up rate than streams 1 & 2. Stream 3 was up to full throughput after only 34 days with no detriment to biogas quality.

By section 9 it was clear a large portion of seed sludge was crucial to a speedy conversion to TH sludge digestion. Digesters 7&8 received transferred seed sludge from 1&2 as stream 4
ramp up was accelerated further whilst monitoring the key performance indicators. As a result stream 4 achieved full throughput in just 25 days.

Section 10 is yet to be commissioned.

**Energy Generation**

This summer has been one of the driest and warmest summers for a long time and as a result United Utilities have experienced their lowest primary sludge yield in a decade. Graph 2 shows sludge throughput at SBAP since January 2013. A steady increase in sludge can be seen as each stream is brought on line, another of the feeder sites and another 25% of liquid sludge was used to commission and maximise the potential for gas production and energy generation. Up to July the actual values were matching the theoretical commissioning figures in terms of raw sludge quantities (1500tDS/wk) and energy generated (1343MWh/wk).

![Graph 2: Total Sludge Throughput](image)

**Graph 2: Total Sludge Throughput**

Commissioning of SBAP has now spanned three seasons and it has become apparent that quality of sludge has changed with them. There was a long dry cold spring followed by a long dry hot summer. It could be argued that this has resulted in a decrease of sludge quantities at the works that contribute sludge, shown in Graph 2, along with a drop in sludge quality associated with “digestion” within the network sewers. Prior to July when sludge quantities and qualities were as planned, electrical generation was high and meeting commissioning targets. However, the large trough shown on Graph 3 clearly shows the effect of processing less sludge with a lower volatile content in terms of energy generation.
**Graph 3**:  **Electricity Generation v’s Sludge Throughput**

**TH Feed Pumps**

There were three occasions where foreign objects have impacted on the reliability of feed to the TH plant. The first of these instances occurred in January 2013 on start-up of stream 1 TH. The pulper feed pump had become jammed and after inspection, significant damage was seen to the rotor and stator of the progressive cavity pump. Three large pieces of metal had found their way into import silo ‘A’ either from construction activity or in the cake being imported. The pump was replaced quickly with no further problems. The second instance occurred in March 2013 when a level detection instrument from the hopper on unloading conveyor ‘A’ sheared before being conveyed into the silo. Again, this resulted in a damaged stator on the pulper feed pump. The last incident, shown in Figure 4, occurred in October 2013. On this occasion a bolt had been transferred from the import silo to the pulper on stream 4 without any issue. However, the bolt found itself embedded in the stator of the recirculation pump on the pulper tank.

During each of the incidents, downtime was kept to a minimum due to the flexibility of having two cake unloading facilities and four streams of TH. During the third incident, sludge destined for stream 4 was balanced between stream’s 1 to 3 whilst the pump was replaced, resulting in no detriment to biogas quantity and energy generation.
It is impossible to determine the exact source of the debris on the first and third incident but care must be taken at the feeder sites to ensure no objects can manifest themselves in the sludge cake. Whilst downtime for pump changes is relatively short and easily managed, the cost can be high for the replacement parts.

**Performance Summary**

As described earlier the majority of the DPT plant was commissioned in section 6. Table 2 shows the performance test data for this section detailing design criteria against actual test values. The 28 day performance test was carried out on between 6th March 2013 and 3rd April 2013 in full automatic control. In addition to the performance tests identified in Table 2, a fourteen day continuous reliability test was carried out to demonstrate the plant’s reliable operational performance under automatic control. This reliability test was started at the end of the 28 day performance test.

As shown, the TH plant achieved an average of 86tDS/d for the period however there were occasions where the throughput dropped below 83.25tDS/d. This was largely due to a number of level detection monitors in ancillary tanks suffering from condensation build up and sensitivity issues giving inaccurate readings. The plant however outperformed on a number of days with the maximum of 99tDS/d on one occasion so this was deemed acceptable.
Table 2: DPT and Stream 1 Performance Test

<table>
<thead>
<tr>
<th>Description</th>
<th>Units</th>
<th>Criteria</th>
<th>Average value</th>
<th>PASS/FAIL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thickening centrifuge throughput</td>
<td>tDS/d</td>
<td>&gt;48</td>
<td>53.8</td>
<td>PASS</td>
</tr>
<tr>
<td>Thickening Solids capture</td>
<td>%</td>
<td>&gt;95</td>
<td>96.8</td>
<td>PASS</td>
</tr>
<tr>
<td>Thickening poly consumption</td>
<td>kg/tDS</td>
<td>&lt;10</td>
<td>7.85</td>
<td>PASS</td>
</tr>
<tr>
<td>Cake Import Facility Throughput</td>
<td>Wet t/h</td>
<td>&gt;100</td>
<td>117.6</td>
<td>PASS</td>
</tr>
<tr>
<td>TH Stream 1 Throughput</td>
<td>tDS/d</td>
<td>&gt;83.25</td>
<td>86.0</td>
<td>PASS</td>
</tr>
<tr>
<td>TH Stream 1 Outlet Quality (e coli)</td>
<td>CFU/g</td>
<td>&lt;500</td>
<td>1.2</td>
<td>PASS</td>
</tr>
<tr>
<td>TH Stream 1 Outlet Quality (salmonella)</td>
<td>Per 50g</td>
<td>0</td>
<td>0</td>
<td>PASS</td>
</tr>
<tr>
<td>Digestion Stream 1 Throughput</td>
<td>tDS/d</td>
<td>&gt;83.25</td>
<td>86.0</td>
<td>PASS</td>
</tr>
<tr>
<td>Dewatering throughput as cake</td>
<td>tDS/d</td>
<td>&gt;44</td>
<td>53.0</td>
<td>PASS</td>
</tr>
<tr>
<td>Dewatered Sludge Cake Quality</td>
<td>%DS</td>
<td>&gt;28</td>
<td>29.0</td>
<td>PASS</td>
</tr>
<tr>
<td>Dewatering Poly consumption</td>
<td>kg/tDS</td>
<td>&lt;10</td>
<td>9.51</td>
<td>PASS</td>
</tr>
<tr>
<td>Dewatering Solids capture (including DAF)</td>
<td>%</td>
<td>&gt;98</td>
<td>98.8</td>
<td>PASS</td>
</tr>
<tr>
<td>Dewatered Sludge Cake Quality (e coli)</td>
<td>CFU/g</td>
<td>&lt;500</td>
<td>8</td>
<td>PASS</td>
</tr>
<tr>
<td>Dewatered Sludge Cake Quality (salmonella)</td>
<td>Per 50g</td>
<td>0</td>
<td>0</td>
<td>PASS</td>
</tr>
<tr>
<td>Digester Temperature</td>
<td>ºC</td>
<td>40 +/- 1</td>
<td>In range</td>
<td>PASS</td>
</tr>
<tr>
<td>Boiler steam production</td>
<td>Kg/h</td>
<td>&gt;5700</td>
<td>6337</td>
<td>PASS</td>
</tr>
</tbody>
</table>

Unlike COD destruction, the volatile solids destruction was not a requirement of the performance test but was needed for information to ascertain the health of the system as a whole. Table 3 shows both VS and COD destruction for each TH streams performance test period. The average feed VS content was 79%. Each stream achieved the design target.

Table 3: Volatile Solids and COD destruction

<table>
<thead>
<tr>
<th>Stream</th>
<th>Average VS Destruction (%)</th>
<th>Average COD Destruction (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design</td>
<td>58</td>
<td>56</td>
</tr>
<tr>
<td>1</td>
<td>59</td>
<td>62</td>
</tr>
<tr>
<td>2</td>
<td>57</td>
<td>58</td>
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<td>3</td>
<td>60</td>
<td>61</td>
</tr>
<tr>
<td>4</td>
<td>59</td>
<td>61</td>
</tr>
</tbody>
</table>
The biogas yield for each stream is shown in graph 4. It can be seen that all streams start off with very high production as they are seeded with TH sludge but then reduce close to the design figure of 422Nm$^3$/tDS.

Graph 4:  Biogas Production per TH Stream

Pathogen Removal

As mentioned earlier, preliminary works started in early 2012 with the emptying and cleaning of digesters 1&2. Once cleaned, with the new gas mixing system installed, the filling process could be started with TH seed sludge. This decision to clean the digesters was made early in the life of the project as UU needed to secure an outlet for the cake as soon as the digesters were full and hence HACCP compliance was required from the outset. This meant less than 1000 coliform units per gram dry solids of E.coli and absence of Salmonella in the final cake product was required. As commissioning of Stream 1 TH commenced in January 2013 and digesters 1&2 began to discharge, extensive sampling was undertaken to prove that the sludge was of enhanced quality. Graph 5 shows a continuation of that sampling with only three occurrences in six months greater than 200 CFU/gDS with no Salmonella present.

Graph 5:  Stream 1 E.coli Performance
Streams 2 to 4 were very much different as these digesters were converted from conventional treatment to enhanced treatment. As a result, significant time was needed between the commissioning of each stream to enable the TH sludge to displace the conventional sludge and provide a stable enhanced product. It can be seen on Graph 6 that this took stream 2 three months before it performed to the required standard. Streams 3&4 however converted more quickly due to the increased amount of seed sludge used to start up the respective streams. Graph 7 shows digesters 5&6 were compliant within two months and Graph 8 shows digesters 7&8 were the quickest at just one month, again due to the accelerated ramp up and high level of feed sludge used at start up.

Graph 6: Stream 2 E.coli Performance

Graph 7: Stream 3 E.coli Performance
Graph 8: Stream 4 E.coli Performance

Unlike stream 1, there was no finite requirement for streams 2 to 4 to be compliant quickly as the outlet to MVPC was available to take conventionally treated sludge. However, it was an objective to export as much enhanced treated sludge as early as possible whilst reducing the sludge quantity for incineration. There was also the added incentive of small gains on the commissioning programme.

Conclusions

The plant has achieved its maximum throughput design figure of 83.25tDS/d on all 4 streams of thermal hydrolysis. This was achieved through close monitoring of digestion performance, detailed analysis of real time data and essential planning of regional sludge movements.

The dewatered cake consistently meets 28%DS and achieves the enhanced sludge standard of 1000 CFU/gDS with no Salmonella present.

The volatile solids destruction has increased from 43% when conventional, to 58% post thermal hydrolysis. This has increased biogas production meeting the design point of 422Nm3/tDS.

Both raw sludge thickening and digested sludge dewatering centrifuges achieve 95% and 98% solids capture respectively, whilst staying within the polyelectrolyte consumption targets.

Whilst the plant successfully treats all sludge from liquid and cake imports, investigations are on-going in to the quantities and qualities of raw sludge available at different points during the year. When sludge is readily available the electrical generation targets of this plant will be monitored but it is believed that they will be achieved based on commissioning data.

References