

ENiGMA TIPS THE SCALES IN THE TREATMENT OF WATER & WASTE WATER

FERTILISER MANUFACTURER - VACUUM SYSTEM/PUMPS

Fertiliser manufacturer, **Kemira Agro U.K.**, part of the Finnish based Kemira Group; Europe's second largest producer of fertilisers is situated in Ince near Chester.

The company employs a workforce of 500 to manufacture around one million tons of chemical fertiliser per annum for the agricultural market. The fertiliser is produced primarily for the UK, but small amounts are shipped to Ireland and Western Europe.

Effluent is collected into two settling ponds for treatment prior to discharge. The water is pumped out of the ponds using a vacuum filter, leaving the solids to settle at the bottom of the ponds as sludge. The sludge is vacuum filtered, allowing the dry solids to be disposed of on site. Throughput of the filter is 1600 tonnes of dried solids per annum.

To aid filtration, the water is dosed with lime, resulting in it containing high levels of calcium carbonate. As the water vaporises, the calcium is left, coating the vessels and pipes with limescale deposits. Before the installation of **ENiGMA** Technology the scale would gradually build up resulting in plant shutdown every month for cleaning.

The vacuum system and pumps had to be acid washed necessitating a shutdown of the sludge filter for up to 4 days at a time. Potentially, a problem could have arisen whereby both ponds could have become full of sludge resulting in total plant shutdown.

In November 1996, **ENiGMA** was installed for a six-month trial period, on to the 8" line discharging the filtrate water from the sludge filter to the vacuum receiver and pipe. The level of scale was checked at the beginning of the trial and again three months later.

After three months, the scale in the vacuum receiver had almost disappeared and the in the line leading to the vacuum pump the scale was soft and beginning to disappear.

During the trial period, the vacuum system was shut down twice to remove scale that had come away from the pipe wall and had accumulated in the system.

At the conclusion of the six-month trial period, it was decided that by treating the vacuum pump's seal water supply with the same Unit the results would be even more enhanced.

Since then, **Kemira Agro UK** has experienced no plant shutdowns providing the company with savings on maintenance and chemicals. It anticipates a payback on the system in less than 2 years based on maintenance costs alone.

AN ENVIRONMENTALLY FRIENDLY WAY OF REMOVING STRUVITE

ENiGMA has successfully removed struvite build-up from a dewatering centrifuge at a sewage treatment plant in the City of Winnipeg, Canada.

Struvite, a hard crystalline scale consisting of mainly magnesium and ammonium phosphate, coated the inside of the sludge-dewatering centrifuge at the sewage treatment plant.

After approximately 800 hours running time (around 1 month), the centrifuge would become inoperable and had to be taken out of service for cleaning. Cleaning took one complete day and was carried out manually by two men using hammers, chisels and a chemical wash.



Following a six-month installation the centrifuge was opened for inspection, and it was found that most of the build-up had been removed, and only soft struvite was visible further inspection was carried out three months later and it was noted that even less soft struvite was present. The equipment was removed to establish whether the struvite would reappear without the system treating the sludge. Three months later a survey of the dewatering centrifuge found the struvite starting to reappear.

Regular surveys carried out since the system was again reinstalled have resulted in the centrifuge remaining free from substantial struvite build-up.

FIBRE MANUFACTURER – VAPOUR

CONDENSER

Courtaulds Fibres Performance Products produces between 50 and 55 tons of flame-retardant fibre a week for use in curtains, bedding, children's clothing, etc. Part of the process involves the recovery of Acetone, a relatively expensive and highly flammable chemical, by a fully automated carbon bed adsorption unit. An integral part of this unit is a water-cooled condenser, used to recover a steam/Acetone distillate.

ENiGMA was installed onto a mild steel pipe feeding the cooling water to the vapour condenser. Prior to installation, the condenser required tedious and exacting cleaning to the tubes, either by the use of acid, with its consequential disposal problems, or by drilling at a cost of £1200 per annum.



Since installation the condenser has remained scale free providing a payback in less than two years.

WATER TREATMENT PLANT LIME DOSING EQUIPMENT

Crystallation fouling was occurring at the **Moyola Water Treatment Works** in Ballymena, Northern Ireland due to chemical dosing. **ENiGMA** was tested on a section of pipe, which was stripped out after three months to ascertain whether limescale had been arrested.

When the inspection was carried out, it was found that existing scale was slowly being removed and remaining scale was much softer.

A further test was carried out on a one-inch pipe using ferric aluminium sulphate. This chemical is dosed into the water supply to act as a coagulate to remove peat staining, but tended to cause crystallisation fouling within the pipes.

The **ENiGMA** technology prevented crystallisation occurring resulting in reductions in maintenance and pipe failure. It is likely that the use of this technology will help minimise corrosion problems associated with chemical usage.

PLUMBING FITTINGS MANUFACTURER -

COOLING SYSTEM

Established in 1934, **Sanbra Fyffe** employs a workforce of 125 at its Conex Works in Dublin, manufacturing 10 million plumbing components per annum. The fitments are sold through plumbers' merchants and other outlets in Ireland, the United Kingdom, France and New Zealand.

An Inductotherm 125 VIP induction furnace is used by the company to smelt bronze. The furnace is capable of handling 100 kilos of bronze at a time, which is then poured into sand moulds. The copper induction coils within the induction furnace are maintained at a constant temperature by cooling water.

Until **ENiGMA** was installed, the company used water-softening equipment to prevent scale build-up in the recirculating water system. In addition to the cost of buying salt and re-gen water, maintenance of the softener cost **Sanbra Fyffe** around £2,000 per annum.

Searching for a less problematic alternative to the softener, the company looked at the possibility of installing **ENiGMA** to treat the water in both the make-up and return pipes.

Prior to the installation, **Sanbra Fyffe's** Engineering Manager, Fergus Russell, contacted the manufacturers of the Inductotherm furnace to ask their opinion on fitting a unit to treat the cooling water. They were advised to exercise caution as no other company had tried this form of water treatment on their equipment.

Sanbra Fyffe decided to install the system and monitor the results with calcium balance, chloride and total hardness tests. The System was installed to the main water feed and coils fitted to treat the water in the make-up and recirculating pipes.



Regular inspection, monitoring and tests were carried out over several months. These showed that not only had the technology prevented the build-up of scale in the recirculating system, but also removed existing scale which had formed in pipework despite the water softening equipment.

Management at Sanbra Fyffe have received a payback time of about 18 months and are extremely pleased with the results.

WASTE TREATMENT LINES TO SLURRY TANK

One of four plants owned by **Whelan Environmental Services**, the treatment plant in Aston, Birmingham handles around one million gallons of waste each week.

Waste is brought to the plant by the company's fleet of eighteen tankers from plastics and chemical companies and the metal industry. The waste is treated with acid and oxidizing/reducing agents. Metals are reduced to their lowest oxidation state so that they can be easily precipitated out of solution.

Lime powder is added from a silo through an auger and into a tank where it is mixed with water to form slurry. Until recently, Whelan Environmental used 140 tons a week of hydrated lime but when prices reached £54 a ton, the company switched to quick lime which not only cost £29 a ton less but also enabled the company to reduce its usage by a third.

However, using quick lime caused major maintenance problems in the system. Calcium carbonate formed in the lines necessitating system shutdown every two months for descaling.

Despite this, the lines gradually became more persistently blocked requiring them to be cleaned every two weeks and then eventually unblocked every few hours. When this situation was reached, the company had to switch back to hydrated lime.

In January 1996, after the system was completely cleaned, Whelan Environmental resumed its use of quick lime and ENiGMA was fitted on the slurry feed from the pumps to the tanks. Since then, there have been no problems with scale blockages.

The company anticipates a saving of £20,000 a year in maintenance and material costs and received a payback on the system in just three months.

"We are delighted with ENiGMA and are amazed at the savings we have made using the system", said Miles Freeman, Works Manager.

WASTE WATER TREATMENT PLATE HEAT EXCHANGER

Southern Water is celebrating finding a solution to the scaling up of its plate heat exchangers and condensers at its new state-of-the-art wastewater treatment works at Ford, West Sussex. The company has worked closely with **Environmental Treatment Concepts (ETC)** to resolve the problem by installing the **ENiGMA** Descaling System onto the drying system. This has resulted in a dramatic reduction in time spent cleaning the plates from 12 hours a day to just 6 hours every 2 to 3 months.

Opened in 1999, the Ford wastewater treatment works is part of **Southern Water's** Bognor Regis and Littlehampton wastewater scheme, which has been introduced to eliminate the daily release of waste into the sea. Part of a multi-billion pound environmental programme by Southern Water, the Ford site is one of six new treatment works built along the South Coast to meet EEC regulations.



The £53 million scheme enables wastewater from Littlehampton, Bognor Regis and the surrounding areas to be pumped through 16km of underground pipelines and to undergo a series of treatment processes before the cleaned wastewater is released back into the environment through a 3.3km outfall. The Ford plant treats up to 62 million litres of wastewater from more than 130,000 people every day.

The wastewater treatment process involves a number of procedures resulting in the production of a valuable, organic fertiliser.

When the wastewater arrives at the site it flows through 6mm screens to remove debris and then through a grit trap, known as a detritor, to remove grit and sand.

Following sand and grit removal the wastewater is piped into one of three settlements tanks, each holding 2,000 tonnes, where between 60 and 70 percent of the remaining solid waste is settled out. The settled wastewater then passes to aeration tanks where it is mixed with a biologically active sludge that starts a microbiological action to reduce organic pollutants remaining in the wastewater.

Once this process is completed, the solid material is removed from the bottom of the tank and transferred to the sludge-recycling centre. The first stage of the recycling process involves blending the different sludges to produce a homogenous mixture of water and solid material.

Polymers are added to thicken the mixture and this is fed into one of three large digester tanks where it remains for up to 14 days. During this time a temperature of 35°C is maintained in the digester, allowing bacteria within the waste to break down organic matter to water, carbon dioxide and methane gas.

The methane gas is stored on site in a gasholder. A proportion of the gas is used to provide the necessary heat to maintain the temperature of the digestion process with the remainder being used to heat the dryer.

The second stage of digestion cools the material and feeds it into a centrifuge dewatering plant, which separates the solid material from the water and creates a "cake". The "cake" is fed into a huge drying machine, which heats the *cake* to temperatures of 90°C.

This evaporates the remaining water to produce virtually odour-free, dry granules, which are then sold as fertiliser to customers for £10 per tonne. This is a major financial saving for Southern Water, which used to have to transport solids to landfill at a cost of £1,000 a tonne.

Prior to the *ENiGMA* being installed, the plate heat exchangers were producing high differential pressures every 24 hours that necessitated the plates having to be individually descaled with jet washing and wire brushing.

This procedure took 12 hours each and every day. The high levels of scale were due to the wastewater treatment centre being situated in a hard water area and also that the condensed water is a by-water product of the sewage inflow.

Following a site survey by an **ETC** engineer it was agreed that *ENiGMA* would be fitted onto the drying system to treat the make-up water and on the feed to the pipe taking the cooling water from the condensers to the heat exchanger.

"We were initially sceptical", says Mark Day, Process Scientist. ***"However, the system has now been installed for two months and instead of having to shutdown everyday for up to 12 hours we now just wash down the heat exchanger plates every couple of months which takes between 3 and 4 hours. In addition, we have seen a remarkable change in the condensers, which, during inspections, show that the scale is now soft and being removed from the sides."***

"The thermal drying is a critical section in the recycling system and one that we cannot afford to shutdown", concludes Mike Walker. ***"The ENiGMA is working way beyond our expectations and will in the long term save us costs on preventative maintenance, labour and downtime"***.

LAWNMOWER MANUFACTURER – WASH PLANT

Atco-Qualcast, manufacturers of the famous Qualcast, Atco and Suffolk Punch lawnmowers is now part of Robert Bosch GmbH. The company's site at Stowmarket, near Ipswich, covers an area of around 18 acres and employs a workforce of around 550 producing more than 600,000 units per annum.

The factory uses bore hole water with a high calcium and magnesium concentration of between 500 and 600 ppm, which rises to 800 ppm in summer when the water table drops.



Water is pumped to a Remal Wash Plant, comprising of five tanks that are used to treat and rinse components.



PFIZER PHARMACEUTICAL – SANDWICH WASTE WATER TREATMENT

The treatment plant of leading global pharmaceutical company **Pfizer**, at its UK site in Sandwich, Kent, handles 100 cubic metres of wastewater an hour, which is piped to the plant on a continuous flow from all the manufacturing plants throughout the site.

Processed water passes through the activated sludge biological digestion plant and is then disinfected to meet bathing quality water standards. The water is then discharged into the river in accordance with Environment Agency Consent Conditions.

The disinfecting process uses sodium hydroxide dosing to increase the wastewater's pH to above 10. This action causes the precipitation of calcium salts, which results in the severe scaling of the pipework and disinfecting tanks.

Remedial maintenance work, carried out to descale both the tanks and the pipework every two to three months, necessitated the use of both high pressure water jets and acid cleaning, using outside contractors and Pfizer employees. The annual cost of descaling pipework and tanks was calculated at between £30,000 and £40,000.

Every steel component used at the factory is treated in the plant using an iron phosphate pre-treatment and a rinse procedure, prior to powder coating.

The high levels of calcium carbonate present in the water caused the pipes, pressure sprays and mild steel tanks to quickly develop limescale build-up necessitating plant shut down every 2 to 3 months for manual and acid descaling.

This entailed manually descaling with a hammer and chisel followed by an acid treatment. Despite descaling, limescale quickly returned and within two months would become a thickness of 12mm causing increasing fuel costs, less efficient equipment and a higher usage of iron phosphate.

Atco-Qualcast looked for a permanent solution to the problem that would be more in keeping with the company's "green" policy.

Following descaling, **ENiGMA** was installed onto the incoming water feed and on to each of the 3 and 4-inch respective sections of the water and iron phosphate rinse tanks.



Looking for a solution, Pfizer wanted a product that would not only reduce costs but would also ensure its wastewater treatment plant did not need to be shut down for cleaning. Following a detailed site survey by an engineer, **ENiGMA** technology was installed onto an 8-inch line taking the processed water from the activated sludge biological digestion plant to the disinfecting tanks.

Since then, the scaling of the wastewater treatment system has decreased to a level where maintenance is now only carried out once or twice a year. Pfizer has seen a payback on the unit in less than three months.



Since the units were installed, there has been no build-up of scale in the pipes, pressure sprays and equipment. A light dusting of soft calcium is now easily removed with a hose. Costs have been saved on labour, downtime and energy.

currently looking at other possible locations where they can benefit from its use.

“I have found the ENiGMA technology to be very reliable and effective. It has given us an increase in overall plant performance and is backed by excellent service. The system costs a fraction of the price we would pay annually for cleaning. Also, as ENiGMA is a “fit and forget system” there is no maintenance required”, said Plant Manager, David Bell.

PULP & PAPER MILL SMELT TANK

A subsidiary of **REPAP Enterprises Inc**, REPAP in New Brunswick, Canada, has two sites daily producing 250 metric tons of bleached and unbleached softwood pulp, 1300 tons of lightweight coated printing papers and 350 tonnes of bleached and unbleached ground wood pulp. The two sites use approximately 21.5 million gallons of water per day which is pumped from the Miramichi River.

REPAP had experienced severe scaling problems inside the smelt tank and also on the recirculating line and mixing blades. The scaling had been treated by using hydro-blasting during plant shutdown periods. However, despite this the scale would coat the inside of the smelt tanks and there would be approximately 4 feet of sludge on the floor of the tank. In addition, the recirculation and extraction lines would block with scale and build-up on the mixing blades, causing premature wearing of the bearings, which resulted in the burning out of the motors.

Knowing *ENiGMA* technology had been successful in treating green liquor transfer lines in a number of pulp mills, it was decided to install the system onto the 8" recirculation lines approximately 2 feet from the entry point of the smelt tank. A unit was also installed onto the 6" green liquor transfer lines at approximately mid-point of the lines, which also included the weak wash line. The second unit was installed to eliminate scale in the green liquor lines and to treat the weak wash before entering the smelt tank.

After three months the smelt tank was opened for inspection. The tank walls contained little or no scale, the floor grates were visible and the mixing blades were scale free. The efficiency of the smelt tank and equipment is now greatly improved.

After discontinuing their hydro-blasting and inspections, REPAP has eliminated the downtime and associated capital costs. The payback period will be very brief when compared to the original treatment and replacement costs. REPAP has purchased the system and is