KEE
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THE SOLUTION TO WATER POLLUTION NEWSLETTER
INSIGHT

# KEE SUPPLY A FOG REMOVAL SYSTEM THAT IS GREASESHIELD

**AN AUTOMATIC GREASE REMOVAL SYSTEM** which removes FOG and food from commercial kitchen effluent, the system provides exceptionally high drainage protection by extracting and discharging the food solids and then the fat, oil and grease. This reduces the oil content in the discharge effluent significantly.

As a self-maintaining automatic separator, the unit stays clean and odour free and works without the need for staff involvement. The unique system works as follows:

**Stage 1 - Food Removal:** Food debris is automatically removed by a filter screen as effluent enters the GreaseShield. The solids are separated, liquid removed by an auger and discharged into a separate food collection container for disposal.

**Stage 2 - Oil Separation:** The majority of the oil is able to float to the top and create a layer, as effluent travels twice the length of the innovative system. A baffled wall on the outlet of the chamber contains the floating oil.

**Stage 3 - Oil Removal:** Inside the GreaseShield's separation chamber is a semi-submerged slowly rotating cylinder. Constructed in an oil-attracting but water repellent material the rotating cylinder becomes coated in oil. As it turns, this oil is scraped off by a rubber wiper blade and the oil runs into an external container.

**Stage 4 - Self Cleaning Wash Down**: The system runs a regular self-cleaning cycle so there is no cleaning for staff to do. To avoid standing water, the cycle includes an internal wash-down and activation of circulation pumps. This ensures that there are no odours.

The GreaseShield is a cost effective grease trap. Savings are achieved as there is no need for periodic pumping, enzymes, chemicals or any heating elements.

Importantly, the GreaseShield protects drains and public hygiene by efficiently removing Fats, Oil and Greases (FOG) whilst removing, dewatering and transferring solid contaminants for recycling.

Not only is it the only grease trap that magnetically treats the effluent to soften hard water and assist bio-remediation using nature's own solutions, but also the only self-cleaning grease trap. It significantly reduces BOD, COD and SS loadings. ❖

# KEE IMPROVES PERFORMANCE AND REDUCES $CO_2$ FOOTPRINT

**AS WITH ALL IRISH TOWNS, Mountmellick, County Laoise, has grown greatly over the past few years. Its existing wastewater treatment plant was designed and installed in the mid 1970s, with further works being added later, the last being a sludge dewatering plant installed and commissioned within the last few years.**

The original works consisted of a Wham Mechanical Screen followed by an Oxidation Ditch for biological treatment, two final settlement tanks and sludge dewatering works. The biological treatment of the wastewater was provided by use of an activated sludge process through a 'Race Track' shaped oxidation ditch. The main aeration equipment in use was a horizontal brush aeration system, as was the practice during the 1970s. At Mountmellick this consisted of four horizontal rotors, but the brush rotor aeration capacity was inadequate and was supplemented by Venturi Aerators. Consequently the plant was failing consent.

In addition to the problems associated with the failure of consent, current installed power for the aeration system at Mountmellick was too high and with the need to plan for expansion of the plant capacity from 5000PE to 7000PE, it was an opportunity to review the whole aeration system for process performance as well as power saving to reduce carbon footprint.

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After evaluation of the actual dissolved oxygen requirements, it was agreed that the plant upgrade should be carried out in two phases using KEE Process Triton® dual mode fine bubble aerator/mixer.

For the Phase 1 upgrade, it was necessary to bring the process performance of the plant to meet the required environmental discharge consent and reduce the overall carbon footprint. Phase 2 was to consider the plant capacity upgrade from 5000PE to 7000PE and reduce maintenance requirements.

To provide the projected AOR (actual oxygen requirement), eight 3.7kW Tritons® were required, in addition to the existing horizontal brush rotors which would need to be retained. This assumed that nitrification would be accepted as a future treatment objective, otherwise the Tritons on their own would be sufficient to provide all the projected DO and mixing for the 7000PE capacity.

Of all the aeration equipment on the market, Triton® aeration units are the easiest to install. There is no need to decommission existing works while installation is being carried out. The Tritons® fine bubble aerators are surface mounted and therefore the aeration tank or the oxidation ditch do not need to be decommissioned, emptied, refurbished, refilled and re-commissioned. Tritons® can be bridge-mounted, wall-mounted, float-mounted or guide rail-mounted for SBR configuration.

At the Mountmellick site a novel adaptation used a float mount option where the floats were anchored to a steel bridge across the ditch with 'H Frames' attached to the bridge. This gave the operators the option to have fluctuating water levels as the H frame pivoted the Triton® floats to the bridge. The existing DO probes were used to control the brush aerators through the variable speed drives.

Within 20 minutes of the Phase 1 installation being completed and the four Tritons® being commissioned, the mixed liquor DO concentration started to rise and it was evident that the units were re-suspending solids that had been settled out in the bottom of the ditch previously. Within two days of commissioning, the four Tritons® units were achieving 1-2mg/l DO constantly, with the existing brush rotors only coming on to assist at times of heavy load when the DO concentration started to drop.

Thus, compared with the situation before the Triton® installation, the plant performance has been regained and the capacity increased by 40% for little extra energy use. The carbon footprint can be further reduced if, as required by the consent for discharge, nitrification of the effluent was not pursued.

## AIRE-$O_2$ TRITON® UNITS

Triton® units offer a cost effective and efficient aeration and mixing of the effluent. As the aeration/mixing function is combined in a single processor and operate independent of each other, there is no longer the need for additional mixing equipment for process optimisation. Triton® is a 'fine bubble' aerator as per EPA guidelines and as it is capable of aerating and mixing contents of reactors up to 10m deep it is possible to improve on the oxygen transfer efficiencies by the strategic arrangement of Tritons® in deep basins. KEE has installed Triton® units on a number of sites throughout the UK and Ireland such as Keith WwTP, Aberfeldy WwTP, Taw Valley Creamery and Ulster Farm By-products Ltd with all sites now showing a marked improvement in treatment and carbon footprint.

The maintenance requirements for Tritons® are minimal with simple water-lubricated bearings requiring change every five years. The on-site bearing change takes about 30-40 minutes and does not require the plant operation to be disturbed during this minimal maintenance task. ❖

# OXYGEN AND MIXING TREATMENT IS GIVEN BY KEE DUAL PROCESS

**KEE PROCESS has been awarded** an ongoing Framework Contract by Severn Trent Water Ltd for supply of surface and subsurface aeration equipment.

KEE will be supplying its efficient dual mode processor which provides process oxygen and mixing for activated sludge basin, oxidation ditch or a pocket activated sludge system. The Triton enables process to be optimised for BOD removal, nitrification and denitrification as required. Denitrification is made possible as the Triton can provide mixing whilst the aeration is turned down, thereby enabling oxygen and ORP control.

KEE were awarded 93% score when assessed in the tender against other contenders when comparing lifetime cost, technical and commercial capabilities and KEE's H&S achievements. KEE is also a Framework Supplier of RBCs for Severn Trent Water Ltd. Under this contract KEE would supply new RBC Plants and all the remedial work required on existing Plants, throughout STW area. ❖

# KEE SUPPLY WASTEWATER TREATMENT SOLUTIONS TO NORTHERN IRELAND

**KEE HAS BEEN SUPPLYING RBC Treatment Plants to Northern Ireland Water for some years and has recently concluded the Western and Southern Division RBC Framework Contract.**

Under the Southern and Western Division RBC Framework Contract KEE supplied and built 24 Modular Treatment Plants for populations ranging from 300 to 3000 PE, with final effluent standards ranging from BOD-only removal through to full nitrification with ammoniacal nitrogen concentration of less than 3mg/l on a 95 percentile basis. In many instances the required final effluent suspended solids concentration is less than 10mg/l.

KEE is also process partner with BSG and WIS for the Integrated Wastewater Framework for the Southern Division. Under this Framework the partners provide solutions for larger wastewater treatment plants using the most appropriate technology for the application which includes activated sludge or RBC process. The partnership has also recently been awarded the Rural Wastewater Investment Programme Frame-work for NIW. Under this contract the partnership would provide packaged RBC plants to treat formula A flows for the first two hours and then an FFT of 3 x ADWF. KEE provides the process design, the plants and on-site comissioning into the partnership with the other partners providing screens, electrical, civil and other on-site related supply. ❖

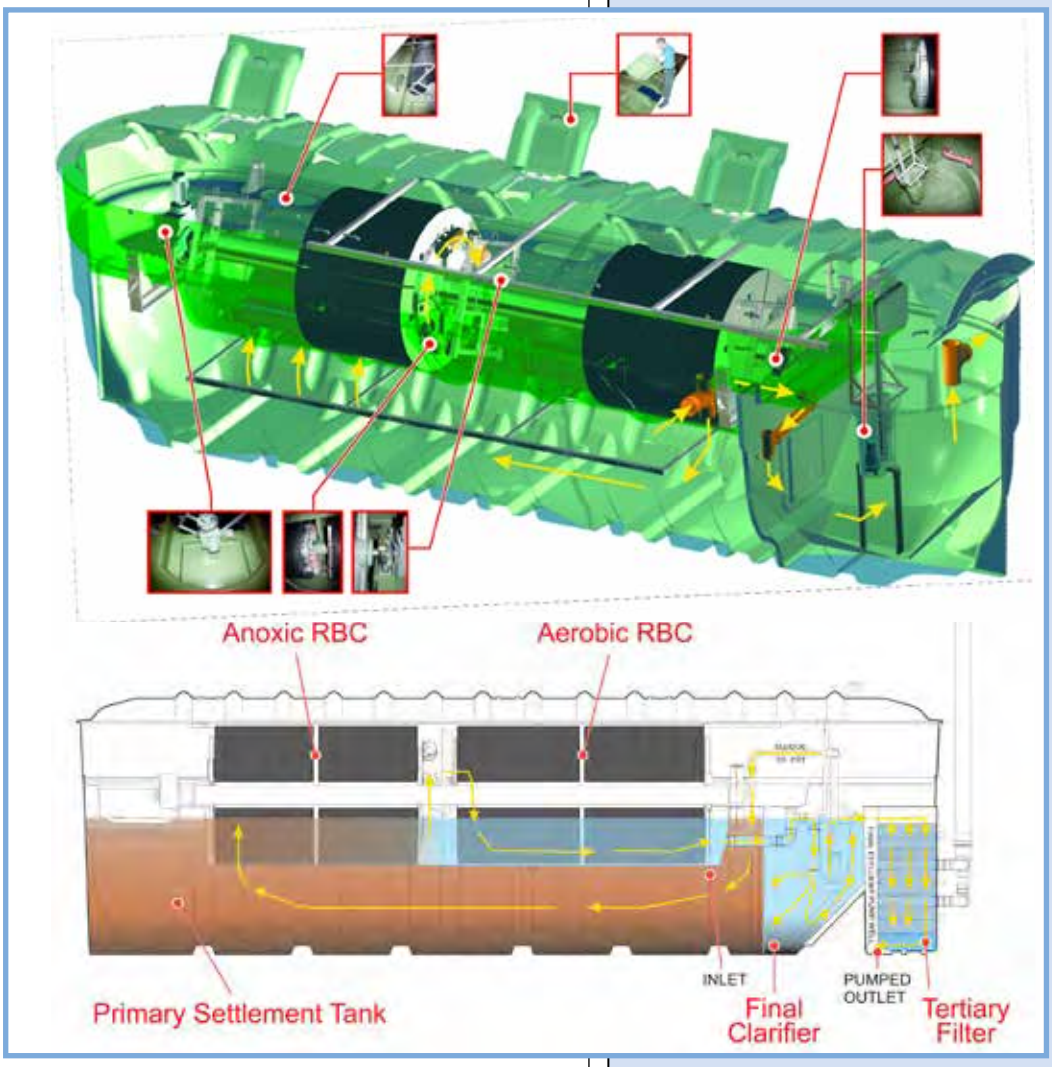
# THE VERSATILE PACKAGED TREATMENT SYSTEM

**KEE PROCESS HAS INTRODUCED** the NuDisc® Single Piece Packaged Plant and the NuDisc-R® – which are innovative and truly versatile systems for the effective treatment of wastewater, including nutrient removal. A new optional feature has been built into the NuDisc® Single Piece Packaged Plant to create the new KEE NuDisc-R® Packaged Plant System incorporating physical-biological tertiary treatment with water recycling.

The design of the KEE NuDisc® provides a structural GRP Tank and internal components designed for a life in excess of 30 years. It can be applied to achieve any one or a combination of requirements, including $BOD_5$ reduction, nitrification, total nitrogen reduction or phosphorous removal. It provides the assurance that wastewater is being properly handled and the risk of pollution in the local environment is minimised. KEE can provide a fixed price maintenance package to cover for all mechanical and electrical items and the labour costs after the initial warranty periods.

The KEE NuDisc® uses the well proven principle of attached growth RBCs, which support an active film (biomass) for biological treatment of the wastewater. The RBC stage is divided into two specific zones, the first acting as an anoxic reactor and the second as an aerobic reactor. The whole system, including the primary settlement tank, the RBC and the final settlement tank, are housed in a single GRP tank and arranged in such a way that flow attenuation becomes an integral part of every plant.

At the first stage of the treatment process, the wastewater enters the primary settlement tank. Here the solids are settled out and retained as sludge, which is drawn off periodically for disposal. The partially clarified liquor is then brought in contact with the anoxic stage of the RBC reactor where partial degradation of BOD and de-nitrification take place. The biomass in the anoxic stage also provides biological attenuation of organic pollutants, which are partially treated and degraded into much more readily treatable substrates for the aerobic RBC stage.




The downstream aerobic RBC stage is operated under plug flow conditions where BOD removal and nitrification take place. The KEE NuDisc® technology can be applied to different applications to achieve the desired final effluent quality. For instance, where phosphorous removal is required this is achieved by coagulating phosphorous out of the treated effluent at the end of the RBC stage.

The final clarifier is benched at the bottom to facilitate the consolidation of sludge which is then returned to the primary clarifier through the pump assisted hydrostatic sludge return system. In applications requiring de-nitrification, this is achieved by further treating the nitrified effluent in the anoxic zone of the treatment system.

## KEE NuDisc® - R
## Built-in Optional Tertiary Treatment

After using the KEE NuDisc there is the option of using the KEE NuDisc-R. The treated effluent from the final clarifier can be discharged to a watercourse or, as an option, this can be further treated to a much higher quality in a physical-biological tertiary stage.

This physical-biological filter includes media with extremely large surface area to volume ratio and is arranged in the unit to work as alternating aerobic and anoxic zones for the most effective breakdown of the residual organic constituents (hard BOD) of the treated wastewater from the first and second zone RBC process.

The tertiary filter stage is fitted with natural wind turbine or electric fan assisted aeration zones for creating the alternating aerobic-anoxic stages in the filter. The tertiary stage media structure is such that the effluent undergoes breakdown of the remaining soluble organic material and the fine solids contained in the wastewater. The fine organic solids are captured and retained in the media for breakdown. ❖

# KEE DESIGN AND BUILD LARGEST RBC PROCESS PLANT IN THE UK

**KEE Process, through Imtech Process Ltd, has supplied and built the largest RBC plant in the UK for Dwr Cymru Welsh Water (DCWW) at Crynant. This plant upgrade meets the tight effluent consent standards using a 'low carbon' process.**

DCWW's policy is to provide a sustainable strategy which responds to climate change, therefore a low carbon footprint solution comprising the largest rotating biological contactor (RBC) and reed bed installation in Wales has been installed.

The Crynant WwTW, designed to treat municipal wastewater from 5680 PE, is sized for full treatment for the first 90 l/s of all the flows arriving at the works. The final effluent has to meet new discharge consent (10mg/l BOD, 15 mg/l SS and 5 mg/l AmmN).

## Considerations for process selection

With the revised consent requiring full nitrification, DCWW had to choose an appropriate process which delivered least capital and lifetime costs, lower headloss without use of intermediate pumping stations and provided a solution with a low carbon footprint. The processes considered were trickling filter, activated sludge and RBCs. The site at Crynant has poor ground conditions for construction and therefore the process selected needed the least site construction.

Trickling Filter was ruled out as the capital cost was high and required an intermediate pumping station to overcome the restricted headloss on site. The activated sludge process was ruled out due to high levels of infiltration leading to diluted influent wastewater and resultant sludge settleability problems in the final settlement tank.

RBCs were, therefore, the preferred process solution for carbonaceous BOD removal and nitrification, followed by tertiary treatment. RBCs require minimal headloss and this avoids the need for an intermediate pumping station. Coupled with this, the lower motor ratings for the drive result in a favourable carbon footprint for the RBC process compared with an activated sludge process.

It was also possible to redeploy existing tankage on site to act as primary settlement tanks and, with the use of tertiary filters, it was only necessary to build one final settlement tank. The tertiary treatment was through a twin reed bed system with lower construction and operating costs.

KEE Process supplied six 4.5m diameter RBCs to act as the biological stage and these were arranged to operate in parallel. The managed flow technology built into all RBCs enables the flow to the biological stage to be divided as desired without the need to build any complicated hydraulic features and the managed flow also enables process optimisation and provides process stability.

The plant was commissioned in January 2008 and has consistently met the discharge consent, even before the tertiary treatment stage. The carbon footprint of the RBC process is 12% lower than that of an activated sludge process and this carbon footprint includes factors such as electricity consumption, sludge treatment, sludge transport and sludge disposal. ❖