

# CASE HISTORY

## CLIFF QUAY

End User	Anglian Water
Process	Nitrification in the AMTREAT™ reactor
Application	Removal of ammonia from Sludge Treatment Liquors



### Introduction

ACWA was awarded this turnkey contract, including civil works from Anglian Water Services to treat the centrate liquors from a sludge treatment centre prior to discharge to the head of the wastewater treatment works.

The WwTW was designed as a non-nitrifying plant, with ammonia discharge consent of 50 mg/l. However, return of liquors from the sludge treatment centre resulted in regular failures of the WwTW final discharge consent. The aim of the sludge liquor treatment plant was to reduce the concentration of ammonia to a level that would not impact on the final discharge consent of the WwTW.

ACWA used the AMTREAT™ Process, for which ACWA has the registered design. The Amtreat™ system is a purpose-designed high rate activated sludge process that can be specifically used for treating high-strength ammonia wastewaters. By careful control of key design parameters, high ammonia removal efficiencies can be achieved at high loading rates.

The advantages of such a process is that the technology and equipment used is familiar, easy to operate and control, has a smaller footprint compared to conventional activated sludge processes, full nitrification/denitrification is achievable, and as temperature is maintained at a constant 25°C, there is no seasonal dependency.

Typical ammoniacal nitrogen removal rates are in excess of 96%. This project included the design, construction (including civils) and commissioning of an AMTREAT™ plant.

## Design Information

The following table indicates the Influent quality, the clients requirements and the actual final effluent quality achieved from this AMTREAT™ plant.

Description	Influent Characteristics Average	Effluent Quality Requirements	Average Effluent Quality Achieved (95%ile)
Flow m <sup>3</sup> /day	300		300
Suspended Solids mg/l	750	500 (95%ile)	150
BOD mg/l	800	500 (95%ile)	250
COD mg/l	1800		500
Ammoniacal Nitrogen mg/l	1200	50 (absolute)	15
Phosphorus	-	-	-
Alkalinity (as CaCO <sub>3</sub> ) mg/l	1200 (min)	-	-
pH	6.5 – 8.0	-	7.0 – 8.0-
Temperature °C	15	-	20 - 25

## Plant Description

The centrate liquors gravitate from the sludge treatment centre to a liquor collection sump, from where submersible duty/standby pumps transfer the liquors to a balancing tank. The balancing tank, equipped with a mixer to keep solids in suspension, provides 18 hours storage that allows for balancing of peak flows and loads. Duty/standby progressive cavity pumps transfer the liquors, via a heat exchange system, to the AMTREAT™ reactor.

The liquors from the balance tank pass through a shell and tube heat exchanger that raises the temperature of the influent to the operating temperature of 25°C. The raw centrate liquors are monitored for flow, temperature and ammonia. In addition return activated sludge (RAS) is returned prior to the heat exchangers, where it mixes with the raw liquors before passing through the heat exchange system. This ensures that both the raw centrate liquors and RAS are at the optimum operating temperature before entering the AMTREAT™ reactor. The hot water for the heat exchangers is supplied from the existing digester heating system, and controlled by temperature monitors installed in the AMTREAT™ reactor.

The heated liquors and RAS mixture enters the AMTREAT™ reactor. Sodium hydroxide is added to the reactor to maintain the alkalinity levels, in order that full nitrification can take place. The reactor is equipped with a fine bubble diffused air system, dissolved oxygen, pH and temperature monitors. The pH monitors control addition of supplemental alkalinity. The temperature of the reactor is continuously monitored and controls the heating system. Three blowers operating duty/duty assist/standby supply air to the reactor. The duty and standby blowers are fixed speed. The duty assist blower is variable speed, and is controlled by the dissolved oxygen requirement, as monitored by the dissolved oxygen meters within the reactor.

The mixed liquors from the AMTREAT™ reactor gravitate, via a degassing pipe to remove entrained gas, to the settlement tank. Within the settlement tank, the biomass settles to the bottom from where it is transferred to the collection cone by a fixed bridge scraper. Duty/standby transfer pumps return the biomass, via the heat exchangers, to the reactor. Surplus biomass is transferred to storage tanks from where it is sent for further treatment. The clarified liquor overflows a peripheral weir and gravitates to the treated liquor collection sump. Duty/standby submersible pumps transfer the treated liquors to the discharge point. The treated liquors are monitored for flow and ammonia.

Alkalinity is maintained in the reactor by the addition of sodium hydroxide. pH monitors in the reactor control the addition rate. Duty/standby variable speed dosing pumps transfer the chemical from dedicated storage tanks to the reactor.