

Dunore Point WTW

extensive improvements including two-stage ozonation

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Dunore Point water treatment works, situated in the north east corner of Lough Neagh which, in turn with the Silent Valley reservoirs, services the Greater Belfast area and parts of Antrim and Templepatrick, is now the largest in Ireland. Abstracting water from Lough Neagh, all treatment is conducted on site prior to pumping to Belfast some eleven miles away. This phase, which will add two stage ozonation to the works, is only part of the extensive improvements which will see increased efficiencies and ensure that compliance with the European Community Directive for Drinking Water is maintained.



Rear view of plant from left to right: liquid oxygen compound, main plant building, 2nd stage contact tanks with first stage contact tanks to rear (courtesy Water Service)

Treatment process

First stage in the existing treatment process is a pre-chlorination dose of 1 mg/l to stun algae that are prolific under certain climatic conditions. The algae along with coarse elements of dirt are removed in 30 roughing filters at a maximum flow rate of 5m³/m².

From these filters the water is evenly distributed across 28 slow sand filters, each of 2100m² in area. After filtering, the primary treated water flows through these filters at a maximum rate of 0.137m³/m² with the potable water achieving the required standards as noted in Directive 80/778/EEC due to the inherent biological and physical processes. Final treatment is a post-chlorination dose of 3 mg/l to maintain water quality throughout the trunk main to Belfast.

Ozonation is being introduced into the treatment process primarily for reduction in the Trihalomethane (THM) forming potential of the final distribution water in the supply network. Ozonation was found to be effective in this respect following extensive pilot plant

studies at the works. Other benefits by introducing ozone in the process were found in the pilot studies, namely algal removal by the roughing filters is significantly improved leading to a reduction in algae loading on the slow sand filters, with longer filter runs expected. Also colour removal is significantly improved.

The following items are being introduced into the process as part of the ozonation contract.

- * raw water screening to remove unwanted material that may have a detrimental effect on the dosing system;
- * first stage ozonation prior to the roughing filters to inactivate algae. This will replace the pre-chlorination dose;
- * interstage pumps required to overcome additional headloss through the works caused by the introduction of the new second stage ozonation contact tanks;
- * second stage ozonation to further reduce particulate material in the water;
- * bypass facilities around both first stage and second stage contact tanks.

This is the first use of ozone within any of the main treatment works operated by Water Service and if the expected benefits come to fruition then it may be extended to other works.

Design

Outline design of the plant was undertaken in-house by Water Service Design Group with the tender let on the basis of whole life costs. Successful tenderer *T.T.O Ltd* in partnership with *Williams Industrial Services*, was then required to produce the outline civil design. This was developed, again in-house, by *Water Service Design Group* and the civil contract subsequently tendered and let to *John Graham (Dromore) Ltd*.

Installation

Three *Atkins Fulford* raw water in-line pressure screens (screen size of 5mm) have been added to the twin 800mm diameter pumping mains supplying raw water to the works from Lough Neagh. The screens have an automatic flushing sequence based on time and/or pressure differential. The control system ensures that only one screen at any time will flush, with flushing designed to take place on-line, ensuring there is no interruption to water flow to the works. The waste material drains to a collection basket for removal.

Screened raw water feeds the new first stage ozone contact tanks where flow is split into three streams to cover flow rates down to 23 Ml/day. Each stream consists of parallel 400mm and 600mm diameter *Statiflo* static mixers, selected to efficiently cover the required flow range, with a fixed ozone dose of 2.0 mg/l dosed at the inlet to the static mixers. A minimum 4-minute contact time is achieved in the associated sealed reinforced concrete contact tanks.

Water then flows by gravity through the existing 30 roughing filters and into a new interstage pump sump, required to overcome the additional headloss of the second stage contacts in the process. Water is lifted into the second stage contact tanks by four variable speed and two fixed speed *Flowserve* mixed flow pumps with an operating head of approximately 3.1m.

Again, the sealed reinforced concrete second stage tanks sees flow split into three streams, each giving a minimum 8-minute contact time with a variable ozone dose of 1.5 - 2.5mg/l. Ozone dosing is achieved through porous plate diffusers situated in the bottom of each contact tank.

A bypass has been included around both the first and second stage contact tanks. This was included, not only for operational purposes, but also to speed up the construction process.

The ozone is produced from oxygen by three *T.T.O* ozone generators running duty/duty/standby. Free air in the contact tanks is evacuated through duty/standby *T.T.O* destructors to ensure zero ozone gas is put into atmosphere. Oxygen feed gas is produced on site by a *Praxair* vacuum swing adsorption plant (VPSA) sized to supply full requirement of required oxygen gas to feed the ozone plant. This is backed up by a liquid oxygen tank as added security.

At the heart of the control system for the new plant is a networked Allen-Bradley PLC system that allows the plant to run in fully automatic operation. This, in conjunction with the works SCADA system by *Wizcon*, allows the operator to choose set points, mode of operation, handle alarms and monitor other process variables and fully integrates the new plant within the existing treatment process.

The M & E plant has been housed in a new plant building constructed as part of the civil contract to exacting standards, with both the operators and the surrounding environment in mind. Features include



VPSA plant oxygen compressor (courtesy Water Service)



High level view of ozone generator room (courtesy Water Service)



Main VPSA skid (courtesy Water Service)



Duty/standby catalytic ozone destructors (courtesy Water Service)

noise reduction techniques, combined heating and ventilation system to minimise energy usage and gas monitoring and alarm system to ensure a safe working environment.

Construction work commenced February 2001 and, following extensive testing and training, will be fully operational by Summer 2002. ■

Note: The author of this paper, Bob Rowntree is Project Engineer with Water Service (An Agency within the Department of Regional Development) Northern Ireland.