Building on these successes, a Decision Support System (DSS) has been installed at the new Fisantekraal WWTW where it is being used to optimise the control of biological reactors for nutrient removal in a conventional University of Cape Town (UCT) process to treat waste water. A DSS consists of proprietry software running on a separate computer installed in the WWTW control room alongside the plant SCADA and is linked to the bioreactor Programmable Logic Controllers (PLCs) as well as online analytical instrumentation via the plant-wide fibre optic network in order to retrieve data from the process and provide decision support to the plant operator.

Essentially the DSS is an ‘expert system’ that runs a computational model of the biological reactor and various biological and chemical processes. By way of statistical analysis and model prediction, it provides the human operator with information and guidance as to the optimal control settings for the reactor. Although possible, the DSS is currently only acting in a guiding role and not yet directly influencing the control loops in the reactors.

The Fisantekraal WWTW makes use of a Modified University of Cape Town Process (MUCT) and incorporates the technology of the 3-Stage Phoredox Process. This process is capable of both nitrogen and phosphorus removal. Furthermore a facility for dosing Ferric Chloride has also been provided for assistance with phosphate removal if and when required. Traditionally, regular manual laboratory analysis informs the operator as to the state of his process and minor adjustments are made to flow and aeration control in order to achieve optimal operation and affect Ferric dosing when needed. This process does not necessarily take daily flows and temperature variations into consideration and it is therefore possible for the reactor to operate ‘out of spec’ from time to time before corrections can be made. In order to improve on this task, a DSS uses advanced online analytical instrumentation to provide online analysis. Since the plant was designed with a Fieldbus system and the basic flow metering and Dissolved Oxygen (DO) metering in place, the addition of online Ammonia, Nitrate, Phosphate, pH and Redox analysers was a relatively simple task. The electrical power consumption of the bioreactor surface aerators is also taken into account in the predictive model and decision support. The DSS therefore operates on a Dashboard basis assisting in the analysis of online data in making control and policy decisions. The Dashboard translates the various online measurements into valuable and accessible information. The Key Performance Indicators of the WWTW are presented in a graphically attractive online local and web-based environment, which can be accessed by operators and remote supporting staff alike. How does it work? The Dashboard retrieves relevant process data stored in, for example a process historian. This data is aggregated and processed in order to obtain data relevant to the decision making process of the operators.

**Advanced decision support system for waste water treatment works**

By A Schroder, Royal HaskoningDHV

The Nereda wastewater treatment process, implemented at South Africa’s Gansbaai waste water treatment works (WWTW), is utilising an Aquasuite solution (ie the Nereda Controller) - with another similar installation in progress at Nereda WWTW at Wemmershoek near Franschhoek.

International consulting engineering firm and water treatment specialists Royal HaskoningDHV have achieved a first in Africa with the installation of an Expert System from the firm’s Aquasuite basket of water and waste water treatment products at the new Fisantekraal wastewater treatment works outside Cape Town, South Africa.

DSS indicating black dots in optimal band (ie the reactor is running optimally).

DSS Online analytical instrumentation installation on the bioreactor.
This includes aggregated data but also derived parameters such as efficiency. The resulting values are then compared with standards or user-set threshold values in web based displays that are quick and easy to evaluate.

**Conclusion**

The main benefits, therefore, include:

- Operators are able to assess the operational state of the plant at a glance.
- Vast amounts of data are summarised and presented in real-time.
- Different WWTW of the same municipality can easily be compared in a uniform environment via the Web interface.
- Dashboard offers support in complex decisions with many variables, which leads to a better performance while saving money.
- The Dashboards can be made available to the entire waste water treatment department, assuring that non-operational staff can get a quick view of the plant’s performance as well.
- The complete system is also monitored remotely by the suppliers from the Netherlands via a secure internet connection, and the purchase agreement includes one year’s remote support and optimisation of the model.