# Iceberg analysis of trade waste

## An operator's experience

Identifying the source of trade waste going through Palmerston North's wastewater treatment plant has helped minimise its impact and saved clean-up costs – as wastewater treatment technician **Elysia Butler** explains.

Palmerston North is our country's seventh largest city with a population base of approximately 84,000 people. It is the second largest inland city, which limits viable discharge options for the treated wastewater. For this reason, the Palmerston North City Council wastewater treatment plant discharges its treated effluent into the nearest water course, which is the Manawatu River.

Currently the plant is receiving an average loading rate of approximately 7900kg BOD/day (biochemical oxygen demand) which is equivalent to a population of 113,414 people. Thirty percent of the plant's loading comes from industrial trade wastes. The average dry weather flow through the plant is 25,000m$^3$/day. These flows can exceed 160,000m$^3$/day during high rainfall events.

Our Trade Waste officer is based at the treatment plant and has a close working relationship with the operators as well as the environmental health team and industries. The major industries that discharge into our plant are: dairy and food industries, commercial laundries, electro and metal plating industries, pharmaceutical industries and tertiary institutes.

Illegal dumpings and industrial discharges that weren't complying with the constraints set out in the Trade Waste bylaws were having a huge impact on the plant. High amounts of fats, oils and grease were passing through the primary sedimentation tanks into our aerated lagoons and then onto our disinfection system and fouling up lamps.

Operators were spending an increased amount of time unblocking pumps and pipes, cleaning lamps and clearing blockages. Increased BOD and solids loading were making effective treatment difficult and increased phosphorous levels were increasing the amount of aluminium sulphate needed to get the DRP (dissolved reactive phosphorus) down to consent level, which was costly. All of these factors were becoming increasingly frustrating.

### FINDING A FIX

In order to fix the problem, we first needed a way to identify where the waste was coming from, which industry it was coming from and more precisely, which company. We also needed a way of proving this. That's where the s::can instrument and Iceberg analysis come into play. Following consultations it was decided to purchase a s::can unit to help us understand the constituents that were making up our influent and to help us combat the Trade Waste discharges as well as the illegal discharges.

A s::can is an online monitoring instrument that uses UV spectrum analyses to analyse characteristics in wasterwater. (Figure 1)

Iceberg analysis is a sophisticated software package that was designed to identify anomalies in wastewater. It can be used to get a full understanding of the plant's incoming influent. Iceberg analysis uses UV/Visible spectrum data obtained from the s::can instrument to break down and analyse any spectral changes in the characteristics of wastewater. It detects the change in composition by looking at the anomaly spectrum

Figure 1: S::can unit.

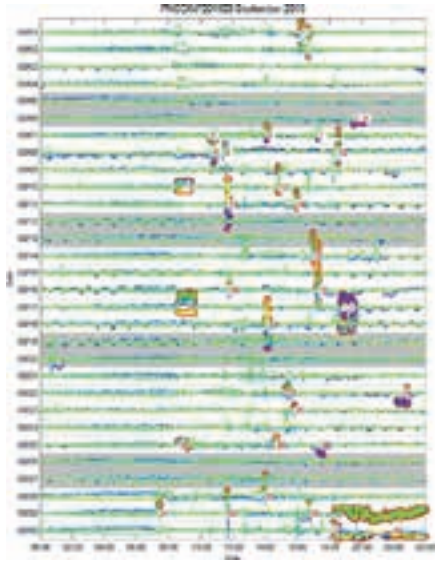

Figure 2: Iceberg analysis for September 2015.

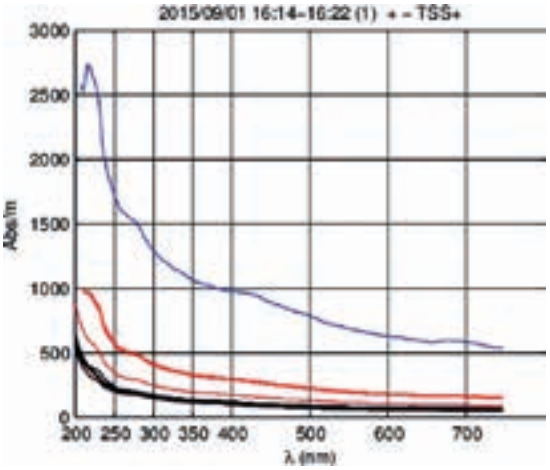


Figure 3: Event fingerprint.

and comparing it against the background.

(Figure 2) shows an example of Iceberg analysis for the month of September 2015. The date is along the y axis with the time along the x axis. Each line represents a full day's worth of data. You can see changes, or 'blips' in the horizontal lines. These blips are anomalies that have been detected and are known as events. These events trigger an alarm and a fingerprint of the event is taken that can be further expanded and analysed.

(Figure 3) shows an example of an event fingerprint. The background absorption, which is the black line, is compared to the event absorption, which is the red line and the compositional change or difference in absorption is calculated and displayed, this is the blue line. Please note, that the compositional change is displayed using a different scale. The y axis represents the absorbance and the x axis represents the wavelength. Different constituents absorb UV/Vis at different wavelengths. From this information, the constituents in the waste can be identified.

(Figure 4) shows the Iceberg analysis and fingerprint typical of dairy waste.

(Figure 5) shows the Iceberg analysis and fingerprint typical of laundry waste.

Five years ago, the s::can instrument was inserted into the head of the plant before preliminary screening had taken place. This position proved to be problematic due to rag and heavy gross solids getting caught on the instrument and interfering with analysis. For this reason the s::can unit was moved and re-positioned post screening, in the inlet channel to the pre-aeration tank. The unit still remains in this location to date.

We needed to begin by building a profile of all the known types of industrial wastes that we were receiving. This would also help us determine our baseline and trigger points for events. All Trade Waste discharges are sampled on a monthly basis. We collected these samples and put them through the s::can for analysis, creating a 'fingerprint'.

The s::can then gives you a fingerprint ID and these fingerprint IDs are then emailed through to DCM Process Control, along with the date, time and company tested. Using its advanced Iceberg analysis program, DCM can then extract the data collected and calculate the constituents in the samples.

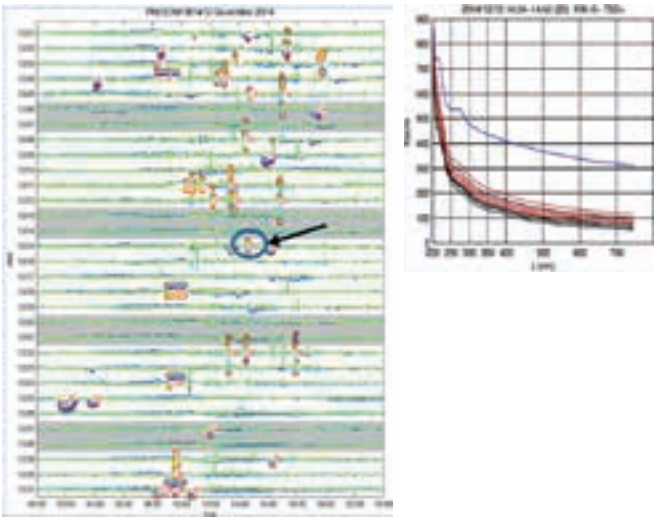

Figure 4: Fingerprint and Iceberg analysis typical of dairy waste.

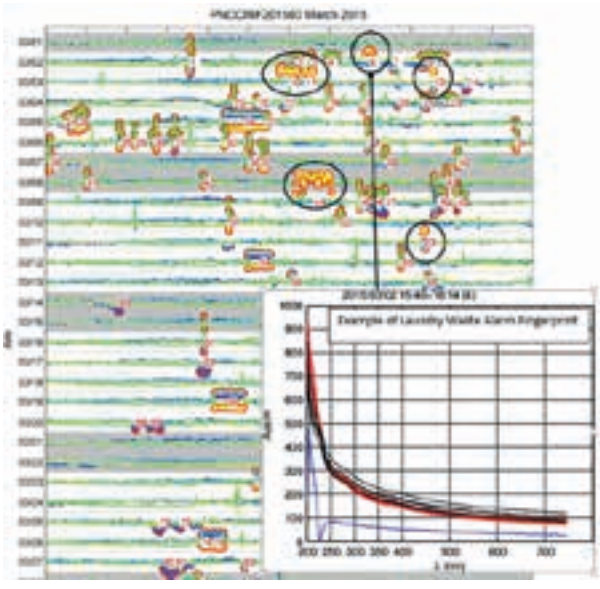

Figure 5: Fingerprint and Iceberg analysis typical of laundry waste.

Figure 6: Waste hydrocarbon.

Once enough data had been collected to build a picture, we were able to identify specific companies that were having difficulties in complying with their Trade Waste consents. Our Trade Waste officer had enough information to enter into discussions with the non-complying industries and help them understand their own trade waste and the impact it was having on our plant.

From the profiles built using Iceberg analysis, our Trade Waste officer could educate the industries, not only on what they were discharging, but also on how they were losing product down the drain unnecessarily. As a result of this, one industry installed a DAF (Dissolved Air Flotation) unit to improve its Trade Waste. This had a significant beneficial impact on our plant.

The high volumes of fats, oils and grease received on a regular basis ceased, and operators noticed a huge reduction in the amount of blockages we were having to clear. The DAF waste from this industry is now tankered to site and fed into our industrial digester and has proven to be a beneficial food source as well as increasing the gas production.

## DETECTING ILLEGAL DISCHARGES

The s::can and Iceberg analysis has also proven to be a useful diagnostic tool when investigating illegal discharges. In March 2016, a huge illegal discharge of waste hydrocarbon flooded through the plant (Figure 6).

To make matters worse, it happened on the weekend and I was the sole operator working. The hydrocarbons were mostly contained within the primary sedimentation tanks. Clean up took three full days and was by way of three liquid waste disposal trucks and operator labour. A total of 40 truckloads were required to remove the majority of the hydrocarbon waste from site. This, as you can imagine, led to a substantial clean up bill.

We were able to utilise our s::can and using the fingerprint method, we could prove that the company we suspected responsible for the incident, indeed was. A sample of hydrocarbon waste had been collected from our sedimentation tanks before clean up commenced. A second sample was collected from the company we suspected was responsible for the illegal discharge.

One at a time, both samples were put through our on-site s::can instrument and fingerprint IDs created. After interpreting the data using Iceberg analysis as well as other lab results, it was verified that the results were almost identical and from the same source. The company responsible was adamant it was not them but when presented with this scientific evidence, they accepted some responsibility.

That company was successfully held accountable. It has paid compensation to the PNCC and we were able to convince them to improve their networks and practices so that this will not happen again in the future.

## SUMMARY

In conclusion, Iceberg analysis has helped us to get a clearer picture of our plant's influent. We can see the impact industrial Trade Wastes are having, we have a good idea where these wastes are coming from and when they are being received at our plant. It has allowed us to work together with industries in a healthier way, which in turn benefits all parties. Investing in this technology has helped us understand, monitor and improve the treatment of the wastewater received at the plant. **WNZ**

At the recent Water Industry Operations Group of New Zealand Conference held in Auckland, Elysia Butler won an award for best technical paper for her work on trade waste analysis. Her prize was to travel to the Australian WIOA conference in Victoria to present the same paper.

• I would like to acknowledge staff from DCM, our trade waste officer Mike Sahayam, my manager Mike Monaghan and my teammates at the Palmerston North Wastewater plant.