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ICEBERG ANALYSIS OF INDUSTRIAL WASTE – AN OPERTAOR'S EXPERIENCE

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ICEBERG ANALYSIS OF INDUSTRIAL WASTE – AN OPERTAOR'S EXPERIENCE

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ABSTRACT

The Palmerston North City Council Wastewater Treatment Plant was having problems with non-compliant Industrial wastes being received at the plant. Something needed to be done to combat this problem.

An S::CAN unit was purchased and using iceberg analysis the process of identifying the constituents in the wastewater began.

This technology has proven to be successful in identifying industries having difficulties complying with their consent conditions. It has helped staff understand the influent being received as well as identify illegal discharges received at the plant.

1.0 INTRODUCTION

Palmerston North is the 7th largest city in New Zealand with a population base of approximately 84,000 people. It is also the 2nd largest inland city, which limits viable discharge options for the treated wastewater. For this reason the PNCC WWTP discharges their treated effluent into the nearest water course, the Manawatu River.

The original Treatment Plant was built back in 1968 for a projected population base of 75,000 People with a designed loading rate of 5,250kg BOD/day. Treatment consisted of screening, followed by primary setting before discharge into the Manawatu River. Treatment also consisted of two anaerobic digesters which were used to further treat the primary sludge.

Currently the Plant is receiving an average loading rate of approximately 7,900Kg BOD/day, which is equivalent to a population of 113,414 people. 30% of the plants loading comes from industrial Trade Waste. 25,000m^3/day is the average dry weather flow through the plant, these flows can exceed 160,000+ m^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, Tertiary Institutes.

Illegal dumplings' 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 plant and fouling up lamps. We operators were spending more time 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 down to consent level, which was costly. All of these factors were becoming increasing frustrating.

2.0 DISCUSSION

But how do we fix the problem? 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 ice-berg analysis come into play. Following consultations it was decided to purchase an 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.

2.1 S::CAN

What is S::CAN? A S::CAN is an online monitoring instrument that uses UV spectrum analyses to analyse characteristics in wastewater.

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Figure 1: ***S::CAN unit***

2.2 Iceberg Analysis

What is Iceberg Analysis? 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 plants incoming influent. Ice berg analysis uses UV/Visible spectrum data obtained from the S::Can instrument to breakdown and analyse any spectral changes in the characteristics of waste water. It detects the change in composition by looking at the anomaly spectrum and comparing it against the background.

Figure 2 is 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 one full day 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.

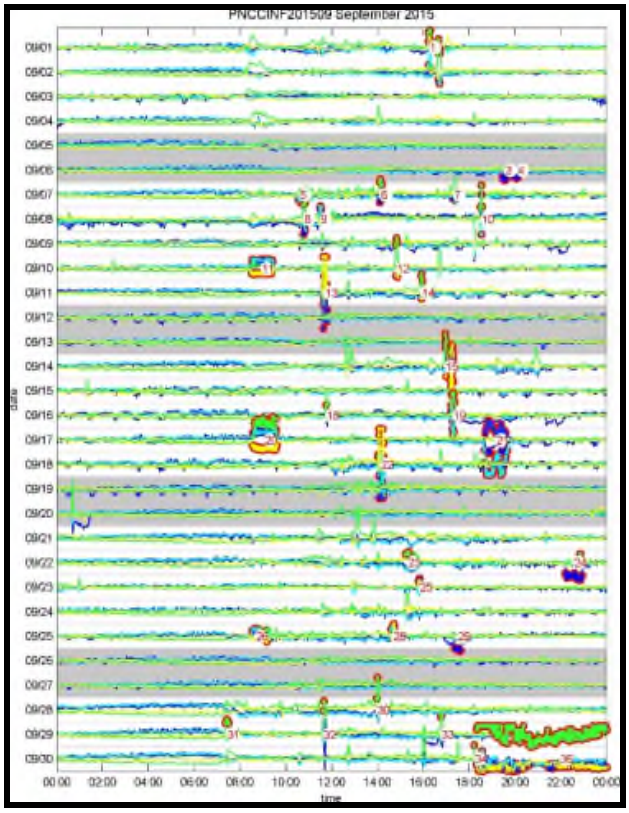

Figure 2: ***Iceberg analysis***

2.3 Event Fingerprint

Figure 3 is 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 wave length. Different constituents absorb UV/Vis at different wave lengths. From this information the constituents in the waste can be identified.

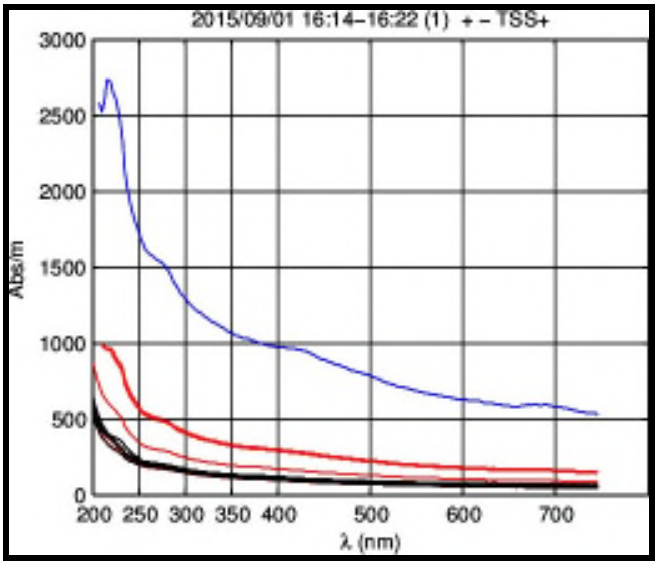

Figure 3: ***Event fingerprint***

2.4 Building profiles / fingerprint data

5 years ago an S::CAN instrument was purchased and installed at the plant. 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 base line 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 'finger print'.

These fingerprint ID's are then emailed through to DCM, along with the date, time and company tested. Using their advanced Iceberg analysis program, DCM can then extract the data collected and calculate the constituents in the samples.

2.5 Results from Fingerprints

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 impacts 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 unit to improve their 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 having to be cleared. The DAF waste from this industry is now tankered to site and fed into our industrial digester which has proven to be a beneficial food source as well as increasing the gas production.

2.6 Summary Reports

As well as monthly iceberg reports, Bi Annual and Annual summary reports can also be provided. Figure 4 shows an annual summary graph depicting the monthly variations between industries and cleaning in 2014 and 2015. These graphs are particularly good when comparing seasonal variations. In general you can see a significant reduction in events across all industries since May 15. This is because we understood more about our Trade waste influent and industries started making improvements.

Figure 4: ***Event fingerprint***

2.7 Illegal Discharge

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. 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. You can imagine all the negative impacts that this had on the plant. Clean up took three full days and was by way of 3 liquid waste disposal trucks and operator labour. A total of 40 truckloads were required to remove the majority of the hydrocarbon waste from site which led to a substantial clean-up bill.

Figure 5: ***Illegal hydrocarbon discharge in sedimentation tank***

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 ID's were 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.

The company responsible was successfully held accountable. They have paid compensation to the PNCC and we were able to convince them to improve their networks and practices. The company has since invested a significant amount of money into improving their systems so that this will not happen again in the future

2.8 Monitoring

Between 24 December and 14 January 2016, temporary monitoring was undertaken to evaluate the performance of our Plants Primary Settling System. A temporary S::CAN monitoring station was installed at the outlet of the Primary Sedimentation tanks.

This allowed for the comparison of data including, but not limited to COD and particle size between the temporary unit and the permanent S::CAN unit already in place. The outcome of the monitoring showed that the Primary Sedimentation tanks are currently operating efficiently. This project is still on going and results from this trial will enable us to make informed decisions regarding treatment and upgrades.

3.0 CONCLUSION

In conclusion, Iceberg analysis has helped us to get a clearer picture of our plants 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. Moving forward, we are currently looking into purchasing an Auto Sampler to work alongside the S::CAN, so that when an event is triggered, the auto sample will collect a physical sample for further analysis.

Investing in this technology has helped us understand, monitor and improve the treatment of the wastewater received at the plant.

4.0 ACKNOWLEDGEMENTS

I would like to Acknowledge Staff from DCM, our Trade Waste Officer Mike Sahayam, my Manager Mike Monaghan and my teammates at Palmerston North Wastewater plant.