

2020  
PAPERWEEK  
CANADA



Feb. 3-6 Feb. 2020  
Fairmont Queen Elizabeth Hotel  
Montreal, Canada

*Utilizing predictive BOD via the peCOD method for  
Nutrient Optimization in Wastewater Treatment*

*Robert V. Menegotto  
President and CEO*

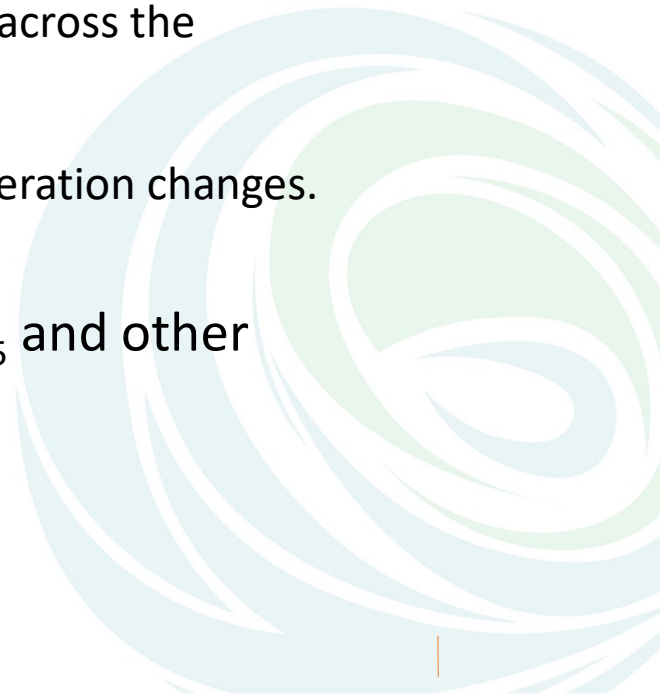


# Problems With Effluent Management

- Reliance on 5 day test (BOD<sub>5</sub>) for effluent quality control
- BOD<sub>5</sub> is a permitted effluent quality parameter but hard to predict
- Nutrient application and aeration is typically either “set & forget” or managed reactively
- Direction of effluent flows in upset conditions needs quick data

# What Would Really Help?

- NEAR-REAL TIME BOD<sub>5</sub> RESULTS!
  - Would give warning of severity of process upsets and data could be used to direct flows
  - Would give near instant estimate of effluent quality across the treatment system
  - Would allow for day-to-day nutrient application or aeration changes.
- Need to find a strong correlation between BOD<sub>5</sub> and other effluent parameters.
  - Chemical Oxygen Demand typically correlates well.



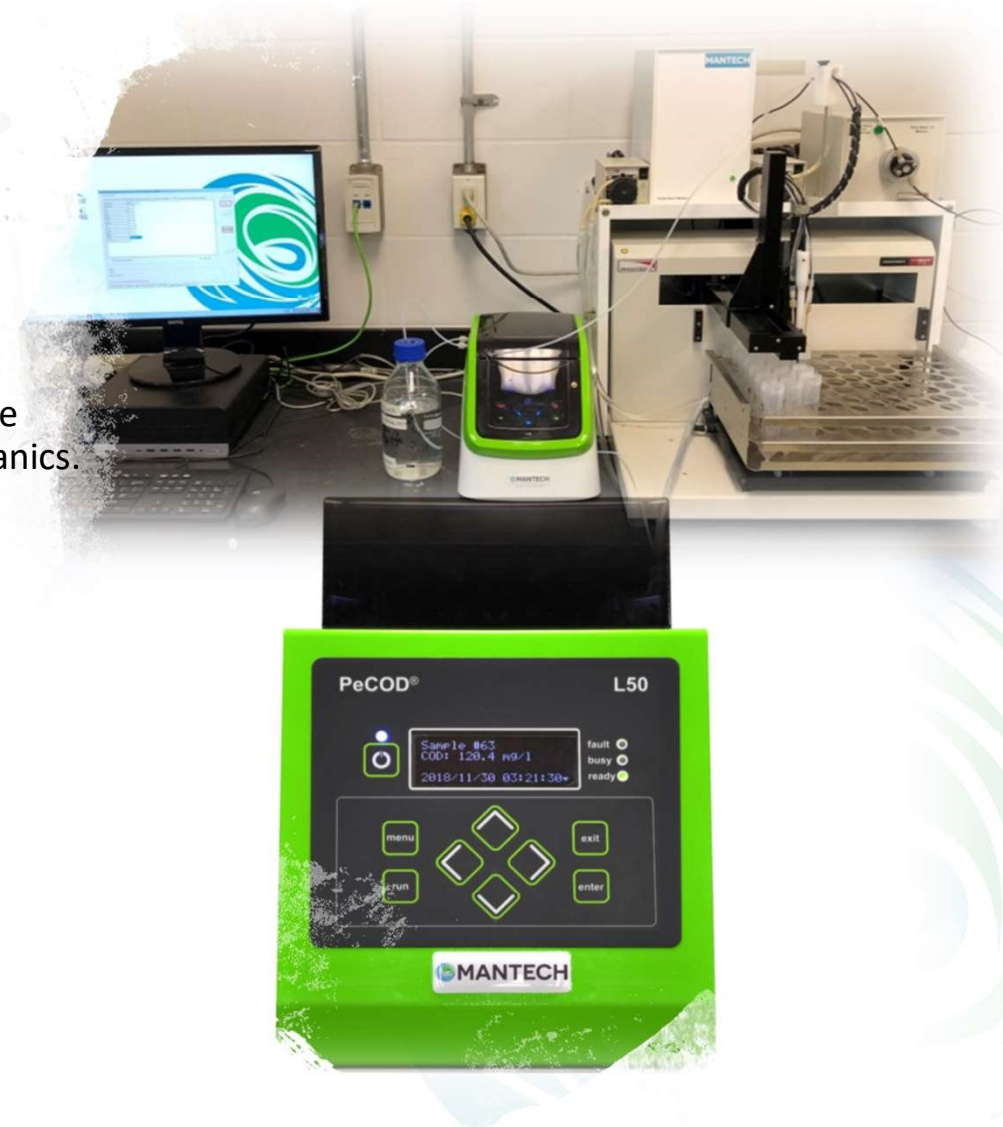
# Chemical Oxygen Demand (COD)

- Traditionally uses mercury dichromate vials
  - High health/environmental hazard
  - 3-4 hour turnaround time
  - Batch size limited by heat block capacity
  - Not efficient when managing upset effluent conditions across an entire ETS



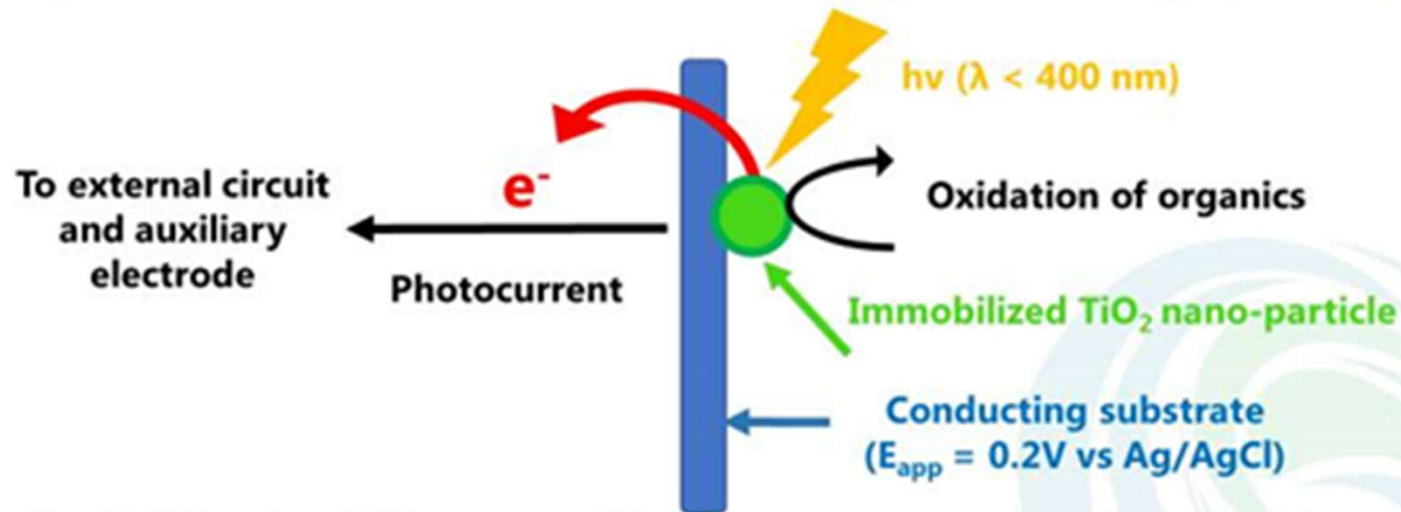
# Photocatalytic COD (PeCOD)

- New green COD technology offered by MANTECH
  - Uses a photoelectric effect across a Titanium dioxide catalyst to create powerful oxidation of soluble organics.
  - Reagents are soluble, environmentally benign salt solutions.
  - Minimum health risk.
  - Results in 10 min/sample.
  - Pre-filtered through 35.0um filter
- Purchased in early 2017.



# PeCOD Technology

## | PeCOD® | A Nanotechnology Based Approach



Roughly 2 times the oxidizing power vs. dichromate

- i.e. Benzene, 1.8 by  $\text{COD}_{\text{Cr}}$  and 2.6 by PeCOD®



# PeCOD:COD correlation

- MANTECH had worked with FPInnovation to test correlations with Dichromate COD in Pulp Mill Effluent

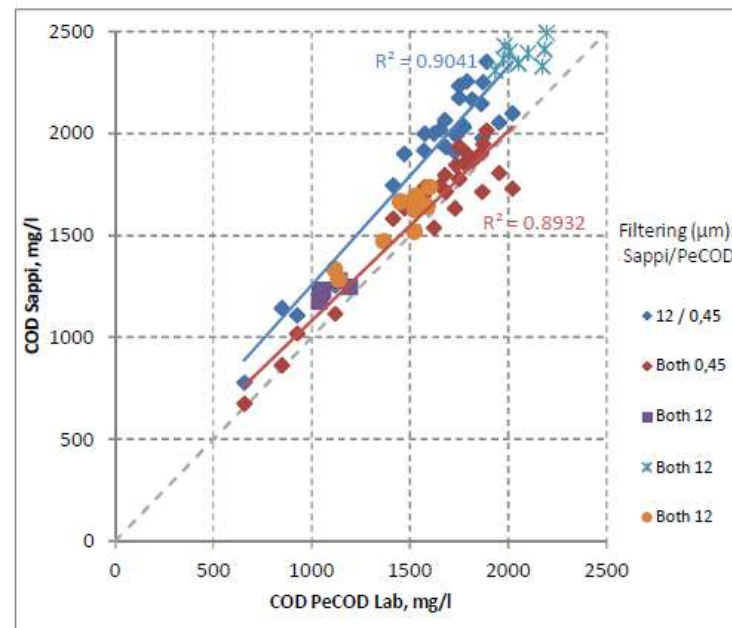


Figure 32. COD results measured with dichromate and peCOD technologies. Samples were filtered either with 12 μm or 0.45 μm filters before the analysis.

# PeCOD:BOD correlations

- Little previous testing for BOD:PeCOD correlations in Pulp Mill effluent
- Because PeCOD is a measure of Soluble COD (35.0 um filter), there should be a good correlation with BOD
- Selected sample locations across the spectrum of the ETS
- Samples were tested twice a week for both PeCOD and BOD

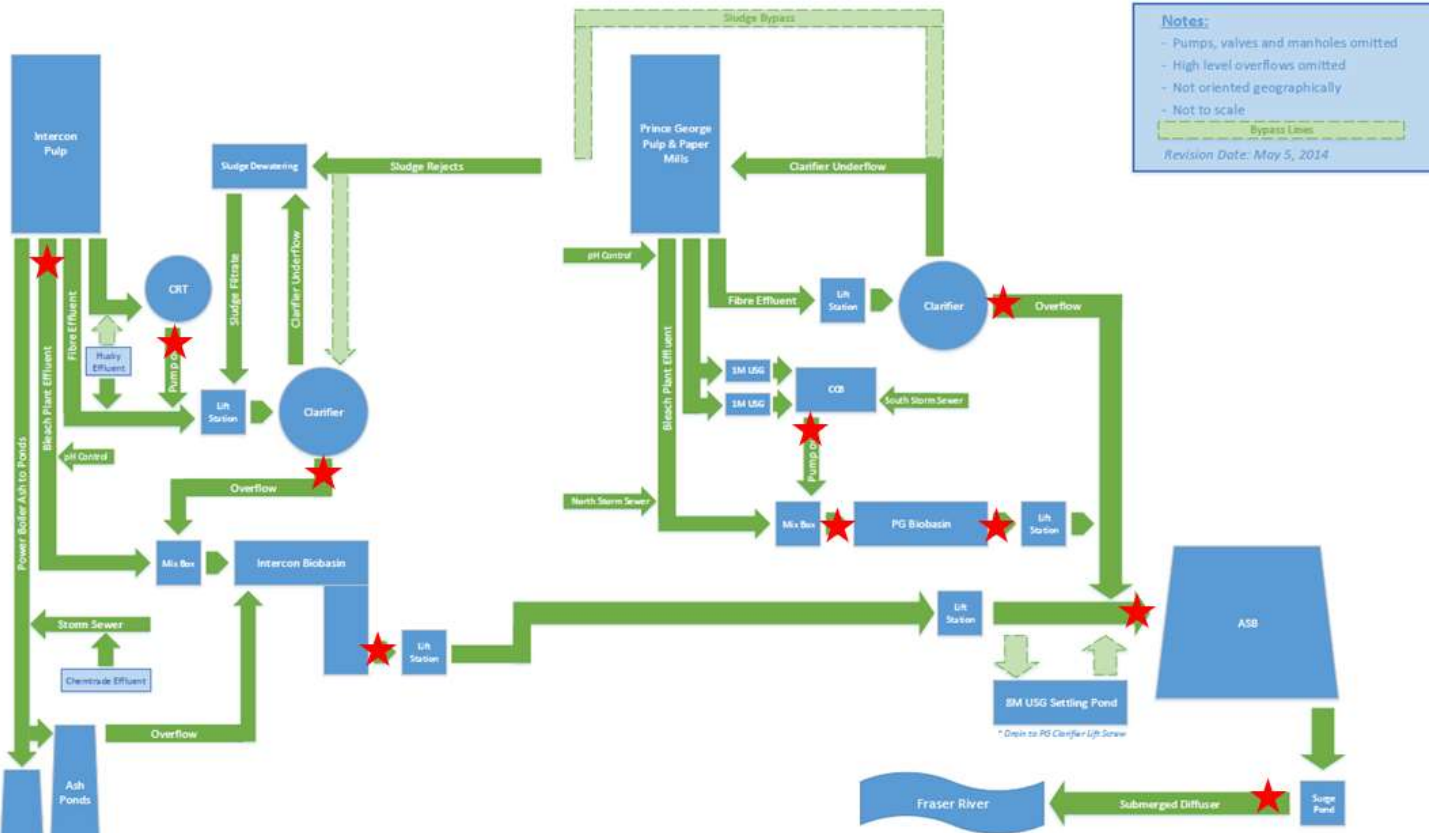




# The Prince George Intercon (Canfor) Effluent Treatment System



# Intercon and PG Pulp Effluent Flow Chart



# PeCOD Correlates With BOD<sub>5</sub>

- *R values  $X > 0.8$* 
  - *CRT, Intercon Clarifier Overflow, PG Biobasin Inlet, PG BWW*
- *R values  $0.6 < X < 0.8$* 
  - *CCB, Intercon Bleach Plant Effluent, PG Clarifier Overflow, ASB Inlet*
- *R Values  $X < 0.6$* 
  - *Intercon Biobasin Midpoint and Outlet, PG Biobasin Outlet, River Outfall*
- *“In all instances the PeCOD slopes for the secondary treated effluents were greater than the slopes for the corresponding primary treated effluents. This could be due to the fact that the treated effluents contain higher levels of recalcitrant COD which the PeCOD measures more effectively than the dichromate method.” FPIinnovations Report (2016)*
  - *Could explain correlations weakening further through the effluent system.*

# Fast BOD<sub>5</sub> Prediction in minutes - Detects Upset Conditions

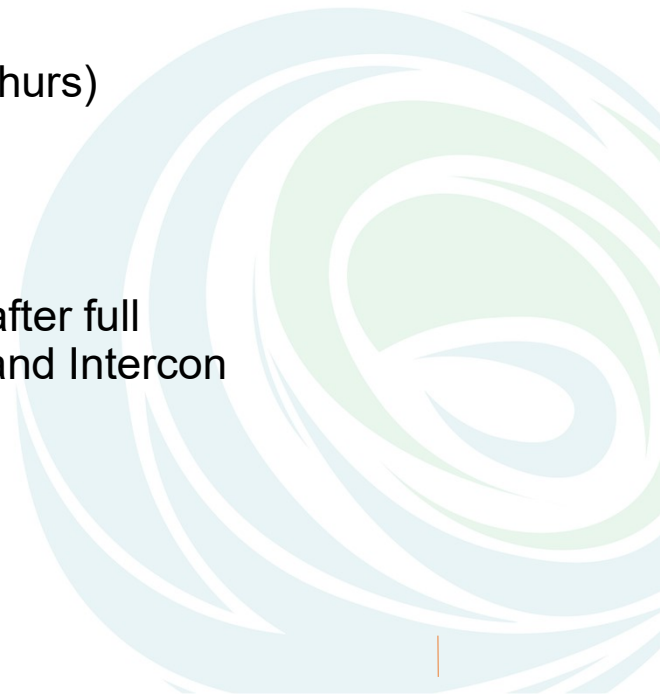
- Monitoring of Effluent System inlet BOD in near-real time.
  - One sample a day (at each location) under normal conditions
  - Shutdowns/upset conditions can run multiple samples per shift
- Can test u-drains as needed, results in 10 min
- Contaminated effluents can be directed to storage basins/tanks and an appropriate pump-back rate set based on data.
- Potential for pumping back liquors into the mill (Weak Black System)
  - has been used for liquor/soap spills

# PeCOD for Aeration control

- Aerated Sludge Basin at PG contains the full flows from both PG and Intercon mills
  - Subsurface aeration grid runs off of 2 or 3 800HP blowers
  - 2 blowers run all the time
  - 3<sup>rd</sup> blower turned on if high loading is expected
- Prior to PeCOD, decisions were based on BOD results, Resin Acid loading and knowledge of operating conditions.
- After PeCOD, decisions still take multiple factors into account PLUS NOW include daily data on inlet loading
- With a cost to run the 3<sup>rd</sup> blower at about \$660 per day, or \$240,000 per year, important to make the right decisions

# PeCOD for Nutrient Management

- **PGPP and Intercon Bio Basin Nutrient Study**
  - Initial results indicate large over application of nutrient in both basins.
  - Using PeCOD to predict appropriate BOD:N:P Ratio.
  - Adjusted application regularly (Targeting daily Mon-Thurs)
  - Reduce nutrient application to PGPP Bio Basin
  - Potential cost savings of ~\$300,000/year over 2018 after full implementation of nutrient management at PG Pulp and Intercon

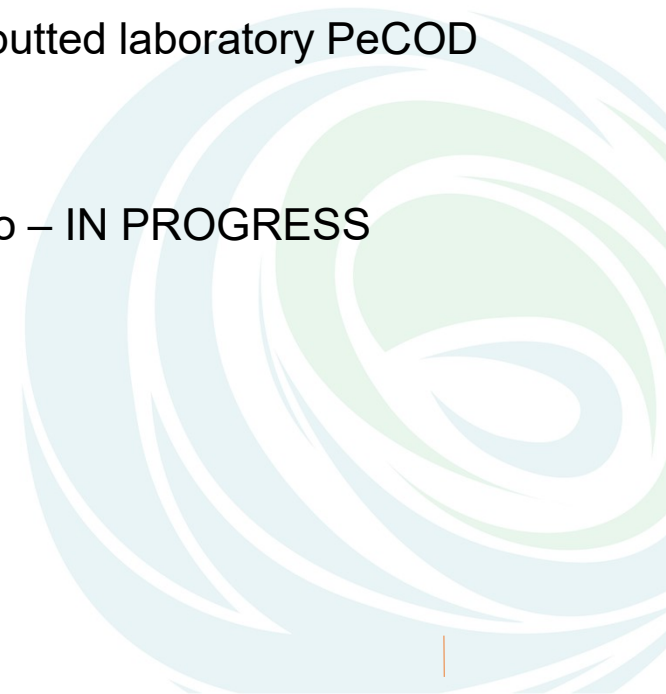


# Results

- Developed the PeCOD/BOD correlation for specific basin inlet sample point that is being used to predict inlet BOD concentration.
- Applied a BOD:N:P ratio of 100 : 2.5 : 1 to determine nutrient application rate.
  - This ratio was chosen over the theoretical 100 : 5: 1 ratio that is typically used for ASB treatment plants as it was more easily obtained with the plant's current nutrient mixture.
- Changes to the nutrient feed being made every 2 weeks to allow ample time for the basin to adjust prior to the next change.
- Reduced nutrient application by approximately 40-50%.
- Potential cost savings of ~\$300,000/year over 2018 after full implementation of nutrient management at PG Pulp and Intercon

# Next Step

- Nutrient application rates will have an extra 5-10% added to them as a safety net, as this basin currently feeds residual nutrients to another basin - DONE
- Develop a project to automate nutrient applications based on inputted laboratory PeCOD results – IN PROGRESS
- Change nutrient mixture to better obtain an ideal application ratio – IN PROGRESS
- Invest in second PeCOD analyser – DONE





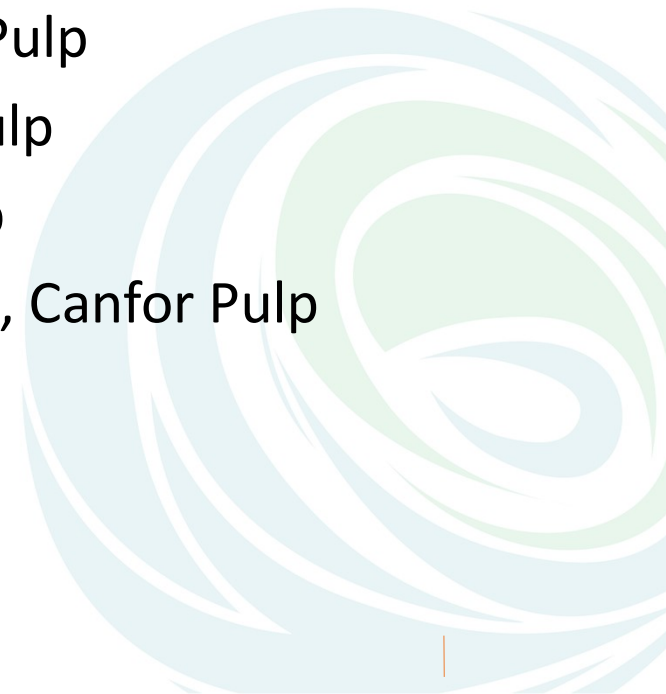
# Other Potential PeCOD Correlations

- Methanol in condensates
- Soda losses in effluent
- Other process stream management options
  - Washing
  - Bleaching



# Acknowledgements

- Matthew Jensen – Environmental Specialist, Canfor Pulp
- Maggie Grierson - Quality Control and Research, Mantech
- Adam Lancaster - Environment Manager, Canfor Pulp
- Joel Fowler - Environmental Supervisor, Canfor Pulp
- Ubaid Hassan - Environmental Intern, Canfor Pulp
- Andrew Sabadash – Environmental Co-op Student, Canfor Pulp



# Questions

