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**Western Canadian Pulp Mill Employs Fast
COD analyzer for Improved Process
Control and Savings**



Problems With Effluent Management



- Reliance on 5 day test (BOD₅) for effluent quality control
- BOD₅ 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 BOD₅ 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 BOD₅ and other effluent parameters.
 - Chemical Oxygen Demand typically correlates well.

Chemical Oxygen Demand (COD)



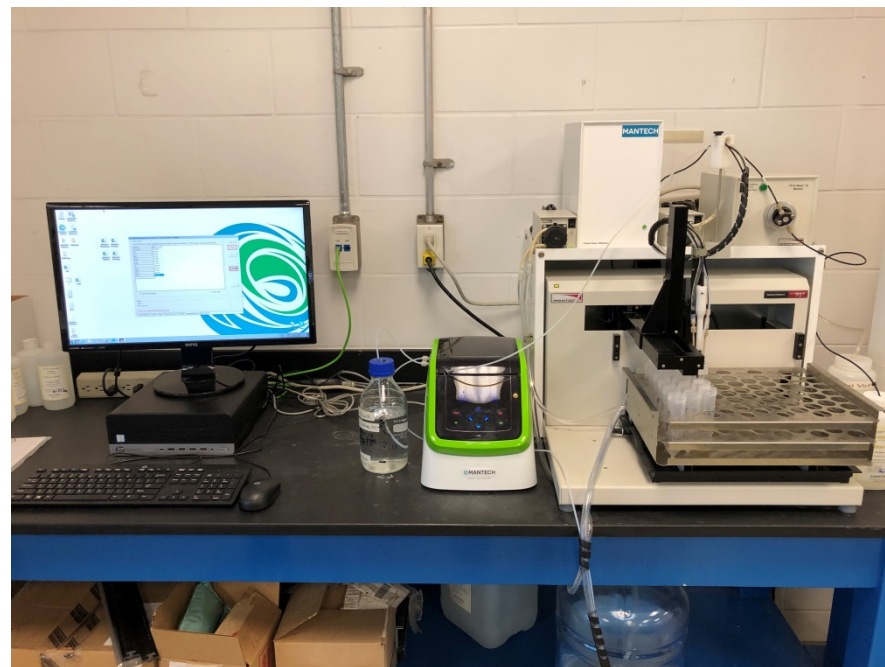
- Traditionally uses mercury dichromate vials
 - High health/environmental hazard
 - 3-4 hour turnaround time
 - Batch size limited by heat block capacity
 - Not efficient when managing upset effluent conditions across an entire ETS



Photoelectric COD (PeCOD)



- New green COD technology offered by MANTECH Inc.
 - Uses a photoelectric effect across a Titanium dioxide catalyst to create powerful oxidation of soluble chemicals.
 - Reagents are soluble, environmentally benign salt solutions.
 - Minimum health risk.
 - Results in 15 min/sample.
 - Measures soluble COD only.
- Purchased in early 2017.



Challenges with PeCOD System



- Ran well initially.
- Mid 2017 – Results and strong correlations indicated imminent BOD₅ permit failure.
 - While BOD₅ had climbed significantly, it did not reach levels close to those predicted.
 - Result of a failed electrode block.
- March 2019 – Instrument started producing consistent errors pertaining to the auxiliary electrode in the electrode block.
 - Troubleshooting indicated the block failed again.
 - Working with Mantech to determine root cause.
 - Effluent chemistry?

The PGI Effluent Treatment System



PeCOD Correlates With BOD₅



		BOD												
		IPBP	CRT	IPCO	IPBM	IPBO	CCB	PGBI	PGBO	PG BWW	PGCO	ASBI	RO	Comp
PeCOD	IPBP	0.64	-0.08	-0.20	0.38	0.21	-0.10	-0.01	0.00	0.20	0.15	0.08	0.10	-0.03
	CRT	-0.09	0.83	0.14	0.15	0.10	-0.21	0.16	0.06	0.06	0.24	0.19	0.19	0.35
	IPCO	-0.17	0.51	0.81	0.25	0.12	-0.12	-0.03	0.08	0.19	0.14	0.17	0.19	0.19
	IPBM	0.36	0.53	0.21	0.43	0.42	-0.13	0.21	0.30	0.17	0.12	0.34	0.26	0.23
	IPBO	0.33	0.36	0.18	0.43	0.46	-0.10	0.18	0.31	0.24	0.13	0.46	0.41	0.30
	CCB	0.11	-0.21	-0.07	-0.13	0.00	0.72	0.04	0.07	-0.13	-0.18	-0.02	-0.19	-0.09
	PGBI	0.20	0.08	-0.05	0.10	0.07	0.01	0.82	0.41	0.52	0.34	0.24	0.27	0.28
	PGBO	0.05	-0.15	0.01	0.04	-0.06	-0.16	0.33	0.34	0.26	0.36	0.20	0.35	0.30
	PG BWW	0.31	-0.01	0.14	0.04	0.14	-0.04	0.32	0.22	0.81	0.57	0.31	0.21	0.23
	PGCO	0.02	-0.02	0.10	0.07	0.06	-0.20	0.09	0.08	0.57	0.69	0.34	0.30	0.25
	ASBI	0.32	-0.06	0.11	0.43	0.47	-0.08	0.31	0.28	0.40	0.35	0.61	0.46	0.43
	RO	0.29	-0.05	0.13	0.12	0.11	-0.03	0.12	0.10	0.36	0.26	0.23	0.38	0.26
	Comp	0.06	-0.01	0.29	0.16	0.12	0.00	0.12	-0.05	0.25	0.27	0.27	0.38	0.36

Statistical outliers removed from Pearson Correlation Coefficient calculation

- According to Mantech, they have shown that PeCOD is capable of measuring recalcitrant COD
 - Recalcitrant COD is “hard” COD that is not easily oxidized.
 - Explains why correlations become weaker further through the effluent system.

Benefits fast BOD₅ Prediction



- Monitoring of Effluent System inlet BOD in near-real time.
- Contaminated effluents can be directed to storage basins/tanks and an appropriate pumpback rate set based on data.
- Creates the ability for a better managed effluent treatment system
- Potential for pumping back liquors into the mill

PeCOD for Aeration control



- ASB at PG contains the full flows from both PG and Intercon mills
 - Subsurface aeration grid run off of 2 or 3 800HP blowers
 - 2 blowers run all the time
 - 3rd 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 but now include daily data on inlet loading
- With a cost to run the 3rd blower at about \$660 per day, or \$240,000 per year, important to make the right decisions

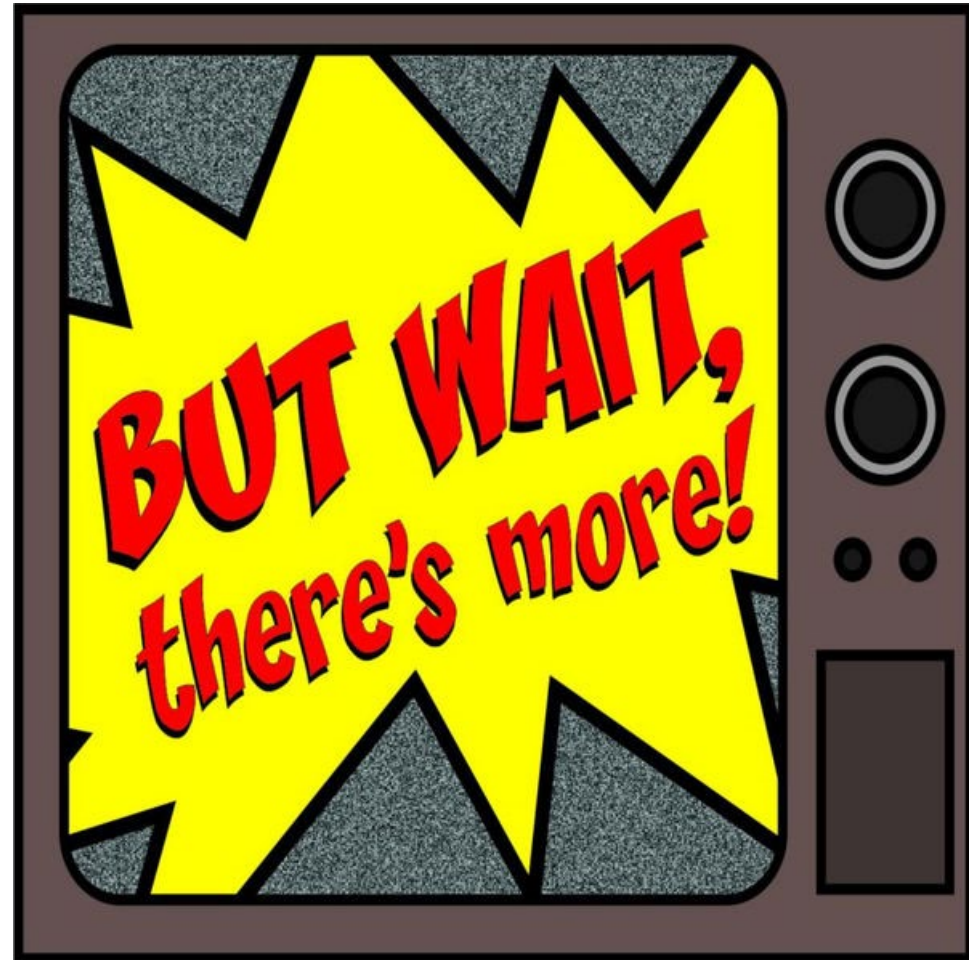
PeCOD for Nutrient Management



- 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.
 - Adjusting application regularly (Targeting daily Mon-Thurs)
 - Reduced nutrient application to PGPP Bio Basin by ~40%.
 - Potential cost savings of ~\$350,000/year over 2018 after full implementation of nutrient management at PG Pulp and Intercon

Other Potential PeCOD Correlations

- Methanol in condensates
- Soda losses in effluent
- Hypochlorite application in potable water (may not be possible due to complications Chloride concentration)
- Other process stream management options



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Questions

