SESSION A –
ENVIRONMENT, BIOPRODUCTS & ENERGY

1.) Rethinking Vacuum Systems to Reduce Energy Costs:
Troy Miller, National Sales Manager – **Gardner Denver: Runtech-Nash**

Overall cost competitiveness is playing more and more important role in paper production. Due to the rising energy prices and cost of the fresh water both minimum energy and water consumption, or better to say maximized energy efficiency and minimized water usage are getting more and more important for paper makers.

Runtech Systems has developed very efficient new Ecopump technology for paper machines vacuum systems. Ecopump technology is based on the variable speed turbo blowers and it can cut the energy costs of a paper machine vacuum system by some 30% to 70% compared to the more traditional technologies.

In addition, the Ecopump blowers are totally water free and thus fresh water consumption of the whole paper machine would be decreased remarkably and at the same time the water handling and/or water treatment costs of the complete vacuum system would be zero.
Due to the fully adjustable speed of Ecopump turbo the vacuum system is very easy to optimize to meet the varying operational situation of the tissue machines which is creating superior operational efficiency of the vacuum system compared to any other vacuum systems available

2.) Energy Management & Debottlenecking of Pulp & Paper Processes:
Enrique Mateos-Espajel, Scientist – **FPInnovations**

Process debottlenecking has become essential to the pulp and paper (P&P) industry in Canada to maximize mill assets utilization and in the context of integrating new technologies such as biorefineries. However, a process integration perspective is required to develop roadmaps of solutions that would simultaneously consider low-cost options in the short-term to improve process operation efficiency while considering the medium/long-term perspective to debottleneck the process. In this work, a systematic approach is proposed to identify, quantify, and classify process bottlenecks and operational inefficiencies at the departmental and mill-wide levels. The approach consists of four steps. First, mill management should establish improvement targets (e.g., pulp production increase targets, operating cost reduction, energy reduction, biorefinery integration, etc.) to guide the debottlenecking process. Then, bottlenecks are identified, screened, and ranked. Screening and ranking are done based on the existing bottlenecks and inefficiencies of each department/process based on the established targets. The next step is process diagnosis which uses multivariate data analysis, process simulation, unit operations best practices, and a root-cause analysis to identify the interactions between different process bottlenecks and the process operation. In the last step, the improvement solutions are established where a roadmap of measures is proposed to reach the desired targets. The proposed debottlenecking approach has been successfully applied in a Canadian kraft mill. A debottlenecking solution with the specific implementation steps was proposed to reach the desired 10% pulp production increase target. It was shown that operational projects and projects with low/medium capital expense (capex) would result in up to 6% pulp production increase with EBITDA potential >1M$/year. Energy reduction projects with non-capital required were also identified and saved the mill 0.3- 0.5 M$/y.

3.) <u>Moving Bed Biofilm Reators (MBBRs) Treating Wastewaters from The Forest Industry – Experience from More Than Two Decades with Pure MBBR & BAS™ Processes:</u>

Daniel Lemarre & Thomas Welander – **Veolia Water Technologies**

The Moving Bed Biofilm Reactor (MBBR) is a technology for biological wastewater treatment, in which biofilm grows on small carrier media. The utilization of an MBBR as pre-treatment to a conventional activated sludge (AS) results in the biofilm activated sludge (BAS™) process. Both pure MBBR and BAS processes have been successfully used over the last two decades for the efficient, compact and stable treatment of different industrial wastewaters, including those from the forestry industry. Pure MBBRs have been used in paper mills and small pulp mills (More than 40 full-scale plants by AnoxKaldnes-VWT). The BAS-process has been implemented in larger pulp mills, often as an upgrade of an existing AS. The operation of the BAS MBBR under nutrient limitations has been shown to improve sludge settleability, decrease sludge production and diminish effluent nutrient discharge (Malmqvist et al., 2007).

Nutrient limitation in the BAS-MBBR, referred to as nutrient-limited BAS (NLBAS™) process generates a biofilm rich in extracellular polymeric substances (EPS) and consequently, the MBBR effluent suspended solids (SS) are slimy and rich in EPS. These solids are readily degradable in the following AS (Welander et al., 2001), thus, yielding a low sludge production of the overall NLBAS™ process. Careful optimization of the addition of nutrients is required to ensure low sludge production without compromising treatment efficiency. Since 2002, several full-scale NLBAS processes have been implemented at different pulp and paper mills worldwide (More than 50 full-scale plants by AnoxKaldnes-VWT). The effluent demands have varied from mill to mill, but the main focus of the treatment has been on organic matter, nutrients and SS. Nevertheless, the removal of toxic compounds and of chemicals originating from pulp bleaching has sometimes been necessary. Ethylenediaminetetraacetic acid (EDTA) used in totally chlorine-free (TCF) bleaching, and chlorates generated from elemental chlorine-free (ECF) bleaching can be removed by MBBRs or BAS given right operating conditions.

The aim of this work is to summarize and compare key treatment process parameters from different full scale installations of MBBR and NLBAS processes in the forestry industry in Canada (including BC) and around the world. Emphasis is given to identifying the adaptable role of MBBR biofilms in the treatment of different types of wastewaters from various pulp and paper mill facilities.

In summary:

- Similarities and differences in treatment results, sludge production and characteristics exist among NLBAS processes likely due to differences in wastewater and operating conditions.
- NLBAS processes present stable operation, maximum removal of organic matter, low sludge production and good sludge characteristics, compared to conventional AS or BAS processes.
- High removal of EDTA and chlorate is obtained when necessary by the growth of specialized microorganisms in the MBBR biofilm.
- The concentrations of soluble, biologically available N and P have been low for all NLBAS processes with strict effluent discharge demands for nutrients.
- Pure MBBR can also meet treatment objectives. It provides a more compact system than NLBAS, but produces more sludge and requires higher nutrient dosages.

4.) <u>Maintaining A Healthy & Efficient ASB</u>:

Kari Plamondon, Lab Supervisor – **West Fraser Pulp**

Environmental sustainability is a huge global challenge that we are all navigating in todays world. The Pulp and Paper Industry recognizes that environmental sustainability is a key factor in long-term business success, and that in-order-to lessen our environmental footprint we must develop and implement best management practices to ensure a high standard of environmental excellence. There are many aspects to consider when developing these practices, but we are not alone in treading these waters, and I'd like to share some success that we have found here at Hinton Pulp, Hinton Alberta.

Many in our industry are aware that Canadian Pulp Mill Wastewater is regulated under the Pulp and Paper Effluent Regulations and a variety of other regulatory bodies depending on what Province the mill is operating within. Each mill operates under an Environmental Approval, which supports Federal and Provincial regulation and provides effluent monitoring parameters and release limits for that specific operation. These limits are based off of the size of, and production capacity, of the Mill and are set to ensure that the Mill's effluent is not going to cause harm to the receiving waters and aquatic life to which it's discharged. A few of these monitoring parameters that you may know of are: BOD– Biological Oxygen Demand, TSS– Total Suspended Solids and Acute Lethality/ Toxicity.

However, not all in our industry are aware that the analytical results from these wastewater parameters are influenced not only by what we are sending down the sewers and how we are treating the effluent mechanically but by 'who' is treating our effluent. Here at Hinton Pulp, not only do we work hard to limit the amount of pollutants entering our sewers and provide preliminary and primary treatment of our effluent, we also work hard to keep the 'who' of our effluent treatment system happy and healthy.

Secondary Treatment Systems or Aerated Stabilization Basins (ASBs) and the microorganisms that call them home play a pivotal role in the efficiency of a wastewater treatment system and the amount of pollutants that are later discharged to receiving waters. But how do we keep these organisms happy and healthy? By providing them an Environment where they can thrive, and by optimizing these 7 growth pressures of the ASB.

1. F/M Ratio (food to microorganism ratio)
2. Temperature
3. Dissolved Oxygen
4. pH
5. Nutrients (Nitrogen and Phosphorus)
6. Reduce Toxic & Inhibitory Compounds
7. Increase Retention Time

Hinton Pulp also performs routine monitoring of the biomass in our ASB in order to understand what impact we have on our microorganisms. This monitoring includes microscopic evaluation of the floc structure and morphology of the biomass, as well as a quantity vs quality evaluation on the microorganisms found in each slide. We call this our Maturity Index, it is a numerical value that can be input into spreadsheets to easily track the overall health of our ASB. With these tools we have found that we can better control the efficiency of our ASB and in turn what impact we have to our watershed.

5.) Environmental Footprint Benefit Through Boiler Water Treatment Optimization Case Study:

Gregorie Poirier-Richer, P.Eng., Senior Boiler Products Application Engineer –
Suez Water Technologies & Solutions

Steam Boiler chemistry operation and optimization is a complex process that requires to consider the plant's operation requirements, the system's design and the feedwater quality and variations. The resulting operation can have significant repercussions on the plant's performance and reliability, as on one end, running below the acceptable guidelines increases fuel, water and chemical usage; but pushing the system too hard can cause deposition, corrosion and foaming affecting turbine and production operations. A holistic approach must be taken to consider every component of the boiler system and understand the various impacts. This case study reviews the factors to consider when optimizing boiler water chemistry control, and the benefits that were documented in-regards-to fuel, water and chemical savings, as well as waste-water contaminant discharge and greenhouse gas emission reductions. This project not only had impacts on the boiler protection and performance improvement, but also eliminated the need for significant engineering modifications and capital expenses on the boiler water pretreatment system and the plant's waste-water system.

6.) Kraft Lignin Production at Hinton Pulp:

Kyle Wells, PhD. Lignin Recovery Plant OMC – West Fraser-Hinton Pulp (in conjunction with)
Noram & FPInnovations

It is widely recognized that climate change is leading to a range of direct and indirect effects on the global ecology and economy. Forest biomass is increasingly being viewed as a potential solution to the growing global demand for clean energy and renewable raw materials because of its relatively high availability, sustainable management and multiple existing value chains. Using wood fibre-based products in everyday life can help reduce carbon emissions through carbon storage and avoided greenhouse gas emissions while providing biomaterials and biochemicals with existing and new functionalities. One such promising bioproduct is kraft lignin.

Over the last few years, several processes were developed for the extraction of high-quality lignin from black liquor and three of these were implemented at the industrial level. One of these processes is the LignoForce™ process which was jointly developed by FPInnovations and NORAM, and implemented at the West Fraser, Hinton mill in Alberta, Canada. A unique feature of this process is that the black liquor is oxidized with oxygen prior to lignin precipitation under controlled conditions. Under these conditions, malodorous sulphur compounds are destroyed, chemical requirements are reduced, lignin filterability is improved and purified lignin is recovered at high solids content.

The main objective of this paper is to provide an overview of: The main features of the LignoForce™ process in terms of unit operations, general layout and chemicals required.

The main features of the LignoForce™ lignins produced from the Hinton LignoForce™ lignin plant in terms of chemical composition, molecular weight distribution, main functional groups and thermal properties
Several emerging medium and high-value applications of LignoForce™ kraft lignin including: a) as a partial replacement of phenol and/or phenol formaldehyde (PF) resins for wood adhesive applications (e.g. plywood and OSB), b) as a partial replacement of isocyanate adhesive in medium density fibreboard (MDF) and c) as a partial replacement of polyols in rigid polyurethane (PU) foams used for thermal insulation purposes.