The importance of cleaning and deposit control in improving paper machine efficiency

A cleaning program will greatly reduce the number of breaks

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Abstract: Weyerhaeuser Inc., Dryden, ON, is a fine paper mill in Northern Ontario. An increased emphasis on paper machine shutdown cleaning and deposit control has helped to substantially reduce breaks and increase efficiency. A coordinated chemical deposit-control program was supplemented by cleaning programs focused on difficult to reach areas which were suspected as possible contributors to breaks. The programs involved are discussed and the correlation with improved machine runnability is presented.

Cleaning

Paper machine cleaning should involve all sections, from the forming to the reel. The cleaning can be mechanical, chemical or a combination of both. Cleaning programs can be applied during paper machine operation, either continuously or on an on/off time cycle. These “on-the-run” programs can reduce the speed of deposit build-up and also control target deposit-forming materials such as pitch or microbial slime. Deposits will still build-up on the paper machine and regular shutdown cleaning is required to remove them.

Deposit build-up occurs in many areas of the paper machine. Some of these deposits can lead to loss of production, sheet defects and breaks but can also act as a binder for other materials leading to the build-up of deposits. Over the last two years changes were implemented to the microbial deposit-control program that have improved the effectiveness of the program, and have been a major factor in the improved runnability of No.1 paper machine.

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Sodium bromide is used with hypochlorite as the activator. This program prevents the build-up of deposits.
of microbial slime on and in shower bars such as the breast roll shower and also in areas that the shower water hits. It has proven to be effective and the sheet defects coming from the breast roll shower have been eliminated.

Deposits on the wet end of the paper machines are mainly stock, PCC and microbial slime. Table I shows a typical analysis of deposits from the paper machine. The high percentage of ash and calcium indicates that the deposit contains a large amount of PCC.

The type of deposit can change depending on the location. For example, No.1 paper machine can have a build-up on the roof of the white-water flume. This can be seen at the white-water flume hatch at the rear of the forming section. This deposit, when present, is always almost 100% microbial slime. That provides a good indication of the degree of microbial slime in the paper machine system.

The microbial deposit-control program controls the build-up of slime, but a good cleaning program is required to remove the stock/PCC type deposits that accumulate. The short white-water loop on the paper machine receives a caustic boil-out on a scheduled basis.

This program uses caustic and two proprietary cleaning chemicals designed to help remove inorganic and organic deposits. The boil-out solution is heated to 60°C and has a pH of 12. The solution is circulated through the short white-water circuit for a minimum of two hours. This program has been in place for a number of years.

Boil-outs are widely used in the paper industry, especially in fine paper mills. They are very effective at cleaning the internals, piping and headbox of the short white-water circuit. It has been found, however, that a boil-out can’t remove all deposits from the wet end.

The boil-out solution flows out through the headbox slice and is carried over the foil-boxes by the forming fabric. The boil-out solution flows through the forming fabric and over the foil-boxes, but only over the first two or three. In addition, areas such as the save-all are not reached by the regular paper machine boil-out.

Every six months or so a boil-out is done starting in the stock prep system. An alkaline cleaning solution is pumped forward through the various stock tanks, and then finally to the paper machine system where it circulates. Normally additional caustic and/or cleaners will be added to insure that target pH is maintained.

Unfortunately, it is not possible to circulate the boil-out solution through the entire system — beater to wet end. The fact that all-stock chests must be empty means that the full system boil-out is rarely done.

For the reasons above, a foam-cleaning program was started during shutdowns. The wet end is hosed down to remove loose deposits; these would be mainly the build-up of stock that occurs. A portable foam gun is used to spray a foaming caustic cleaner on all accessible surfaces. A mildly alkaline degreaser is the product of choice because it is effective in removing grease as well as general dirt and deposits. The low caustic product reduces the risk of injury. The foam-cleaning unit uses an air driven pump to throw the cleaning solution onto the machine surfaces. Air is also injected into the cleaning solution to create the foam. The foam is allowed to sit for 15 to 30 minutes, and then rinsed off with water. Good rinsing is important to completely remove the caustic cleaning solution for safety reasons, and also to remove the softened deposits. This method of cleaning allows dirty areas to be targeted.

Extensive foam cleaning is scheduled when forming fabrics are cut off. Without the forming fabric in place, it is possible to foam the inside of the foil-boxes and in the centre of the paper machine — areas that are impossible to reach with the forming fabric in place.

The foam cleaning has been proven to be effective in cleaning off almost all deposits. Some deposits such as hard scale-like PCC deposits would require acid foam cleaning or some sort of bead blast cleaning.

Acid foam cleaning has not been tried for safety reasons. Soda blast cleaning has been used to clean the forming section of No.2 paper machine. Plans call for the cleaning of the forming section of No.1 paper machine with soda blasting when scheduling permits. Soda blasting uses baking soda (sodium bicarbonate) as the bead. This type of bead blasting is used for its ease of clean-up, because it does not damage bearings on the paper machine.

It is possible that once the soda blasting has removed the deposits then a mild acid foam-cleaning solution may be able to control the build-up of the PCC scale-type deposits.

Pitch-type deposits in the forming section are only a problem when hardwood kraft slush pulp is used. A proprietary organic dispersant product is used at these times to prevent these deposits. It is applied through one of the forming fabric cleaning showers continuously, when hardwood slush kraft pulp is being used on the paper machine.

At Dryden, mist eliminators have been installed on No.2 paper machine. These have reduced deposits in the forming section to a large degree. Mist eliminators are being considered for No.1 paper machine.

Save-all: The save-all has proven to be an important area in deposit control. If it remains dirty and untreated, it can then serve as an area for deposit growth. Deposits should not be allowed to grow to the size that they start to fall off. If the deposits are allowed to remain too long, then microbial growth can occur. These deposits can serve to help seed the system.

The save-all is cleaned on shutdowns with a water hose. All that is required is that the stock deposits that form on the walls and the doors are removed.

Press Section: Shutdown foam cleaning is also done in the press section, where the press section framework is cleaned. If press felts have been removed prior to the foam cleaning, then press rolls and the interior areas of the press section can be foamed and cleaned.

Dryer Section: The dryer sections of the paper machine are an area that often gets neglected. Many mills will boil-out the wet end and batch clean the press felts, but will do little in the dryer section other than clean the outside of the dryer hood and doors.

In many cases this is due to the lack of cleaning showers in the dryer sections. Flooding showers are required to apply cleaning solutions and to ensure proper timely rinsing. It is very important to completely rinse the cleaning solution from the dryer fabrics. This is especially true of alkaline cleaning solutions, where high temperatures in the dryer section can work with any residual caustic and lead to damage or even loss of the dryer fabric.

Currently, a cold-water wash is used to remove starch and loose deposits. It is not effective in removing organic-type material embedded in the dryer felts. For this reason, chemical cleaning is being considered as well as the installation of continuous high-pressure cleaning showers.

The dryer fabrics are but one area of concern. Number 1 paper machine was experiencing sheet defects and breaks at the calendar stack. Investigation lead to the suspicion that deposits on the dryer section felt rolls were the cause of these defects. The first cleaning was done by manually scraping the dryer felt rolls.
clean with pieces of old doctor blades.

The reduction in defects and breaks was dramatic. Based on the success of the manual cleaning, it was decided to use soda blasting to clean the rolls. This has been done once with good success. It is planned to continue this cleaning on a scheduled basis. It is not known at this time how often the dryer felt rolls would require cleaning.

Size Press: Like the stock system and the wet end of the paper machine, the size starch system requires cleaning at the size press and in the starch system itself. Starch deposits can be hard to remove and over the years many different cleaning "recipes" have been tried.

The big breakthrough in starch system cleaning has been the introduction of enzyme-cleaning products. The enzyme used is amylase, an enzyme that breaks down the starch deposits and thus allowing them to be easily washed away. The enzyme is so powerful and persistent that it is necessary to deactivate the enzyme with hypochlorite or peroxide after the cleaning.

The Dryden mill has used the starch enzymatic cleaner for the last few years with very good success. In the early enzymatic starch cleanings the system was found to have leaks after the enzyme boil-out. Starch deposits that had plugged the leaks were completely cleaned away.

In addition to the enzymatic cleaning, regular caustic cleanings of the system are done. These are effective but do not match the enzyme cleaning. The size press area itself is cleaned with hot water.


Keywords: PAPER MACHINES, RUNNABILITY, SHUT DOWN, MAINTENANCE CLEANING, DEPOSITS.
PAPER MACHINE RUNNABILITY
The Dryden mill has maintained detailed records of downtime and breaks for a number of years. Figures 1 to 3 show the average breaks per day for each month from January 1998 to the present. Figure 1 is for wet end breaks, Fig. 2 is size press breaks and Fig. 3 is calendar and reel breaks. In all three cases the trendline clearly displays a marked reduction in breaks.

There are mechanical and operational improvements that have also played a part in the reduction of breaks and in good production. The major part of the efficiency improvements is attributed to the scheduled, intensive cleaning that has and is being done.

In summary, Fig. 4 shows the average total breaks per day for No.1 paper machine from January 1998 to September 2000. The trendline clearly indicates the marked reduction in breaks for the paper machine. This has resulted in increased paper machine efficiency. In the time period discussed the absolute efficiency of No.1 PM has increased from 76.7% in 1998 to 80.9% YTD 2000.

CONCLUSIONS
Over the last few years, a practice has been followed on No.1 paper machine at Weyerhaeuser Canada, Dryden Operations that has emphasized the importance of regular, scheduled cleaning of all sections of the paper machine. All areas of the paper mill are involved, and need to be. Cleaning from the beater to the winder is required to enjoy all of the benefits of a clean system. Step reductions in breaks cannot always be attributed to specific cleaning operations. In some cases, however, for example the cleaning of the dryer felt rolls; a marked reduction in sheet defects was noted.

The cleaning programs, in conjunction with the other deposit-control programs, have been a major factor in the reduction of breaks and increases in efficiency that have been enjoyed. An excellent illustration of this is that No.1 paper machine ran from 10:00 a.m. February 25, 2000, to 6:54 a.m. March 6, 2000, without a break — a total of 9.9 days.