CHAPTER 7

MANAGEMENT APPLICATIONS

In this chapter, possible management applications of the results of the MRA predictive environmental model are introduced as guidelines for the process operator. The work in the development of the model has identified some relationships between material use and recycling of partially finished product in the paper making process and the resulting wastewater quality. These relationships are presented in this chapter in terms of the root event and cause for wastewater conditions that vary from normal parameters, respectively. The root cause can, then, lead to suggestions for improving and planning industrial paper production in order to manage wastewater generation more effectively.

7.1 Management Applications for Industrial paper

For the plant operators, achieving better wastewater quality, while maintaining desired production rates and cost factors, can be accomplished by consideration of the root causes of wastewater load increases and suggested actions as shown in Figure 7.1.

Examination of the root event and cause for industrial paper production reveals that there are three major events and causes of excess wastewater load generation in the industrial paper mill. These are increased use of broke that results from contaminants in the feed stock, excess chemicals in white water due to poor addition control of chemicals and poor retention of fines and filler, and overflow of white water due to frequent changing of production to different paper grades as well as scheduling the machine operations (between paper machine and wastepaper plant).

A challenge to the plant operators will be to manage these causes among the paper types through the suggested actions. Considerations must be given to the input used and to the limitations of the paper machine that was not originally designed for rapid change over to production of different paper grades as discussed in the following section.

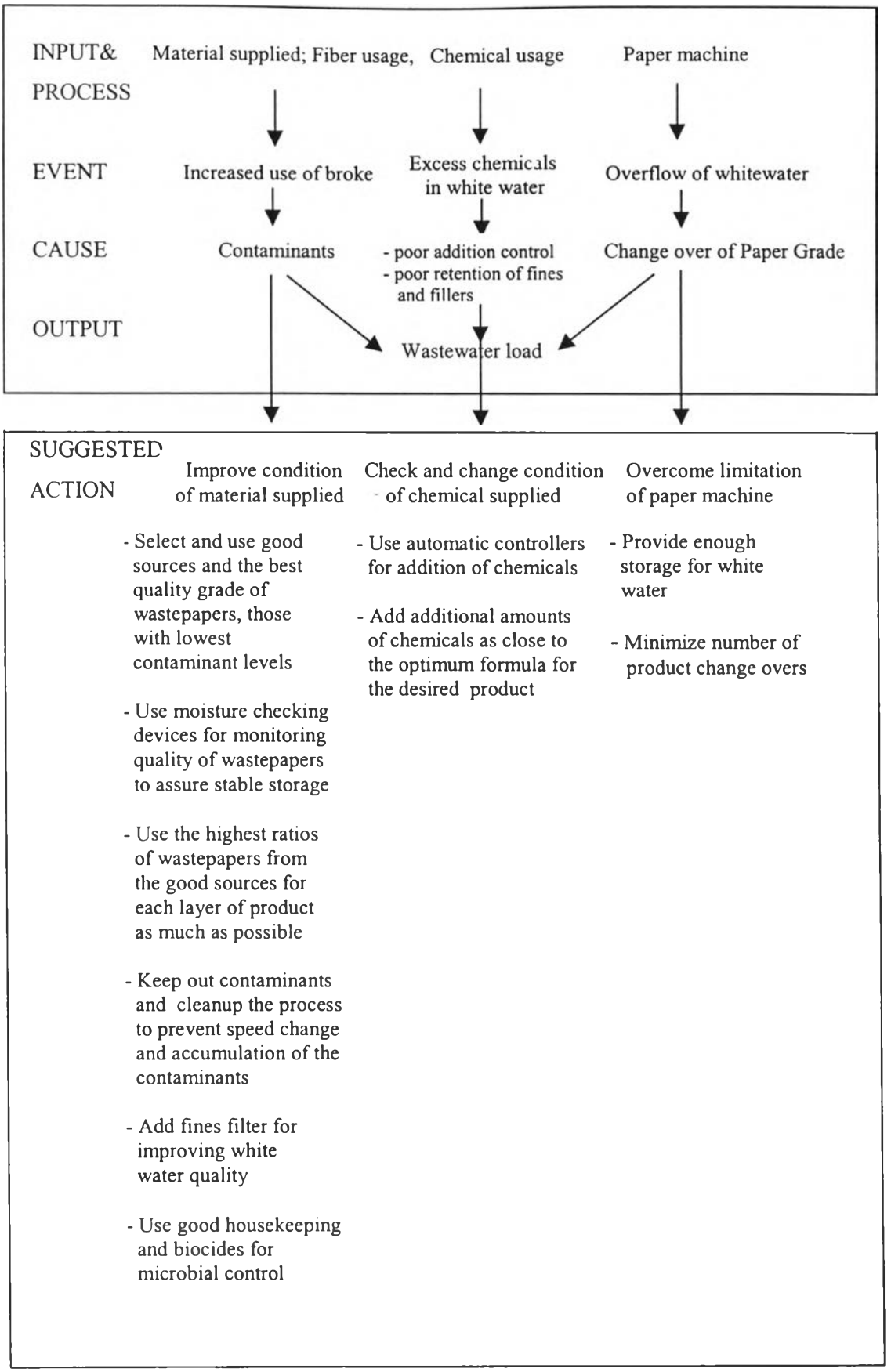

Figure 7.1 Schematic of wastewater load generation and its management

7.2 SS Load Control

In order to control the increase of SS load, the following suggested actions are introduced for the plant operators.

1) Select and use good sources and the best quality grade of wastepapers, those with lowest contaminant levels

This action can help to reduce the SS load at the different source of fibrous materials supplied. Fibers contain different amounts of contaminants depending on the collection method. Pre-consumer waste (printing and cutting collected from the plant) should be used more than post-consumer waste (mixed grades collected from households and supermarkets) because it contains lower contaminants. Based upon the levels of contaminants in types of wastepapers, grade A quality fibers should be used more than grades B and C. In addition, the quality of wastepapers supplied from aboard (called import wastepapers), such as, United States (US) and Japan is generally better and more available amounts than those from local source. For example, for GF, A_3 that is pre-consumer waste imported from US has better quality of fibers than A_4 that is pre-consumer waste from local source. While A_5 has better quality fibers than A_3 or A_4.

If good sources and good quality of wastepapers are selected and used as a source of fibers, there are lower contaminants in the fibers resulting in fewer web breaks and less loss of fiber in the effluent. This can reduce the SS load at the early stage.

2) Use moisture checking devices for monitoring quality of wastepapers to assure stable storage

Although good sources and good quality of wastepapers are selected and used, the use of moisture checking sensing devices can help to assure that the quality of fibrous material meets the criteria of wastepaper quality. Usually, moisture content is in the range of 6 –13 % for high quality wastepapers. High moisture content can cause rotting due to the biological degradation of the organic materials [54]. This can increase the accumulation of these material causing web breaks and discharge of suspended solids that can contribute to the increase of SS load.

If the moisture checking devices for monitoring quality of wastepapers are used, and high moisture content fibers not put into the production stream, the SS load can be reduced.

3) Use the highest ratios of wastepapers from the good sources for each layer of product, as much as possible

This action can help to reduce the contaminants (stickies, ink, and natural fines) and deteriorated fibers. The high ratios of wastepapers from the better sources for each layer provide fewer contaminants that contribute to the SS load. For example, for GF, A_3 which is a better grade of fiber than A_4 could be used at a level of 100%, while A_4 is not used for the middle and bottom layers.

If the fibers from the better sources are used as much as possible in each layer, the SS load occurring from the contaminants in wastepapers is decreased.

4) Keep out contaminants and cleanup the process to prevent speed change and accumulation of the contaminants

Usually, a certain operational speed of the paper machine is used. If there are contaminants acting as obstacles in the system, the speed of machine quickly changes due to tension control mechanism causing web breaks. This action can help to lower the sudden change of speed of paper machine and to clean the accumulations of contaminants; stickies, natural fines, and organic deposits in the system that cause suspended solids and web breaks. Thus, if this action is performed, it can help to reduce SS load as well.

5) Add fines filter for improving white water quality

Usually, the stocks component or furnishes of two paper grades are not identicals. The white water during the change of paper grade is drained off to the effluent due to the lack of equipment for water purification in this area. In order to reduce the discharged water and increase recycle water for other uses in the mill, it is suggested to add a fines filter in the white water system to separate suspended solids and water for the different types of paper grades. Then, fibers in the stock components are recovered, and process water is clarified for further use in the mill. This can help to reduce SS load.

6) Use good house keeping and biocides for microbial control

Good housekeeping usually means minimizing the amount of microbes entering the mill and preventing the formation of deposits. It includes control of microbial purity of fresh water, raw materials, chemicals, and additives. If there is no good housekeeping, slime lumps due to the accumulation of organic materials frequently occur. Biocides should be used to eliminate the organisms responsible for this contamination that in turn cause web breaks. This action can help to reduce SS load as well.

7) Provide enough storage for white water

This action can help to reduce the overflow of white water that discharges suspended solids; fines and filler to the effluent causing the SS load increase. If there are sufficient storage volume for white water allowing for its eventual reuse in the process, SS load can decrease.

8) Minimize number of product change over

In order to avoid the major losses (fines and filler) due to the overflow of white water from the change over of paper grade, the paper machine should minimize the number of product change overs as much as possible. This action can help to reduce SS load.

7.3 TDS Load Control

In order to control the increase of TDS load, the following suggested actions are presented for the plant operators.

1) Use automatic controllers for addition of chemicals

This action can help to make addition of chemicals as accurate as possible causing reduced loss of chemical additives to the wastewater and contributing to smaller TDS loads. It is beneficial to reduce the loss of dissolved chemicals that contribute to TDS load.

2) Add additional amounts of chemicals (alum, emulsifier, defoamer, and other additives) as close to the optimum formula for the desired product

This action can help to prevent the loss of those chemicals in the effluent that contributes to TDS load. Each paper grade has a standard formula for these additives.

The challenges at this stage is to measure the residual levels of these chemicals in the white water and then to add only enough additional chemical to bring it to the optimum level. If the correct amounts of chemical additives are added, the proper retention occurs. Then, TDS load is decreased.

3) Provide enough storage for white water

This action can help to reduce the overflow of white water that discharges dissolved materials (such as, alum and emulsifier) to the effluent causing TDS load increases. If there is sufficient storage for white water, TDS load can decrease by allowing its eventual reuse in the process.

4) Minimize number of product change overs

Generally, TDS load can be controlled using the same approach previously described for SS load.

7.4 COD & BOD Loads Control

Since the wastewater from papermaking does not contain oil and grease, oxidizable substances measured in terms of COD and BOD thus appear either as dissolved solid or suspended solid. Therefore, COD and BOD loads can be controlled using the same approaches previously described for SS and TDS loads.

Furthermore, if the plant is rebuilt, a system designed for different paper grade change-overs should be used. This can help to reduce wastewater loads from the loss of fibers, dispersed materials, and dissolved materials due to the change over of paper grades. A different design would have an operational system that optimizes the change over of paper grades resulting in the reduction of SS, TDS, COD and BOD loads.