1 ADDENDUM TASK 1.0: TECHNOLOGY DISCUSSIONS

1.1 FOCUS REPORT TASK DESCRIPTION

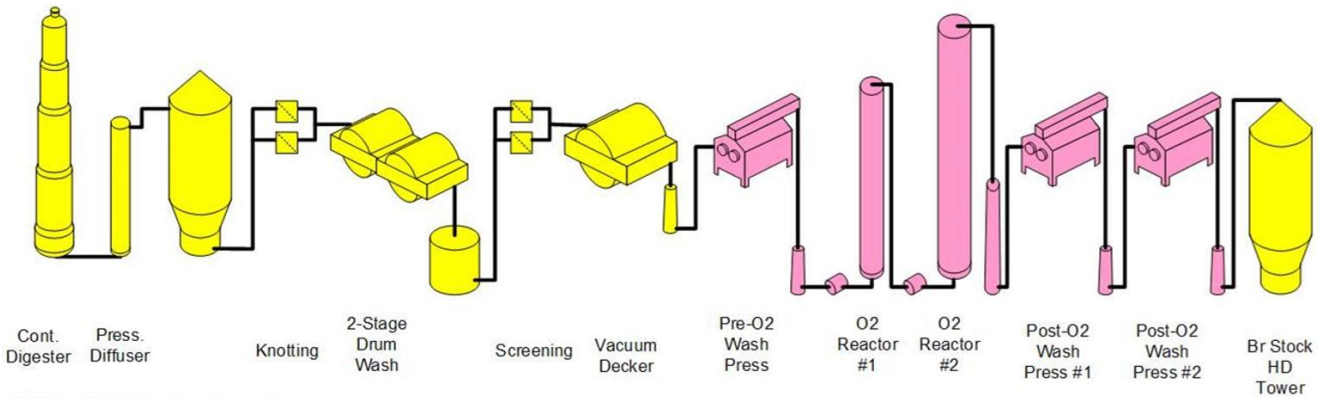
Provide information regarding whether and when new technology and equipment will be installed at the NPNS pulp mill to improve the effluent quality.

1.2 DISCUSSION

1.2.1 Will O_2 Delignification be installed at NPNS pulp mill?

Two-stage Oxygen Delignification technology will be incorporated into the pulp making process at NPNS. The system, as shown in Figure 1-1, below, consists of oxygen reactors and wash presses. It will be installed after the brown stock washing stage and before the existing bleaching stages. The system uses oxygen gas to react with residual lignin that remains in the pulp after brown stock washing. The lignin removed in this new stage will result in the use of less bleaching chemicals to whiten the pulp in the existing bleach plant. It is a significant and well-proven process for ECF pulp and as such it is often referred to as the first stage of bleaching (oxygen bleaching).

Figure 1-1: Typical 2-Stage Oxygen Delignification System



Yellow: Existing Equipment

Pink: Future Oxygen Delignification Equipment

The environmental benefits of Oxygen Delignification are as follows:

- Reduced chlorine dioxide bleaching chemicals by 30 – 40%, with a corresponding reduction in effluent organic loading and chlorinated compounds;
- Reduced effluent color;
- Reduced wood losses;
- Increased recovery of lignin to the liquor cycle, with a resulting reduction in the mill's carbon footprint;
- Reduced energy consumption by reducing aeration requirements in the new ETF, with a resulting reduction in the mill's carbon footprint; and
- Reduced nutrient addition in the new ETF.

The Oxygen Delignification Project has been studied at NPNS. In 2017 NPNS conducted a preliminary engineering study to determine how the project would be integrated into the existing mill processes and developed a high-level cost estimate of the project. As outlined in Section 2.4, the future Oxygen Delignification system was considered in the design of the ETF and will be managed as a separate project to be undertaken after the ETF project is completed. This project is a significant capital expenditure for the mill and an implementation schedule has not been determined at this time.

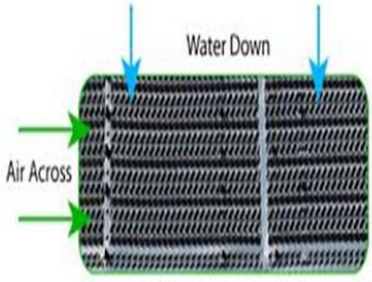
1.2.2 What other technology and equipment will be installed at the NPNS pulp mill?

Non-contact cooling water makes up a considerable portion of the total mill effluent flow. Cooling towers will be installed as an in-mill improvement to recycle non-contact, clean cooling water for reuse within the mill processes during the summer months. Reducing cooling water will in turn reduce the effluent flow. The goal is to reduce the peak summer water flow at the mill by approximately 5,000 m^3/day. This water reduction will help to even out seasonal variation in effluent flow.

Note that these cooling towers are in addition to the effluent cooling towers that will operate year-round at the new ETF. As is industry standard, direct-contact cooling towers will be used. Cooling towers use evaporation to achieve heat transfer. In this case the evaporative medium is recycled raw water. The operation of the cooling towers will result in additional evaporative water losses at the mill. Care will be taken the ensure that the cooling towers stay clean and free of naturally occurring legionella bacteria by employing biocides if and when necessary. The fresh water cooling towers will be installed in conjunction with the ETF project.

A typical cooling tower system is shown in Figure 1-2, below.

Figure 1-2: Cooling Tower System



Fresh water trickles down the medium, as air is blown across. Cooling occurs through evaporation

1.2.3 How will each proposed new technology and/or equipment improve the effluent quality?

The improvement expected from Oxygen Delignification relates to the bleach plant portion of the effluent due to the reduction in chlorine dioxide usage. Lower BOD, COD, AOX and colour in the bleach plant effluent are expected benefits of the project due to a reduction in chlorinated organic compounds. Pollutant loadings in total mill untreated effluent are primarily, but not entirely, a result of bleach plant effluent. At NPNS, bleach plant effluent represents roughly 75% of the total untreated effluent load which is very typical when compared to industry standards for a mill with conventional bleaching without oxygen delignification. The KSH Design Specification No: 10-1113-A000-09400 (third case: After O_2 Delig.), presented in Section 2.4, summarizes the impact of the improved bleach effluent fraction on the overall untreated or influent effluent quality before treatment.

Fresh water cooling towers installed to allow recycle of non-contact cooling water will reduce peak summer effluent flow by approximately 5,000 m^3/day. The reduction of peak effluent flow will help to reduce seasonal variations in flow through the ETF.

1.3 SIGNATURES

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