

Cleaner production opportunity assessment study in SEKA Balıkesir pulp and paper mill

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Abstract

This study was designed to apply cleaner production concepts in a Turkish pulp and paper mill, for the first time in Turkey, to introduce the concept as well as to provide a framework for future initiatives. To achieve this objective a comprehensive waste reduction audit was conducted at SEKA Balıkesir pulp and paper mill. First, audit schemes from different sources were examined and compiled that resulted in the methodology employed in this work. The audit covered water emissions and water usage. Then, the collected data were compared with international environmental performance indicators from other companies in the USA, Canada, Australia, and Europe. This comparison provided specific opportunities for improvement at different processes in the mill. For each viable opportunity, different waste reduction measures were analyzed and determined. Furthermore, the benefits of the identified waste reduction options were analyzed for increasing production efficiency and achieving target raw effluent pollution loads from the mill.

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1. Introduction

Industrial production without adequate regard for environmental impacts has led to an increase in water and air pollution, soil degradation, and large-scale global impacts such as acid rain, global warming and ozone depletion. To create more sustainable means of production, there must be a shift in attitudes towards proactive waste management practices moving away from control towards prevention. A preventive approach must be applied in all industrial sectors. Used in complement with other elements of sound environmental management, cleaner production is a practical method for protecting human and environmental health and supporting the goal of sustainability [7].

The pulp and paper industry, which produces commodity grades of wood pulp, primary paper and paperboard products, is divided into pulping process lines: chemical pulping, mechanical pulping, and semi-chemical pulping. The products of the pulp and paper industry can also be categorized by the pulping process used in paper and paperboard production [28]. Processes in the manufacture of paper and paperboard can, in general terms, be split into three steps: pulp making, pulp processing, and paper production. First, a stock pulp mixture is produced by digesting a material into its fibrous constituents via chemical, mechanical, or a combination of chemical and mechanical means. In the case of wood, the most common pulping method, chemical pulping, releases cellulose fibers by selectively destroying the chemical bonds in the glue-like substance (lignin) that binds the fibers together. After the fibers are separated and impurities have been removed, the pulp may be bleached to improve brightness and processed to a form suitable for papermaking equipment. At the papermaking stage, the pulp can be combined with dyes, strength building resins, or texture adding filler materials, depending on its

Abbreviations: ADP, Air Dried Pulp; BOD, Biochemical Oxygen Demand; COD, Chemical Oxygen Demand; CTMP, Chemi Thermo-mechanical Pulp; EPIs, Environmental Performance Indicators; TSSs, Total Suspended Solids.

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intended end product. Afterwards, the mixture is dewatered, leaving the fibrous constituents and pulp additives on a wire or wire-mesh conveyor. Additional additives may be applied after the sheet-making step. The fibers bond together as they are carried through a series of presses and heated rollers. The final paper product is usually spooled on large parent rolls for storage [16].

The pulp and papermaking industry is a very water intensive industry and ranks third in the world, after the primary metals and chemical industries, in terms of fresh water consumption. Historically, the pulp and paper industry has been considered to be a major consumer of natural resources (wood, water) and energy (fossil fuels, electricity) and a significant contributor of pollutant discharges to the environment [1,4,13,21,26].

SEKA (Turkey pulp and paper mills) Balıkesir pulp and paper mill processes wood logs and purchased kraft for newsprint production. It is an integrated mill with wood debarking and chip making, pulp manufacturing, pulp bleaching and paper manufacturing [14]. A flow diagram for the overall mill processes is given in Fig. 1. The design capacity of the mill is 100,000 tons/year. The average monthly newsprint production of the mill between October 2000 and September 2001, when this study was conducted, was 6667 tons, which was approximately 80% of design [14,15].

The objective of this study was to apply cleaner production concepts to a Turkish pulp and paper mill, for the first time in Turkey, introducing the concept as well as providing a framework for future initiatives. To this purpose a comprehensive waste reduction audit was conducted at the SEKA Balıkesir pulp and paper mill. First, different audit schemes from different sources were examined and compiled leading to the methodology employed in this work. The audit covered water emissions and water usage. Then, the collected data were compared with international environmental performance indicators

from other companies in the USA, Canada, Australia, and Europe. This comparison provided specific opportunities for improvement at different processes in the mill. For each opportunity determined from this approach, different waste reduction measures were analyzed and determined.

2. Methodology

A waste audit procedure is a systematic tool used to identify the opportunities of cleaner production. The information from a waste audit can be a starting point for investigating pollution issues at any facility. Such an assessment of waste generation as well as raw material and energy consumption can highlight areas for potential intervention and provide a baseline for comparing subsequent increases or decreases in a specific waste stream. Based on the UNEP's Audit and Reduction Manual for Industrial Emissions and Wastes [22] and other relevant literature ([4,8,23,26–28,30]), the methodology to be used in this study to identify waste streams and energy usage were developed and implemented. In order to conduct a purely descriptive audit in nature, providing a detailed picture of all the relevant waste streams, a material balance approach was utilized for the SEKA Balıkesir pulp and paper mill.

Based on resource constraints, this study covered the main departments in the SEKA Balıkesir Mill, namely, wood yard and chipping operations, CTMP process operations, and paper machine operations. It should be noted that departments like maintenance workshops can have significant environmental impacts (e.g. production of waste oils, leaking petroleum products storage tanks) and that landfills and other storage sites can produce contaminated leachate which can have an impact on groundwater as well as surface water. Generally, however, these departments have a minor role to play in cleaner production efforts, as compared to the production departments. Because Mill performs routine tests on wastewater analysis as

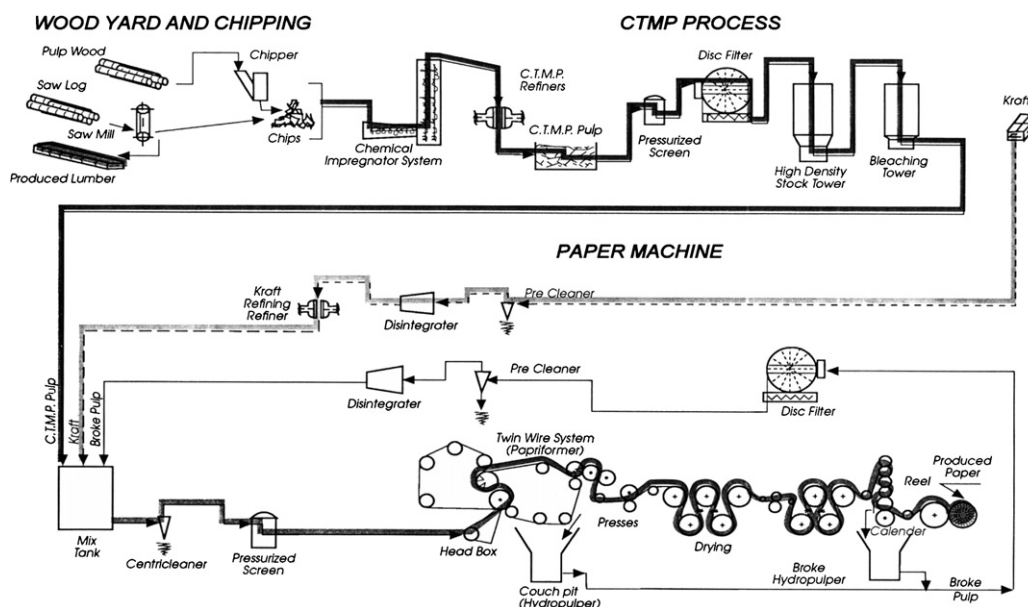


Fig. 1. Process flow diagram of SEKA Balıkesir pulp and paper mill.

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