April 2015

Columbia Manufacturing, Inc.
Plating Operations Achieve Zero Wastewater Discharge

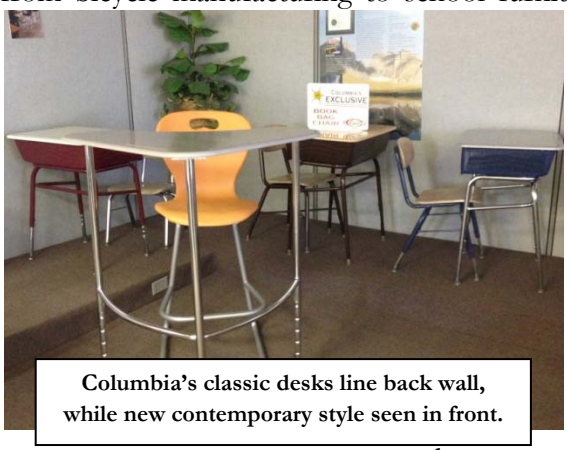
Summary

Columbia Manufacturing Inc., in Westfield, Massachusetts, originally started out as a bicycle manufacturing company, but has transitioned into the second-largest manufacturer of school furniture in the nation. The school furniture manufactured at Columbia is made from tubular steel that is bent and welded into various configurations, cleaned, plated, and then completed with the attachment of the seat or desktop. The product is difficult to plate because of its size, various configurations, and tubular construction. Columbia's master plan was to eliminate plating operations entirely with a new line of powder painted finishes; however, a large share of the market continues to demand traditional finishes.

Columbia Manufacturing Inc. eliminated the use of 147,000 gallons of water per day in their plating operations and has saved $3,000,000 in water and sewer fees, among other cost savings, by upgrading the plating equipment and integrating a zero-discharge wastewater treatment system. The new, efficient plating line enables the company to recover and reuse 98% of the plating chemistry that would previously have been lost, resulting in a drastic reduction of hazardous waste generation.

Background

Columbia Manufacturing Inc. has operated at its Westfield, Massachusetts facility since 1877, and currently has a workforce of 70 employees, during their peak season. The company transitioned from bicycle manufacturing to school furniture manufacturing, currently producing classic desks, tables, and chairs as well as contemporary, ergonomic and collaborative styles.



Columbia's classic desks line back wall, while new contemporary style seen in front.

Water Conservation

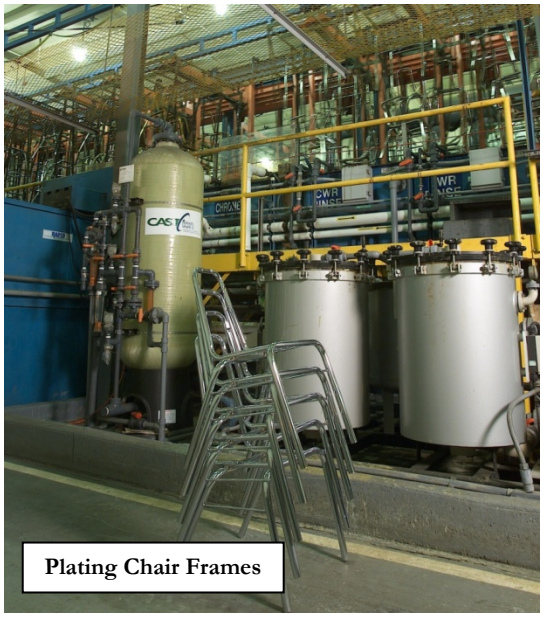
Due to a growing demand for their product and that 75-80% of the furniture they manufacture is chrome plated, Columbia needed to expand and upgrade its outdated plating line. Hindering their ability to remain competitive was a nickel-chrome plating line that was slow, inefficient, and costly to operate. The production line lacked counter-flow rinses and used about 150,000 gallons of water per day. The wastewater treatment system, used to treat the waste rinse water prior to discharge, was also an inefficient use of raw materials, which presented a great liability and added expense to the company.

Columbia used a facility-wide approach to modernize and expand its nickel-chrome plating line. The company sought systems that could expand production capacity while reducing water use, chemical and labor costs, and the generation of hazardous waste and wastewater. The company decided on a special racking system, which has gone through several modifications, combined with a

Napco automated nickel-chrome plating line and a CASTion zero-discharge resource recovery system. This new line tripled the company's plating capacity and minimized waste generation.

The reformatted plating operation integrated a new plating line, with drag-out recovery and counter-flow rinse tanks, and three CASTion vacuum distillation units for treating each of the segregated rinse water streams from the cleaner/acid line, nickel plating line, and chromium plating line.

Water from all three vacuum distillation units runs through an ion exchange system with the following steps: ultrafiltration, granular activated carbon, ion exchange, final filtration and ultraviolet sterilization. The resulting de-ionized (DI) water is reused on the plating line, resulting in a closed-loop process, where all industrial wastewater discharges to the sewer are eliminated.



Plating Chair Frames

Approximately 98% of both the nickel and the chromic acid is recovered from the dilute rinse waters and concentrated for reuse in the plating tanks. The savings from the recovery and reuse of chromium trioxide is equivalent to 600 pounds per week. The concentrated waste from the treatment system goes to a filter press, where the resulting filter cake is then properly disposed of as a F006 hazardous waste. Water is added to the system only to make up for evaporation from the tanks. Columbia is now exempt from air and water discharge permits and from hazardous waste treatment permits (RCRA-TSD) because of the integral zero-discharge system.

Results

Reductions: Columbia eliminated the use of 147,000 gallons per day of process water and no longer generates 130,000 gallons per day of wastewater from the new plating processes. All of the wastewater is recovered as DI water and used in the rinse baths. As for the plating chemistry, approximately 98% of the nickel and chromic acid plating chemistry is recovered and reused. Since installation in 2001, Columbia has saved $3,000,000 in water and sewer fees, $3,850,000 in nickel purchase and usage, and $800,000 in chrome purchase and usage.

Economics: Columbia has spent nearly $4 million for the new closed-loop waste treatment system, including installation, infrastructure upgrade, and other environmental upgrades. Additional gas-fired boilers and evaporative cooling towers were required by the CASTion system, yet the overall return on investment on the CASTion system was less than two years. Since 2008, Columbia has reduced its thermal energy cost by nearly $500,000 annually, by eliminating unused and underutilized space, as well as many other energy saving initiatives.

This case study was prepared by the Office of Technical Assistance and Technology (OTA), a branch of the Massachusetts Executive Office of Energy and Environmental Affairs. The OTA helps businesses and other organizations improve their environmental performance by helping them comply with relevant regulations, reduce toxics use, and conserve energy, water, and other resources.
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