



Essential Expertise
for Water, Energy and Air

Mill Reduces Costs by nearly \$3 MM using MetriX® Technology

Reduced energy costs, lower basis weights and increased production for linerboard producer




Mill Overview

Grade:	Recycled Linerboard
Machine Type:	Fourdrinier with top wire former, 3 nip press- 1 st double felted straight-through, 2 nd bottom felted straight-through, 3 rd double-felted Sym Belt shoe
Machine Speed:	2300 fpm (700 m/min)
Basis Weight Range:	37-69 lb (181-337 g/m ²) linerboard
Tons Per Day:	930 tpd
System pH:	5.8–6.1

Business Situation

A producer of recycled corrugating medium and linerboard wanted to reduce its dependence on natural gas while increasing production, improving strength, and lowering basis weight on 37 lb (181 g/m²) linerboard grades. Of primary importance in lowering natural gas consumption was the elimination of the mill's size press. The size press, a large consumer of steam,

was used to apply starch to the surface of the sheet for increased strength. Past attempts to shut down the size press had resulted in an inability to meet strength specifications and an increase in rejected board. The mill had attempted to run supplemental wet-end strength pro-grams in order to eliminate the size press but was not able to meet ring crush or mullen targets on 37 lb (181 g/m²) grades. In addition to

ENVIRONMENTAL RESULTS	eROI	ECONOMIC RESULTS
Assuming 1,000 BTU/lb of steam and 350 operating days, mill saved 84 billion BTUs per year	 energy	\$500,000-\$760,000
A 2.5 lb or 6% decrease in basis weight with no loss of strength	 earth	\$2,300,000 in fiber savings per year
123,000 tons of CO ₂	 air	Value varies based on regulated carbon credit market

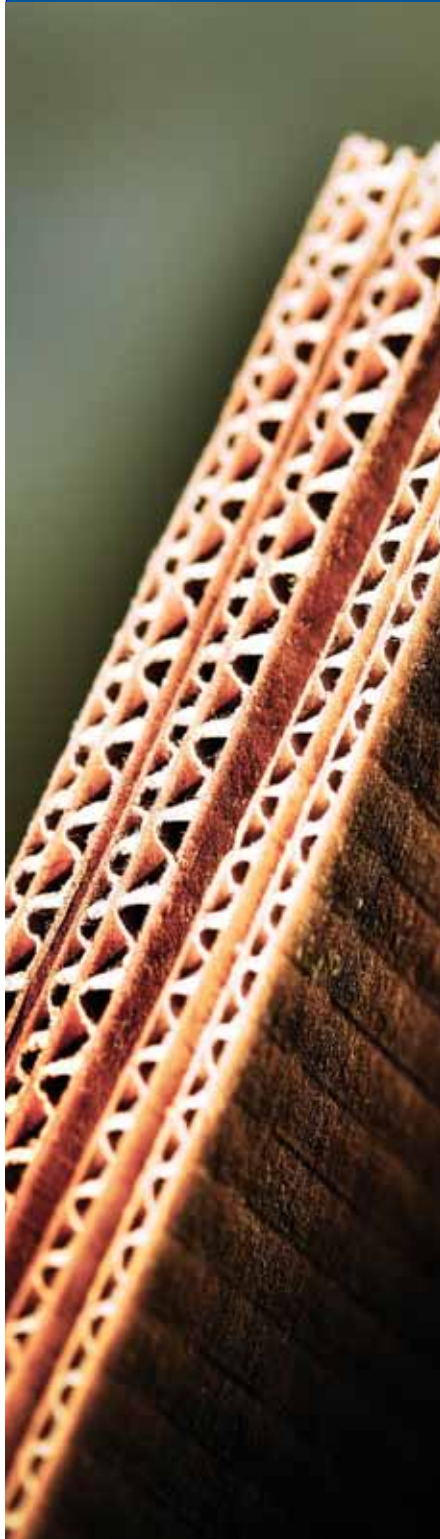


Table 1 – MetriX Program designed for recycled linerboard producer.

NALCO® 3479 – anionic flocculant	Post-screen (base ply)	0.3 kg/ton (0.60 lb/ton)
NALCO 3479 – anionic flocculant	Post-screen (top ply)	0.2 kg/ton (0.40 lb/ton)
MetriX 64110 (74018) – base ply	Suction side of machine chest pump	0.8 kg/ton (dry) – (1.7 lb/ton)
MetriX 64110 (74018) – top ply	Stuff box drop leg	0.6 kg/ton (dry) – (1.3 lb/ton)

eliminating use of its size press, this manufacturer also wanted to increase production and lower basis weight.

Analysis of Business Situation

Key Drivers

- Reduced demand for natural gas
- Increased productivity
- Reduced operational costs

Challenge/Opportunity

- Strength limitations
- Inability to remove size press

Program Design

Nalco’s first step in working with this customer was to determine the financial impact of lowering natural gas consumption with the elimination of the mill size press. In addition, financial modeling was conducted using historical process data and current mill costs to determine the net impact of production increase and basis weight reduction scenarios.

With discussions regarding financial objectives complete, Nalco worked with the mill to evaluate a number of mechanical, operational, and chemical (MOC) options to improve strength and production and

Table 2 – Multi-phase Nalco program evaluation.

Evaluation Phase	Phase Objective
Phase 1	Demonstrate improved dry strength, drainage and drying on 37 lb liner while holding basis weight, machine speed, and moisture constant
Phase 2	Implement operational changes need to convert strength, drainage, and drying on 37 lb liner into reduced basis weight and maximized machine productivity

to eliminate the need for the size press. Specifically, the mill investigated adjustments to stock refining and “bump” tested starch, alum, and retention aid dosages. These evaluations were successful in identifying operational best practices by grade but none proved successful in meeting speed and strength requirements. Nalco machine audits indicated that drainage and strength improvements would be necessary to meet mill objectives.

In order to design a solution that would provide step changes in drainage and strength development, Nalco designed a multi-component program. As a part of the program, Nalco recommended its MetriX system, consisting of an anionic flocculant and a reactive polymer. Program components with proposed feed points and dosages are outlined in Table 1.

In preparing for on-machine evaluations, Nalco and the customer agreed that mill goals would be best achieved by implementing a two-phase program. The objectives of each phase of this evaluation are summarized in Table 2.

Key Performance Indicators

Prior to machine evaluations, Nalco worked with the mill to establish the following Key Performance Indicators (KPIs) for the two-phase program:

- Increase board strength (ring crush, mullen)
- Reduce steam consumption
- Reduce natural gas consumption
- Lower basis weight
- Increase machine speed
- Increase production
- Justify program cost performance

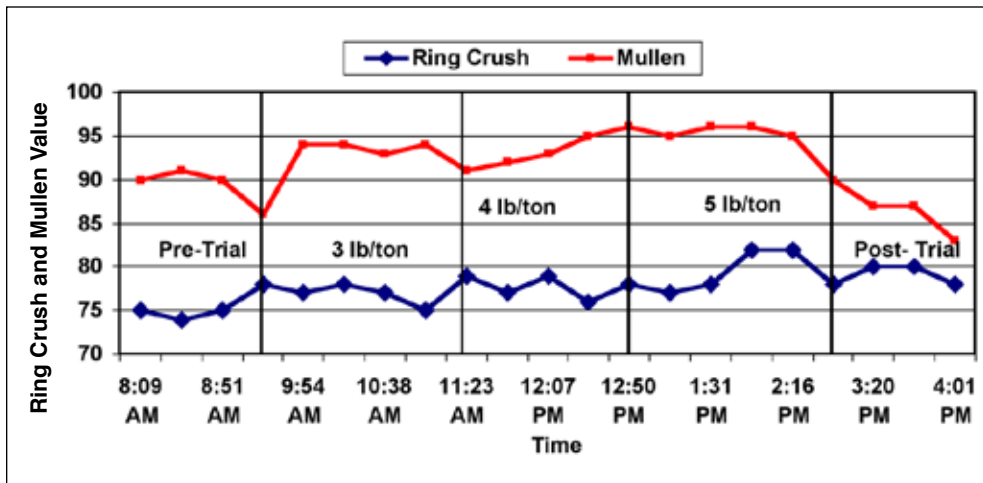


Figure 1 – Nalco’s approach resulted in a 5% ring crush and 6% mullen increase.

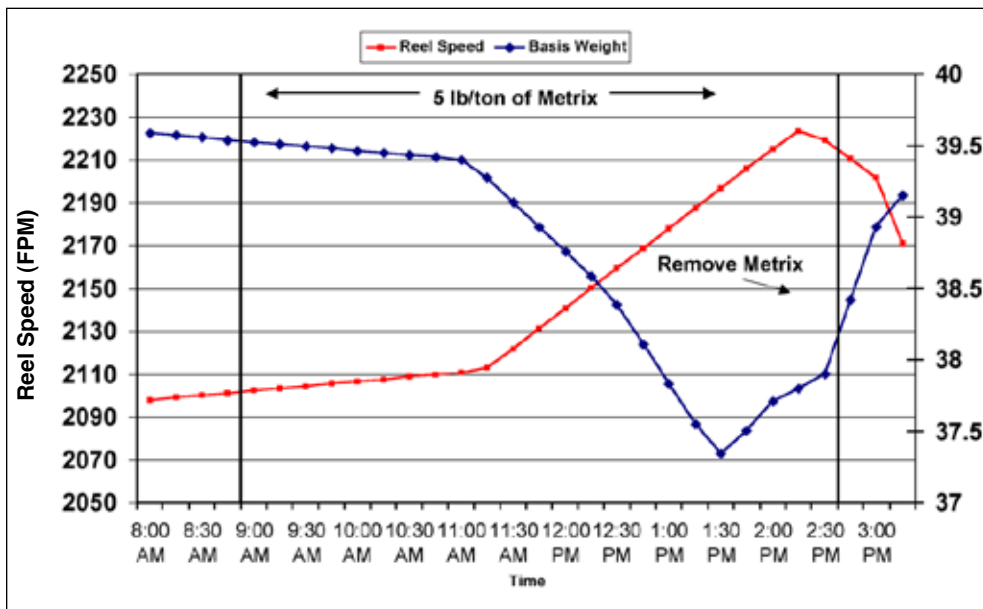


Figure 2 – Nalco’s approach resulted in a 6% increase in machine speed and a 2.5 lb or 6% reduction in basis weight.

Program Results

The on-machine retention components were optimized and process stability confirmed prior to introduction of the reactive polymer. During Phase 1 of the evaluation, 12 hours of data was collected with the size press operating and anionic flocculant fed to both the top and base

sheet. No reactive polymer was fed during this period. Once base line data had been collected, the size press was taken off-line and the machine stabilized for another 12 hours before reactive polymer was introduced at 1.0 lb/ton dry (0.45 kg/ton). Dosage was then increased in 1.0 lb/ton (0.45 kg/ton) increments

every 30 minutes until a dosage of 5.0 lb/ton dry (2.3 kg/ton) was reached. It was during this incremental product introduction that dosage and threshold performance were documented and linked; measured by strength, drainage and drying. Nalco determined that maximized program performance was achieved at 3.0 lb/ton (1.4 kg/ton) of reactive polymer. Immediate drainage improvement on the table, as measured by wet-line position and flatbox levels, was also documented. As a result, operators began removing steam from all dryer sections in order to keep sheet moisture constant. Phase 1 of the Nalco program provided the customer with a number of benefits:

- A 3.5 point or 5% increase in ring crush (Figure 1)
- A 5.5 point or 6% increase in mullen (Figure 1)
- Improved table drainage and sheet pressability
- A steam decrease of 10,000 – 15,000 lb/hour to the dryer section resulting in a \$500,000 - \$760,000 reduction in natural gas consumption.

During Phase 2 of the evaluation, Nalco's program components were introduced at the dosages found to provide maximum performance in Phase 1. The goal of Phase 2 was to reconfirm the results of Phase 1 and provide machine operators with the flexibility to make the operational and mechanical changes needed to reduce basis weight and maximize machine productivity. With the introduction of the Nalco program, ring crush increased by 4 points or 5.5% and mullen increased 6.0 points or almost 7%. This data confirmed the Phase 1 strength results. At this point, machine operators made a number of operational changes to reduce basis weight and maximize productivity. In addition, water was added to the headbox to convert increased drainage into improved formation and increased fiber-to-fiber bonding. The results of Phase 2 are summarized below:

- A 2.5 lb or 6% decrease in basis weight (Figure 2)
- A 130 fpm (43 m/min) or 6% increase in machine speed (Figure 2)
- A 4 ton/hour increase in production (Figure 3)
- A steam decrease of 10,000 – 15,000 lb/hour to the dryer section resulting in a \$500,000 - \$760,000 reduction in natural gas consumption
- Sheet strength specifications met

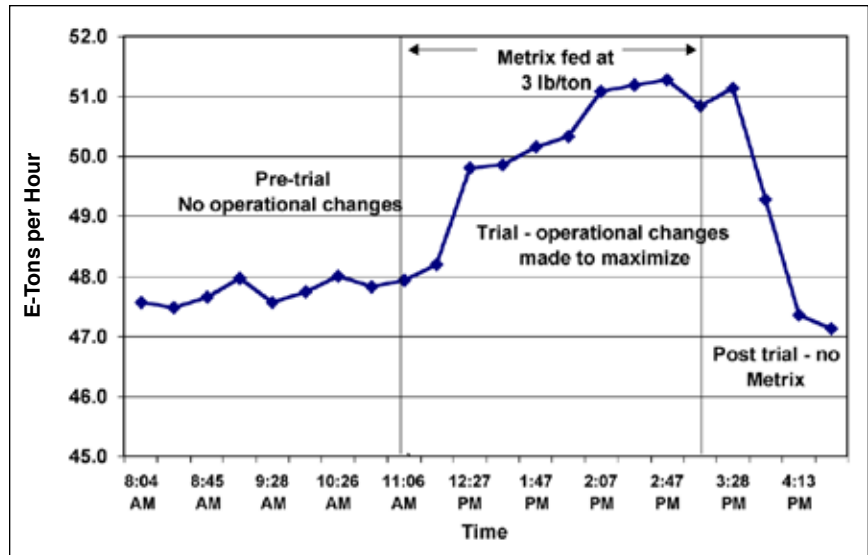


Figure 3 – Nalco's approach resulted in a 4 ton per hour increase in linerboard production.

Maintaining the Value

In order to gauge program efficacy over time, the KPIs, established for initial evaluation of program benefits, were used to routinely evaluate the program's value and to support Monthly Executive Summary meetings held between Nalco and the mill. Because the primary box converting site was located close to the mill site, management personnel from that converting location were also involved in monthly review sessions. In-mill KPIs included nominal basis weight, productivity rate, and total operational cost per ton. Converting site KPIs included Box Compressive Strength, line efficiency, and total productivity.

Conclusion

A Nalco solution designed with mechanical, operational, and chemical components allowed a recycle corrugating medium and linerboard mill to reduce energy consumption by increasing drainage, dewatering, and drying on its machine. In addition to reducing mill energy costs, the Nalco program provided the mill with the flexibility to lower basis weight and increase production without sacrificing sheet strength.

Nalco reports Environmental Return on Investment (eROI) values to customers to account for contributions in delivering both environmental performance and financial payback.

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