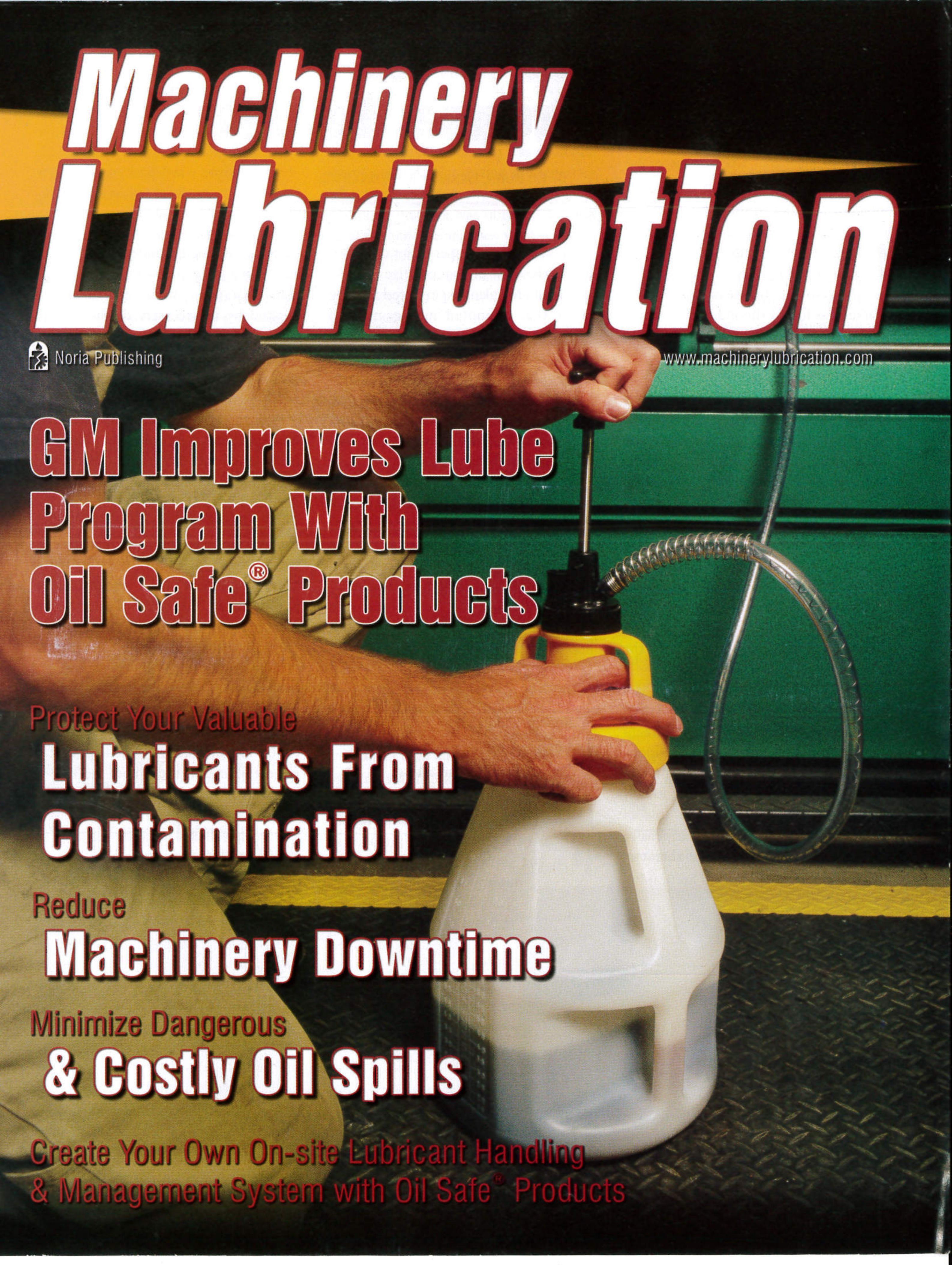
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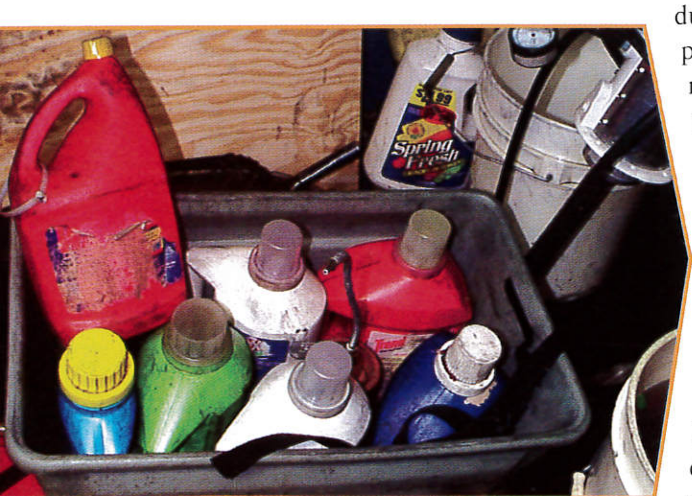
GM Invests in Lube Program Upgrades

By Ed Bohn, General Motors Corp.

Increased competition from international manufacturers for market share in the North American automotive market has forced the industry to revisit and change many long-held beliefs and practices in quite a few automotive manufacturing plants.

Employees at the General Motors Corp. Linden Assembly Plant in New Jersey have capitalized on this movement. One strategy has been to address the traditionally low-priority practice of plant lubrication through the predictive maintenance group. These efforts have delivered outstanding value to the company. This article summarizes the process employed by the team to replace old practices with new ones, including motivation, modifications and improvements, and the value created by the program over the last three years.

Lubrication is often overlooked as a strategic maintenance function until a significant event, usually a failure or other significant threat to the business, reveals the need for a different approach. The failure that prompts change usually results in an injury and/or a loss of production, and/or the asset is expensive to repair. In other cases, the threat of going out of business, or major cutbacks, breaks the cycle of poor practice.



Inappropriate Oil Delivery Bottles

The Linden plant experienced a failure event that prompted management to revisit its maintenance practices. When management focused on the event and its consequences, it was moved to deploy predictive maintenance technologies, including vibration analysis, infrared (IR) thermography, ultrasonic analysis and lubricant-based analysis techniques.

At the onset of the improvement program, the author, a plant lubrication specialist, received approval to implement an in-house oil analysis lab as the basis for validating lubrication improvements and promoting positive change.

The following five key issues were identified at the onset as targets for improvement:

1. Lubricant consolidation
2. Lubrication training
3. Storage and handling
4. Lubricant coding system
5. Performance benchmarking.

Lubricant Consolidation

There were more than 30 products in use at the time, many of which were duplicates. Working with the preferred supplier, the team reduced the number of products in service by 53 percent, from 30 to a manageable 14.

Employing too many lubricants creates confusion among personnel, especially those such as shift mechanics who are not routinely involved in the lubrication process. One cannot effectively lubricate machinery without getting the right lubricant in the right machine. Reducing unnecessary confusion was a good first step. There were many instances where the confusion created by unnecessary duplication of gear oils and hydraulic fluids resulted in cross-contamination.

Lubrication Training

Prior to the program, there was little understanding company-wide about the importance of lubricant cleanliness, contamination control and best practices for storing and handling lubricants. Products were delivered in drums and stored open-to-atmosphere. Additionally, the proper methods for delivering lubricants from stores to the machines were not defined. The lack of lubrication precision resulted in the ingress of atmospheric contaminants and frequent mixing of lubricants, some of which are not compatible. Training was given a high priority and was one of the first action steps to improve the process. The lubrication technicians and mechanics were given training on the proper method of lubricant selection, handling, contamination control, sampling and routine care of lubricants through classes conducted at the GM technical center in Detroit.

Storage and Handling

Storage and handling practices at the plant changed dramatically. Before the upgrade there were no specific containers dedicated to each type of fluid. Consequently, the lubricants were transported from stores to the equipment in any container that was available, including open cans, plastic bottles, buckets, etc. This led to a significant amount of lubricant contamination in mechanical systems throughout the plant.

The team decided to use dedicated containers, beginning with Nalgene®

plastic bottles and then moving to Oil Safe® lubricant dispenser bottles. The bottles were designated for use with a given product and were labeled accordingly. Currently there are 60 lubricant dispensers distributed among three staging areas. Each has a label that correlates to a specific product.

The team also selected and began to use the first of three lube carts to carry the lubricants throughout the plant. Some modifications were required, and two more carts were ordered with the modifications in the second year of the program. This effort significantly reduced the number of cases of lubricant contamination over the three years since the program was launched.

Lubricant Coding System

Management also addressed the need to coordinate the equipment requirements with the labeling of lubricant storage and delivery containers. It created a coding system that used words, images and colors to define the specific product for each application. Once identified, the products were then matched with the correct storage and transfer container. The result was a visual system that clearly communicated which lubricant the machine required, and which container held that particular lubricant. The technician or mechanic requires no special knowledge to use the simple matching system.

Performance Trending

The last issue addressed was the requirement for benchmarking and trending. The team needed to create a process to measure current results against a benchmark, and to develop a means to communicate to management what resources were required to correct deficiencies. The solution was to implement a mini-lab for testing and reporting of lubricant and machine condition. A sampling program was initiated and the results from the analyses were recorded for scheduling of corrective maintenance (CM work orders) in the Computerized Maintenance Management Program.

GM Linden uses corrective maintenance (CM) work orders to schedule corrective activities for equipment based on the results from one or more of the predictive technologies. The team now issues only a fraction of the work orders that it did in the early days of the program, despite the fact that there are now many more items routinely tested.

A good example of the lasting value created by the program is the avoidance of a major problem on a laser-cutting tool used to cut floor pans. Several months into the program, oil analysis revealed a problem on an expensive and critical turntable drive.

The problem was further investigated with vibration analysis, thermography and ultrasonic analysis. The initial readings revealed a high ferrous content, but there was no specific noise to correlate with bearings or gear wear. The microphotograph, however, clearly points to a developing issue. The other technologies showed no unusual patterns or evidence of high heat. Nonetheless, the convictions were strong enough to warrant a work order for corrective repair. Upon investigation, mechanics discovered an open inspection panel, which was allowing a free flow of laser cuttings and sparks into the oil sump. This discovery prevented a loss of revenue due to downtime and high repair costs.

Transfer Containers with Colored Oil Labels

In an effort to quantify the value of the oil lab and its related corrective maintenance actions, the CM work orders are characterized by value (cost avoidance) in the computerized maintenance management system (CMMS) and tracked. A conservative view is generally taken at the department when making these projections. With this in mind, the value of the CM work produced through the efforts of GM Linden's lubrication team for a 28-month term exceeds the $1.6 million dollars already identified as savings. (Production opportunity costs are not included in these figures.)

The following cost analysis in Table 1 shows, in round and conservative numbers, the relative value that the lubrication practices improvement effort has delivered.

Conclusion

Although traditionally given a low level of importance in the manufacturing world, lubrication processes and habits can have a significant bearing on the productivity of an operation, either positively or negatively. Though the annual cost of lubrication, including labor and materials, is not a large part of the maintenance budget, the way that the dollars are spent is important. Deployment of lubrication best practices combined with the on-site testing to track the quality of the lubrication effort is an effective way to achieve productivity improvements and cost reductions in both general maintenance and in the machinery lubrication practices. With managerial support for training, improvements in storage and handling, and continuous improvement in lubrication procedures and practices, this focus on lubrication improvements can deliver strong financial rewards for relatively few dollars invested. ML

Table 1

Estimates	Simple 5-Year Financial Analysis of Program Improvement 0	1	2	3	4	5
Savings						
Documented Savings (Yrs. 1 and 2)*	-	$900,000	$700,000			
Lubricant Expenditure Savings**		$19	$17	$42	$26	$26
Projected Savings (Yrs. 3, 4, 5)**				$500,000	$500,000	$500,000
Subtotal - Program Savings		**$900,019**	**$700,017**	**$500,042**	**$500,026**	**$500,026**
Capital Purchases	Initial Expenses					
IFH Storage Bins	$9,000					
Lube Trucks		$10,000	$20,000			
Lab Equipment	$55,000					
Expense Purchases						
Lubrication Training	$16,000					
Oil Safe® Containers	$5,700					
Material Handling Changes	$4,550					
Tagging System	$560					
Increase Lubricant Consumption						
Lab Equipment Training	$10,000					
Subtotal - Program Expenses* **	**$100,810**	**$10,000**	**$20,000**	-	-	-
Depreciation Tax Shield ****		$4,440	$5,640	$5,640	$5,640	$5,640
Total Cash Flows	**$(100,810)**	**$894,459**	**$685,657**	**$505,682**	**$505,666**	**$505,666**
Discount Rate (factor) *****	15% 1	0.8696	0.7561	0.6575	0.5718	0.4972
Discounted Cash Flow	$(100,810)	$777,790	$518,455	$332,494	$289,116	$251,405
Projected 5-Yr. Return	$2,068,451					
Payback Term - Months	2					
IRR (based on 20%)	738%					
NPV 5-Yr. Estimate	$2,068,451					

* Actual savings documented in formal cost program.
** Projected savings based on undocumented and anticipated savings.
*** Expenses include initial outlays and additional outlays during the first and second years.
**** Tax shield based on straight-line depreciation at a 30 percent corporate tax rate.
***** Discount rate equals the estimated target for returns on capital purchases.