



Green Cross for Safety® Awards 2022 Finalist | Excellence

United States Steel Corporation

The U. S. Steel Minnesota Ore Operations (MOO) consist of two open-pit taconite mines – Minntac and Keetac – that supply the company’s North American plants with iron ore pellets for use in the steelmaking process. Caterpillar front-end loaders and 240-ton Caterpillar/Komatsu haul trucks transport crude ore and waste out of the mines to processing units. Tires for these vehicles are approximately 12 feet tall and weigh nearly 9,000 pounds.

From a safety standpoint, the company did not have a consistent method to track real-time data associated with the health of the tires. This meant employees performed routine tasks near tires that were potentially overheated, experiencing high/low air pressure, or defective to the point of instability. In the past, these large tires have been associated with significant injuries. Recently, a U. S. Steel employee sustained multiple fractures to his ankle and knee when a left rear tire exploded while he was trying to board a lift truck. Additionally, MOO took 22 tires out of service in 2021 for premature failure caused by heat separation.

It was determined that by installing the Michelin Earthmover Management System (MEMS 4) monitoring tool, U. S. Steel could reduce the number of tires taken out of service by half. With this system, internal sensors are mounted inside the tires and programmed to provide real-time data to user-friendly dashboards. The dashboards help ensure tires are operating within temperature and pressure specifications. MOO Mine Control is then alerted when any established limits are exceeded. Tires within manufacturer operating limits display a green readout; tires above 170 degrees F an amber “CAUTION;” and tires above 176 degrees F a red “ALERT.” Once tires go into “CAUTION” or “ALERT” status, Mine Control will notify the driver to initiate proactive controls to prevent a failure.

During the trial phase of the MEMS monitoring system, the original design included a monitoring screen located inside each haul truck cab. However, due to operator concerns about the brightness of the display screen at night and an associated risk of distracted driving, the decision was made to relocate the monitors to Mine Control. Installing the display screens at Mine Control also provided a centrally located command center to continuously monitor the health of all tires in service and track the movement of each truck via GPS.

In the below chart, six tires in service on Truck 4259 are monitored in real time. The tire in position 4 is in “CAUTION” status. For this specific vehicle, Mine Control would notify the driver to take actions that include adjusting the inflation pressure or, in the case of increased temperature, rerouting the vehicle for a shorter haul. If a tire reaches “ALERT” status, that vehicle would be taken to a predetermined rest area. Once the tires cool down and return to the green zone, they can return to service or, if needed, go to the maintenance shop.



4259 | Production ⓘ
 Last heard 04-20-2022 14:45:13
 Last GPS update 04-20-2022 14:45:11



	Position	Temperature	Pressure	Prec		
	1	84 °F	118 PSI	115 PSI	ⓘ	
	2	79 °F	117 PSI	114 PSI	ⓘ	
	3	73 °F	113 PSI	113 PSI	ⓘ	
	4	79 °F	124 PSI	114 PSI	ⓘ	
	5	77 °F	111 PSI	113 PSI	ⓘ	
	6	73 °F	116 PSI	113 PSI	ⓘ	

The benefits of the MEMS 4 monitoring system were clear from the start of the project and break down into three key elements: safety, productivity and performance. Employee safety is always U. S. Steel’s concern and Safety First is the company policy. The system allows employees to check tire pressure and temperature from a remote location, ensuring a safer working environment. Additionally, productivity is a huge driver in the success of this process. Tire pressure and temperature are measured in real time without stopping the vehicles. This eliminates downtime related to pressure checks and adjustments of tire inflation. Lastly, performance has increased not only when it comes to the tires, but also in regard to the efficiency and consistency with which the company safely operates its equipment. MEMS starts the tire life at the correct air pressure and helps ensure that correct pressure is maintained throughout the tire’s life. The possible interface with tire management software also allows improved recording of performance data.

Since the implementation of the MEMS 4 monitoring system, the number of tires removed from service has dropped to zero. On average, the cost of a new Caterpillar 240T tire is \$45,000, which translates into an approximate cost avoidance of almost \$1 million in the first year of implementation.

U. S. Steel uses the MEMS 4 monitoring system on 34 vehicles at MOO’s open pit taconite mines. To fully realize the potential benefits of this monitoring tool, the company expects to purchase and install these units on an additional 41 haul trucks by the end of 2022. The MEMS 4 monitoring system has additional capabilities that monitor positions, speeds and routes with GPS mapping and geofencing technology. By identifying high traffic areas or areas where vehicles operate near offices or employee workstations, the company can limit operator speed to ensure drivers avoid any unwanted interaction between vehicle and pedestrian.

U. S. Steel believes the work put into this project will ultimately reduce incidents and potentially save lives. Therefore, the company plans to share its success in eliminating hazards associated with tire pressure and temperature through benchmarking activities and best practice presentations with professional organizations and conferences.



Many companies strive for world-class safety performance. However, the path to “zero” is rarely clear. U. S. Steel believes that leveraging data can help light the way, but only a perpetual, unwavering commitment to evolving safety processes will help find new ways to eliminate or reduce risk and ensure that each employee returns home safely to their family every single day.