



# An Ounce of Prevention

*Leading indicators represent the future of proactive, preventive safety performance metrics.*

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In a world where some form of human error is involved in almost all accidents and incidents, it should come as no surprise that trailing indicators (measurements taken after something undesirable has already occurred) are the traditional metrics that transportation organizations use to measure operational safety, health, and wellness performance.

### **Leading vs. Trailing Indicators**

Various common trailing indicator measurements in maritime operations include OSHA recordable personal injury rates, allisions, collisions, groundings, cargo damage, and man overboards. The severity and cost of each event are also commonly studied as trailing indicators. While these measurements are vital measurements of the health of an organization, they are historical measurements of undesirable events that have already had a negative impact upon individual employees and the organization's bottom line.

Trailing indicators document what happened in the past and thus cannot be changed. While trailing indicators play a role in determining what needs to be done to improve results, they should not be solely relied upon. More importantly, this approach by itself does not help to identify or champion the specific activities, actions, and behaviors required to achieve the desired results. If you rely on trailing indicators, you are still taking a reactive rather than a proactive approach to the pre-

vention of unwanted events. Many times, transportation companies will try to hold on to trailing indicators for planning purposes—like a man who can't swim clings to a life ring for survival. He places his trust in this method because it is a proven product with a solid history of saving lives. The key word here, however, is "history."

Leading indicators, on the other hand, are those activities, behaviors, processes, standards, etc. that lead to desired results from employees properly implementing their training and subsequently being held accountable for those actions. While a safety management system based on leading indicators will ultimately affect all of those measurements associated with trailing indicators, the impact will be much broader in all performance fields and will be felt much farther upstream.



**Figure 1: The ACL flagship, the M/V Norb Whitlock. Photo courtesy of American Commercial Lines Inc.**

Results of a safety management system based on leading indicators in maritime operations might safely achieve productivity improvements reflected in vessel run times, barge turn rates, and reduction in port times.

These improvements may lead further to the desired results of reduced insurance premiums and other intangible benefits. The shift to management via leading indicators will change the company's entire culture, impacting everyone regardless of rank or position, and will very likely result in significant performance improvements and additional cost savings.

### Leading Indicators in Action

American Commercial Lines Inc. (Figure 1) uses a leading indicator-based safety management system. This system includes a continuous-improvement implementation and evaluation program that requires:

- proper training for all crewmembers,
- adherence to operational and safety procedures,
- a mandatory near-miss reporting policy,
- implementation of the Crew Endurance Management System (CEMS) program.

The first step in shifting from a reactive, trailing indicator-based safety management system to a proactive, leading indicator-based safety management system is to understand where each organization is at the present time. You must have a clear definition of the current status, developed from field behavioral observations.

American Commercial Lines Inc. (ACL) implemented a field workplace performance standards verification program in which experienced personnel and supervisors conduct unannounced observations of employee behavior (Figure 2). The written reports from the workplace performance standards verification program document whether or not employees are following policies and procedures, such as wearing required personal protective equipment and complying with safety rules and hazardous communication policies.

Additionally, supervisors hold regular safety meetings and provide written documentation of their findings to senior managers, who, in turn, must also take the necessary actions to assure safety through adherence to company policies, standards, and procedures.

This "leading indicator emphasis" requires that companies place a much greater focus on training and accountability at all levels within the organization. We all must understand that being truly proactive means creating an organizational vision of how you want things to be while simultaneously dealing with the conditions that currently exist.

With that said, the challenge becomes shifting our operational culture from post-incident, corrective actions based on root cause analysis results, to the new frontier of proactive risk management, based on leading indicators.

At American Commercial Lines, the first set of leading indicators comes as a result of employee participation with a mandatory near-miss reporting policy. Near-misses are accidents that almost happen or might have happened. An analysis of the chain of events leading up to the near-miss event enables procedures to be evaluated and revised, as necessary, to prevent an unwanted event in the future.

The key here is that, if left unaddressed, these behaviors could eventually result in an unwanted event. In

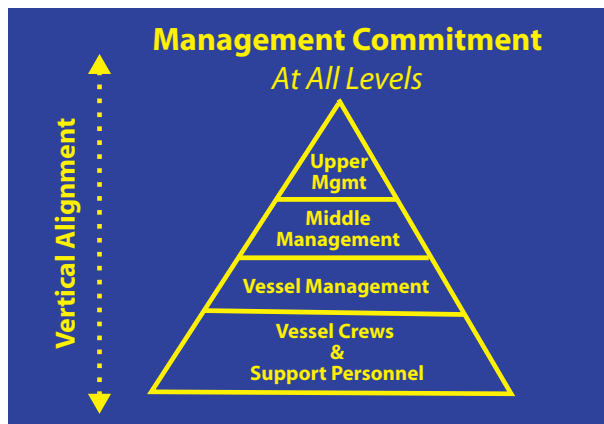
**Figure 2: An American Commercial Lines employee (upper left) observes work practices as part of the company's workplace performance standards verification program. Photo courtesy of American Commercial Lines Inc.**



other words, many “near-misses” may eventually add up to a “hit.” That is why the behaviors must be reviewed. By exposing patterns of behavior, ACL has identified leading indicators that can be proactively addressed.

Near-miss reports are often submitted to the manager of vessel safety and/or the appropriate operations manager. These reports of incidents that resulted in neither injury nor vessel accident must contain the following information:

1. what occurred,
2. what could have resulted,
3. what the significant causes were,
4. how to help fellow employees to avoid this type of near-miss,
5. boat or facility name,
6. date of the incident,
7. date a safety meeting was held concerning this near-miss.



**Figure 3: ACL found that the best way to introduce any new safety program was through demonstrated management commitment at all levels.**

This is the first snapshot of the behaviors present, documented by employee participation, and will highlight some of the leading indicator areas where training and education programs should focus. ACL developed key leading indicators in the war against “competent errors” (errors made by otherwise qualified personnel) in maritime operations by adding a mandatory Crew Endurance Management System policy in addition to the company’s mandatory near-miss reporting program.

American Commercial Lines found that the best way to introduce any new safety program is through demonstrated management commitment at all levels in a top-down approach, as depicted in figure 3. ACL began by educating the organization’s vertical alignment, establishing a common mental model, and

developing a final common path through open discussion. This process will progress to full implementation of the leading indicator approach to safety.

### Managing Crew Endurance Risk Factors

After an organization’s working group and/or major stakeholders have acquired a solid understanding of basic CEMS principles, the next step is to conduct an assessment of risks onboard the vessel. By addressing crew endurance risk factors, mariners are armed with the tools necessary to combat error. A more alert mariner will be able to make better risk-based decisions through a higher level of situational awareness.

“Improper management of crew endurance risk factors, including sleep, diet, and stress, has been shown to reduce the body’s ability to conduct physical and mental tasks, thereby causing crewmembers to:

- Think less clearly.
- Make poor decisions.
- Become irritable.
- Have problems communicating with others.
- Experience degraded endurance throughout work and leisure hours.
- Become withdrawn and less willing to resolve issues and problems.
- Have less ability to fight disease.”<sup>1</sup>

Identifying crew endurance risk factors within an organization and managing the associated risks are key in this process. The USCG CEMS Guide for Maritime Operations Addendum outlines 15 principal risk factors that are found in maritime operations.<sup>2</sup>

Using the list of principal risk factors enables a working group to outline the current situation and identify the most common factors present. ACL and many other operators have found the following to be the most common crew endurance risk factors, in order of frequency of occurrence:

1. sleep fragmentation,
2. poor sleep quality,
3. insufficient daily sleep duration,
4. family stress,
5. isolation from family,
6. poor diet.

The frequency with which each of the risk factors occurs can be a leading indicator to a problem. Studies have found that human error accidents and incidents can be directly attributed to these risk factors if left uncontrolled.<sup>3</sup> The key to improvement is how these leading indicator risks are managed. The best place to start is with the following guidance, reprinted from the USCG CEMS Guide for Maritime Operations.

American Commercial Lines recognizes the importance of crew endurance and, specifically, the importance of ensuring an adequate work and sleep environment for our crewmembers. As such, ACL is investing millions of capital dollars to improve crew work spaces and living spaces (Figure 4). These improvements include:

- darkening staterooms,
- increasing light intensities,
- reducing noise and vibration,
- providing quality bedding.

#### Crew Endurance Tips

Stress reduction and morale boosters can render a large payoff for a relatively small investment. In addition to the vessel modifications described above, ACL found that installing satellite television also easily boosted morale, as crewmembers realized the company's keen interest in their mental and emotional well-being.

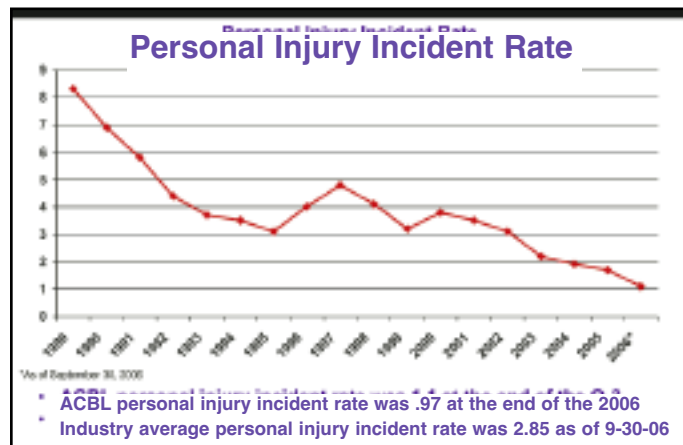
Management, captains, and crewmembers can all contribute to the control of stress-related risk factors by implementing a consistent stress management program. American Commercial Lines has found the following list of recommendations to be successful in reducing stress and improving the quality of life onboard vessels:

- Train employees new to their job situation, particularly those recently promoted.
- Develop time-management strategies.
- Make a variety of exercise equipment available to crewmembers (treadmill, stationary bicycle, etc.).
- Promote crew participation in problem-solving using a team approach.
- Identify and reduce stressful factors, particularly those involving interpersonal relationships.
- Provide crew resource management training.
- Emphasize good communication with crewmembers, realizing that alienation, withdrawal, and lack of participation are signs of stress in all ranks and positions.
- Implement an on-watch rest policy.
- Implement an on-watch early meals policy.
- Implement an on-watch early shower policy.
- Implement a watch change time policy.
- Implement a common courtesy policy.
- Implement a continuous feedback policy.
- Provide vessel culinary training for cooks and modify the daily menu so that meals are balanced. Offer plenty of fresh vegetables and fruits, fresh juices, whole-grain bread, and low-fat meats such as turkey, fish, and chicken.

Instituting a near-miss program, CEMS, and workplace behavioral observations are examples of how American Commercial Lines began the transition to a leading indicator-based safety management system. As shown in figure 5, ACL's personal injury incident rate has drastically declined over the years. This decline is a result of changes in our organization's safety culture, driven by continuous innovation and changes in our safety management system. The decrease in injuries also reflects millions of dollars in cost savings for the company through reductions in injury claims.



**Figure 4: Renovated crew accommodation spaces, modified to CEMS specifications. Photo courtesy of American Commercial Lines Inc.**



**Figure 5: Chart of personal injury incident rates over time. Chart courtesy of American Commercial Lines Inc.**

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#### Endnotes:

1. Crew Endurance Management Practices: A Guide for Maritime Operations, January 2003, p. 33. This original guide to CEMS can be found at <http://www.uscg.mil/hq/gm/cems/PDF/Guide%20for%20Maritime%20Operations.pdf>.
2. The Crew Endurance Management Practices: A Guide for Maritime Operations ADDENDUM, September 2005, p. 35. The addendum can be found at <http://www.uscg.mil/hq/g-m/cems/PDF/Final.pdf>.
3. Commandant Instruction 3500.2, dated 30 MAR 2006, and Crew Endurance Management Practices: A Guide for Maritime Operations, January 2003, p. 33.

