Using Leading Indicators to Improve Safety Management

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Introduction

There are many articles and webinars on leading indicators at safety conferences and in EHS publications, and everyone rightly agrees they're good things. But it's not always clear to the average EHS professional what leading indicators are, how they improve safety, and what kinds of factors need to be considered to effectively use them. That's why we created this guide.

In what follows, we'll explain what leading indicators are, how they work, and how to make effective choices in your leading indicators. We'll also highlight examples of what good leading indicator selection and management look like in practice.

What are Lagging Indicators?

Before defining leading indicators, let's define *lagging* indicators.

Lagging indicators are metrics related to your current or past state of safety. One easy way to tell a metric is lagging is that it's documenting or measuring safety incidents that already happened – they're backward looking. Common examples of these are the recordable incident rate (RIR), which measures the number of OSHA recordable injuries and illnesses per 100 full-time employees (FTEs), and the days away, restricted or transferred (DART) rate, which measures the frequency of injuries or illnesses resulting in restricted duty or days away from work. **FIGURE 1**, taken from instructions to OSHA's Form 300A, indicates how to calculate the RIR.

Worksheet

Total number of injuries and illnesses _____ X 200,000 ÷ Number of hours worked by all employees _____ = Total recordable case rate 0

Number of entries in Column H + Column I _____ X 200,000 ÷ Number of hours worked by all employees _____ = DART incidence rate 0

Reset

FIGURE 1: *OSHA's Form 300A | Worksheet*

Lagging Metrics are Sometimes Regulatory Requirements

The example from OSHA's Form 300A above shows that some lagging metrics are regulatory requirements for employers. In the US, OSHA's Recordkeeping Standard requires employers covered by the Standard to document work-related injuries and illnesses meeting OSHA's recording criteria (e.g., they resulted in death, medical treatment beyond first aid, loss of consciousness, days away from work, restricted duty, or diagnosis of significant injury or illness by a physician) on Forms 300 and 301 within 7 days of learning of the incident.

Employers covered by the Recordkeeping Standard would also need to complete Form 300A and post a signed copy in an accessible location in the workplace from February 1 through April 30 of each year. Additionally, all employers covered by the Occupational Health and Safety Act, whether they're subject to the full provisions of the Recordkeeping Standard, would need to report occupational fatalities to OSHA within 8 hours, and incidents involving amputations or resulting in hospitalization within 24 hours.

It's very important to realize that for OSHA, completion of these forms and reports is not just a regulatory box-checking exercise. In the view of OSHA and stakeholders who weighed in on the need for OSHA to develop the regulation, these requirements are essential for employers to have the necessary information to effectively manage workplace safety – after all, if they lack knowledge of injuries and the reasons they happened, they're probably not going to be able to prevent more from happening. As OSHA states in the instructions for Form 301, "these forms help the employer and OSHA develop a picture of the extent and severity of work-related incidents."

Because of the importance of injury and illness recordkeeping to safety management, other global regulatory bodies have also established injury and illness reporting and documentation requirements. For example, in Canada, employers must report certain workplace injuries and illnesses to the appropriate Worker's Compensation Board in the province where their facility is located. And in the UK, Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (RIDDOR) requires employers to report workplace fatalities, injuries and other "dangerous occurrences" including some near hits/near misses.

The Problems of Under-Recording and Under-Reporting

Despite these long-established regulatory requirements for occupational injury and illness recordkeeping, businesses often don't report injuries they need to report, don't submit reports they need to submit (e.g., 300A) or don't record injuries they should've recorded. For example, a 2014 study published in the American Journal of Industrial Medicine found that 90% of Bureau of Labor Statistics (BLS) Survey of Occupational Injury & Illness (SOII) respondents failed to meet one or more reporting requirements, due to either misunderstanding or disregard for OSHA recordkeeping regulations. This problem isn't limited to the United States, either. A 2015 study reviewing British Columbia (BC) workers' compensation data found that between 7% and 24% of work-related fatalities between 1991 and 2009 weren't captured by the workers compensation system.

There are a couple of key takeaways to note here. The first is that some lagging metrics are regulatory requirements because of the identified importance of the records for enabling employers to identify and control workplace risks and protect the occupational safety and health of workers. The second takeaway is that despite the importance and the regulatory obligation, many employers are still not recording their occupational injuries and illnesses. We'll revisit this point later in the guide, but for now, remember these points the next time you hear or see someone arguing that lagging indicators are passé or somehow irrelevant compared to leading indicators.

> *Leading indicators provide tangible actions you can take today to positively influence safety outcomes.*

What are Leading Indicators?

Leading indicators track *activities related to achievement* of a safety management goal, rather than completion of the goal itself. They look *forward* by making sure you're taking proactive measures to achieve the results you want to see, by completing and tracking actions you've determined to be directly related to the achievement of primary goals. If you've chosen leading indicators well and can verify they're trending in the right direction, you can be optimistic that you're on the way to meeting your goals.

Now that we've made that distinction, let's muddy the water a bit, because people often get themselves twisted up trying to figure out which types of indicators are *inherently* leading or lagging. But already this discussion hints that the terms "leading" and "lagging" may not describe properties of the indicators themselves, as much as they describe what you do with them.

A 2020 Safety + Health article reviewed some of the nuances involved. For example, tracking "near hits" or "close calls" is commonly thought of as a leading metric, even though they're "lagging" in the sense of documenting unsafe events that already happened, because they're used to identify and correct workplace hazards and improve future performance. Really, any measurable activity or trend, including even the number of recordable incidents, can be a leading indicator if it's proactively used to identify and correct hazards and positively impact future safety performance.

How Do Leading Indicators Help Improve Safety?

This explanation of leading indicators makes a nice segue to show how choosing and tracking the right leading indicators helps improve safety. In short, it's by making sure you're paying attention to future performance, not just past performance.

You need to understand past performance, of course, and regulations such as OSHA's Recordkeeping Standard require many businesses to track lagging metrics such as numbers of recordable injuries and illness and RIR. As discussed, lagging metrics can also sometimes double as leading metrics if you're using them to engage with and improve safety performance. But ultimately, you need more than metrics that are only based on past hazardous conditions and past behaviors that led to safety incidents. You need a good range of carefully chosen present-focused leading metrics to improve your ability to actively investigate and address current hazards. If you're not doing so, your metrics tracking is just documenting poor safety performance, rather than enabling better future performance.

Leading indicators help by providing tangible actions to take today to positively influence safety outcomes. Organizations with a robust leading indicator program have the advantage of a proactive approach rather than a reactive approach, which helps them identify and correct hazards before they can lead to injuries and illnesses.

Choosing Your Leading Indicators/OSHA Leading Indicator Guidance

Of course, the effectiveness of leading indicators depends on choosing them wisely. One of the common misconceptions about leading indicators is that any leading indicator is automatically "better" for safety management than any lagging indicator. One reason this assumption is false is because the distinction between leading and lagging indicators is not always clear, and it depends largely on what you do with them. Another reason is that leading indicators only work well if they're measuring an activity crucial to improving safety, and you're effectively managing them.

For example, many EHS managers consider "safety tours" or "safety stand downs" to be classic examples of leading indicators. These are events where a group of employees, often involving management leadership, spend some time allotted to finding hazards and opportunities for improving safety. Sure, this seems proactive and positive and these events certainly *can* be good leading indicators, but it's also entirely possible they'll have no impact at all on safety. Too many "safety walk throughs" are unfocused and unspecific in their aims, and don't delve deeply enough into working conditions or engage enough with employees to generate actionable "intelligence" about safety.

You need more than leading indicators—you need the right leading indicators. OSHA provides an excellent guidance document called **Using Leading Indicators to Improve Safety and Health Outcomes**, shown in the screen capture below *(FIGURE 2)*.

FIGURE 2: OSHA Guidance Document

In this guidance, OSHA advises that effective leading indicators need to have the following "SMART" characteristics:

Specific: Leading indicators need to clearly specify what you'll be doing and tracking to achieve a safety goal.

Measurable: If you can't measure your leading indicator, you also can't track it, which defeats the whole purpose.

Accountable: Being accountable in your choice of leading indicators means you're deliberately choosing to track activities that will make progress toward your goal. The concept of relevancy is baked into this—you're showing you take the goal seriously by doing what's necessary to achieve it.

Reasonable: There's no use setting goals that are more aspirational than they are achievable in the real world, and then having to track leading indicators that will just document your failure to do what couldn't be done. Reasonableness is related to accountability, because if you're serious about improving safety, you need to choose realistic goals and relevant leading metrics.

Timely: Are you choosing a leading metric that's readily trackable, and are you tracking it frequently enough to identify and address trends?

You're more likely to choose and manage your leading indicators well if you have the full engagement of all workers throughout your organization. You need to include them throughout the process, from participation in incident investigations and risk assessments to planning corrective actions, and identifying specific leading indicators needed to address identified hazards.

Test Case: Preventing Trips and Falls

Let's take a closer look at how leading indicators can help by focusing on a specific test case— preventing trips and falls.

Here's the situation. Suppose you notice from your incident tracking that you've had a surge in trip/fall injuries; digging further, you see they've mostly happened in a single area. Thanks to your employees' participation in root cause analyses for those incidents, you learn the falls happened because of tools and packaging materials obstructing walkways. You resolve to reverse this trend—reduction of trips and falls becomes a primary safety management goal.

But how do you get there? That's where leading indicators come in.

The first step is to carefully choose leading indicators likely to help achieve your objective. If your objective is to reduce trips/falls, then choosing leading indicators aimed at eliminating the causes of those incidents seems like just the ticket. Since in this case you know cluttered walkways are the root cause of incidents, a good strategy is to do inspections to ensure walkways are unobstructed. Specifically, you determine that you need to inspect floors in this area daily and develop a specific checklist to ensure you're looking at the right things, like in the example below *(FIGURE 3)*.

As part of your adoption of this leading indicator, you also need to adopt a schedule to review progress. Once per week, you'll review daily inspection records for the past week, and identify deficiencies, such as incomplete checklists or inspections that are uncompleted. Then you can determine the reasons for the issues you're seeing, put corrective actions in place and see if the actions appear to be effective during future weekly reviews.

You can see how this example meets all the SMART criteria mentioned above. It's *specific* because you're using a tailored checklist for inspections and tracking the number of inspections that don't identify obstructions as a key metric. It's *measurable* because it's simple enough to track the inspections, especially if you're using the right EHS software to conduct the inspections. You're being *accountable* because you've used incident management analytics to identify a problem and its root cause, and then set up an activity to address the root cause. It's *reasonable* because your stated goal of reducing the incidence of trips/falls was achievable. Finally, you've ensured it was *timely* by doing an inspection frequently enough to be able to identify meaningful trends.

Daily Clean Up Checklist

- ☐ Rewind air hoses
- ☑ Package tools and equipment away from work station floors
- ☐ Store unused car parts in storage areas away from floors
- ☑ Sweep floors of debris and other objects that can lead to slips or falls

FIGURE 3: Daily Clean Up Checklist Example

Myths About Leading Indicators

Before moving on, let's look at common myths about leading indicators, and their relationship to lagging indicators.

The chart below *(FIGURE 4)* shows some of the most frequently encountered myths and brief explanations of what they get wrong.

Myth	Reality
LIs are predictive	Kind of, but only to a degree
They're superior to lagging indicators, or replace them	They do things lagging indicators can't do, but work closely with them
They represent "new" thinking	The idea of LIs has been around for a very long time
LIs are inherently useful	Not at all - it's quite possible to pick LIs that don't matter much to your understanding of safety

FIGURE 4: Myths About Leading Indicators

It's a rare day when an enterprising EHS professional doesn't find examples of other real or imagined EHS professionals espousing some version of these myths. Here are a couple examples of statements this author has seen or heard on multiple occasions at safety conferences and in social media posts, followed by responses based on what this guide has covered so far.

1. *"We need to stop documenting all the employees we're hurting and find out why they're getting hurt, so we can prevent it!"*

   The kernel of truth in this assertion is that documenting workplace injuries *alone* will not lead to the proactive safety culture needed to prevent injuries. But from there, several things go wrong. For starters, the options presented in this statement are not mutually exclusive. You can and should do both. A primary reason should be obvious from the discussion of key lagging metrics like the injury and illness records required by the OSHA Recordkeeping Standard – how do you learn *why* employees are getting hurt unless you first learn *that* they're getting hurt? And since there are widespread problems of under-reporting and under-recording of occupational injuries, it doesn't seem like a good idea to downplay their importance.
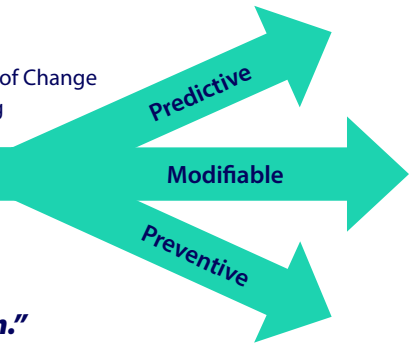
Lagging Metrics
Injury Reports | Near Misses
Recurring Events | Days Away (DART)

Leading Metrics
Preventive Maintenance | Mgmt. of Change
Process Hazard Analysis | Training

"The Rear-View Mirror"   INCIDENT   "The Road Ahead"

Predictive

Modifiable

Preventive

(cannot be influenced or changed)

"You don't know where you're going until you know where you've been."

FIGURE 5

2. *"Safety measures its success by how much less it screwed up this year compared to last year – how many fewer people did we hurt? OMG, that's so negative! No other industries do that!!"*

This is one of those statements that can seem insightful until you think about it a little more, and realize it just isn't true. Reporting metrics that track a reduction in an undesirable outcome are common across industries and professions. For example, does anyone really think an accountant wouldn't need to track the percent reduction in metrics related to undesired trends, such as the days payable outstanding (DPO), which is the average number of days it takes for a customer to pay their bill, or the payment error rate, which is the frequency of errors by the accounts payable department? There's an irony here, too, which is that the EHS professionals making this assertion are (even if unintentionally) falling into one of the most common habits of ineffective safety management: the avoidance of "bad news." The idea that negative feedback is a "downer" is where many problems in the safety world start. It makes it difficult to identify areas for improvement.

Keep these two statements in mind, because we'll come back to them at the end of the guide and supplement them with additional insights we've learned along the way.

The Logic Model of Metrics

Hopefully by this point in this guide, you're realizing that you're not faced with a binary choice of whether to use lagging metrics or leading metrics. It's not either/or, it's both/and. You need both kinds of metrics because they do different, complimentary things, as shown in the diagram above *(FIGURE 5)*.

In general, a *logic model* is a roadmap to think through a problem, identifying a path from intervention to impact. The diagram below *(FIGURE 6)* shows a typical logic model schematic based on the standard ANSI Z16.1-2022, "Safety and Health Measures and Performance Metrics," for the relationship among different kinds of metrics in a safety management system.

Let's take a closer look at each step in the logic model.

Input: These are the resources you need to produce an output, with "resources" interpreted very broadly. Some examples of input you can measure through metrics are money, time, number of dedicated staff, or expansion of an existing safety management program in terms of numbers of departments or employees covered.
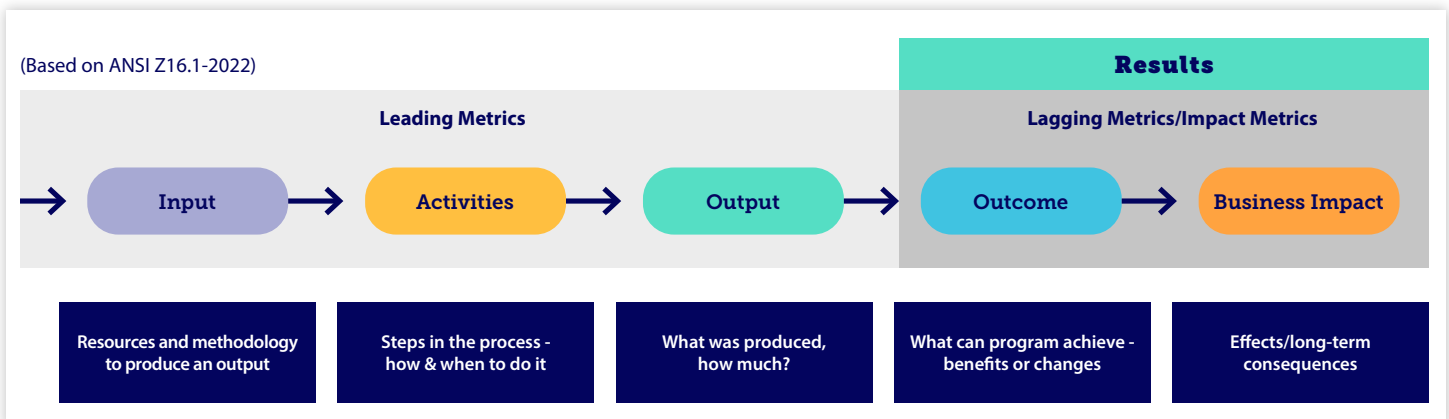

(Based on ANSI Z16.1-2022)

Results

Leading Metrics — Lagging Metrics/Impact Metrics

Input → Activities → Output → Outcome → Business Impact

| Resources and methodology to produce an output | Steps in the process - how & when to do it | What was produced, how much? | What can program achieve - benefits or changes | Effects/long-term consequences |

FIGURE 6: *The Logic Model of Metrics*

Activities: This is what you're doing to accomplish your goals. The metrics you choose to measure your activities should reasonably quantify key details about the number or intensity of activities completed, such as the total numbers of activities to date or the percentage completion for a specific activity.

Output: These are metrics that track what you produced or provided.

Outcome: These metrics track the completion of the primary safety goals you're trying to achieve. In other words, these are the things that happened directly because of your safety programs.

Impact: Impacts are indirect, or long-term, consequences of your safety program that probably would not have happened if you had not accomplished the primary goals measured via your output metrics. For example, your primary goal is always going to be to improve some key safety indicator, such as reducing the number of occupational injuries. After a while of achieving that objective, you may likely see a secondary benefit of improved employee morale, as measured by specific surveys for that purpose. It's always going to take a while to see and document the trends captured by impact metrics but doing so will help you and your stakeholders understand all the benefits of your safety programs.

Note in the chart above, "output" is the last category of metrics on the "leading indicator" side and provides a natural connection point to "outcomes" on the "lagging indicator" side of the chart. This is also a reminder that "outcomes" are the primary goals you're trying to achieve, and that lagging indicators are therefore indispensable to your safety management system.

The Logic Model of Metrics in Action

A practical example of how to choose and track metrics across each of the categories above might help.

Suppose you have a workplace where you know that measured sound pressure levels in some departments exceed the action level (AL) of 85 A-weighted decibels (dBA) established in OSHA's Hearing Conservation Standard. According to the Hearing Conservation Standard, employers must enroll all employees exposed to an 8-hour time weighted average (TWA) of 85 dBA or higher in a hearing conservation program (HCP) and conduct baseline and annual audiograms. Each year, the employer must then compare the results of the annual audiogram for each employee with the employee's baseline audiogram to check for a standard threshold shift (STS) – a measured change in hearing threshold of 10 dBA or more at 2000, 3000, and 4000 hertz (Hz) in one or both ears. It's even more important that employers track STSs because, unless a licensed medical professional determines that the hearing shift resulted from medical issues or exposures unrelated to the work environment or a retest confirms there was no STS, the OSHA Recordkeeping Standard requires the employer to record the STS on OSHA 300 and 301 forms.

Under these circumstances, you'd have clear safety priorities to protect your employees from occupational noise exposure, by reducing the number of employees exposed above the AL who need to be in your HCP and reducing the number of employees with identified STSs. You might come up with a logic model metrics table like the one below *(FIGURE 7)*.

You can probably best understand the reasoning summarized in this table if you start with the "outcomes" column, second from the left. These are your primary objectives. You know you have sound pressure levels in the workplace above the AL, and you have employees with recorded STSs, so your primary goals are to reduce the number of employees with STSs and reduce the number of employees in the HCP. You enter those as your two "outcomes" in that column of the chart.

But to achieve those outcomes, you first need information about where you stand today. You need "input" metrics like those on the left side of the chart, such as the percentage of the workplace covered by noise surveys, and the percentage of workers exposed to noise levels above the AL. Once you have that baseline information, you can plan the activities needed to improve, and the metrics to measure those activities. For example, you know all your employees exposed above the AL need audiograms, because the Hearing Conservation Standard says so, and because you need the audiograms to determine if occupational noise exposure is impacting their hearing. You also know you need to control

Input	Activities	Output	Outcome	Impact
% of workplace covered by noise surveys	% of employees above AL who have audiograms	% of noise hazards controlled	Fewer standard Threshold Shifts (STSs)	Less downtime to administer an HCP
% of workers exposed to noise above action level (AL)	% of new equipment over noise limit	# of new noise controls	Fewer employees in hearing conversation program (HCP)	HCP cost reduction

FIGURE 7

noise at the source and reduce the amount of equipment in the workplace that generates noise above established limits. Therefore, you'd want to track activity metrics such as the percentage of employees exposed to noise levels above the AL who have audiograms, and the percentage of new equipment over the noise limit. These are leading indicators that directly support achieving your lagging indicators – the primary goals of your safety program.

What kinds of "impact" metrics can you track? Remember, these are secondary consequences of achieving your primary outcomes – they're not what you were directly trying to accomplish, but your accomplishment of those goals made these additional benefits possible. For instance, you'll probably find that the amount of time needed to administer your HCP falls if you don't need to include as many employees in it, so tracking that reduction might be a good idea. You may, for similar reasons, find the costs associated with your HCP also fall and decide to track cost as an impact metric. As previously discussed, it may take a while for these impacts to manifest but tracking these metrics will help you demonstrate the full value of your safety efforts to stakeholders.

Using a Balanced Set of Metrics

The balanced metrics approach follows directly from the logic model of metrics. That's because the logic model shows how different kinds of leading and lagging indicators work together to track activities predictive of achieving your primary goals, and directly document achievement of the goals themselves. Another takeaway is you should have sets of lagging and leading metrics related to the full spectrum of workplace safety. You need to identify and control risks, but also focus on ways of improving your safety management system itself. A balanced set of metrics puts all these attributes together, as shown in **FIGURE 8**.

Let's dive deeper into how to use a balanced set of metrics by focusing on the risk side of the scale.
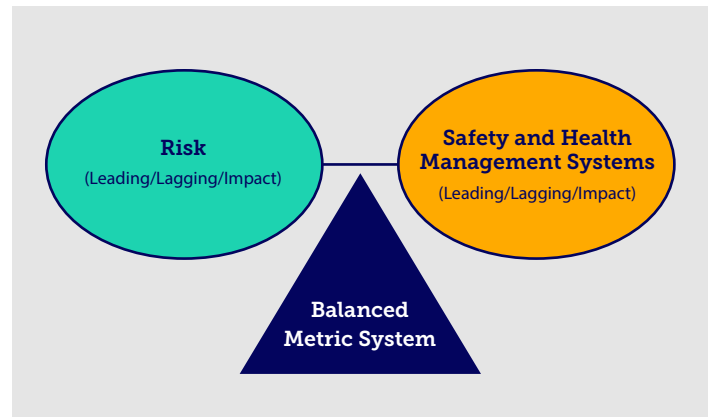

FIGURE 8

A Brief Overview of EHS Risks

Management of EHS risks is a multi-step process that begins with risk consultation and ends with risk monitoring, as shown in the diagram below *(FIGURE 9)*.

Since not everyone is familiar with these terms, let's review.

Risk: Ultimately, everything you do as an EHS professional comes down to identifying and controlling risks. Even so, sometimes it's not clear what the term "risk" means, and this lack of clarity can undermine effectiveness. It's a good idea to reference the definition used in ISO 45001, the international standard for occupational health and safety (OH & S) management systems. 45001 defines risk with an elegant simplicity as an "effect of uncertainty," and in the note to the definition, states that "risk is often expressed in terms of a combination of the consequences of an event (including changes in circumstances) and the associated 'likelihood' of occurrence."
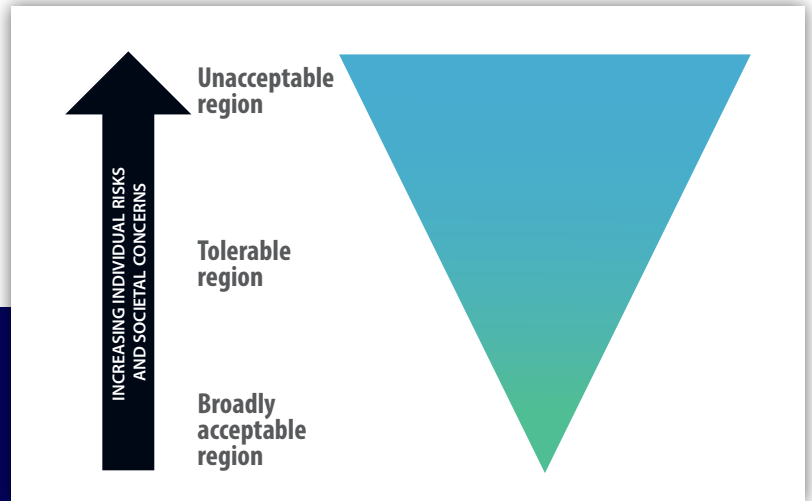

FIGURE 9

FIGURE 10

FIGURE 11

The common way of measuring and reporting risk magnitudes is through a tool called a *risk matrix*, as shown in the image above **(FIGURE 10)**.

Risk consultation: Risk consultation is essentially a process to ensure you're well-prepared to begin identifying risks. It involves seeking out the right stakeholders who have the knowledge of operations and associated operational risks needed to effectively identify risks.

Risk identification: This is self-explanatory. After you've secured engagement with the right stakeholders, it's time to go to work identifying your main occupational hazards, which are conditions that give rise to specific associated risks.

Risk assessment: When you're assessing risks, you're evaluating their magnitude, keeping in mind the definition of risk as a product of probability and impact.

Risk control: Risk controls are ways to reduce the overall magnitude of a specific risk. There are several categories of risk controls, distinguished in part based on whether they operate on the probability or impact side of the risk equation. *Preventive controls* are used to reduce the potential for an accident or injury to happen in the first place. *Mitigative controls* operate on the impact side and reduce the severity of impact if the accident does happen. On the post-accident side, you may also have *detective controls*, which let you know that something has happened so you can act as quickly as possible to mitigate the severity.

Many EHS managers rightly wonder "how low they should go" when it comes to risk control. That is, how much risk reduction is enough, and how much residual risk can you have before it's no longer acceptable? This is a vexing question, because it inevitably involves consideration of tradeoffs between the effort and time involved in additional risk reduction and the improvement to safety. The As Low as Reasonably Possible (ALARP) principle formalizes this tradeoff and is an important part of the safety approach embedded in some international standards and regulations, like the UK Health and Safety at Work Act and Control of Major Accident Hazards (COMAH). The diagram above **(FIGURE 11)** illustrates the ALARP principle, and its model of a spectrum of risks from "unacceptable" to "tolerable" to "broadly acceptable."

Risk monitoring: Many EHS managers skip this step, but it's an important one. Monitoring is the step where you review that all your risk controls are in place and are operating as planned. It helps ensure all the hard work put in during the preceding steps accomplished their intended purpose.

Selecting Balanced Sets of Metrics

Now that you have a good grounding in risk and the different stages of the risk management process, it's time to see how a balanced set of metrics can help. Let's start by running through the process of selecting balanced metrics for the risk identification step.

It's a good practice to follow the approach described in ANSI Z16.1-2022, ANSI's recently issued standard on "Safety and Health Metrics and Performance Measures," and create a chart with four columns:

1. **Goals:** The primary objective(s) you're trying to achieve.
2. **Lagging metrics:** These are the metrics measuring direct achievement of your goals.
3. **Leading metrics:** These are metrics that are logically associated with, and predictive of, the achievement of your primary goals.
4. **Impact metrics:** Here, you're tracking metrics that document long-term, secondary impacts of achieving your primary goals.

You can, of course, have more than one primary goal for each step in the risk management process. Here's what your chart might look like for risk identification *(FIGURE 12)*. Metric examples are partially based on examples provided in ANSI Z16.1-2022.

Let's review how the different metrics in the table relate to each other, and to your overall safety goals.

First, note that your primary goals are on the left side of the chart. Your main priorities are to improve your process of identifying and evaluating levels of control and tighten up the connection between risk controls and risk causes, as shown in the left column. The next column to the right contains your lagging indicators, which are direct, quantifiable measurements that you're achieving your goals. For example, if you've achieved your goal of improving identification and control of risks, measures of incident rates and especially serious incident rates like Days Away, Restricted or Transferred (DART) rate should fall accordingly, so documenting those metrics is necessary to demonstrate you've succeeded in meeting your goals.

The second column from the right contains your *leading indicators*, which measure activities associated with and predictive of achieving your goals. For example, if you learned from root cause investigations that underlying reasons for incidents include lack of safety audits for operations, then the percentage of operations with completed safety audits would be a useful leading indicator.

Here's another chart of balanced metrics, this time for risk control *(FIGURE 13)*.

Goal	Lagging	Leading	Impact
Improve process to identify hazards and evaluate level of control	• Incident rate • Serious incident/fatality rate (e.g., DART) • % of incidents that involve hazards that have not been risk assessed	• % of operations with safety and health audits • % of audit findings completed on time • % of hazards abated using multiple layers of treatment	• Reduction in total incident costs • Reduction in machine downtime • Reduction in incident-related absenteeism
Improve connection between risk controls and risk causes	• % of incidents where ineffective/ incomplete risk assessment was a contributing factor • % of incidents that involve hazards that have not been risk assessed	• % of incident investigations with corrected causal factors • % of control failures	• % reduction in machine downtime • Savings related to treatment and control improvements • % injury absenteeism reduction

FIGURE 12: *Examples of Balanced Metrics for Risk Identification*

Goal	Lagging	Leading	Impact
Lower the levels of residual risk using ALARP principles	• % reduction of residual risk • # of serious/high risks that have not been mitigated	• % of planning risk reductions achieved • % of controls verified	• % decrease in incident-related downtime • % reduction in incident-related costs (e.g., workers' comp)
Improve process to design or re-design the workplace	• # of new design and re-design elements • % of risks designated as "high"	• # of risk reductions using design level of control • # of risk assessment team members trained in design-level controls	• Amount of $ designated for design-level controls • % decrease in incident related downtime

FIGURE 13: *Examples of Balanced Metrics for Risk Control*

Once again, you can quickly see how these metrics work together. If you set a primary goal to lower levels of residual risk using ALARP principles (left column), you'd choose lagging metrics that directly measure that, such as "% reduction of residual risk." You'd also want to choose and track some leading indicators predictive of achieving your goals, like the percentage of risk controls verified – if you're verifying more of your controls, you're assuring they're in place and working as anticipated, which will tend to reduce residual risk. Finally, on the right-hand column, you track metrics related to longer term trends that depend on achievement of your primary goals. For example, you may find that documented reduction of residual risk leads to "impact" trends such as decrease in incident-related downtime.

You can repeat this exercise for safety management system goals and associated metrics. Remember, a balanced metrics approach needs to include well-selected metrics for both risk management and safety management system elements, and continual tracking and sharing of results.

Leading Indicators and Predictive Analytics

This example suggests some of the ways that healthy use of leading indicators dovetails with the emerging area of *predictive analytics* in safety data management. Increasingly, EHS software is evolving from being a simple storehouse (or "dead letter office!") for safety data toward a source of intelligence for making better, more proactive decisions to improve safety.

An example of predictive analytics is the use of artificial intelligence (AI) in ergonomics software to analyze job tasks and physical motions to identify potential overexertion hazards that if left unaddressed, could lead to musculoskeletal disorders (MSDs). Another is use of incident management software to identify patterns and trends within incident records that can be addressed with actions, including inspections such as in the example discussed earlier, to prevent future incidents.

Leading indicators and predictive analytics share a focus on planning, and on proactivity over reactivity. Adding some predictive analytics capabilities to safety programs built on a solid foundation of leading indicators can be a great way to continue evolving toward a safety management system that shapes its own future, instead of simply reacting to its past.

Key Takeaways on Leading Indicators

To help review some of the key concepts in this guide, let's revisit the two assertions of common misconceptions about leading indicators discussed earlier. The initial responses to those statements were based mostly on common sense and existing background knowledge, but now you can supplement them with some of the things you've learned about the logic model and balanced metrics.

1. *"We need to stop documenting all the employees we're hurting and find out why they're getting hurt, so we can prevent it!"*

   Actually, leading and lagging metrics work together. There's no pass on tracking lagging metrics, because in some cases regulations require them, and because (by definition) they measure achievement of primary safety goals. Leading metrics supplement them and improve the effectiveness of your safety management system by tracking that you're doing the things that make achievement of your goals more likely. By using the logic model and the balanced model of metrics, you can capture and use all the important data about your safety performance and use it to improve safety.

2. *"Safety measures its success by how much less it screwed up this year compared to last year – how many fewer people did we hurt? OMG, that's so negative! No other industries do that!!"*

   As you learned in the discussion of balanced sets of metrics, you need to track the frequency of undesired outcomes to see if you're improving. For example, if your goal is to reduce levels of residual risk using the ALARP principle, the percent reduction of identified risks that you have not yet mitigated would be a good lagging metric to measure achievement of that. The right combination of lagging and leading metrics improves risk identification, control, and monitoring.

That should give you some perspective about the relevance of leading indicators and how EHS professionals can use them. But perhaps you're looking for some additional summary? After all, you've received a lot of information in this guide. Here are some of the key takeaways.

- **Lagging and leading indicators are both important.** You need to model your safety management system after the Roman god Janus *(FIGURE 14)*, whose two faces look behind him and ahead of him at the same time. To know where you're going, you need to know where you've been. In fact, you've seen that the dividing line between leading and lagging indicators can be blurry, and the distinction really comes down to how you're using any particular indicator.
- **Choose leading indicators well.** Leading indicators aren't inherently magical. They'll work only if you take the time to choose them well, based on your analysis of your most relevant safety issues and their contributing causes, and then effectively review and manage them. OSHA's SMART principles are great criteria for selecting and tracking leading indicators.
- **Involve your employees.** Your employees probably have more information relevant to safety than you do, because they spend every day in the workplace performing various job tasks. Actively seek their input and involve them in every step of the process.
- **Leading indicators help you shift from reactive to proactive approaches.** Leading indicators can be one of the main pillars of a sturdy safety management system that evolves with your organization and shapes its future.
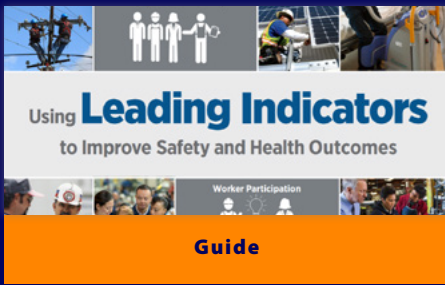

FIGURE 14: Roman God Janus

Looking for More Information?

Using Leading Indicators to Improve Safety and Health Outcomes

This guide has drawn from OSHA's great resource on leading indicators in a few places, and interested readers should definitely **check it out in its entirety**.

Guide

OSHA-ASSP Leading and Lagging Indicators

For a great discussion about leading and lagging indicators, check out the American Society of Safety Professionals (ASSP) webinar **here**. And if you can find it, hunt down an article by Pam Walaski, CSP called, "The Role of Leading and Lagging Indicators in OSH Performance Management," published in the August 2020 issue of the American Society for Safety Professional (ASSP) publication *Professional Safety Journal*. It's not only a great piece on leading indicators, but also a great piece on general safety management.

Webinar

EHS Performance Metrics: How to Drive Workplace Safety and Sustainability Through Better Data

Finally, if you're looking for a presentation that goes into detail about performance metrics and provides specific examples of both leading and lagging indicators, check out our own **on-demand webinar**.

Webinar

Using Leading Indicators to Improve Safety Management

Check out our **on-demand webinar** for further discussion of the topics covered in this guide, including the ways that leading and lagging indicators work together within an effective, action-focused occupational health and safety management system, as modeled by ISO 45001.

Webinar

Stay Updated

We're always adding more content to our **blog** and our **Resources page**, so be sure to check there often!

Blog & Resources

Let VelocityEHS Help!

VelocityEHS understands that successful safety management means being proactive, and that's why VelocityEHS **Safety**, part of our VelocityEHS Accelerate® Platform, gives you all the tools needed to identify and correct hazards and makes it easy for your workforce to participate. Inspections capabilities make it easy to develop tailored checklists you can use to conduct inspections connected to your safety goals, and from there, you can use actions management tools to easily prioritize and track follow-up actions. Incident management capabilities within the solution also help uncover patterns hiding in your safety data that can inform your future actions to improve safety.

Our industry-recognized **Ergonomics** solution gives you powerful AI tools to identify job tasks and associated employee physical motions with a potential to result in MSDs, so you can reduce ergonomic risks before an injury happens.

We've seen that risk management is a key part of a balanced metrics approach to safety that includes well-chosen leading metrics. Our **Operational Risk** solution can help you complete and share risk assessments, apply ALARP principles and share knowledge of risk control and pathways with your workers.

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