Dakota
SOFTWARE

Understanding EHS Analytics

Turning data into action for proactive safety & compliance

% Completed On-Time
64.6%
↗ 5% Change | 61.8% Prev. 12m

Red Flag Audit
5.4%
↘ -17% Change | 6.5% Prev. 12m

Introduction

Smarter, Measurable EHS Performance

Since the dawn of the information age, organizations have sought competitive advantage through data and analytics. For EHS professionals, the stakes are even higher: data impacts compliance, safety, and environmental outcomes that affect both people and performance.

Organizations are **investing in EHS management systems** to meet strict regulatory expectations and drive operational excellence, but legacy systems and limited interoperability continue to restrict data-driven decision-making as data quality remains a concern. Quality data, which has always been important, is even more crucial now with the integration of **AI and automation**. While AI excels at making sense of unstructured data, organizations that continue to integrate humans into the process of normalizing and organizing their EHS information will be positioned to unlock far deeper insights and stronger predictive analytics as AI becomes more integrated into EHS workflows. Without a foundation of high-quality data and an understanding of when and how human intervention is essential, effective data-driven decisions cannot be made.

This ebook is your roadmap **to bridging that gap, showing how EHS data, when properly structured and analyzed, becomes a source of continuous improvement and business value.**

Why EHS Needs to Be Data-Driven

EHS performance has a direct impact on an organization's bottom line, reputation, and employee satisfaction. When decisions are based on measurable insights rather than intuition, outcomes improve across every dimension:

Operational Efficiency: Identify inefficiencies and reduce waste.

Employee Engagement: Use safety data to drive morale and retention.

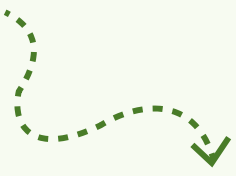
Compliance Confidence: Anticipate and mitigate regulatory risks.

Community Trust: Demonstrate transparency and responsibility.

Today's EHS teams collect more data than ever before, driven by mobile-equipped frontline workers, automated data capture from sensors and beacons, and the broader influx of information created by Industry 4.0. While this surge in data offers unprecedented visibility, it can also become overwhelming without the right systems in place. Raw information scattered across spreadsheets, forms, and disconnected tools rarely provides a clear picture of organizational performance.

When organized and analyzed effectively, however, EHS data becomes a strategic asset. It helps organizations uncover hidden safety trends, justify capital projects, and benchmark performance against industry norms, including insights available through **public regulatory datasets**. Becoming truly data-driven means moving from fragmented records to centralized, normalized, and contextualized information that tells a meaningful story.

A key part of that story is understanding **leading and lagging indicators**. Leading indicators—such as near misses, safety observations, and proactive audit findings—help predict future risks and hazards. Lagging indicators—such as OSHA injury and illness data, TRI releases, or Notices of Violation—measure historical performance. Both are essential for building an accurate view of compliance and safety maturity.



Across EHS disciplines, several common KPIs illustrate how these indicators function:

Health & Safety

- Leading: near misses, unsafe condition observations, and training completion rates.
- Lagging: **Total Recordable Injury Rate** (TRIR) and workers' compensation costs.

Environmental

- Leading: strategically conducted audits or self-assessments.
- Lagging: emissions, discharges, and waste volumes tracked through permits and regulatory reporting.

EHS Compliance

- Leading: number and status of certifications, management system maturity, and audit readiness.
- Lagging: Notice of Violation (NOV), fines, and overdue corrective actions.

ESG

Investor pressure to standardize ESG disclosures has increased the need for accurate reporting tools and investment-grade data. While **ESG shares metrics with EHS**—such as carbon emissions and worker safety—it also considers broader economic, geopolitical, and societal risks that shape business strategy.

Because the volume and variety of EHS data continues to grow, organizations need platforms that transform information into insight rather than noise. A data-driven EHS approach ensures not only compliance but also smarter decisions, better risk management, and stronger alignment with organizational strategy.

05

Leading and Lagging Indicators You Should Be Tracking

Leading Indicators (Predictive)

- Near misses and safety observations
- Completion rates of employee training
- Internal audit results and self-assessments
- Regulatory preparedness levels

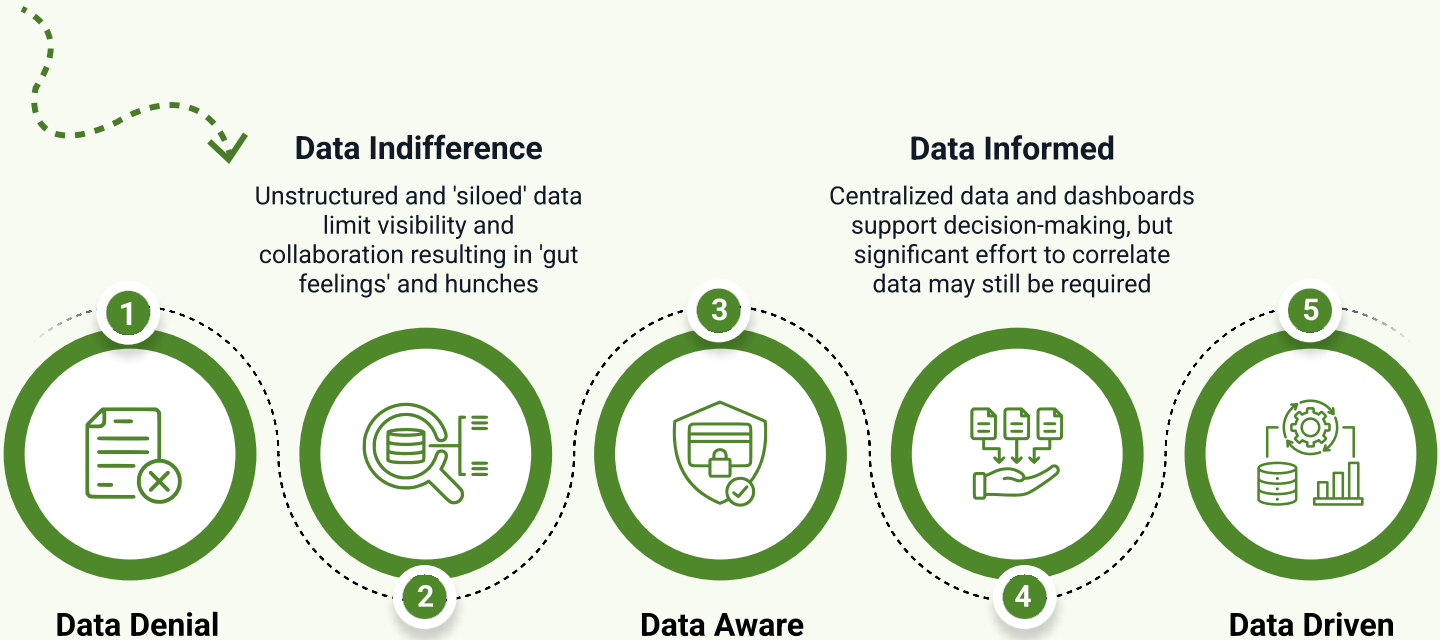
Lagging Indicators (Historical)

- Recordable injury rates (TRIR)
- Worker compensation costs
- Environmental emissions volumes
- Fines, penalties, and NOVs

EHS maturity requires tracking both leading indicators to anticipate problems and lagging indicators to measure outcomes. The combination reveals true performance trends across safety, environmental, and compliance domains.

The Journey to Predictive and Proactive EHS Management

Every organization is somewhere along the **data maturity continuum.**



Data Denial
Disorganized and/or non-existent data makes identification and resolution of issues nearly impossible

Data Indifference
Unstructured and 'siloed' data limit visibility and collaboration resulting in 'gut feelings' and hunches

Data Aware
Semi-structured data may allow collaboration, but curation is still manual and time-consuming, hindering analysis efforts

Data Informed
Centralized data and dashboards support decision-making, but significant effort to correlate data may still be required

Data Driven
Automated curation to a centralized and normalized database provides full visibility and answers EHS questions in real-time

Progressing through these stages requires cultural alignment as much as technical change—leadership must view EHS data as a strategic asset, not an administrative burden.

The Stages of Data-driven EHS Management

Stage 1 Data Denial

In this initial stage, organizations operate in a fully reactive, compliance-only posture where data is fragmented, inconsistent, and often not trusted. Paper forms, inboxes, and spreadsheets dominate workflows, creating blind spots that make it nearly impossible to recognize emerging patterns or manage risk effectively.

Even with the amount of technology available, the **2024 Global EHS Readiness Index (GERI) Report** indicates that nearly 20% of organizations still rely primarily on paper and spreadsheets for core EHS functions, leaving them "highly exposed to risk" due to a lack of visibility and traceability. Many in this stage have no formal EHS platform and little understanding of the value of structured data.

Operational culture in Stage 1 is typically described by:

- **Reactive decision-making** driven by incidents, complaints, and inspections rather than prevention.
- **Low workforce engagement**, caused by cumbersome manual processes.
- **Minimal reporting capability**, often limited to year-end summaries compiled manually.
- **High administrative burden**, since every process requires re-entering or tracking data by hand.

Organizations in this stage can meet basic compliance requirements, but their lack of digitization prevents proactive risk management.

Stage 2

Data Indifference

Organizations in Stage 2 often recognize the importance of data but lack the systems, structure, and culture needed to use it effectively. The same report linked above highlights that 47% of EHS leaders cite multiple disconnected solutions as a major challenge in data management, and stage 2 is where this fragmentation becomes the most visible.

Here, data lives in individual point systems, departmental tools, or legacy databases that don't communicate effectively. Each site or business unit maintains its own process, resulting in inconsistent workflows, data formats, and controls across the organization. Leaders may be "capturing data", but they have no reliable way to compare sites, analyze trends, or benchmark performance.

Key characteristics of an organization in Stage 2 include:

- **Persistent data silos** where meaningful insights never reach corporate decision-makers.
- **Decision-making based on gut feelings**, assumptions, or "the way we've always done it."
- **Low adoption of EHS systems**, due to usability issues and inconsistent workflows, discourages participation.
- **Difficulty responding to regulators**, because documentation is scattered across systems and owners.

Stage 3

Data Aware

Organizations in Stage 3 begin to understand the strategic value of data, but they still lack the infrastructure to realize it. Data may be centralized in theory, but it is still largely unstructured, manually curated, or dependent on specialized roles to prepare for analysis. The GERI Report notes that 60% of EHS leaders are not confident in the quality and quantity of the data they capture, which is a defining feature of this stage. Although some digital tools exist, the complexity of combining multiple platforms into meaningful insights creates bottlenecks that have to be addressed.

Key characteristics of an organization in Stage 3 include:

- **Semi-digitized workflows**, but with manual processes still required to align or clean data.
- **Reports require advanced skills** (e.g., Excel specialists, analysts, or IT) to compile or interpret.
- **Data used inconsistently** across sites, with some areas maturing faster than others.
- **Decision-making is influenced by HIPPOs** (Highest-Paid Person's Opinion) when data isn't fully trusted or accessible.

In this stage, organizations often experience "technology fatigue" as they juggle partial digitization, disparate tools, and inconsistent adoption. Despite progress, data rarely influences strategic discussions, and EHS outcomes remain vulnerable.

Stage 4

Data Informed

Stage 4 is where most mature organizations begin to see real improvement. Companies in this stage have established a centralized repository or unified EHS platform, even if onboarding new data sources still requires non-trivial effort. Organizations reaching Stage 4 often see rising maturity scores, stronger workforce adoption, and significantly improved visibility.

Here, data becomes the basis for decision-making, not just a record of past events. Although tech integrations may not yet be fully seamless, centralized dashboards, automated alerts, and standardized reporting greatly enhance transparency.

Key characteristics for organizations at Stage 4 include:

- **Centralized, semi-automated data flows** reducing the need for manual curation.
- **Dashboards and BI tools** begin surfacing actionable insights.
- **Cross-functional visibility**, enabling benchmarking across sites or business units.
- **Stronger workforce engagement**, thanks to more intuitive digital tools.
- **Proactive risk management**, with leaders using data to target high-risk areas before incidents occur.

Stage 5

Data Driven

Stage 5 organizations are at the highest EHS maturity levels. They typically operate with fully integrated EHS ecosystems, advanced analytics, and highly automated data workflows. Only a small number of organizations are usually able to reach this data maturity level, but those that do are able to achieve significantly stronger safety performance and future readiness.

In Stage 5:

- **Data is normalized at entry**, ensuring quality and consistency across the enterprise.
- **Analytics platforms empower non-technical users**, democratizing access to insights.
- **Predictive and prescriptive analytics** (e.g., AI, ML, and trend modeling) inform strategic decisions.
- **New data sources (IoT, sensors, wearables)** can be added rapidly without disrupting workflows.
- **Workforce adoption is high**, as systems are intuitive and embedded into daily operations.

Leaders at this stage routinely ask questions like:

- "What trends are emerging across sites?"
- "Can we predict incident likelihood?"
- "What would happen if we changed this process?"

With full visibility across the enterprise and the ability to analyze leading indicators at scale, organizations evolve from compliance-driven to strategy-driven. EHS becomes a recognized contributor to **operational efficiency, culture, risk reduction, and business value**.

Recommendations for Moving Forward

For Data Denial scorers

- Centralize EHS data and standardize collection processes.
- Consistently track key metrics across all sites.
- Introduce basic reporting to visualize incidents and compliance.

For Data Indifference scorers

- Connect siloed data sources for better visibility.
- Automate routine reporting to reduce manual effort.
- Use leading indicators in conjunction with lagging metrics to anticipate potential risks.

For Data Aware scorers

- Integrate systems to create a unified view of EHS performance.
- Expand analytics to identify trends and root causes.
- Share insights across teams to inform decision-making.

For Data Informed scorers

- Automate collection & reporting to drive proactive decisions.
- Establish continuous improvement processes
- informed by data.
- Extend analytics to provide predictive insights for risk mitigation.

For Data Driven scorers

- Refine analytics models and dashboards for maximum insight.
- Embed EHS data into enterprise strategy and risk management.
- Promote a culture of continuous improvement and data-driven decision-making.

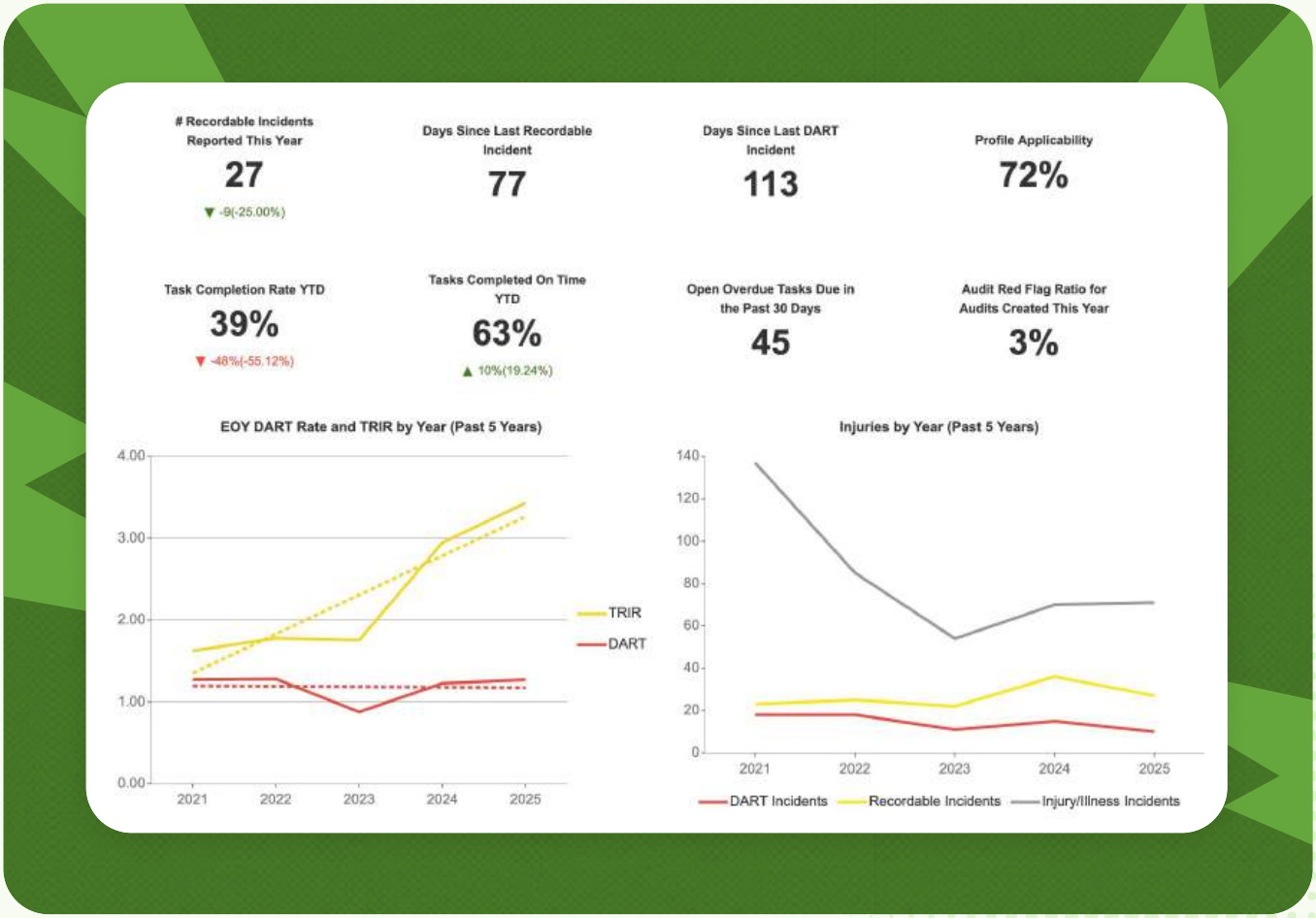
Dakota Software's solutions are designed to help EHS teams evolve along this maturity curve, from collecting reliable data to leveraging analytics for proactive improvement.

Talking the Talk: Improving Data Literacy

Understanding the relationship between leading and lagging indicators is crucial for developing a modern, data-driven EHS program. As we mentioned earlier, leading indicators reflect the actions and behaviors that reduce risk (outputs), while lagging indicators measure the results and outcomes of those actions (e.g., injuries, violations, environmental releases, etc.).

These concepts have become standard in executive meetings because organizations increasingly recognize that meaningful performance improvement requires clear goal-setting, strong data literacy, and the ability to interpret signals before harm occurs.

However, developing fluency in data is still uneven across business functions. **Revenue-driving departments such as Sales, Marketing, IT, HR, and Customer Success adopted data analytics early due to their reliance on KPIs, dashboards, and forecasting models**.



By contrast, Operations and EHS teams have historically digitized later, leaving gaps in data capability, analytical confidence, and cross-functional collaboration. As health and safety become more predictive, connected, and visible at the board level, EHS professionals need stronger data literacy skills to participate in and influence strategic decision-making.

Data Literacy: A Core Competency for Modern EHS Leaders

Data literacy is more than the ability to look at a spreadsheet. Qlik and Accenture's **Seven Principles of Data Literacy** indicates that **data literacy includes the ability to read, understand, question, analyze, and communicate** data effectively. **Gartner** adds that data literacy is now one of the most critical skills for driving business outcomes, noting that organizations with strong data-literate cultures outperform peers in decision quality, agility, and innovation.

For EHS practitioners, this means being able to:

- Interpret leading and lagging indicators correctly
- Challenge assumptions with evidence
- Translate complex findings into clear messages for executives and frontline teams
- Use data ethically and responsibly
- Build confidence in data quality by understanding its origins, limitations, and context

This foundation allows safety leaders to move from reporting what happened to shaping what will happen next.

Essential Data and Analytics Concepts for EHS Teams

Below are explanations of core terms to reflect modern data literacy thinking and EHS needs.

SMART Goals (Foundational to All EHS Metrics)

SMART goals remain a reliable structure for aligning leading indicators with operational intent. OSHA's guidance emphasizes that quality leading indicators must be **Specific, Measurable, Accountable, Reasonable, and Timely**, ensuring that EHS activities translate into meaningful outcomes.

A data-literate EHS leader uses SMART goals not only to set direction but also to evaluate whether the data being collected is fit for purpose. SMART goals help prevent common challenges—such as tracking indicators simply because they are easy to measure rather than because they drive meaningful change.

Business Intelligence (BI)

BI involves using technology, data models, dashboards, and analytical frameworks to generate insights that support **strategic, tactical, and operational decisions**.

Modern BI tools allow EHS leaders to:

- Visualize trends in incident frequency or severity
- Compare performance across sites
- Identify hotspots of recurring risk
- Communicate findings in a way that executives understand

BI skills are increasingly expected of safety professionals, who must "translate data into understanding" rather than simply report numbers.

Data Analytics

Data analytics refers to the processes and techniques used to transform data into insight. A data-literate EHS leader understands the four analytical modes:

- **Descriptive:** What happened?
- **Diagnostic:** Why did it happen?
- **Predictive:** What is likely to happen next?
- **Prescriptive:** What should we do about it?

In practice, this means using tools such as spreadsheets, visualization platforms, statistical software, or even AI-enabled systems to recognize patterns related to hazards, behaviors, near misses, and compliance gaps.

Data Normalization

Normalization makes data consistent and comparable, a foundational principle of data literacy. Without it, organizations cannot benchmark between sites or track trends reliably.

Normalization supports:

- Standardized terminology
- Consistent data formats
- Reduction of errors and duplication
- Clear, repeatable analytics

For EHS leaders, this means ensuring incident categories, audit findings, risk ratings, and corrective actions follow the same structure across the organization.

Centralized Data (“Single Source of Truth”)

A centralized database enables the governance, integrity, and consistency needed to support trustworthy analytics. Gartner emphasizes that fragmented data systems reduce data trust and create “decision friction.”

For EHS programs, centralization delivers:

- Unified data models
- Reliable version control
- Faster access to insights
- Reduced administrative burden
- Stronger compliance readiness

This is especially critical when EHS data is used in corporate ESG reporting, where accuracy and traceability are essential.

Operational Data

Operational data is "live" data generated during day-to-day EHS activities—e.g., inspections, observations, equipment checks, incident reports, or chemical inventory updates. According to RRC, EHS professionals must increasingly interpret this data on the spot to support immediate decision-making, such as adjusting workflows or identifying emerging hazards.

The Data Journey

Statistics Canada describes the data journey as a set of stages—often cyclical rather than linear—such as collection, validation, transformation, analysis, interpretation, and communication.

Gartner and Qlik both emphasize that a mature data journey includes:

- Clear data ownership
- Good metadata practices
- Ethical data use
- Critical thinking is applied at every step
- The ability to communicate insights effectively

For EHS, this ensures that data not only exists but also produces meaningful, actionable knowledge.

Being “Data-Driven”

A data-driven EHS organization utilizes data—and the insights derived from it—to inform decisions, rather than relying on intuition or anecdotal experience.

Data-driven EHS teams:

- Use leading indicators to prevent incidents before they happen
- Model “what if” scenarios to assess operational changes
- Communicate insights in a clear, compelling way
- Build trust with executives through transparency and rigor
- Integrate analytics with strategy, training, and operational planning

Ultimately, being data-driven means using evidence to steer culture, performance, and risk reduction, not merely to comply with reporting obligations.

Common Challenges Along the Way

Changing processes, creating new technical avenues, and adapting your culture to base decisions on data rather than feelings occur at multiple levels and don't happen overnight. Even when you speak the "language of data" fluently, technical, cultural, and procedural pitfalls can trip you up if you're not prepared. Here are some of the obstacles to watch for on the path to becoming data-driven.

1 Avoid Preconceived Notions and Oversized Changes

As your data maturity grows, you must continually question assumptions and examine performance from different angles. Treat data-driven improvement as an ongoing cycle, not a one-time project. Often, small, incremental changes gain more buy-in than sweeping transformations.

In software development, this approach is known as iteration: testing hypotheses, making small adjustments, and gradually building improvement over time. EHS professionals already understand this through continuous improvement principles—apply the same mindset to your analytics journey.

2 Don’t Limit Future Analysis Opportunities

It’s easy to focus on getting a system up and running today, but your future self will want more data, more context, and more sophisticated analysis. Consider the long-term value of establishing good data practices early, even if it requires extra work now.

Ask questions such as:

- How likely is missing or incomplete data?
- Are we tracking metrics that are prone to distortion, like task on-time completion?
- Will this structure support deeper analysis months or years from now?

Solving these issues early is far easier—and far less expensive—than trying to untangle them later.

3 Don’t Get Lost in the Weeds

Seeing all your EHS variables in one place can be exciting, but more data isn’t always better. Avoid the temptation to build endless charts that don’t meaningfully support decision-making.

Stay focused on outcomes by continuously asking: “Does this analysis help us achieve our EHS goals?” If the answer is no, you’re likely drifting into the weeds.

4 Avoid “Analysis Paralysis”

Large volumes of data can overwhelm teams and slow decision-making. Setting deadlines, prioritizing criteria, and defining what constitutes “enough information” can prevent overanalysis.

Remember:

- Data reduces risk; it does not eliminate it.
- Business intelligence informs decisions; it does not replace human judgment.

Use data to guide choices confidently, **knowing that waiting for perfect information often creates more risk than it removes**.

Building a Business Case for Analytics

EHS leaders understand that better data leads to better decisions—but securing executive approval for analytics tools or EHS software is often the most challenging part of the journey. Leaders must translate technical value into business value, speak the language of the C-suite, and demonstrate how analytics will solve enterprise-level challenges—not just EHS-specific ones.

Executives rarely approve projects solely based on regulatory needs. They want clear, defensible answers to questions such as:

- How will this reduce risk exposure?
- How does it strengthen operational performance?
- How fast will we see ROI?
- Does this support digital transformation and future scalability?

Dakota Software identifies several common barriers to EHS approvals: difficulty quantifying ROI, lack of alignment with corporate priorities, insufficient internal advocacy, and uncertainty about IT requirements. A strong business case anticipates these concerns by providing clarity, demonstrating urgency, and showing the direct financial and operational benefits of an analytics investment.

5 Keys to a Winning Business Case

1 Align with Business Goals

Tie analytics initiatives to strategic priorities such as operational efficiency, cost containment, risk reduction, sustainability targets, and supply chain resilience. Frame analytics as a business enabler, not an EHS luxury. Approvals come easier when leaders see how EHS supports enterprise objectives—especially where risk and productivity intersect.

2 Build a Cross-Functional Coalition

Include partners from Finance, IT, Legal, Operations, and ESG early. Cross-functional support enhances credibility and helps decision-makers view analytics as part of a broader organizational improvement effort. Support from these teams strengthens your influence and reduces internal friction.

3 Get on the IT Roadmap

Demonstrate how analytics aligns with ongoing or planned digital transformation initiatives, as well as how compatibility with existing systems supports scalability, and highlight how unified analytics reduces tech complexity—one of the most significant pain points identified in modern EHS programs.

4 Ensure Credibility Through Data and Clarity

Executives expect concrete evidence. Use transparent ROI models, relevant benchmarks, real incident cost data, and industry statistics. Clearly articulate the cost of "doing nothing," including hidden costs such as administrative burden, compliance failures, and inefficiencies.

5 Show Them the Money

Demonstrate financial value through reduced incidents, fewer audits, minimized fines, streamlined processes, and improved inspection readiness. Dakota Software emphasizes that quantifying avoided costs—especially those associated with serious injuries or regulatory penalties—makes your case far more compelling.

EHS analytics isn't just a compliance tool. It is an investment in operational visibility, risk intelligence, and organizational resilience. A well-prepared business case demonstrates that analytics not only enhances EHS performance but also strengthens the entire enterprise.

Build a Stronger, More Persuasive Proposal

For a step-by-step guide, templates, and proven strategies for securing executive approval, explore our comprehensive resource on Building a Business Case.

EHS Data & Analytics Software

Turn disconnected EHS information into actionable intelligence. **Modern EHS data platforms bring together compliance tasks, incident records, audit findings, and operational metrics into a single, structured environment, making it easier for teams to measure performance and identify emerging risks.**

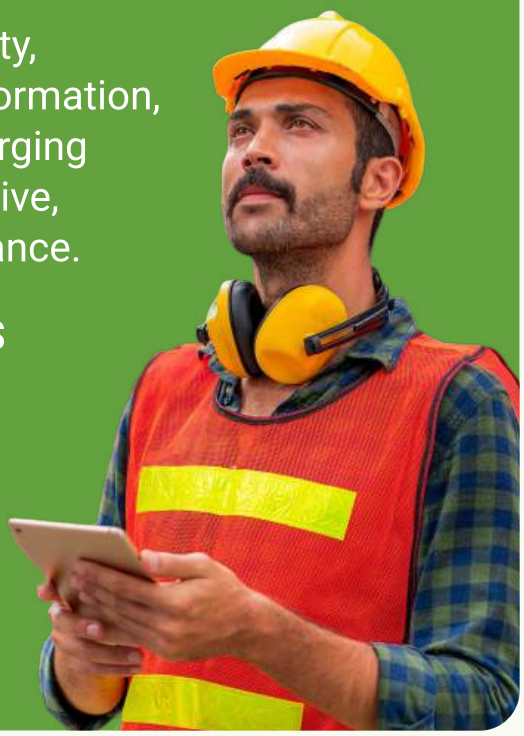
Key capabilities include:

- Roll-up and drill-down reporting across all EHS functions
- Dynamic dashboards for tracking incidents, compliance activities, and key performance indicators
- Context-rich insights supported by integrated regulatory information
- Self-service analytics that allow users to explore trends and surface leading indicators

As organizations advance their data maturity, tools that centralize and normalize EHS information, combined with powerful analytics and emerging AI-driven capabilities, enable a more proactive, data-driven approach to safety and compliance.

When paired with Dakota's ProActivity EHS Software, this creates true end-to-end visibility—from data collection all the way to strategic decision-making.

Request a Demo



Key Takeaways

EHS leaders must transition from **reactive compliance tracking to proactive, data-driven decision-making.**

Business Intelligence (BI) transforms **fragmented data into operational insight.**

Centralization and normalization are essential for **accuracy and trust**.

Leading and lagging indicators together **provide a 360° view of performance**.

Tools like Dakota Insights make data actionable, empowering **EHS teams to measure, improve, and communicate their success.**