# EHS Risk Management Guidebook:
# A Practical How-To Guide

**EtQ**

## Executive Summary

Nearly 4 in 5 Environmental, Health and Safety (EHS) professionals recognize that risk management is a key factor in achieving EHS goals, yet mitigating risk with technology remains a challenge.[1]

Across many industries, problems with collaboration and data analysis present roadblocks to effective risk management. Common difficulties include:

- Ineffective cross-departmental collaboration. Companies often rely on email chains or shared network drives to exchange EHS data. This approach reduces productivity and allows information to easily become lost or buried.

- Disparate data systems that don't talk to each other. EHS data is often spread across various systems, from EHS point solutions to related business systems such as human resources and quality records. These data silos block visibility, making it impossible to get a comprehensive view of risk across a plant, business unit or enterprise. Companies can't see which issues should be their priority in terms of allocating resources to risk mitigation.

- Inefficiency of archaic systems. A full 25% of companies still use spreadsheets and manual tools to track risk management activities like risk assessments and audits.[2] This makes it difficult to gather information, creating a huge paperwork burden and limited functionality that allows EHS risks to go unmanaged.

This white paper will provide a practical approach to EHS risk management from a technology perspective. We'll look at some basic concepts behind risk management, plus how companies can use technology to reduce risk and improve EHS outcomes.

## Risk Management: A Strategic Business Issue

The potential for unmanaged risks to cause widespread damage is driving increased stakeholder pressure for transparency around risk. Investors, employees, regulators and communities now demand more disclosure from the EHS sector on how companies address risks to workers and the environment.

Experts agree that to grow profitably, a company must systematically manage and reduce risk. Research consistently shows that strong EHS performance correlates with better financial outcomes. One such study demonstrated that EHS leaders deliver at least three times the financial returns compared with publicly traded companies as a whole.[3]



Figure 1. Modeled Investment returns over a 13-year period for 17 recipients of the American College of Occupational and Environmental Medicine (ACOEM) Corporate Health Achievement Award
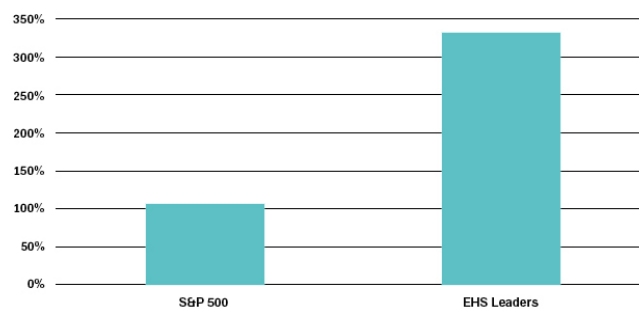
More than 40% of chief financial officers (CFOs) surveyed in another study said that EHS programs boost company productivity, with nearly 1 in 3 reporting that these programs also reduce overall costs.[4]

## Risk Management Basics

Risk is defined as the probability of an event multiplied by its impact or severity . An event may be probable, but with consequences so minimal it would be considered low risk. Conversely, an event that occurs rarely but has severe consequences is considered high risk (like a chemical explosion or equipment-related fatality).

In the EHS environment, effective risk management requires 4 basic elements:

- Hazard identification to uncover potential risks involving people, processes and equipment.

- Risk assessment to prioritize which risks need controls. This is essential for allocating resources in the right places, instead of trying to fix everything.

- Implementing controls such as additional training or engineering controls.

- Monitoring of controls and measurement of residual risk to ensure controls are effective.
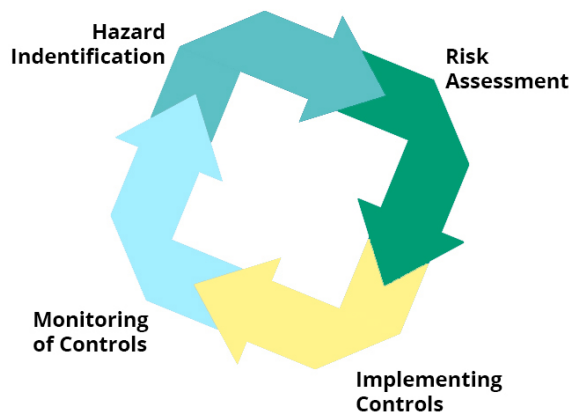
It's important to note that risk assessment on its own does not constitute risk management. Risk assessment is just one step in a larger closed-loop process that focuses on continuous risk reduction.

## Common Risk Models

EHS professionals use a number of risk models for different situations. Three of the models they use most often are the risk matrix, the decision tree and bowtie risk assessment.

### 1. Risk Matrix

The risk matrix is the most commonly used tool in EHS management. It allows you to quantify the risk associated with a hazard, allowing you to set clear guidelines on whether or not the risk is acceptable.

**How it works:** To create a risk matrix, you first break out different levels of probability and impact into verbal scales, assigning each level a numeric value:

### Table 1. Verbal and Numeric Risk Scales

| Severity | | |
|---|---|---|
| Verbal | Numeric | Description |
| Catastrophic | 5 | Likely to result in death |
| Critical | 4 | Potential for severe injury |
| Moderate | 3 | Potential for moderate injury |
| Minor | 2 | Potential for minor injury |
| Negligible | 1 | No significant risk of injury |

| Frequency | | |
|---|---|---|
| Verbal | Numeric | Description |
| Frequent | 5 | Hazard likely to occur |
| Probable | 4 | Hazard will be experienced |
| Occasional | 3 | Some manifestations of the hazard are likely to occur |
| Remote | 2 | Manifestations of the hazard are possible, but unlikely |
| Improbable | 1 | Manifestations of the hazard are very unliklely |

You then plot the numbers on a matrix or chart, with each square calculated as the product of the corresponding frequency and severity level :



Figure 2. Risk Matrix Example

This allows you to quantify the risk associated with a given hazard. Each hazard will fall into one of the following areas on a color-coded risk matrix:

- **Green:** Low or generally acceptable risk.
- **Red:** High or generally unacceptable risk.
- **Yellow:** Moderate risk.

Next, you must interpret the results and decide how to act. This requires your company to:

- Agree on a definition of risk. From CEO to production line workers, everyone must have a common understanding of what defines high and low risk.
- Vet the risk matrix with historical data. By plotting past incidents on the risk matrix, you can pinpoint the division between acceptable and unacceptable risk.
- Create decision-making guidelines. Company policy should dictate the specific number or range that requires new controls to be implemented before proceeding.

### 2. Decision Tree

A decision tree outlines possible decision paths or outcomes for a given situation. Used less often than the risk matrix, it's useful for helping employees know how to apply company policy in a situation that contains many variables.

**How it works:** The decision tree asks a series of questions that lead the reader to a specific action. The decision tree below uses a chemical spill on the shop floor as an example:

Figure 3. Chemical Spill Decision Tree
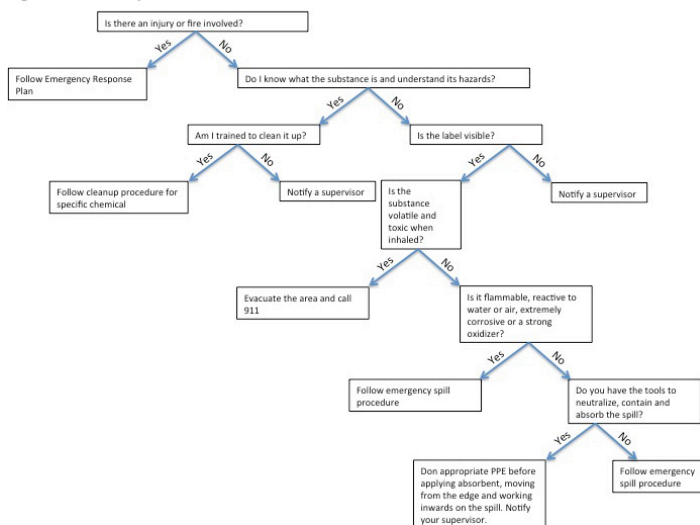


You can use this risk model for many EHS scenarios requiring special procedures, including confined space entry, hazardous material disposal and lockout/tagout (LOTO).

### 3. Bowtie Risk Assessment
Companies use bowtie risk assessment to mitigate the risk of rare but potentially catastrophic events, allowing them to visualize complex risk environments .
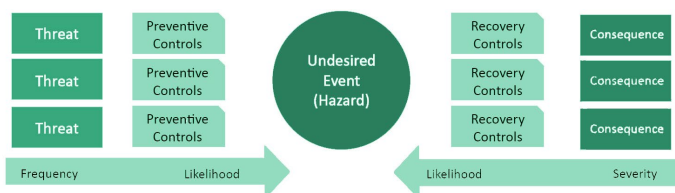


**How it works:** The left side of the bowtie model shows preventive controls, which represent barriers to the event. On the right side are recovery controls that would reduce the impact if the event did occur. This detailed threat string outlines potential pathways through existing barriers to hazard release, and even possibly through reactive barriers.

High-risk industries like oil and gas have long used the bowtie model to reduce the risk of events like oil spills and wellhead blowouts. Other industries are now applying bowtie assessments to their processes as well, especially for loss of control events where companies have little or no historical data to inform risk planning.

## Leveraging Technology for More Effective Risk Management
Manual tracking methods like spreadsheets make it easy to minimize or underreport risk, especially at individual sites. Integrated EHS Management Systems are changing the way companies mitigate risk, shifting the focus from rear-facing approaches that assign blame to proactive strategies aimed at continuous risk reduction.

Automated EHS Software also creates new opportunities in areas such as:

- **Tracking leading indicators:** Traditional EHS risk management focuses on lagging indicators like incidence rates and injury costs. Collecting and linking together more data allows you to identify leading indicators with better predictive capabilities.

- **Leveraging Big Data:** Leading systems make it easy to integrate vast quantities of EHS data with business intelligence tools like Cognos and Qlikview.

- **Performing advanced modeling:** Integrated systems create robust datasets that enable advanced modeling such as Monte Carlo simulations.

In the following sections, we'll look at key EHS functions where companies should focus on implementing Risk Management tools and strategies, with practical tips on reducing risk through automation and integration.

## Incident Management
The U.S. Occupational Safety and Health Administration (OSHA) estimates that injuries and illnesses cost employers $1 billion nationally every week in workers' compensation costs alone.[5] Part of the reason is because companies often treat incident management as a reactive process, using it solely to address incidents that have already occurred.

Companies with strong EHS performance also use incident data as a predictive tool, reducing organizational risk and minimizing the likelihood of recurrence. Essential Risk Management software tools and functions to improve your incident management process include:

- Using a risk matrix to prioritize high-risk incidents for corrective action.

- Tracking near-misses to improve predictive capabilities and prevent incidents. Mandatory near-miss reporting increases your ability to

analyze high-risk events so you can identify trends and unmanaged risks. EtQ's experience shows up to 1 in 3 near-misses may have serious potential for harm, underscoring the need to treat them as safety incidents (and not just lucky breaks).

- Creating dashboard alerts for high-risk incidents and near-misses, as well as for when key incident management tasks are overdue.

- Linking high-risk incidents to corrective action requests. Integrated EHS Software routes corrective action requests automatically through review, root cause analysis, action taken and verification. This prevents high-risk incidents from getting buried, also making it easy to access the risk mitigation history for incidents.

## Corrective Action

Too often, organizations use corrective action as a punitive tool rather than a continuous improvement process. This approach leads to underreporting and increases risk, a key reason why companies must move away from assigning blame and towards identifying how to minimize the risk of recurrence.

A robust technology-enabled corrective action process focuses on corrective action effectiveness while enabling a deeper understanding of the context and causes of safety incidents. Key Risk Management strategies to boost effectiveness include:

- Filtering corrective action requests by risk to ensure high-risk items receive priority attention. Without risk-based filtering, you increase the risk of recurrence and allow problems to become systemic.

- Collaborating on root cause analysis to reduce subjectivity of results. Incidents typically involve intersecting processes, and uncovering the true root cause often requires multiple viewpoints.

- Measuring residual risk as a final verification step to ensure the corrective action reduced risk to acceptable levels.

- Proactively applying lessons learned across the enterprise. Root cause findings identified in one plant should be applied in all other facilities, reducing risk by preventing the problem from occurring in other locations.

## Change Management

From moving employees between production areas to installing new equipment, coordinated change management is critical to reducing EHS risk. Many companies have learned the hard way that unmanaged change can lead to disaster, even shutting down production for extended periods and costing millions of dollars.

At the same time, change is a necessity in order to benefit from new opportunities. Change Management tools within integrated EHS Software systems allow you to make important changes while managing risk, ensuring business continuity so your company can grow profitably with minimal risk of interruption.

Important risk mitigation techniques to incorporate into your change management process include:

- **Performing a risk assessment** before you make a change in processes, people or equipment. This could mean using a risk matrix to assess the risk of a particular hazard, or using a decision tree to analyze the costs of various alternatives.

- **Using Job Safety Analysis** to identify hazards associated with new procedures or equipment. You can assess the risk of the procedure as a whole as well as for individual steps, helping you pinpoint areas for strategic risk reduction.

- **Using integrated project planning tools** within the EHS System to ensure costs and timelines don't balloon out of control.

- **Linking employee training requirements** to change management initiatives. People are your biggest variable when it comes to EHS risk, and employee training is a common weakness around change management.

- **Updating related documents** such as protocols and emergency response plans. Any changes to processes or equipment should trigger documentation updates, preferably within an integrated, permissions-based Document Control system.

## Assets and Equipment

Preventive maintenance is more cost-effective and safer than reactive maintenance. And while you don't want to take equipment out of service too soon, waiting even a minute too long presents serious risks. Using integrated software to automatically upload equipment data to the EHS Management System lets you precisely monitor equipment needs, reducing costs and malfunction risks.

Tools and capabilities to leverage within the EHS Management System for reducing equipment-related risks include:

- **Creating risk dashboards with automated alerts** for when equipment needs calibration or maintenance, or when monitoring systems show abnormal conditions.

- **Integrating employee data** to prevent workers who don't meet certification or training requirements from operating equipment.

- **Filtering maintenance tasks by risk** to ensure the most important repairs and calibration issues get priority attention.

- **Tracking leading indicators** around equipment maintenance and monitoring activities. Smart sensors that feed data from equipment to the EHS System can provide predictive data that allows you to stay ahead of problems.



## Employee Training

When you look at safety incidents, it's rare that accidents are purely the result of mechanical failure. That's because human behavior will always be the biggest variable when it comes to operational risk. An EHS Management System mitigates this risk by automating compliance with employee training requirements, reducing safety incidents that result from insufficient training.

Critical risk mitigation activities to improve the effectiveness of employee training programs include:

- Updating training requirements whenever key changes are made to documents, processes or equipment, as well as when workers change departments or roles.

- Automating scheduling so that employees who need to take certain courses are automatically added to the roster.

- Adding post-training assessments to ensure competence in key areas.

- Tracking leading indicators around employee training, such as analyzing how number of training hours or course updates affect incidence rates.

- Generating new training requirements from other functions within the EHS Management System, including Change Management, Document Control and Audit Management modules.

## Audits

Audits play a central role in EHS risk management. Due to the extensive preparation involved and findings generated, however, many companies miss key opportunities to mitigate risk throughout the audit process. Automated EHS Software makes audits more effective by eliminating busy work and helping you incorporate audit results into your risk management strategy.

Key Risk Management tools and functions to focus on as part of your audit program include:

- **Sorting noncompliances by risk** so high-risk problems get priority follow-up.

- **Initiating corrective action requests from the audit record** so you can track risk mitigation history and make sure unsafe conditions aren't allowed to persist.

- **Monitoring leading indicators** that relate to your audit program, such as number of significant findings as a proportion of the overall total, number of repeat findings and average time to corrective action closure.

## Regulatory Compliance

Unmanaged regulatory risks cost companies more than $143 million in OSHA penalties in 2014, with penalty amounts set to rise as much as 80 percent on August 1, 2016.[6] The most frequent citations OSHA gives are

for hazard communication, respiratory protection and lockout/tagout procedures for controlling hazardous energy.[7]

Unfortunately, companies have thousands of requirements to comply with, and it's often difficult to understand which regulations even apply to an organization. Effective compliance tracking is a huge issue, and a key area where EHS Software can reduce risk and minimize a company's regulatory exposure.

Top EHS performers typically adopt some version of the following risk-based compliance process:

- **Create a list of all applicable regulatory requirements** in the EHS Management System (an integrated system will do this for you).

- **Link each requirement to existing controls** such as employee training or engineering controls.

- **Identify all requirements without controls,** or where controls don't sufficiently reduce risk.

- **Conduct a risk assessment** using your risk matrix to identify high-risk gaps where you need to focus on adding or improving controls. An integrated EHS Management System lets you link regulatory gaps to Corrective Action, Employee Training and Document Control systems.

## Industrial Hygiene

Industrial hygiene is a critical part of EHS management. Calculating time-weighted averages to stay within OSHA's Permissible Exposure Limits (PELs) can be a complex task, however, given the fact that employees often move from one work area to another.

Medical surveillance, while an essential part of industrial hygiene, is largely a rear-facing process that uncovers health impacts of past exposures. Advanced technology and data collection strategies that enable more proactive risk management around industrial hygiene include:

- **Wearable devices connected to the Internet of Things (IoT ):** While still in its infancy, this technology is poised to revolutionize industrial hygiene monitoring. From ergonomics to gas concentrations to noise levels, wearable devices can generate large volumes of highly specific, real-time data.

- **Centralized Reporting:** Feeding data from wearable devices to an integrated EHS

Management System lets you go beyond simple alerts to leverage advanced risk mitigation opportunities. For instance, exposure data can help you identify high-risk procedures and work areas and how they change over time. Linking the data to your Risk Register allows you to verify that these areas are audited, appropriate controls are in place and the controls effectively reduce risk.

- **Hazard communication:** EHS Software mitigates exposure risks with centralized tracking of hazardous substances. This ensures your safety data sheets and labels meet new OSHA requirements that align with Globally Harmonized System of Classification and Labeling of Chemicals (GHS). It also allows you to enter toxic substances into your Risk Register so you can track them and identify substitutions.

## Contractor and Supplier Management

Contractors and suppliers introduce significant EHS risk, with even a single mistake having the capability to cause a serious incident. In extreme cases, these incidents can have long-term impacts on brand value and even an entire industry's reputation.

Key steps for incorporating risk management into contractor and supplier compliance programs include:

- **Tracking compliance certificates** to ensure all contractors and suppliers meet internal and regulatory standards.

- **Identifying high-risk suppliers and contractors** through proactive compliance history tracking.

- **Standardizing policies** for how to handle supplier issues. For example, a decision tree or risk matrix can help you identify whether an incident calls for a corrective action, enhanced inspection rules or reevaluating the relationship entirely.

- **Assigning corrective actions** to partners with secure, cloud-based access to the EHS System to engage suppliers and subcontractors in your safety process.

## Sustainability

Sustainability monitoring is now a core business practice, with companies recognizing the risks of inefficient resource use and unplanned releases. Conversely, investments in sustainability provide a measurable boost to the bottom line. For example,

Dow Chemical calculated that $1 billion in sustainability improvements have delivered an overall return to the company of more than $5 billion.[8]

The following elements can help you build a sustainability program that proactively mitigates risk and reduces operational costs:

- **Tracking environmental aspects,** defining objectives and using Centralized Reporting tools to watch long-term trends and progress towards your goals.

- **Identifying high-risk equipment or processes** that require proactive equipment monitoring and special attention during audits. This can also improve overall equipment effectiveness and productivity.

- **Standardizing equipment inspection** rules and centralizing inspection checklists within the EHS Management System.

- **Setting dashboard alerts** connected to equipment monitoring systems for when emissions parameters approach or exceed threshold limits.

- **Linking smart sensors to the EHS System** so equipment data isn't just overwritten on the device or dumped onto a spreadsheet. Integrated data management lets you make connections between overall asset performance and sustainability measures.

## Enterprise Risk Management

Risk has become a universal language for helping executives make decisions in all operational areas, from quality and safety to finance, security and human resources. EHS Software allows companies to standardize risk management practices across the enterprise, improving consistency in how individuals identify and mitigate risk.

Enterprise Risk Management strategies to focus on include:

- **Centralizing all risk items** in a Risk Register. This gives you an easily accessible source for assessing risk across the organization.

- **Establishing risk templates** for different types of risk items, including who is responsible and what decision-making criteria are.

- **Creating roll-up reports** that show risk across different organizational areas to enable more strategic decision-making.

- **Linking risks in different areas** to identify trends and common underlying sources of risk. This can also help EHS teams secure needed investments in risk management initiatives that impact other areas of the organization.

## EHS Software Checklist

Evaluating EHS Management Systems and determining whether they meet your organization's unique needs is a time-consuming process. This checklist provides some important considerations for any system under evaluation:

- Integration: Integrated systems provide more functionality than point solutions. It's also important to consider whether your EHS Software is capable of directly integrating data from related systems such as quality, human resources, manufacturing systems and finance.

- Automation: An automated system reduces the risk of human error and improves productivity, also reducing administrative overhead.

- Mobile: Mobile capabilities allow you to extend risk management to the field. This helps engage employees so you can capture more (and more detailed) safety data. The key is having a mobile platform for all EHS functions, not just a few mobile apps.

- Flexibility: You should be able to customize an EHS system to your business, not the other way around. Ease of use is also a huge factor in user adoption.

- Scalability: It's important to evaluate how difficult it is to scale up the system, since you'll likely want to add new users and locations as your business grows.

## Closing Thoughts

Big Data now allows companies to collect and analyze vast quantities of data faster, better and cheaper than ever before. For organizations to gain maximum benefit from these advances, an integrated approach is needed that addresses the gaps created by disparate point solutions and outdated manual tracking systems.

Ultimately, the key is building a system that ties together not just different EHS functions, but also the entire enterprise as a whole. Only then can companies achieve a higher standard of protecting both worker safety and our shared environmental resources.

## About EtQ

EtQ is the leading Quality, EHS, Operational Risk and Compliance management software provider for identifying, mitigating and preventing high-risk events through integration, automation and collaboration. At the core of EtQ's framework is a compliance management platform that enables organizations to implement best in class compliance processes configured to meet their existing processes, create new compliance processes and automate and control their compliance ecosystem. EtQ's product lineup includes traqpath™ for individual compliance users, VERSE Solutions™ for small to medium sized businesses and Reliance™ for enterprise organizations. EtQ was founded in 1992 and has main offices located in the U.S. and Europe. To learn more about EtQ and its various product offerings, visit www.etq.com or blog.etq.com.

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