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Abstract

The pharmaceutical industry requires strict safety standards to protect employees and ensure operational excellence. Workplace accidents can be significantly reduced through effective safety training programs. This project applies the **DMAIC methodology** to assess the impact of safety training on accident reduction within a pharmaceutical environment. Data related to training participation and workplace incidents were analyzed to identify trends and improvement opportunities. The results demonstrate that structured safety training contributes to increased safety awareness and a reduction in workplace accidents. This project highlights the importance of continuous training as a key component of an effective Environmental, Health, and Safety (EHS) management system.

Key Terms: EHS, Safety Training, Accident Reduction, DMAIC Methodology, Pharmaceutical Industry

Problem Statement

Despite the implementation of established safety policies and procedures, workplace accidents continue to occur within pharmaceutical environments. Variability in the effectiveness of safety training programs and differences in employee engagement may contribute to inconsistent safety performance across operations. In many cases, safety training outcomes are not systematically measured, making it difficult to determine their true impact on accident reduction. Additionally, limited visibility of safety performance indicators can delay corrective actions and preventive measures. Addressing these gaps is critical to strengthening the Environmental, Health, and Safety (EHS) culture, improving compliance, and reducing workplace accidents. This project seeks to evaluate the effectiveness of safety training initiatives and identify opportunities for continuous improvement using a structured DMAIC approach.

Methodology

This project follows the **DMAIC methodology** to evaluate the impact of safety training on accident reduction within a pharmaceutical environment. During the **Define** phase, the scope of the project and safety-related concerns were identified. In the **Measure** phase, data related to workplace incidents and safety training participation were collected and reviewed. The **Analyze** phase focused on identifying trends, gaps, and potential root causes affecting safety performance. Improvement opportunities were identified during the **Improve** phase, emphasizing enhanced training strategies and employee engagement. Finally, the **Control** phase supports sustainability through continuous monitoring and reinforcement of EHS practices.

Phase	Description
Define	Identify safety challenges and project scope
Measure	Collect workplace incident and training data
Analyze	Analyze trends and root causes of accidents
Improve	Identify improvement opportunities in safety training
Control	Monitor performance and sustain EHS improvements

DEFINE PHASE

Safety performance concerns were identified through the review of historical incident reports, near-miss records, and unsafe condition observations. Gaps between training completion and real-world safety behavior were recognized as a key opportunity for improvement.

Content	
Project Focus	Evaluate the effectiveness of EHS safety training in reducing workplace accidents and unsafe behaviors in pharmaceutical manufacturing.
Problem	Workplace incidents, near misses, and unsafe behaviors continue to occur despite high training completion rates, suggesting a gap between training delivery and real-world application.
Goal	Determine whether safety training is associated with measurable improvements in safety performance and identify opportunities to strengthen training impact.
Scope	Analysis of historical EHS records (incidents, near misses, BBS observations, PPE compliance, audits, training completion) in a pharmaceutical manufacturing environment.
Stakeholders	Employees/Operators, Supervisors, EHS Team, Training/Compliance, Operations Leadership.
Key Metrics (High-Level)	Incident frequency, near-miss reporting trends, PPE compliance, procedural adherence, training participation/completion.

MEASURE PHASE

Baseline safety indicators were established using historical EHS data, including workplace incidents, near misses, PPE compliance observations, and training participation records. These metrics provided visibility into safety performance trends prior to and following training reinforcement.

Figure 1. Distribution of Safety Events

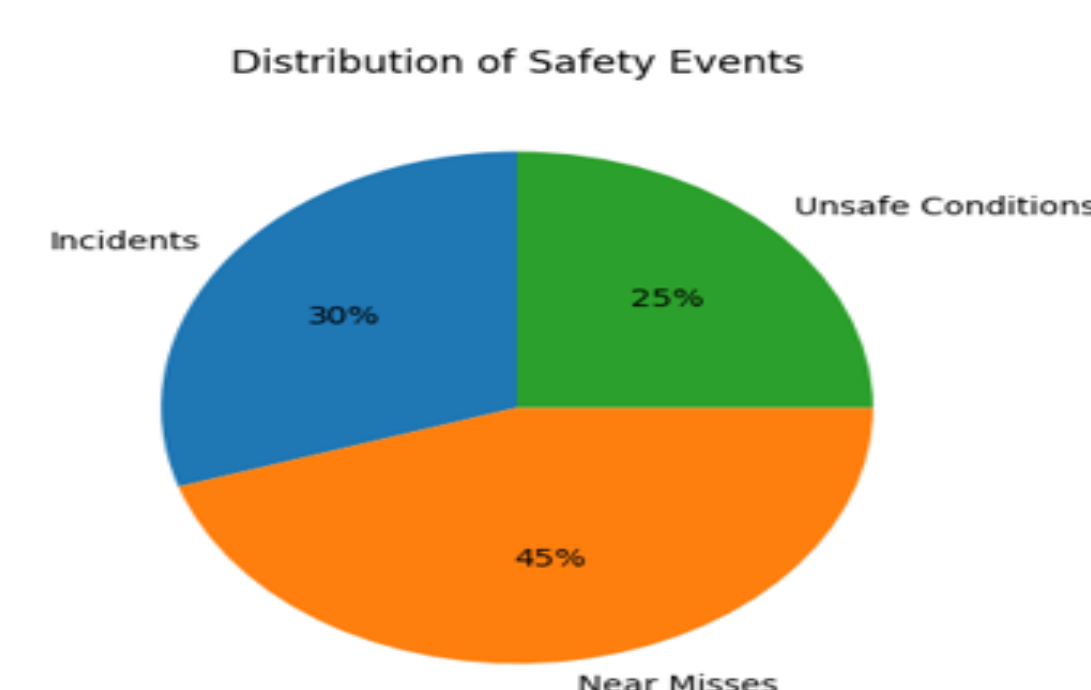


Figure 2. Safety Training Participation by Year



ANALYZE PHASE

During the Analyze phase, safety performance data were examined to identify trends, patterns, and potential root causes related to workplace accidents and unsafe behaviors. Results showed that behavior-based indicators, including PPE compliance and procedural adherence, were more sensitive to safety training than equipment- or facility-related events. Periods following safety training reinforcement demonstrated improved behavioral performance and increased near-miss reporting. These findings suggest that safety training has a stronger influence on employee behavior and hazard awareness than on incident reduction alone, highlighting the importance of focusing analysis on leading safety indicators.

Results and Discussion

Figure 3. Comparison of Safety Indicators

This chart compares incident-based indicators with behavior-based safety indicators.

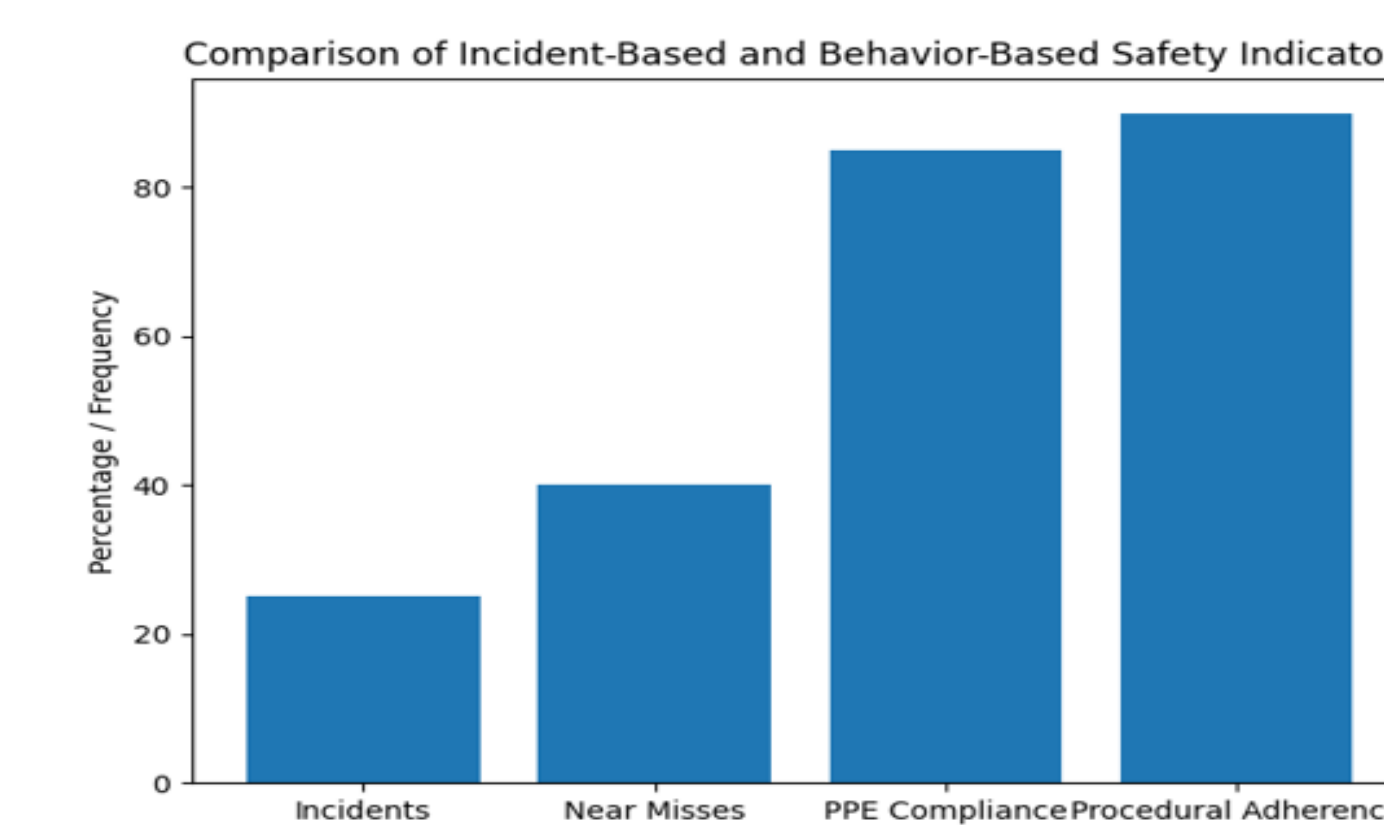
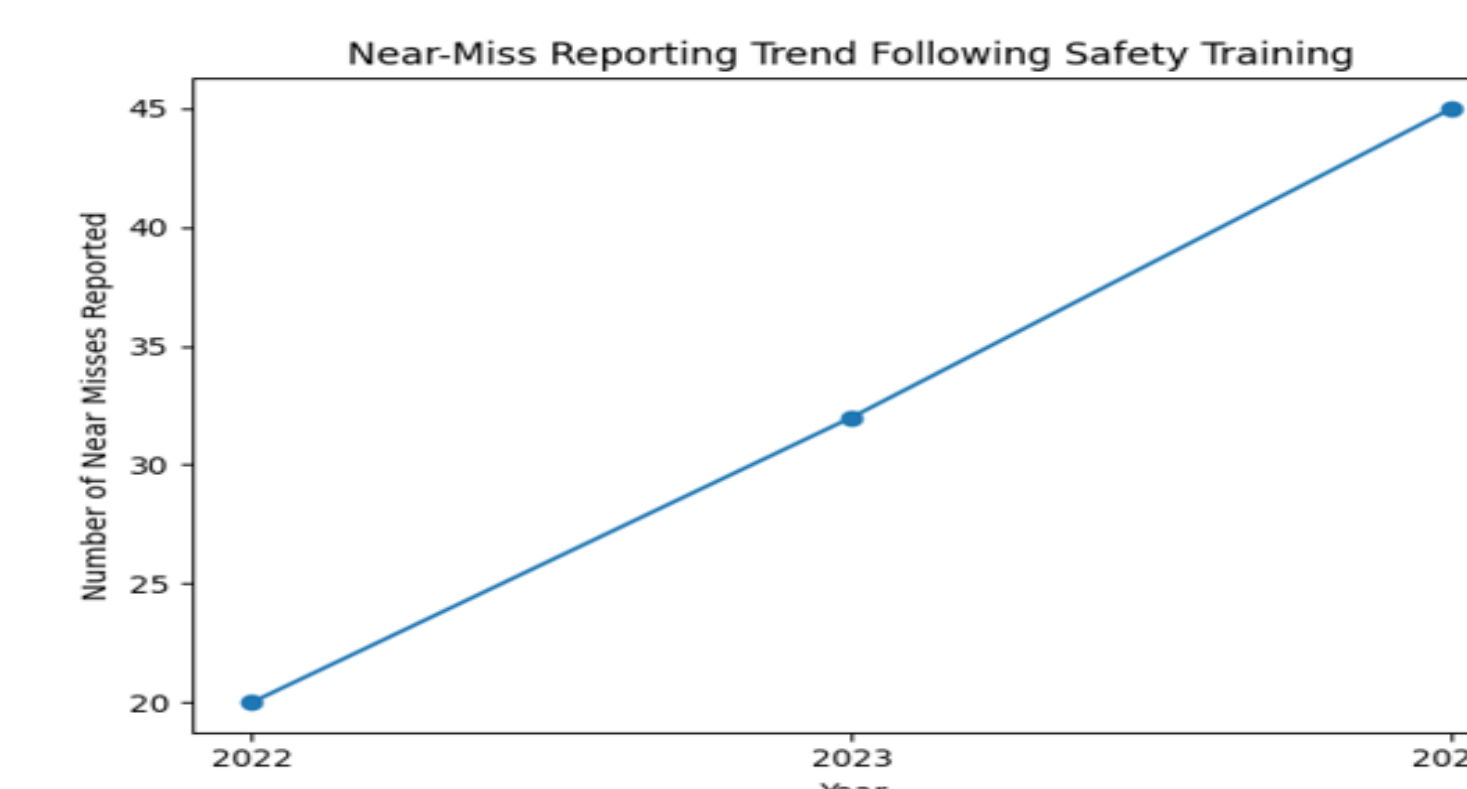


Figure 4. Near-Miss Reporting Trend Over Time

Increased near-miss reporting indicates improved hazard awareness and safety culture.



- Behavior-based safety indicators showed greater improvement following safety training, particularly in PPE compliance, procedural adherence, and hazard awareness.
- Increased near-miss reporting reflected improved safety awareness and reporting culture, rather than a decline in safety performance.

IMPROVE PHASE

Based on the findings from the analysis, improvement actions focused on strengthening existing EHS safety training programs. Proposed improvements include enhancing job-specific and hands-on training, reinforcing learning through safety drills and real-case scenarios, and increasing supervisory engagement to support safe behaviors. These actions aim to improve training effectiveness, increase behavioral consistency, and reduce the likelihood of workplace accidents. The Improve phase emphasizes practical application and continuous reinforcement rather than the creation of new training systems.

CONTROL PHASE

The Control phase focuses on sustaining the improvements achieved through enhanced EHS safety training. Ongoing monitoring of safety performance indicators, including incident trends, near-miss reporting, PPE compliance, and behavioral observations, supports long-term effectiveness. Standardized training refreshers, routine audits, and supervisory feedback are used to reinforce safe behaviors and prevent regression. Continuous evaluation ensures alignment between training effectiveness, regulatory compliance, and organizational safety objectives.

Control Element	Description
Safety Indicators	Incident rate, near-miss reporting, PPE compliance, behavioral observations
Monitoring Method	Routine audits, safety observations, EHS dashboards
Frequency	Monthly and quarterly reviews
Responsible Team	EHS team, supervisors, and operations leadership
Response Actions	Training refreshers, corrective actions, and coaching

Conclusions

This project demonstrated that EHS safety training plays a critical role in improving workplace safety within pharmaceutical manufacturing environments. The application of the DMAIC methodology provided a structured approach to evaluate training effectiveness using both incident-based and behavior-based safety indicators. Results highlighted that behavior-driven outcomes, such as PPE compliance, procedural adherence, and hazard awareness, were more responsive to safety training reinforcement than incident reduction alone. Strengthening job-specific, hands-on training and continuous monitoring supports sustained safety performance and reinforces a proactive EHS culture.

- EHS safety training demonstrated a stronger impact on behavior-based safety indicators, such as PPE compliance, procedural adherence, and hazard awareness, than on incident reduction alone.
- The DMAIC methodology provided a structured and data-driven approach to evaluate training effectiveness and support continuous improvement within pharmaceutical manufacturing environments.

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