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Main Issues and Improvement Measures in Safety Education and Training for Employees in Chemical Enterprises

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Abstract: The chemical industry is characterized by high risks, complex processes, and the chain-reaction nature of accidents. Employee safety education and training serve as the cornerstone for accident prevention and ensuring safe production in enterprises. This paper systematically analyzes the aforementioned issues and proposes targeted improvement measures from five dimensions: enhancing strategic awareness, restructuring the curriculum system, innovating teaching methods, improving the closed-loop evaluation mechanism, and activating subjective initiative. The aim is to provide a reference for chemical enterprises to establish a scientific and efficient safety education and training system, effectively elevate the safety competence of all employees, and strengthen the defense line of safety production.

Keywords: Chemical enterprises; Employee safety education and training; Issues; Improvement measures

Introduction

Workplace safety serves as the lifeline for the survival and development of chemical enterprises, with employees' safety awareness and skill levels directly determining the robustness of this lifeline. As China's chemical industry advances toward large-scale, intensive, and high-end development, production facilities have become increasingly complex, with intertwined and overlapping safety risks, placing unprecedented demands on the professional safety competencies of practitioners. Therefore, conducting an in-depth analysis of the underlying issues in training practices and exploring educational and training models that

align with the needs of modern chemical enterprises and adult learning principles holds significant practical importance for preventing and mitigating major accidents and promoting safety within the industry.

1 Overview of Safety Education and Training for Chemical Enterprise Employees

1.1 The Concept of Safety Education and Training for Chemical Enterprise Employees

Safety education and training for employees in chemical enterprises refers to a comprehensive set of educational, training, and developmental activities systematically organized by the enterprise in accordance with national work safety laws and



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regulations, industry standards, and its own production process characteristics. It aims to enhance employees' safety awareness, attitudes, knowledge, and operational skills. Rather than being a mere transfer of information, it is a systematic process encompassing consciousness cultivation, knowledge dissemination, skill practice, behavior correction, and emergency response capability improvement. The training targets all personnel across the enterprise, including decision-makers, managers, technical staff, and operators. Its content covers a broad spectrum, including legal regulations, process safety, equipment operation, hazard identification, occupational health protection, emergency response, and case studies of accidents. Distinct from general knowledge education, safety training in chemical enterprises is characterized by its strong job-specific focus, practical operational emphasis, continuous updating, and mandatory nature. The core objective is to shape employees' "safety mindset," transforming safety behavior from external constraints into intrinsic consciousness.

1.2 The Importance of Safety Education and Training for Employees in Chemical Enterprises

Chemical production universally involves high-risk factors such as high temperature and pressure, flammability, explosiveness, toxicity, and hazards. Even minor negligence or operational errors can lead to catastrophic consequences. Therefore, the importance of safety education and training is self-evident. Firstly, it serves as the primary defense against human errors and preventing accidents. Systematic and effective training enables employees to master operational procedures, accurately identify potential risks in the work environment, and make correct judgments and responses under abnormal conditions, fundamentally reducing accidents caused by "ignorance" and "incompetence." Secondly, it is the core vehicle for implementing corporate safety production responsibilities and building a safety culture. Through continuous education and guidance, companies can internalize safety concepts as shared values among employees, fostering an organizational atmosphere where "everyone prioritizes safety, and every task is performed with safety in mind" ^[1]. Thirdly, it is a basic requirement for safeguarding employees' lives and health and fulfilling corporate social responsibilities. Respecting life and protecting employees from

occupational harm represent the ethical baseline for the survival and development of chemical enterprises. Lastly, in the long run, high-level safety literacy across the workforce enhances the stability and reliability of production operations, reduces property losses, production interruptions, and reputational damage caused by accidents, thereby transforming into a core competitive advantage for enterprises. In an increasingly stringent regulatory environment and a complex risk landscape, safety education and training are no longer optional but an essential path for chemical enterprises to achieve high-quality and sustainable development.

2 Main Problems in Safety Education and Training for Employees in Chemical Enterprises

2.1 Insufficient Corporate Emphasis

Although most chemical enterprises verbally emphasize "safety first," safety training is often relegated to a subordinate position in actual operations. Senior managers tend to allocate resources to production and sales activities that directly generate economic benefits, viewing investment in safety training as a cost rather than an investment. This strategic neglect manifests in multiple ways: training budgets are slashed, training sessions are frequently displaced by production tasks, and cancellations of training to "meet deadlines and accelerate progress" are commonplace; training programs lack professional instructors and facilities, often being hastily handled by part-time personnel; when conflicts arise between safety training and production, training is typically sacrificed. This utilitarian attitude—"prioritized in rhetoric, marginalized in practice, and abandoned when busy"—fundamentally undermines the seriousness and effectiveness of safety training.

2.2 Lack of Targeted Training Content

Many companies' safety training programs suffer from a severe "one-size-fits-all" approach. The training materials remain unchanged for years, with content that is overly generalized—focusing primarily on universal legal regulations and basic safety knowledge—while being severely disconnected from the specific process characteristics, equipment risks, and operational details of particular roles. There is a lack of differentiated instruction for employees at different levels, in different

roles, and with varying degrees of risk exposure. For instance, the content and methods used to train new hires, transferred employees, contractors, and seasoned staff are largely identical, failing to address the unique knowledge gaps and skill requirements of each group. Furthermore, training content updates lag behind, often failing to incorporate new processes, equipment, standards, or lessons learned from recent industry accidents. This results in a significant disconnect between training and actual workplace practices, leaving employees feeling that the training is neither insightful nor practical.

2.3 Single Training Method

Currently, safety training in some chemical enterprises remains stuck in the traditional "classroom lecture" model, primarily characterized by instructors reading from PowerPoint presentations and employees passively attending large-group sessions. This one-way, passive, spoon-feeding approach to teaching severely contradicts the principles of adult learning, which emphasize practice, interaction, and the connection of experience. The training process is monotonous and lacks diversified methods such as case studies, scenario simulations, interactive discussions, and hands-on practice. Particularly in chemical production, many operational skills require the integration of hands and minds, as well as the ability to make emergency judgments and handle abnormal situations—competencies that cannot be effectively acquired through classroom lectures alone. Training often prioritizes theory over practical application, and even when hands-on sessions are included, they frequently become mere formalities due to inadequate equipment and time constraints ^[2]. This singular approach results in low employee engagement, significantly diminishes training effectiveness, and hampers the transformation of knowledge into practical capability.

2.4 Unscientific Training Effectiveness Evaluation

Most companies equate the evaluation of training effectiveness simply with organizing a closed-book exam, where the content often revolves around rote memorization of concepts and regulations. Employees can easily pass by cramming before the test or "borrowing" answers from peers. This assessment method only measures short-term memory and fails to gauge the true level of employees' safety awareness,

depth of understanding of operational procedures, or emergency response capabilities in unexpected situations. More critically, the evaluation results are not effectively linked to employees' performance, promotions, or compensation, leading to a situation where "whether you learn or not makes no difference, and whether you learn well or poorly yields the same outcome." Deep-level assessment mechanisms, such as post-training follow-up feedback, on-site behavior observation, and long-term competency evaluation, are severely lacking. As a result, companies cannot accurately grasp the actual effectiveness of training, nor can they provide data-driven support for improving future training programs. This traps training in an inefficient cycle of "being conducted year after year with the same outdated approach."

2.5 Low Employee Participation Enthusiasm

In a training system lacking scientific design and effective incentives, employees generally view safety training as an additional burden or a mandatory task. On one hand, the training content is dull and the methods are monotonous, making it difficult to stimulate employees' intrinsic interest. On the other hand, heavy production tasks leave employees physically and mentally exhausted, and training that encroaches on rest time is more likely to trigger resistance. Additionally, since the evaluation of training effectiveness is often superficial, employees do not perceive any practical benefits to their skill development or career advancement, leading to a lack of internal motivation to participate. When safety training lacks active engagement and deep involvement from employees, regardless of the resources invested by the company, it is challenging to achieve the intended internalization of outcomes.

3 Improvement Measures for Employee Safety Education and Training in Chemical Enterprises

3.1 Enhancing Corporate Emphasis on Safety Education and Training

The top decision-making level of an enterprise must elevate safety training to a strategic priority and establish the core principle that "inadequate training constitutes a major safety hazard." First, investment in safety training must be incorporated as a rigid constraint in the enterprise's annual budget, ensuring

sufficient allocation of funds, time, instructional staff, and facilities, along with the establishment of a specialized audit mechanism. Second, a "top leader" accountability system should be implemented, making the effectiveness of safety training a key performance indicator for managers at all levels, thereby promoting a responsibility chain where "managing production necessitates managing safety, and managing safety necessitates managing training." Enterprises should regularly convene dedicated safety training meetings to study and resolve practical issues, and integrate training plans with production and operational plans in deployment, implementation, and inspection. Safety training must be transformed from a "soft task" into a "hard indicator," fostering a corporate-wide atmosphere that respects training and values competence^[3].

3.2 Optimize Training Content

Breaking away from the "one-size-fits-all" training model, we have established a precise, tiered, categorized, and position-specific curriculum system. First, we conduct job requirement analyses to identify core safety knowledge and skills for each position based on risk assessment results and operational guidelines, forming a tailored "one-position-one-strategy" training matrix. Second, we implement differentiated instruction: new employees receive intensified foundational onboarding and initial hands-on supervision, experienced staff focus on training for new technologies, case studies, and corrective habits, while managers emphasize legal regulations, risk management, and leadership development. Third, we promote dynamic content updates by incorporating a "case studies into textbooks" mechanism, promptly translating lessons from incidents within our company and industry into practical training materials that educate through real-life examples. Additionally, we enhance core practical content such as process safety analysis, emergency response procedures, and specialized operational standards to ensure training aligns precisely with on-site realities.

3.3 Innovative Training Methods

Transform the traditional single-mode lecture-based approach by introducing diverse, interactive, and experiential teaching methods to enhance the appeal and effectiveness of training. Vigorously promote the dual-teaching model of "classroom + field," extending

training sessions to production areas, control rooms, and maintenance sites for practical exercises such as "point-and-call" drills, on-the-job training, and on-site hazard identification. Actively apply digital technologies like virtual reality (VR), augmented reality (AR), and simulation to create highly immersive accident scenarios and operational training environments. This allows employees to experience accident risks and practice complex operations under controlled safety conditions, achieving "realistic" safety education. Promote case study discussions and role-playing exercises to encourage employees to analyze accident causes and simulate response procedures through interaction. Additionally, leverage corporate online learning platforms, micro-courses, short videos, and other formats to meet employees' fragmented and personalized learning needs, forming a blended training model that integrates online and offline approaches.

3.4 Establishing a Scientific Mechanism for Evaluating Training Effectiveness

Establish a four-level evaluation system encompassing the reaction, learning, behavior, and results layers to comprehensively and objectively measure training effectiveness. First, at the reaction level, collect trainees' immediate feedback on training content, instructors, and methods through questionnaires and group discussions. Second, at the learning level, move beyond purely theoretical exams by employing practical assessments, scenario simulations, case analyses, emergency drills, and other diverse methods to comprehensively evaluate the depth of trainees' knowledge and skill acquisition. Third, at the behavior level, implement a post-training behavior tracking mechanism to assess whether employees apply what they learned in training to their actual work through on-site observations, behavioral safety observations, daily inspections, and other means. Behavioral changes are used as a key basis for performance evaluations^[4]. Fourth, at the results level, correlate training outcomes with safety performance indicators such as accident rates, violation rates, and hazard rectification rates to validate the long-term organizational value of training.

3.5 Stimulating Employee Enthusiasm for Training Participation

By addressing institutional, incentive, and cultural aspects, we aim to shift the mindset from "being forced

to learn" to "I want to learn." At the institutional level, we establish a strong linkage mechanism between safety training and job promotion, salary adjustments, and excellence evaluations, making training assessment results a key reference for employees' career development, thereby enhancing the "value" of training. On the incentive front, we set up special reward funds to generously reward employees who take the initiative to learn, possess exceptional skills, or excel in emergency responses or competitions; we also promote a "mentorship allowance" system to incentivize experienced employees to share their expertise. Culturally, we organize recognition activities such as "Safety Star" and "Skilled Worker" awards to set learning benchmarks; we encourage employees to participate in the development and delivery of training courses, transforming frontline staff from passive recipients into active participants and contributors, boosting motivation through a sense of identity. Additionally, we schedule training sessions thoughtfully, coordinating them with production tasks to minimize conflicts between work and learning, demonstrating humanistic care for employees, and fundamentally igniting their intrinsic motivation to engage in safety training.

Conclusion

Safety education and training for employees in chemical enterprises is a fundamental, long-term, and systematic strategic project. Its quality directly impacts

the survival and development of the enterprise and the life safety of employees. Confronting core issues such as insufficient attention, vague content, outdated methods, ineffective evaluation, and low participation, enterprises must demonstrate the courage to undergo self-renewal with resolute determination. There is no end to the path of improvement. Only by elevating safety training to a strategic level, restructuring content based on needs, innovating methods aimed at practical results, scientifically evaluating with data support, and inspiring full internal drive through value recognition can a truly effective safety education and training system be established.

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