

Occupational Safety Regulations in Brazil: An Overview of the Main Regulatory Standards (NRs) and Contemporary Challenges

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Abstract

Occupational health and safety regulations play a fundamental role in protecting workers, reducing occupational risks, and promoting safer work environments in Brazil. The Brazilian Regulatory Standards (Normas Regulamentadoras – NRs), established by the Ministry of Labor, provide technical and legal guidelines for accident prevention, occupational disease control, and safety management across different economic sectors. This article presents an overview of the main Regulatory Standards in Brazil and discusses their importance, practical applications, and contemporary challenges in occupational safety management. The study was developed through a qualitative theoretical review based on scientific articles, official documents, legislation, and institutional publications related to workplace safety and regulatory compliance. The analysis highlights the relevance of standards such as NR-1, NR-6, NR-10, NR-12, NR-17, NR-18, and NR-35 in promoting preventive practices and improving occupational safety culture. Furthermore, the study examines challenges related to regulatory compliance, worker training, technological changes, inspection limitations, and the need for continuous updating of safety practices. The findings indicate that effective implementation of Regulatory Standards contributes significantly to accident prevention, organizational efficiency, and worker well-being in contemporary professional environments

Keywords: Occupational safety, Regulatory Standards (NRs), Workplace risk management.

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I. INTRODUCTION

Occupational health and safety have become increasingly important topics in contemporary society due to the growing complexity of productive processes, technological advancements, and the need to ensure safe and healthy working conditions across different economic sectors. In Brazil, workplace accidents and occupational diseases continue to represent significant social and economic challenges, affecting workers, companies, and public health systems. According to Oliveira (2017), occupational safety should be understood as a set of preventive measures aimed at minimizing risks and preserving workers' physical and mental integrity. In this context, the Brazilian Regulatory Standards, known as Normas Regulamentadoras (NRs), play a fundamental role in establishing technical and legal guidelines for occupational risk prevention and safety management.

The Regulatory Standards were established by the Brazilian Ministry of Labor through Ordinance No. 3.214/1978 and are continuously updated to address new technological, organizational, and occupational realities (BRASIL, 1978). These standards define mandatory requirements related to occupational safety, health protection, risk management, worker training, and preventive practices applicable to both public and private organizations. According to Saliba and Corrêa (2019), the NRs represent one of the most important instruments for promoting occupational safety culture in Brazil, as they establish standardized procedures capable of reducing accidents and improving working conditions.

Among the existing standards, NR-1 stands out as the foundational regulation for occupational safety and health management in Brazil. NR-1 establishes general provisions and guidelines applicable to all Regulatory Standards, including the implementation of the Occupational Risk Management Program (PGR) and preventive measures aimed at identifying, evaluating, and controlling workplace hazards (BRASIL, 2020a). According to Garcia (2021), the modernization of NR-1 reinforced the importance of preventive management and introduced a more systematic approach to occupational risk assessment within organizations.

Another highly relevant regulation is NR-6, which addresses Personal Protective Equipment (PPE). This standard establishes the obligations of employers and employees regarding the supply, use, maintenance, and supervision of protective equipment intended to minimize exposure to occupational hazards (BRASIL, 2022a). As highlighted by Mattos and Másculo (2018), the adequate use of PPE significantly contributes to accident prevention, particularly in activities involving physical, chemical, biological, and mechanical risks. However, the authors emphasize that PPE should complement, rather than replace, collective protection measures and safe work procedures.

Electrical safety is another critical area addressed by Brazilian occupational regulations. NR-10 establishes minimum requirements and safety measures for activities involving electrical installations and services, aiming to guarantee worker safety and prevent accidents related to electric shock, fires, and explosions (BRASIL, 2022b). According to Barbosa Filho (2018), electrical accidents are often associated with inadequate training, lack of maintenance, and noncompliance with technical procedures, making NR-10 essential for risk prevention in industrial, commercial, and construction environments.

In industrial and manufacturing sectors, NR-12 plays a strategic role in accident prevention involving machinery and equipment. This regulation establishes safety principles related to machine design, operation, maintenance, emergency systems, and worker training (BRASIL, 2022c). According to Tavares (2016), machinery-related accidents are among the most severe occupational incidents due to their potential to cause permanent injuries and fatalities. Therefore, compliance with NR-12 is fundamental to ensuring safer production environments and reducing occupational risks associated with mechanized processes.

The construction industry, historically characterized by high accident rates, is regulated by NR-18, which establishes guidelines for safety and health conditions in construction activities (BRASIL, 2020b). According to Fundacentro (2021), civil construction remains one of the sectors with the highest incidence of occupational accidents in Brazil, largely due to falls from height, inadequate work conditions, and insufficient worker training. NR-18 addresses issues such as collective protection systems, temporary electrical installations, scaffolding safety, and construction site organization, contributing significantly to accident prevention in the sector. Similarly, NR-35 addresses work at heights, establishing minimum safety requirements for activities performed above two meters where there is a risk of falling (BRASIL, 2022d). According to Araújo (2020), falls from height remain one of the leading causes of fatal occupational accidents in Brazil, especially in construction, maintenance, and industrial activities. The implementation of NR-35 requires worker training, risk analysis, emergency planning, and the adoption of appropriate fall protection systems.

Ergonomics has also become an important concern within occupational safety management. NR-17 establishes ergonomic parameters aimed at adapting working conditions to workers' physiological and psychological characteristics, promoting comfort, safety, and productivity (BRASIL, 2021). According to Iida and Guimarães (2016), ergonomic inadequacies contribute significantly to musculoskeletal disorders, fatigue, stress, and reduced work performance. In modern work environments, especially those involving repetitive activities and prolonged use of digital technologies, ergonomic management has become essential for occupational health promotion.

Despite the advances promoted by Regulatory Standards, important challenges remain regarding their effective implementation and enforcement. According to Saliba (2020), many organizations still face difficulties related to compliance costs, lack of safety culture, insufficient worker training, and limited inspection capacity. Additionally, technological transformations associated with Industry 4.0, automation, and new work models require continuous updating of occupational safety regulations and preventive practices.

Therefore, understanding the role and application of Brazilian Regulatory Standards is fundamental for promoting safer and healthier workplaces. This article aims to provide an overview of the main occupational safety regulations in Brazil, discussing their practical importance, preventive contributions, and contemporary challenges within occupational health and safety management systems.

II. METHODOLOGY

This study was developed through a qualitative and exploratory research approach based on a comprehensive theoretical literature review. The objective of the methodological process was to analyze the main Brazilian Regulatory Standards (Normas Regulamentadoras – NRs) related to occupational health and safety, emphasizing their practical applications, preventive contributions, and contemporary challenges in professional environments.

The research methodology involved the systematic selection, reading, and interpretation of scientific articles, academic books, technical manuals, institutional publications, legislation, and official documents related to occupational safety and health management in Brazil. The literature review included both national and international references addressing workplace risk prevention, occupational accident reduction, safety culture, regulatory compliance, and risk management practices.

The bibliographic survey was conducted using academic databases and digital repositories such as Google Scholar, Scopus, ScienceDirect, SciELO, and institutional publications from governmental and occupational safety organizations. In addition, official Brazilian legislation and Regulatory Standards published by the Ministry of Labor and Employment were analyzed to ensure legal and technical consistency throughout the study. Priority was given to updated publications discussing recent changes in occupational safety regulations, technological impacts on workplace safety, and contemporary occupational risk management strategies.

The study focused particularly on the analysis of NR-1 (General Provisions and Occupational Risk Management), NR-6 (Personal Protective Equipment – PPE), NR-10 (Electrical Safety), NR-12 (Machinery and Equipment Safety), NR-17 (Ergonomics), NR-18 (Construction Industry Safety Conditions), and NR-35 (Work at Heights). These standards were selected due to their broad applicability, relevance to different economic sectors, and significant role in occupational accident prevention and worker protection.

A comparative and interpretative analysis of the collected materials was performed in order to identify recurring themes, preventive strategies, implementation challenges, and best practices associated with occupational safety management. This analytical process allowed the organization of information regarding the importance of Regulatory Standards in promoting safer work environments and reducing occupational hazards. Furthermore, the study examined the relationship between regulatory compliance, worker training, organizational culture, and the effectiveness of preventive measures in contemporary workplaces.

The research also adopted a critical-reflective perspective, considering the impacts of technological transformations, automation, and emerging occupational risks associated with Industry 4.0 and modern production systems. In this sense, the study sought to discuss not only the legal aspects of occupational safety regulations but also their practical implications for organizations, workers, and occupational health management systems.

Therefore, the adopted methodology provided a broad and updated theoretical foundation for understanding the role of Brazilian Regulatory Standards in occupational safety management. The study intends to contribute to academic discussions, professional practices, and the development of preventive strategies aimed at improving workplace safety and worker well-being in Brazil.

III. DISCUSSION AND PERSPECTIVES

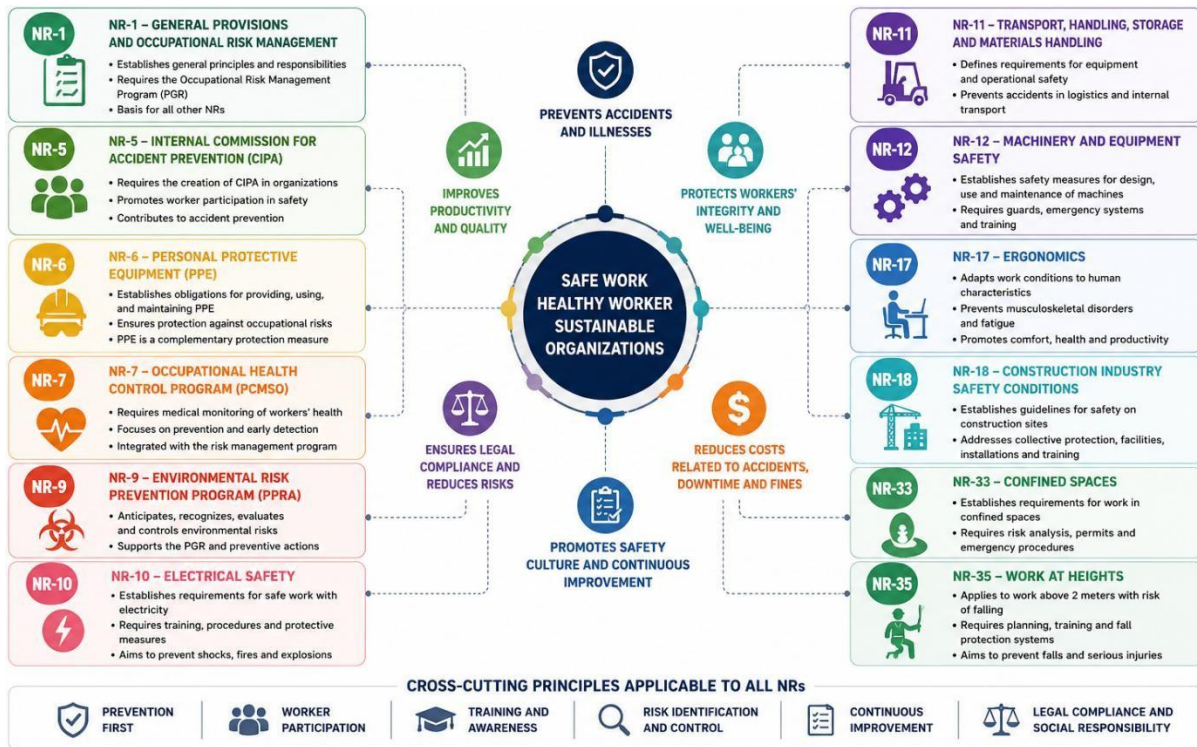


Figure 02: SCHEMATIC ILLUSTRATION

Occupational safety regulations in Brazil play a fundamental role in protecting workers, reducing occupational accidents, and promoting healthier and safer professional environments across different economic sectors. The Brazilian Regulatory Standards (Normas Regulamentadoras – NRs) represent one of the most important legal and technical frameworks for occupational health and safety management in the country, establishing preventive measures, operational procedures, and mandatory requirements aimed at minimizing workplace risks. According to Saliba and Corrêa (2019), the implementation of the Regulatory Standards contributes directly to strengthening safety culture within organizations and improving working conditions through systematic prevention strategies. Nevertheless, despite the existence of detailed legislation and continuous inspection efforts, Brazil still records considerable numbers of occupational accidents and work-related illnesses every year, demonstrating that important structural and cultural challenges remain unresolved.

One of the central discussions in occupational safety management concerns the transition from reactive approaches toward preventive and predictive models of risk control. Historically, many companies adopted safety measures only after the occurrence of accidents or incidents. However, modern occupational safety systems increasingly emphasize hazard anticipation, preventive planning, and continuous monitoring of occupational risks. This evolution became particularly evident after updates to NR-1, which introduced the Occupational Risk Management Program (PGR) as a mandatory preventive strategy for organizations (BRASIL, 2020a). According to Garcia (2021), the implementation of systematic risk management approaches enables organizations to identify hazards more efficiently, reduce operational vulnerabilities, and create safer working environments. In addition, preventive safety management contributes to organizational productivity, reduction of absenteeism, and lower economic losses associated with occupational accidents and legal liabilities.

Another highly relevant aspect involves the effectiveness of worker training and qualification programs. Several Regulatory Standards establish mandatory training requirements for activities involving occupational hazards, including electrical services (NR-10), machinery operation (NR-12), confined spaces (NR-33), and work at heights (NR-35). According to Barbosa Filho (2018), insufficient technical preparation and inadequate understanding of safety procedures remain among the leading causes of occupational accidents in Brazil. In many professional environments, workers perform high-risk activities without comprehensive knowledge of preventive measures, emergency procedures, or proper equipment usage. Consequently, continuous training programs, periodic qualification updates, and practical safety simulations become essential components of effective occupational safety management systems.

The importance of Personal Protective Equipment (PPE), regulated by NR-6, also represents a recurring topic in occupational safety discussions. PPE plays a significant role in minimizing worker exposure to physical, chemical, biological, and mechanical hazards, especially in industrial, healthcare, construction, and agricultural activities (BRASIL, 2022a). However, specialists emphasize that PPE should not be considered the primary or exclusive preventive measure within occupational environments. According to Mattos and Másculo (2018), collective protection systems, engineering controls, process modifications, and organizational preventive strategies should always be prioritized before relying solely on individual protective equipment. Despite this recommendation, many companies still prioritize PPE because of its lower immediate implementation cost compared to structural safety improvements or technological investments. This practice may create a false perception of safety if not accompanied by broader preventive strategies and effective supervision.

The construction industry continues to be one of the sectors with the highest rates of occupational accidents and fatalities in Brazil. Civil construction activities involve multiple occupational risks, including falls from height, structural collapses, electrical hazards, machinery accidents, and exposure to harmful substances. NR-18 and NR-35 establish detailed guidelines regarding collective protection systems, scaffolding safety, work planning, and fall protection measures (BRASIL, 2020b; BRASIL, 2022d). Nevertheless, according to Fundacentro (2021), the sector still faces significant challenges related to informal labor practices, insufficient supervision, lack of safety culture, and inadequate worker training. Small construction companies and subcontracted workers are particularly vulnerable due to limited financial resources and weaker safety management structures. Therefore, strengthening safety education and promoting stricter compliance monitoring are considered essential measures for reducing accident rates within the construction industry.

Another important perspective involves ergonomics and occupational health in modern work environments. The implementation of NR-17 has become increasingly relevant due to technological transformations, expansion of office-based activities, repetitive work tasks, and remote work models (BRASIL, 2021). According to Lida and Guimarães (2016), poor ergonomic conditions contribute significantly to musculoskeletal disorders, chronic pain, fatigue, reduced productivity, and psychological stress. In addition, psychosocial risks such as anxiety, burnout syndrome, emotional exhaustion, and work overload have become increasingly prominent in occupational health discussions. The growing digitalization of work environments has intensified cognitive demands and blurred the boundaries between professional and personal life, particularly in remote and hybrid work arrangements. Consequently, occupational safety management must evolve beyond physical risk prevention and incorporate broader strategies aimed at promoting mental health,

organizational well-being, and quality of life.

Technological innovation and Industry 4.0 also present both opportunities and challenges for occupational safety management in Brazil. Automation, robotics, artificial intelligence, digital monitoring systems, and smart manufacturing technologies are significantly transforming occupational environments. According to Tavares (2016), technological advances may reduce worker exposure to hazardous activities by replacing manual operations with automated systems. However, these transformations also create new categories of risks associated with human-machine interaction, cybersecurity vulnerabilities, cognitive overload, and technological dependence. In this context, occupational safety regulations must continuously evolve to address emerging risks associated with increasingly digitalized and automated production systems. Furthermore, workers and safety professionals require ongoing qualification to adapt to rapidly changing technological scenarios.

Another relevant discussion concerns the difficulties faced by small and medium-sized enterprises regarding compliance with occupational safety regulations. Many organizations encounter challenges related to limited financial resources, insufficient technical knowledge, lack of specialized professionals, and difficulties interpreting complex legal requirements. According to Saliba (2020), smaller companies often struggle to implement comprehensive occupational safety management systems due to operational and economic limitations. In some cases, safety measures are perceived as financial burdens rather than strategic investments in organizational sustainability and worker protection. Therefore, public policies, educational initiatives, and simplified safety management tools are necessary to support smaller enterprises in adopting effective preventive practices.

Additionally, occupational safety culture remains a decisive factor influencing the effectiveness of Regulatory Standards within organizations. A strong safety culture involves worker participation, leadership commitment, preventive behavior, and organizational engagement with health and safety principles. According to Oliveira (2017), safety culture cannot be established solely through legal compliance; it requires continuous educational efforts, communication strategies, and integration of preventive values into organizational routines. Companies with mature safety cultures tend to present lower accident rates, greater employee engagement, and better operational performance.

Finally, the future of occupational safety management in Brazil depends on the integration of legislation, technological innovation, worker participation, organizational responsibility, and continuous improvement processes. Regulatory Standards remain fundamental instruments for protecting workers and promoting healthier professional environments. However, their effectiveness depends not only on legal enforcement but also on organizational commitment to prevention, investment in infrastructure and training, and adaptation to contemporary occupational challenges. Strengthening occupational safety culture, encouraging technological innovation, and expanding preventive education are essential strategies for reducing occupational accidents, improving worker well-being, and ensuring more sustainable and productive professional environments in Brazil.

IV. CONCLUSION

The Brazilian Regulatory Standards (NRs) constitute one of the most important legal and technical frameworks for the protection of workers' health and safety in Brazil. Established and supervised by the Ministério do Trabalho e Emprego, these standards define preventive measures, operational procedures, employer responsibilities, and minimum safety requirements for a wide range of occupational activities, contributing significantly to the reduction of workplace accidents and occupational diseases.

Among the existing regulations, standards such as NR-01, NR-06, NR-10, NR-12, NR-18, NR-23, NR-33, and NR-35 stand out due to their broad applicability and direct relationship with high-risk activities commonly found in industrial, construction, electrical, and confined-space environments. The modernization of several NRs in recent years demonstrates an effort to adapt occupational safety legislation to technological advancements, new work dynamics, and contemporary risk management methodologies.

Despite the progress achieved, numerous challenges remain regarding the effective implementation and enforcement of these standards. Small and medium-sized enterprises frequently face technical and financial difficulties in fully complying with regulatory requirements. Additionally, the persistence of informal labor, insufficient professional training, limited inspection capacity, and resistance to preventive culture still contribute to high accident rates in several productive sectors.

Another important aspect discussed throughout this study is the growing integration between occupational safety and emerging technologies. The incorporation of digital monitoring systems, artificial intelligence, Building Information Modeling (BIM), wearable devices, automation, and predictive risk analysis tools has the potential to significantly improve workplace safety management. These innovations may allow faster identification of hazards, more efficient inspections, and better decision-making processes regarding

preventive actions.

Furthermore, the future of occupational safety in Brazil increasingly depends on the strengthening of educational and institutional initiatives. Continuous professional qualification, technical education in federal institutes, interdisciplinary training, and awareness programs are essential to consolidate a preventive culture within organizations. In this context, occupational safety should no longer be viewed merely as a legal obligation, but rather as a strategic investment capable of improving productivity, reducing economic losses, and promoting human dignity in labor relations.

Therefore, Brazilian Regulatory Standards remain fundamental instruments for ensuring safer and healthier working conditions. However, their effectiveness requires not only legal compliance, but also ethical commitment, technological modernization, educational investment, and collective engagement among governments, employers, educational institutions, and workers themselves.

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