
OCCUPATIONAL SAFETY RISK MANAGEMENT PRACTICES AMONG RAGUNAN ZOO PERSONNEL: AN ANALYSIS BASED ON ISO 31000 STANDARDS

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Abstract

Ragunan Wildlife Park (Taman Margasatwa Ragunan/TMR) is one of the largest zoological parks in Indonesia and is managed by the DKI Jakarta provincial government. As a conservation and public tourism facility, TMR faces significant occupational safety risks, particularly for personnel who interact directly with wildlife and hazardous operational environments. Several recorded incidents indicate that existing safety procedures may not yet fully mitigate potential workplace hazards. This study aims to evaluate the implementation of occupational safety risk management at TMR based on the principles of ISO 31000:2018 and to propose recommendations for improving the current safety management system. This research employs a qualitative case study approach involving semi-structured interviews with zoo personnel, direct field observations, and analysis of organizational documents related to safety management practices. The collected data were analyzed using the ISO 31000 risk management framework, which includes risk identification, risk analysis, risk evaluation, and risk treatment. The findings indicate that TMR personnel face several occupational risks, including wild animal attacks, injuries from work equipment, zoonotic disease exposure, and fire hazards. The application of ISO 31000 contributes to improving risk management practices through enhanced staff training, appropriate use of personal protective equipment (PPE), and periodic risk evaluations. However, challenges remain in areas such as internal communication, supervision, and emergency preparedness. This study demonstrates that the ISO 31000 framework provides a systematic approach for managing occupational safety risks in zoological institutions. The results offer practical recommendations to strengthen workplace safety management and support the sustainable operation of conservation and public service activities at Ragunan Wildlife Park.

Keywords: *Risk Management, Occupational Safety, ISO 31000, Zoo Personnel, Wildlife Park Safety.*

INTRODUCTION

Risk management is a core systematic process that involves identifying, evaluating, and controlling potential hazards that could cause losses for an organization or threaten employee safety. In modern organizational settings—especially those with high-risk activities like zoos—comprehensive risk management systems are essential for ensuring both continued operations and staff protection (Lizarzaburu et al., 2025). The ISO 31000:2018 standard offers a structured, globally accepted method for risk management, focusing on integrating both internal and external contexts, as well as recognizing human and cultural factors that affect management outcomes (Jatmiko et al., 2022). This guideline is highly applicable in a variety of sectors, including government, healthcare, and specialized environments that demand robust safety protocols. The growing complexity and regulatory requirements faced by public institutions highlight the importance of systematic risk management. According to (Hassan et al., 2023), organizations—particularly those with direct human-animal interactions—require advanced methods for identifying and mitigating risks. ISO 31000 equips organizations with a thorough approach to dealing with uncertainties and seizing opportunities for operational enhancement, while protecting against unacceptable risk levels. In addition, the standard's focus on continuous monitoring and adaptability matches the

OCCUPATIONAL SAFETY RISK MANAGEMENT PRACTICES AMONG RAGUNAN ZOO PERSONNEL: AN ANALYSIS BASED ON ISO 31000 STANDARDS

Isniah, et al.

evolving needs of organizations for flexible responses to risks. Occupational safety in zoos presents distinct challenges compared to typical workplaces. Zoo staff encounter multiple risks, such as direct animal contact, zoonotic diseases, accidents with specialized equipment, and emergencies demanding quick action. (Murakami et al., 2021) note that managing risks in specialized settings is complex, and traditional safety procedures may be inadequate. The unpredictable nature of animal behavior and the necessity of close interactions during care and maintenance require risk management strategies that go beyond conventional safety practices. The use of artificial intelligence and advanced analytics is becoming increasingly important in modern risk management systems. (Wong et al., 2024) show that AI-driven risk management allows organizations to respond rapidly to changing situations and supports complex decision-making in environments with limited resources. This technology is particularly useful for zoos, where swift risk assessment and response are critical for protecting both staff and animals. Predictive analytics and machine learning can improve traditional risk assessment by revealing patterns and dangers that might not be obvious through standard observation.

Recent studies highlight strong links between effective risk management and better organizational performance in various fields. (Pangeran, 2022) found through case studies that comprehensive risk mitigation—when combined with balanced scorecard approaches—boosts key performance indicators. Systematic risk identification and mitigation improve efficiency and reduce incidents and costs. This is especially relevant for zoos, where safety incidents can disrupt conservation, education, and erode public trust. Leadership is also crucial for successful risk management. (Ardilo, 2022) reports that emotional intelligence and strong risk leadership directly enhance ISO 31000 implementation. Without these qualities, leaders may struggle to build a positive risk culture, undermining risk management efforts. This underscores the importance of developing leadership skills alongside technical risk management systems, especially in high-risk settings like zoos.

Modern approaches to occupational safety prioritize proactive rather than reactive risk management. (Bochkovskiy & Sapozhnikova, 2023) recommend proactive strategies that go beyond ISO 45001:2018, such as continuous monitoring and quick adjustments for identified hazards. This marks a shift from traditional periodic risk assessments to real-time risk management, which can prevent incidents through immediate action. Such methods are especially relevant for zoos, where staff face ongoing risks and need constant vigilance and adaptability. Studies of international occupational risk management standards reveal important differences in terminology and implementation. (Tsopa et al., 2022) conducted an extensive analysis of professional models, showing critical distinctions among standards like ISO 45001:2018, EU-OSHA, and ILO-BHP 2001. They found that effective risk management depends on understanding these differences for accurate documentation and assessment. This highlights the need for standardized risk management processes and evaluation.

Educational institutions have successfully used ISO 31000 by systematically identifying and mitigating risks. (Febiyanti et al., 2024) demonstrate that schools can improve service and operational stability by implementing risk management frameworks. Integrating risk assessment and mitigation with internal controls helps anticipate and address threats. This supports ISO 31000's suitability for various types of organizations, including specialized settings like zoos. The banking and finance sector also offers useful strategies for advanced risk management in high-risk environments. (Alsahlawi, 2021) discusses hedging and financial technology as ways to enhance risk management, showing positive effects on organizational performance. (Hac et al., 2021) emphasize that developing a risk-aware culture is vital for sustainable growth, especially under shifting economic conditions. These findings indicate that comprehensive risk management goes beyond technical steps—it also requires cultural and strategic commitment in organizations.

Research on climate risk management offers valuable insights into structured approaches for handling intricate and interconnected risks. Reiter et al. (2022) highlight obstacles and strategies in climate risk management, especially concerning indirect consequences of natural disasters. They stress the importance of proactive measures that account for cascading impacts and the interconnectedness of various systems. Their findings point to the need for broad stakeholder involvement and integrated risk

OCCUPATIONAL SAFETY RISK MANAGEMENT PRACTICES AMONG RAGUNAN ZOO PERSONNEL: AN ANALYSIS BASED ON ISO 31000 STANDARDS

Isniah, et al.

management methods that take into account both direct and indirect risk elements. Meanwhile, studies on transportation safety provide useful perspectives on how risk is perceived and managed in public spaces. Ceccato & Loukaitou-Sideris (2022) explore safety perceptions in transit environments across different countries, showing notable links between how risks are viewed, behavioral adjustments, and actual safety results. This research underscores that human factors and the management of perceptions are vital parts of comprehensive risk management strategies (Care & Suppl, 2025).

Although risk management implementation has been extensively studied in many sectors, there remain considerable gaps in the understanding of occupational safety risk management in zoological settings. Most existing research centers on conventional workplaces, financial sectors, schools, or industries, with limited exploration of the distinct features of environments where humans interact closely with animals. Zoo operations involve specialized risks, such as direct exposure to dangerous animals, susceptibility to zoonotic diseases, and the necessity for rapid emergency responses, which demand customized management strategies (Control & Industry, 2022). Additionally, while previous studies confirm ISO 31000's effectiveness in various organizational settings, there is a lack of research focused on how this framework is specifically adapted and applied in zoological institutions. The challenge of combining risk management principles with conservation goals, educational activities, and public safety needs in zoos creates unique complexities that have not been thoroughly investigated in the literature (Christensen et al., 2021).

Moreover, the long-term sustainability outcomes of risk management practices in conservation-oriented organizations require further study to fully understand their impact on achieving institutional missions. This research aims to fill these gaps by conducting a detailed analysis of occupational safety risk management at Ragunan Wildlife Park, utilizing the ISO 31000 framework (Febiyanti et al., 2024). The study enhances current knowledge by providing targeted insights into how risk management can be tailored for zoo environments, highlighting the distinct challenges and opportunities related to human-animal safety, and offering actionable suggestions for improving occupational safety in similar settings (Jatmiko et al., 2022). The results are expected to guide risk management strategies in zoos and contribute to a broader comprehension of specialized risk management approaches (Elsayed et al., 2023).

LITERATURE REVIEW

Occupational Safety Risk Management Practices Based on ISO 31000

Occupational safety risk management has become a critical component of organizational governance, particularly in workplaces that involve direct interaction with hazardous environments, biological agents, or unpredictable conditions such as wildlife management facilities. Zoos represent complex operational environments where personnel interact with animals, visitors, and technical infrastructure, creating diverse safety risks that require structured risk management systems. The implementation of risk management frameworks, particularly those based on international standards, is essential to ensure systematic identification, evaluation, and mitigation of occupational hazards. Among these frameworks, the risk management model established in ISO 31000:2018 provides a comprehensive guideline for organizations to manage risks effectively and sustainably.

Concept of Risk Management and ISO 31000 Framework

Risk management refers to the structured process of identifying, analyzing, evaluating, and controlling risks that may affect organizational objectives. The ISO 31000 framework emphasizes that risk management should be integrated into organizational governance, decision-making processes, and operational activities to enhance resilience and sustainability. According to (Hardjomidjojo et al., 2022), ISO 31000 offers a systematic approach that enables organizations to develop risk-based thinking through clearly defined stages such as risk identification, risk analysis, risk evaluation, and risk treatment. This structured methodology allows organizations to anticipate potential threats and implement appropriate mitigation strategies.

OCCUPATIONAL SAFETY RISK MANAGEMENT PRACTICES AMONG RAGUNAN ZOO PERSONNEL: AN ANALYSIS BASED ON ISO 31000 STANDARDS

Isniah, et al.

The principles of ISO 31000 are designed to be universal and applicable across various sectors, including healthcare, finance, education, and industrial operations. (Lizarzaburu et al., 2025) highlight that ISO 31000 provides flexible guidelines that can be adapted to different organizational contexts while maintaining consistency in risk governance. This adaptability is particularly important in complex operational environments such as zoological institutions where risks originate from multiple sources including animals, environmental conditions, equipment, and human interactions.

Risk Management in Occupational Safety

Occupational safety risk management focuses on identifying workplace hazards and implementing preventive measures to minimize the likelihood of accidents and injuries. In recent years, organizations have increasingly adopted proactive safety management approaches that emphasize prevention rather than reactive responses. (Bochkovskiy and Sapozhnikova, 2023) argue that modern occupational safety management systems must move toward proactive risk identification and early intervention to reduce workplace incidents and improve safety performance.

Similarly, (Bazaluk et al., 2023) emphasize that effective occupational risk management requires systematic assessment of workplace hazards combined with continuous monitoring and improvement mechanisms. Their study indicates that organizations implementing structured risk management frameworks demonstrate higher levels of workplace safety and operational reliability. These findings highlight the importance of integrating occupational safety management with formal risk management standards such as ISO 31000.

Safety performance is also strongly influenced by organizational safety culture. (Kaltah et al., 2021) explain that the relationship between safety culture, safety climate, and safety performance plays a crucial role in preventing workplace accidents. Organizations with strong safety cultures tend to implement more effective risk management practices, including training programs, safety communication systems, and incident reporting mechanisms.

Application of ISO 31000 in Organizational Risk Management

Several studies have explored the implementation of ISO 31000 in different organizational sectors. (Alijoyo, 2023) examined the application of ISO 31000 in Indonesian fintech lending companies and found that the framework significantly improves organizational awareness of risk and strengthens decision-making processes. The study emphasizes that structured risk assessment allows organizations to anticipate potential operational disruptions and maintain stability in dynamic environments.

Similarly, (Febiyanti et al., 2024) demonstrated that implementing ISO 31000 in educational institutions contributes to improved service performance by enabling institutions to identify operational risks and implement targeted mitigation strategies. The research highlights that the adoption of structured risk management frameworks enhances institutional effectiveness and accountability.

Another study by (Pangeran, 2022) explored the integration of ISO 31000 with the Balanced Scorecard (BSC) approach for supply chain risk mitigation in hospital operations. The findings suggest that combining strategic management tools with risk management frameworks enables organizations to align risk management activities with performance objectives.

Furthermore, Tirayoh and (Pangeran, 2023) demonstrated that ISO 31000-based risk mitigation strategies can significantly enhance organizational reputation and financial performance by reducing operational risks and improving stakeholder trust. These findings support the argument that risk management frameworks contribute not only to safety but also to broader organizational sustainability.

Occupational Risk Management Models Based on International Standards

International standards play a crucial role in guiding organizations toward effective risk management practices. (Tsopa et al., 2022) analyzed occupational risk management models based on international standards and concluded that structured risk management frameworks provide clear methodologies for hazard identification, risk assessment, and mitigation planning. The study highlights

OCCUPATIONAL SAFETY RISK MANAGEMENT PRACTICES AMONG RAGUNAN ZOO PERSONNEL: AN ANALYSIS BASED ON ISO 31000 STANDARDS

Isniah, et al.

that organizations adopting internationally recognized standards demonstrate better risk control mechanisms and improved safety performance.

However, (Björnsdóttir et al., 2022) note that despite the widespread adoption of ISO risk management standards, some organizations still face challenges in fully integrating risk management processes into their operational systems. The study suggests that organizations should complement standard-based frameworks with organizational learning and continuous improvement processes to ensure effective implementation.

Risk management also plays a significant role in organizational resilience and sustainability. (Settembre-Blundo et al., 2021) emphasize that flexible and adaptive risk management systems enable organizations to respond effectively to uncertain conditions and unexpected disruptions. This resilience-oriented approach is particularly relevant in environments where operational risks are complex and dynamic.

Technological and Organizational Innovations in Risk Management

Advancements in technology have also contributed to the evolution of risk management practices. For instance, (Lopez et al., 2021) highlight the potential of mixed reality technologies in occupational safety training, allowing employees to simulate hazardous situations in a controlled environment. Such innovations enhance workers' ability to recognize and respond to risks effectively.

Similarly, (Wong et al., 2024) demonstrate that artificial intelligence can support risk management by analyzing large datasets and identifying potential risk patterns within organizational systems. Although these technologies are primarily applied in industrial and supply chain contexts, their principles can be adapted to other operational environments that require complex risk assessment.

Relevance of Risk Management to High-Risk Operational Environments

In environments such as zoos, risk management becomes particularly important due to the interaction between humans and animals, which introduces unique occupational hazards. Risks may arise from animal attacks, zoonotic disease transmission, equipment failures, environmental hazards, or emergency situations such as animal escapes. These conditions require a comprehensive risk management approach that integrates safety procedures, operational controls, and emergency response planning.

The ISO 31000 framework provides an appropriate methodological foundation for analyzing and managing such risks because it emphasizes systematic risk identification, evaluation, and treatment processes. By applying ISO 31000 principles, organizations can develop structured safety management systems that enhance workplace safety and minimize potential operational disruptions.

Research Gap

Although numerous studies have examined the application of ISO 31000 in sectors such as finance, healthcare, education, and supply chain management, limited research has focused on occupational safety risk management in zoological institutions. Zoos present unique operational risks involving animal behavior, biological hazards, visitor interactions, and environmental factors. Therefore, applying ISO 31000-based risk management practices in this context requires further empirical investigation.

This study addresses this research gap by analyzing occupational safety risk management practices among Ragunan Zoo personnel using the ISO 31000 framework. The research aims to identify potential occupational risks, evaluate their likelihood and impact, and propose risk mitigation strategies that enhance workplace safety and operational sustainability within zoological environments.

METHOD

This study adopts a qualitative methodology utilizing a case study approach at Ragunan Wildlife Park (TMR). Data gathering consisted of staff interviews, direct field observations, and a review of documents pertaining to the zoo's risk management practices. Interviews targeted personnel who regularly handle dangerous animals, aiming to collect insights on established safety protocols, encountered

OCCUPATIONAL SAFETY RISK MANAGEMENT PRACTICES AMONG RAGUNAN ZOO PERSONNEL: AN ANALYSIS BASED ON ISO 31000 STANDARDS

Isniah, et al.

challenges, potential hazards, and experiences with incidents or near-misses. Direct observations were conducted to evaluate how safety procedures are practically applied during staff interactions with hazardous animals. The risk identification process entailed categorizing the safety risks encountered by staff, such as attacks from wild animals, injuries related to work equipment, and risks of fire or explosions. Information on these hazards was obtained via interviews with field staff and examination of recorded incident reports at TMR (Lopez et al., 2021). The implementation of ISO 31000 involved reviewing the risk control strategies already in place at TMR and assessing their effectiveness in minimizing workplace accidents (Bazaluk et al., 2023). For data analysis, the researcher employed thematic analysis to highlight key patterns from the interviews and observations, followed by an ISO 31000-based risk assessment, which covers the identification, evaluation, and mitigation of risks present in TMR's work environment. This method adheres to the procedures outlined in ISO 31000, emphasizing systematic and structured risk management in public organizations (Hardjomidjojo et al., 2022). Furthermore, an evaluation was carried out to determine whether TMR's risk management aligns with the international ISO 31000 standards. The process included assessing existing risk controls and formulating recommendations for further improvement.

RESULTS AND DISCUSSION

The results showed that TMR faces 14 occupational safety risks which include attacks of wild animals, bites or scratches, transmission of zoonotic diseases, and accidents that occur due to work equipment. The results showed that TMR faces 14 occupational safety risks which include attacks of wild animals, bites or scratches, transmission of zoonotic diseases, and accidents that occur due to work equipment. Comprehensive risk identification frameworks, as established by contemporary research, emphasize the importance of systematic approaches to categorizing diverse risk factors in organizational environments (Björnsdóttir et al., 2022; Settembre-Blundo et al., 2021). The existing risk management processes at TMR are not fully optimal, especially in terms of the implementation of structured safety procedures. Research demonstrates that inadequate safety culture and climate significantly contribute to suboptimal risk management implementation (Kaltah et al., 2021). The use of inappropriate personal protective equipment (PPE) and infrequent training are the main factors that increase the risk of accidents, as shown in Table 1.

Table 1. Risk Identification

Risk Code	Risk	Brief Impact
R1	Wild Animal Attacks	Severe injuries, major trauma, or death
R2	Bites or Scratches from Small/Medium Animals	Physical wounds, infection, and potential disease transmission
R3	Transmission of Zoonotic Diseases	Infectious diseases transmitted to humans, respiratory problems, and other health complications
R4	Slipping or Falling in Work Area	Physical injuries such as sprains, fractures, or bruises
R5	Injuries from Work Equipment	Cuts or wounds caused by sharp objects or medical tools
R6	Exposure to Harmful Chemicals	Skin irritation, burns, respiratory problems, or poisoning
R7	Physical and Mental Fatigue	Reduced concentration, increased injury risk, and muscle strain
R8	Fire or Explosion	Serious injuries, property damage, and operational disruption
R9	Poor Communication	Misunderstandings, reduced operational efficiency, and increased accident risk
R10	Violation of SOPs	Workplace accidents, spread of disease, and potential legal consequences
R11	Negative Interactions with Visitors	Visitor complaints, reputational damage, and possible safety incidents
R12	Animal Escape Crisis	Threats to human safety and property damage
R13	Security System Failure	Unauthorized access, theft, or vandalism
R14	Natural Disasters	Major damage, injuries, and operational disruptions

OCCUPATIONAL SAFETY RISK MANAGEMENT PRACTICES AMONG RAGUNAN ZOO PERSONNEL: AN ANALYSIS BASED ON ISO 31000 STANDARDS

Isniah, et al.

Analysis

Risk Analysis is the process of explaining the sources of risks that arise, both from positive and negative aspects. The table below presents the Risk Identification from Ragunan Wildlife Park.

Table 2. likelihood

Rate	Likelihood	Description	Estimated Time of Arrival (ETA)
1	Rare	Almost never occurs	Extremely unlikely to happen
2	Unlikely	Rarely occurs	Very rare or unlikely
3	Possible	May occur occasionally	Could happen but not frequently
4	Likely	Occurs regularly	Happens often under normal working conditions
5	Almost Certain	Expected to occur very frequently	Happens almost certainly or very often

Table 2 presents five main aspects of risk analysis, including Likelihood—the chance of a risk happening within a certain period. Likelihood is divided into Rare, Unlikely, Possible, Likely, and Almost Certain. The table uses criteria that estimate the probability of occurrence, following recognized operational risk assessment methods (Tirayoh & Pangeran, 2023).

Table 3. Risk Scale Impact

Scale	Description	Guideline	Impact
1	Very Small	Incident results in a negligible impact and can generally be ignored	1/100 ×
2	Small	Incident results in a minor impact that can be easily managed	1/10 ×
3	Moderate	Incident results in a reasonably serious impact that requires attention	1 ×
4	Large	Incident results in a very significant impact that should be avoided	10 ×
5	Very Large	Incident results in an extremely significant impact and must be avoided	100 ×

Note: The impact/loss is measured in currency units such as rupiah. If the standard moderate scale (scale3) represents IDR 1, then IDR 10 million means a 'large' scale value is 10 times, and other scales adjust accordingly.

The risk impact scale is a tool used to assess the severity of potential consequences arising from risk events. This scale typically ranges from 1 (indicating minimal impact) to 5 (representing significant impact). An impact level of 1 denotes negligible effects that can generally be disregarded, whereas a level 5 signifies critical consequences requiring proactive avoidance. The scale frequently correlates with quantifiable measures such as financial loss or other tangible damages, thereby aiding organizations in prioritizing risks that necessitate greater attention and management. Contemporary management practices highlight the significance of quantitative impact assessment to ensure effective resource allocation within risk mitigation strategies (Parsamehr et al., 2023).

Table 4. Risk Analysis

Risk Code	Risk Description	Likelihood (1–5)	Impact (1–5)	Risk Score (L × I)
R1	Wild animal attacks; bites or scratches from small/medium animals	3 (Possible)	5 (Very High)	15
R2	Bites or scratches from small/medium animals	4 (Likely)	3 (Moderate)	12
R3	Transmission of zoonotic diseases	3 (Possible)	4 (High)	12
R4	Slipping or falling in work areas or cages	4 (Likely)	3 (Moderate)	12
R5	Injuries from work equipment	3 (Possible)	3 (Moderate)	9
R6	Exposure to harmful chemicals	3 (Possible)	4 (High)	12
R7	Physical and mental fatigue (burnout)	4 (Likely)	3 (Moderate)	12
R8	Fire or explosion in the work area	2 (Unlikely)	5 (Very High)	10
R9	Poor communication between staff and management	3 (Possible)	3 (Moderate)	9

OCCUPATIONAL SAFETY RISK MANAGEMENT PRACTICES AMONG RAGUNAN ZOO PERSONNEL: AN ANALYSIS BASED ON ISO 31000 STANDARDS

Isniah, et al.

R10	Violation of SOPs by staff	3 (Possible)	4 (High)	12
R11	Negative interactions with visitors	3 (Possible)	2 (Low)	6
R12	Crisis due to animal escape	2 (Unlikely)	5 (Very High)	10
R13	Security system failure	2 (Unlikely)	4 (High)	8
R14	Natural disasters	1 (Rare)	5 (Very High)	5

Table 4 illustrates the risk values derived from Likelihood and Impact obtained from the management unit of Ragunan Wildlife Park (UP TMR).

Risk Evaluation

Risk evaluation is the process of systematically comparing various risk levels based on analytical results to support informed decision-making. Utilizing multilayered assessment frameworks (Ullah et al., 2021), this approach ensures comprehensive evaluation of potential risks. The table below summarizes the analysis outcomes, detailing the risk assessment findings according to the criteria of Likelihood (L), Impact (I), and Risk Level, categorized as Low (L), Medium (M), and High (H) Risk.

Table 5. Risk Level

No.	Risk Level	Code	Description
1	Low	L	Risks that can be controlled and managed with routine procedures
2	Medium	M	Risks that require appropriate handling and monitoring
3	High	H	Risks that require immediate attention and prompt mitigation actions

Table 6. Risk Evaluation Matrics

Likelihood \ Impact	Insignificant	Minor	Moderate	High	Major
Almost Certain (5)	5	10	15	20	25
Likely (4)	4	8	12	16	20
Possible (3)	3	6	9	12	15
Unlikely (2)	2	4	6	8	10
Rare (1)	1	2	3	4	5

Table 6 presents the results of multiplying the Likelihood and Impact scores, with each criterion assessed on a scale from 1 to 5. This calculation establishes the risk level associated with Ragunan Wildlife Park. The matrix-based evaluation method utilized aligns with standardized ISO risk management principles (Smirnova et al., 2023).

Table 7. Risk Evaluation

Risk Code	Risk Description	Likelihood (1-5)	Impact (1-5)	Risk Score (L x I)	Risk Level
R1	Wild animal attacks	3 (Possible)	5 (Very High)	15	High
R2	Bites or scratches from small/medium animals	4 (Likely)	3 (Moderate)	12	High
R3	Transmission of zoonotic diseases	3 (Possible)	4 (High)	12	High
R4	Slipping or falling in work area or cage	4 (Likely)	3 (Moderate)	12	High
R5	Injuries from work equipment	3 (Possible)	3 (Moderate)	9	Medium
R6	Exposure to harmful chemicals	3 (Possible)	4 (High)	12	High

OCCUPATIONAL SAFETY RISK MANAGEMENT PRACTICES AMONG RAGUNAN ZOO PERSONNEL: AN ANALYSIS BASED ON ISO 31000 STANDARDS

Isniah, et al.

Risk Code	Risk Description	Likelihood (1-5)	Impact (1-5)	Risk Score (L × I)	Risk Level
R7	Physical and mental fatigue (burnout)	4 (Likely)	3 (Moderate)	12	High
R8	Fire or explosion in work area	2 (Unlikely)	5 (Very High)	10	Medium
R9	Poor communication between staff and management	3 (Possible)	3 (Moderate)	9	Medium
R10	Violation of SOPs by staff	3 (Possible)	4 (High)	12	Medium
R11	Negative interactions with visitors	3 (Possible)	2 (Low)	6	Medium
R12	Crisis due to animal escape	2 (Unlikely)	5 (Very High)	10	Medium
R13	Security system failure	2 (Unlikely)	4 (High)	8	Medium
R14	Natural disasters	1 (Rare)	5 (Very High)	5	Medium

Risk Treatment

Risk treatment involves processes designed to eliminate or reduce risks encountered by the company. Effective risk mitigation strategies require a thorough understanding of organizational vulnerabilities and adaptive management practices (Rahman et al., 2021). At this point, 14 treatment recommendations have been developed to address the 12 risks identified in Table 8. Creating targeted mitigation measures illustrates modern, sustainability-focused risk management approaches (Nobanee et al., 2021). Addressing physical and mental fatigue in employees necessitates robust retention strategies that consider both workplace conditions and organizational culture (Alijoyo, 2023).

The comprehensive risk management framework adopted at TMR exemplifies systematic alignment with current ISO 31000 principles through structured steps including identification, analysis, evaluation, and treatment. While the framework aligns with contemporary ISO standards, certain challenges remain regarding guidance for complex organizational contexts (Björnsdóttir et al., 2022). This underscores the ongoing need for continuous improvement and adaptation of risk management techniques, particularly within specialized institutional environments like zoological facilities.

Table 8. Risk Treatment

Risk Code	Risk Description	Level	Mitigation Recommendations
R1	Wild animal attacks	High	Use full PPE, special animal handling training, select experienced staff
R2	Bites or scratches from small/medium animals	High	Use thick gloves, animal handling technique training
R3	Transmission of zoonotic diseases	High	Regular hand washing, vaccination, periodic staff health checks
R4	Slipping or falling in work area or cage	High	Wear anti-slip shoes, keep floors dry, put warning signs in risky areas
R5	Injuries from work equipment	Medium	Work equipment training, regular inspection, avoid carelessness
R6	Exposure to harmful chemicals	High	Store chemicals properly, use mask & gloves, label hazardous substances
R7	Physical and mental fatigue (burnout)	High	Manage work/rest schedule, provide counseling or psychological support

OCCUPATIONAL SAFETY RISK MANAGEMENT PRACTICES AMONG RAGUNAN ZOO PERSONNEL: AN ANALYSIS BASED ON ISO 31000 STANDARDS

Isniah, et al.

Risk Code	Risk Description	Level	Mitigation Recommendations
R8	Fire or explosion in work area	Medium	Provide fire extinguishers, evacuation drills, check electrical & flammable materials regularly
R9	Poor communication between staff/management	Medium	Regular meetings, use group chat or radio for communication
R10	Violation of SOPs by staff	Medium	Routine SOP refresh, regular audits, enforce discipline
R11	Negative interactions with visitors	Medium	Staff training for hospitality & conflict, SOP for problematic visitors
R12	Crisis due to animal escape	Medium	Regularly check & strengthen cages, simulate capture procedures, add safety barriers
R13	Security system failure	Medium	Regularly check CCTV/alarm, have backup systems, prepare emergency SOP
R14	Natural disasters	Medium	Clear evacuation routes, emergency drills, store important documents safely

CONCLUSION

Research at Ragunan Wildlife Park utilizing the ISO 31000:2018 framework determined that workplace accident risk analysis can be classified into four categories: Identification, Risk Analysis, Risk Evaluation, and Risk Treatment. The implementation of this methodology identified two risk levels—medium and high. Furthermore, the study provided targeted recommendations for mitigating 14 specific risks falling within these categories.

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OCCUPATIONAL SAFETY RISK MANAGEMENT PRACTICES AMONG RAGUNAN ZOO PERSONNEL: AN ANALYSIS BASED ON ISO 31000 STANDARDS

Isniah, et al.

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OCCUPATIONAL SAFETY RISK MANAGEMENT PRACTICES AMONG RAGUNAN ZOO PERSONNEL: AN ANALYSIS BASED ON ISO 31000 STANDARDS

Isniah, et al.

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