Implementation of Occupational Health and Safety (OHS) Policy: A Case Study of the Disparity Between PPE Regulations and Field Practices Among Live-Line Maintenance Workers (PDKB) at PT PLN (Persero) UP3 Sukoharjo

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Abstract.
Introduction: This study analyzes the disparity between Personal Protective Equipment (PPE) regulations and field practices among Live-Line Maintenance workers (PDKB) at PT PLN (Persero) UP3 Sukoharjo. The research was motivated by a fatal incident in Lubuk Pakam in 2023 and three near-miss incidents at the research location caused by negligence in the use and supervision of PPE. Research Method: This study employed a qualitative approach with a case study design. Data were collected through in-depth interviews with five informants selected purposively (technicians, preparators, team leaders, and OHS officers), field observations, and documentation review. The data were analyzed using the Miles and Huberman model. Data validity was ensured through source and method triangulation. Research Results: The findings indicate a strong organizational commitment through the provision of internationally standardized PPE, certified training, periodic testing every six months, and multi-layered supervision in accordance with Law No. 1/1970, Government Regulation No. 50/2012, and Minister of Manpower Regulation No. 8/2010. The level of worker compliance is relatively high due to awareness of the risks associated with 20 kV electrical voltage and the safety culture of "one opens, three remind," with PPE internalized as a "second life." However, two main disparities were identified. First, PPE storage in operational vehicles and basecamps has not yet met the ideal standard of controlled storage facilities; this condition is compensated through adaptive mechanisms such as special storage boxes, air-conditioned rooms, and psychological ownership among workers. Second, regarding PPE materials, safety sleeves that should be made of insulating rubber are still made of plastic due to previous procurement. The multi-layered supervision system, supported by peer monitoring, has proven effective in detecting three near-miss incidents before they escalated into fatal events. Conclusion: This study concludes that the effectiveness of OHS implementation is not solely determined by formal compliance based on regulations (rules-based approach), but also by organizational safety culture (safety culture-based approach) and the synergy of social capital. Recommendation: The study recommends accelerating the transition to PPE that meets current standards, improving storage facilities, and strengthening the quality of double-check procedures.

Keywords: *Personal Protective Equipment (PPE); Implementation Disparity; Occupational Health and Safety PDKB.*

I. INTRODUCTION

Occupational Health and Safety (OHS) is a fundamental aspect of protecting workers from the risks of occupational accidents and work-related diseases, particularly in hazardous occupations [1]. In Indonesia, the OHS regulatory framework is stipulated in Law No. 1 of 1970, Law No. 17 of 2023, and Minister of Manpower Regulation No. 8 of 2010 concerning Personal Protective Equipment (PPE) [2], [3]. Although compliance with PPE standards has been proven to reduce the risk of injuries [4], implementation in the field is often suboptimal and frequently challenged by compliance issues [5].Previous studies have revealed a gap between written policies and actual workplace practices [6]. Factors such as knowledge, attitudes, comfort, supervision, and management support play significant roles in determining the effectiveness of implementation [7], [8], indicating that regulations alone are insufficient without value internalization and contextual adaptation at the operational level [9]. In similar industrial contexts, research in the furniture sector shows that low management commitment to occupational safety, limited PPE availability, and weak socialization and supervision are key factors contributing to workers' low compliance [10].In industries with higher risk levels, such as the electricity sector, the challenges of implementing OHS become even more complex. Live-Line Maintenance (Pemeliharaan Dalam Keadaan Bertegangan/PDKB) requires specialized PPE with insulation standards [11]. Technical regulations regarding PPE for PDKB personnel at PT PLN

(Persero) UP3 Sukoharjo refer to Law No. 1/1970, Law No. 13/2003, Government Regulation No. 50/2012, and Minister of Manpower Regulation No. 8/2010.

At the corporate level, these provisions are elaborated through PLN Board of Directors Decree No. 152.K/020/DIR/2003 and PLN Standards (SPLN) which refer to International Electrotechnical Commission (IEC) standards. Field implementation is regulated through Standard Operating Procedures (SOPs) and work instructions with mandatory PPE including safety helmets, insulating gloves, insulating sleeves, insulating boots, non-conductive wear packs, full body harnesses, and supporting equipment [12].PDKB work involves extremely high and complex risks. The primary hazard faced by personnel is electric shock resulting from insulation failure or procedural errors, which may lead to fatal consequences such as cardiac fibrillation, severe burns, or death. Other risks include exposure to arc flash, which produces extreme heat, radiation, and explosive pressure capable of causing severe burns and permanent eye damage. Fall hazards are also a constant threat since tasks are often performed on towers or utility poles at significant heights [13]. The combination of these risks within a high-voltage working environment makes failures in OHS management—particularly improper PPE use a gateway to fatal accidents [11].The novelty of this study lies in its comprehensive analysis of two forms of disparity simultaneously in the implementation of OHS policies in high-risk work: disparities in PPE materials and disparities in PPE storage systems, which are rarely examined together within a single study.

Furthermore, this research specifically reveals adaptive compensation mechanisms developed by field personnel in response to infrastructural limitations, such as psychological ownership and horizontal supervision, thereby enriching the understanding of how high reliability organizations build safety resilience through social capital. Using an in-depth qualitative case study approach, this research not only identifies gaps between regulation and practice but also explores the dynamics of safety culture that mediate policy implementation at the operational level.The relevance of this novelty is further reinforced by preliminary field findings indicating discrepancies between regulations and actual practices, particularly in the use of PPE materials and their storage systems. The urgency of this research is supported by a fatal accident involving a PDKB worker at PLN UP3 Lubuk Pakam in July 2023 [14], as well as three near-miss incidents at UP3 Sukoharjo: (1) almost contacting energized components due to improper PPE installation, (2) tools falling from height due to improperly secured safety lanyards, and (3) a technician nearly falling due to an improperly fastened full body harness. This study aims to analyze the disparity between PPE regulations and field practices among PDKB personnel, focusing on compliance, OHS work culture, and the system of PPE use and management including storage and supervision in order to formulate evidence-based recommendations to improve the effectiveness of OHS policy implementation.

II. METHODS

This study employed a qualitative approach with a case study design to analyze the implementation of the Occupational Health and Safety (OHS) policy related to Personal Protective Equipment (PPE) among Live-Line Maintenance workers (PDKB) at PT PLN (Persero) UP3 Sukoharjo. Informants were selected using purposive sampling based on their direct involvement in PPE usage and the implementation of OHS policies, consisting of two technicians, one preparator, one team leader, and one OHS officer.Data were collected through in-depth interviews, field observations, and document review. Observations were conducted to assess the practices of PPE usage and storage, while documentation included regulations, standard operating procedures (SOPs), and the company's internal documents.Data analysis followed the model of Miles and Huberman [15], which involves data reduction, data display, and conclusion drawing. Interview data were transcribed, coded, and categorized into two main themes: (1) compliance and safety culture, and (2) the PPE usage system and PPE management, including PPE storage and supervision. Data validity was ensured through source and method triangulation by comparing findings from interviews, observations, and documentation.

III. RESULT AND DISCUSSION

3.1. Informant Characteristics

Table 1. Research Informant Profile

No	Informant Code	Position	Years of Service	Education	Certification	Interview Date
1	T-01	PDKB Technician	5 years	Vocational High School (Electrical Power Installation Engineering)	PDKB Level 2	26 January 2026
2	T-02	PDKB Technician	6 years	Vocational High School (Computer and Network Engineering)	PDKB Level 2	26 January 2026
3	P-01	PDKB Preparator	8 years	Diploma (D3) in Electrical Engineering	PDKB Level 2, Supervisor, PPE	28 January 2026
4	TL-01	PDKB Team Leader	10 years	Bachelor's Degree in Electrical Engineering	PDKB Level 3, Supervisor, PPE	28 January 2026
5	KK-01	OHS & Security Officer from UP3 Sukoharjo	8 years	Bachelor's Degree in Electrical Engineering	AK3U, Supervisor, OHS Auditor	29 January 2026

The five informants were selected because they possess relevant understanding and direct experience related to the focus of the study. Technicians (T-01, T-02) provide the perspective of PPE users in the field, the preparator (P-01) understands the PPE management and maintenance system, the team leader (TL-01) is familiar with aspects of team supervision and compliance, while the OHS officer (KK-01) provides a perspective on regulatory compliance and the safety audit system. This diversity of informants enables data source triangulation and a comprehensive understanding of the implementation of OHS policies within the PDKB environment.

3.2. OHS Compliance and Work Culture

3.2.1. Company Commitment to Establishing OHS Policies and Work Rules Regarding Mandatory PPE Use for PDKB Officers.

Based on the data obtained, the OHS commitment and policies related to the use of personal protective equipment (PPE) in live-line work (PDKB) indicate that the company places occupational safety as a top priority. This commitment is not only stated in written policies but is also implemented through work systems, budget allocation, and supervision mechanisms that are consistently carried out at the operational level. The research findings also show that all informants perceived the company's commitment to OHS in PDKB work as very strong, as stated by informant KK-01:

"…The company's commitment is very strong and well-structured… in PDKB, OHS is not merely a formality but truly a top priority. There are complete SOPs and work instructions regulating the mandatory use of PPE," (KK-01)

This strong commitment is reflected in the provision of internationally standardized PPE, certified training, periodic testing of insulation equipment every six months, and a layered supervision system. The budget allocation for PPE is never treated as a cost-saving object, placing safety above operational targets. As stated by informants T-01, T-02, P-01, and TL-01:

"…OHS is not just a formality; it is the top priority… PPE is always complete, periodically tested, and there is zero tolerance for incomplete equipment." (T-01)

"…The commitment is manifested in the daily work system… every task begins with PPE inspection, OHS briefing, and risk evaluation…" (T-02)

"…No work is allowed to proceed without verification of PPE completeness… I am responsible for ensuring that PPE is available, in proper condition, and suitable for the work method…" (P-01)

"…The commitment is not merely formal… the risk of fatality is high, so safety is the top priority, with a dedicated budget for internationally standardized PPE and mandatory periodic testing." (TL-01)

Based on interviews with other informants, this was further emphasized by KK-01:

"…The company's policy establishes the principle of zero accident. This commitment is evident in the provision of internationally standardized PPE, certified training, periodic testing of insulation equipment,

and layered supervision. From a budgetary perspective, PPE is never treated as an area for cost reduction…" (KK-01)

The implementation of Occupational Health and Safety (OHS) related to Personal Protective Equipment (PPE) at PT PLN (Persero) UP3 Sukoharjo has gone beyond merely fulfilling administrative obligations based on PLN standard regulations (SPLN). Instead, it has been integrated into the daily operational work system and organizational culture. This commitment represents a concrete implementation of the hierarchy of OHS regulations in Indonesia. The primary legal foundation is Law Number 1 of 1970 concerning Work Safety, which obligates employers to fulfill occupational safety requirements, including the provision of PPE [2]. This mandate is further strengthened by Government Regulation Number 50 of 2012 concerning the Occupational Health and Safety Management System (SMK3) and technically regulated in the Minister of Manpower Regulation Number 8 of 2010 concerning PPE [3], [16]. Thus, the measures taken by PT PLN (Persero) UP3 Sukoharjo directly realize the legal obligations mandated in Article 3 paragraph (1) of Law No. 1/1970 and Article 3 paragraph (1) of Ministerial Regulation No. 8/2010 [2], [3].At the corporate level, these regulatory mandates are further elaborated by PT PLN (Persero) through comprehensive internal policies, such as the PLN Board of Directors Decree Number 152.K/020/DIR/2003 concerning the Occupational Safety Guidelines for Electricity Operations, as well as various PLN Standards that refer to international IEC (International Electrotechnical Commission) standards [17]. These policies are technically implemented at the operational unit level through the Standard Operating Procedures (SOP) for Live-Line Work (PDKB) and Work Instructions. These technical documents regulate not only the procedures for inspection and use but also the types of PPE that must be used according to the work method, ensuring safety throughout every work process. According to informants, work methods are divided into three categories: barehand (direct contact), hot stick (distance), and combination. This was emphasized by KK-01:

"The use of PPE is regulated in the PDKB SOP, Work Instructions, and the company's OHS Guidelines. It clearly explains the types of PPE required based on the work method, such as Barehand (BH), Hot Stick (HS), and Combination." (KK-01)

To ensure that formal regulatory policies up to SOP implementation operate effectively, PT PLN (Persero) UP3 Sukoharjo conducts multi-layered socialization of OHS regulations. This process begins with basic education and training for four months at the PLN Training Center (Udiklat), followed by daily safety briefings and special briefings whenever regulatory changes occur, as stated by TL-01:

"The safety culture in PDKB is formed through a long and consistent process. It starts with strict personnel selection, followed by intensive education and training for four months, and continues with field habituation. Every day we conduct safety briefings, which are not merely formalities." (TL-01)

This tiered process, from training to field habituation, not only increases knowledge of regulations but also builds an understanding of the technical urgency behind each safety policy. Through this process, PT PLN (Persero) UP3 Sukoharjo has fulfilled the mandate of the regulations. This is consistent with the findings of Hale and Borys, who state that the effectiveness of OHS implementation is determined by the internalization of safety values through continuous communication and training [18]. The alignment between formal policies and field implementation also confirms the findings of Smith et al., which state that adequate PPE provision, supported by a strong safety culture, constitutes the primary foundation for OHS implementation in high-risk industrial sectors [4].

3.2.2. PDKB Officers' Compliance with Established K3 Policies and Regulations, Especially Regarding the Use of Personal Protective Equipment (PPE) in the Field

Based on the research findings, Occupational Health and Safety (OHS) compliance among PDKB personnel is classified as high and represents an important aspect of safety implementation within this unit. Compliance is not only reflected in the administrative use of personal protective equipment (PPE), but also in the consistency of personnel in carrying out safety procedures. This condition is supported by an initial verification system, multilayered supervision, and individual awareness of the high risks associated with live-line work. All informants assessed the level of personnel compliance as very good, as stated by informant KK-01 as supervisor and internal auditor:

"...The level of compliance in this unit is very good... the use of complete PPE is applied in almost all work activities..." (KK-01)

The high level of compliance is driven by several main factors. These include awareness of the extreme risks associated with the job, work experience that develops an understanding of the technical consequences of negligence, and firm and consistent team leadership. This was expressed by informants T-01, T-02, P-01, and TL-01:

"...the level of compliance is quite high. Because our work risks are significant, everyone is aware. No one dares to climb the pole without complete PPE..." (T-01)

"...the level of compliance in our unit is high. This is because our work involves extreme risks, so everyone realizes that even a small mistake can be fatal..." (T-02)

"...the level of compliance is high because before work begins there is an initial verification conducted by me and the supervisor..." (P-01)

Although the compliance level is relatively high, several inhibiting factors were identified, particularly related to physical comfort. For example, rubber-based PPE tends to be heavy and hot, especially under extreme weather conditions. This was explained by informant T-02, a technician:

"However, there are also factors that may influence non-compliance, such as discomfort caused by certain PPE that is heavier or hotter, especially rubber-based protective coats. In hot weather conditions, this can be physically exhausting. Nevertheless, due to strict supervision, comfort issues do not lead workers to remove their PPE." (T-02)

Under such conditions, potential violations may still occur; therefore, a tiered sanction mechanism is implemented, ranging from verbal warnings, written warnings, coaching, to performance evaluation. Preventive approaches are prioritized over punitive measures, with a focus on behavioral improvement. As stated by informant T-02:

"...PPE is our second life; we wear it not because we fear sanctions, but because we want to return home safely." (T-02)

This statement was reinforced by informant KK-01:

"...It is a combination of awareness and supervision. At first it is because of the rules, but over time it becomes intrinsic awareness..." (KK-01)

OHS compliance among PDKB personnel is therefore formed through a combination of strict supervision systems, procedural verification, firm leadership, and individual awareness of the risks associated with high-voltage work. Although technical constraints such as PPE discomfort exist, these do not significantly reduce the level of compliance. Consequently, OHS compliance in the PDKB environment is not merely rule-based compliance but has developed into a safety awareness that is embedded in daily work behavior.Regulations concerning the mandatory use of PPE for workers have been clearly established in Indonesian legislation. Article 12 letter b of Law Number 1 of 1970 concerning Occupational Safety requires every worker to wear the mandated PPE [2]. This provision is reinforced by the Regulation of the Minister of Manpower Number 8 of 2010 Article 5 paragraph (1), which states that PPE must be used in workplaces that have potential hazards [3]. In the context of electrical work, PLN standards and IEC 61472 regulate the technical requirements of insulating PPE that must be fulfilled to ensure protection against electric shock risks [17]. The high level of compliance within the PDKB unit indicates that these regulatory mandates have been consistently implemented at the operational level.

The high compliance of PDKB personnel in using PPE is influenced by several factors, particularly awareness of the extreme risks involved in 20 kV electrical networks, work experience that builds an understanding of the technical consequences of negligence, and firm and consistent team leadership. These findings are consistent with research by Nurhayati et al., which states that accurate risk perception is positively correlated with compliance in PPE use [5]. The inhibiting factors identified mainly relate to physical comfort, such as rubber-based PPE that is heavy and hot under extreme weather conditions. Nevertheless, strict supervision systems and a strong safety culture are able to overcome these obstacles so that they do not lead to serious violations. This finding is consistent with Fitriani and Hermawan, who

reported that ergonomic aspects present challenges in PPE implementation but can be addressed through supervision and habituation [7].A tiered sanction mechanism is applied through a coaching approach, beginning with verbal warnings, followed by written warnings, and special guidance for serious violations. Preventive measures are prioritized over punitive ones, emphasizing behavioral change rather than punishment alone. This mechanism reflects the philosophy of just culture proposed by Reason, in which human errors are viewed as opportunities for learning and system improvement rather than merely objects of punishment [9]. This approach is also in line with Government Regulation Number 50 of 2012, which emphasizes the importance of preventive strategies within occupational safety management systems [16].

Although the level of formal compliance is relatively high, three near-miss incidents occurred during the observation period. These incidents included almost touching an energized component due to imperfect PPE installation, equipment falling from height because the safety tether was not properly secured, and a technician nearly falling due to an improperly tightened full-body harness. The primary cause of these incidents was negligence during the double-check supervision process. This indicates that high formal compliance does not entirely eliminate potential risks. According to Leveson's modern safety system theory, accidents may occur due to complex interactions among humans, technology, and organizational systems, even when each component individually complies with established procedures [19]. These findings emphasize the importance of continuous evaluation and learning from incidents, even when no fatal accidents occur.

3.2.3. Establishing and Maintaining a Work Safety Culture in the PDKB Officer Environment

Based on the research findings, the occupational safety and health (OHS) work culture among Live-Line Maintenance (PDKB) personnel demonstrates a strong internalization of safety values in daily work activities. This culture is not formed solely through formal regulations, but also through habituation, competence development, and social control among team members. All informants described that safety culture has become a distinctive characteristic of the PDKB team, as expressed by informants T-01, T-02, P-01, and TL-01:

"…The safety culture here is formed because we realize that the risks are very high. We have been trained and accustomed to it from the beginning…" (T-01)

"…The culture of 'one notices, three remind'… social control is strong, PPE is our second life." (T-02)

"The safety culture in PDKB is formed through consistent habituation and a supportive system…" (P-01)

"The safety culture in PDKB has been formed through a long and consistent process… the principle is that if one person is negligent, the others must remind them…" (TL-01)

These statements were further reinforced by informant KK-01:

"…The safety culture in PDKB is formed through a systematic and continuous process… internally, disciplinary sanctions apply, along with preventive approaches and coaching…" (KK-01)

The OHS work culture among PDKB personnel has been strongly established through a combination of habituation, competence, social control, and preventive disciplinary systems. Safety is not merely viewed as a formal obligation but has evolved into a value and work tradition embedded in everyday behavior.The development of a strong safety culture within the PDKB environment is in line with OHS regulatory mandates in Indonesia. Government Regulation No. 50 of 2012 concerning the Occupational Safety and Health Management System emphasizes the importance of commitment and leadership in building a safety culture [16]. At the technical level, the PDKB Work Instructions also mandate the habituation of safe behavior through briefings, supervision, and continuous evaluation as part of efforts to build a resilient safety culture in high-voltage work environments.Safety culture within the PDKB environment has become deeply rooted and represents a distinctive characteristic of the team. One of the core principles is the concept of "one notices, three remind," as expressed by informant T-01:

"…The parties involved include the OHS supervisor, work supervisor, team leader, and ourselves, who remind each other. This culture of mutual care is very strong; the principle is 'one notices, three remind.' If any non-compliance is found, it is immediately addressed and corrected…" (T-01)

This principle has become a collective norm that regulates interactions among technicians in the context of occupational safety. The expression implies that responsibility for safety does not lie solely with individuals or supervisors but is a collective responsibility shared by all team members. When one person is negligent, at least three others will remind them, creating a strong and effective mechanism of social control in the field.The principle of "one notices, three remind" reflects two core principles of safety culture proposed by Tan Hongqiang and Wu Chao (2014) in *Study on Core Principles of Safety Culture*, namely the Safety Culture Reciprocity Principle (the principle of mutual influence among individuals) and the Safety Culture Control Principle (control through values and norms) [20]. The reciprocity principle is reflected in the mechanism of mutual reminders among coworkers, where each team member exerts reciprocal influence on the safety behavior of others. Meanwhile, the control principle is manifested through social regulation based on collectively internalized norms, where safety values function as behavioral control mechanisms that are more effective than formal supervision alone.This culture has developed through a long and consistent process, beginning with strict personnel selection, followed by intensive education and training for four months at the training center, and reinforced through field habituation such as daily safety briefings. Exemplary behavior from senior workers and leaders plays an important role in transmitting safety values from one generation to the next. The internalization of PPE is further strengthened by another principle, namely PPE as a "second life," as expressed by technician informant T-02:

"…We often say that PPE is our 'second life.' So it is not only because we fear sanctions, but because we want to return home safely." (T-02)

This principle indicates that safety values have become embedded in the professional identity of technicians, going beyond mere formal compliance with written regulations. The phenomenon of mutual reminders represents a manifestation of peer monitoring, which is characteristic of high reliability organizations (HROs)—organizations capable of consistently maintaining high safety performance under high-risk conditions [21]. Reason argues that a mature safety culture is characterized by an informed culture, in which organizational members possess awareness of risks and act collectively to control them [9]. These findings reinforce the argument of Gunningham and Sinclair that the effectiveness of OHS policy implementation is not solely determined by formal rule-based compliance (*rules-based approach*), but also by the internalization of safety values within organizational culture (*safety culture-based approach*) [6].

3.3. PPE Usage and Management System

3.3.1. Types of PPE, Usage Procedures, and Consistency of Officer Use of PPE in PDKB Work

Based on the data obtained, the use of mandatory Personal Protective Equipment (PPE) in PDKB work has been regulated in detail according to the work methods applied. These methods are divided into three categories: direct contact method, distance method, and combination method. All informants mentioned the types of PPE that must be used for each work method.In the direct contact method, the required PPE includes 20 kV insulating gloves, electrical-standard safety helmets, protective goggles, non-conductive wear packs, insulating safety boots, insulating sleeves, full body harnesses, and insulating covers for bare conductors. In the distance method, the PPE components are relatively similar but do not include insulating gloves, with greater emphasis on the use of insulated tools and maintaining a safe distance. Meanwhile, the combination method represents an integration of the two approaches, with adjustments made according to technical conditions in the field, as explained by informants P-01, KK-01, and T-02:

"PPE required in PDKB work includes safety helmets, protective goggles, non-conductive wear packs, insulating gloves according to voltage class, insulating sleeves, safety shoes or insulating boots, and full body harnesses. For certain methods, additional protection such as insulating coats is also used. The procedure for using PPE includes physical and administrative checks before work begins..." (P-01)

"The required PPE includes electrical-standard safety helmets, insulating gloves according to voltage class, insulating sleeves, insulating boots, non-conductive wear packs, full body harnesses, protective goggles, and supporting equipment such as lanyards and insulated buckets. All are adjusted to the work method used." (KK-01)

This statement was reinforced by informant T-02 as a field technician:

"…The Direct Contact Method requires the use of comprehensive PPE because workers have direct contact with energized lines. This includes 20 kV insulating gloves as the primary protection, electrical-standard safety helmets, protective goggles, non-conductive wear packs, insulating boots, insulating sleeves, full body harnesses, and insulating covers to shield bare conductors. Meanwhile, for the Distance Method, the PPE used is almost the same but without insulating gloves, since workers do not make direct contact. The main focus is on the use of auxiliary equipment such as insulated poles or sticks and maintaining a minimum safe distance of 60 cm from energized lines. The Combination Method integrates both approaches, so the PPE used is adjusted to the specific conditions and needs in the field." (T-02)

The procedure for PPE use is implemented systematically through three main stages. The first stage involves physical and visual inspection before work begins to ensure the suitability of the PPE. The second stage involves monitoring during work activities to ensure that PPE is worn according to established standards. The third stage involves cleaning and recording after work as part of equipment maintenance. Regarding negligence, informants indicated that although minor lapses have occurred, corrective actions were taken quickly and firmly:

"Minor negligence has occurred, but it was immediately corrected before work began." (KK-01)

"The harness installation was not optimal, so the work was stopped and corrected." (TL-01)

"If PPE is missing, the work is stopped until everything is complete. There is no compromise." (T-02)

The use of PPE in PDKB work has generally been implemented comprehensively and adjusted according to the work method used. The implementation procedure is carried out systematically through initial inspection, supervision during work, and post-work evaluation. Although minor negligence has occurred, corrective actions are taken promptly and firmly. This indicates that the implementation of PPE usage is carried out with strict discipline and does not tolerate deviations from safety standards. The provisions regarding PPE usage have been comprehensively regulated within Indonesian legislation. Minister of Manpower Regulation Number 8 of 2010 Article 3 paragraph (2) stipulates that PPE must be adjusted according to the potential hazards and the body parts requiring protection [3]. This provision is further reinforced by technical standards established in PLN Standards (SPLN) as well as by the International Electrotechnical Commission through IEC 61472, which regulates the technical specifications of insulating PPE for live-line work, including insulation class, periodic testing periods, and inspection procedures to ensure equipment feasibility. Therefore, the regulatory framework provides a comprehensive normative and technical basis to ensure worker protection [17].As a derivative of these regulations, the PDKB Standard Operating Procedure (SOP) classifies PPE usage according to the work method, namely Direct Contact, Distance, and Combination methods.

In the Direct Contact method, workers are required to wear complete PPE, including 20 kV insulating gloves, electrical-standard safety helmets, protective goggles, non-conductive work clothing (wear packs), insulating boots, insulating sleeves, full body harnesses, and insulating covers for bare conductors. In contrast, in the Distance method, the PPE used is nearly identical but excludes insulating gloves. The primary focus is on the use of insulated tools and maintaining safe distances. Meanwhile, the Combination method represents a hybrid of both approaches, adjusted to technical field conditions. This classification reflects the differentiation of risk that necessitates adjustments in the types of protection used. Workers' understanding of the required PPE types is generally uniform and comprehensive. Conceptually, this arrangement demonstrates alignment between normative standards and operational requirements [17]. Nevertheless, although the regulatory framework and workers' understanding are clearly established, this study identifies a disparity between written regulations and actual practices, particularly in the material

aspect of PPE. In terms of material, although SPLN and Minister of Manpower Regulation Number 8 of 2010 mandate the use of rubber-based Safety Sleeves with high insulation capacity according to the working voltage class, field observations still reveal the use of plastic-based Safety Sleeves from older procurement. As a consequence of this disparity, the risk of insulation failure and electrical current penetration increases significantly, since plastic materials do not possess insulation resistance equivalent to rubber materials according to the technical standards required for certain working voltages.

This condition is influenced by the gradual transition process of equipment replacement as well as considerations related to worker comfort, as explained by informant T-01:

"…Besides the fact that the existing stock is still available, rubber-based PPE is heavier and hotter. Using insulating coats can be more flexible, so physically it is more exhausting to use rubber-based equipment…" (T-01)

This condition is consistent with findings from previous studies indicating that the implementation of new policies generally goes through an adaptation phase due to technical constraints, budget limitations, and practical resistance from users. This disparity reflects the difference between formal compliance and substantive compliance, as described by Gunningham and Sinclair, where administrative compliance does not necessarily reflect the full internalization of safety values [6]. In the context of PDKB, the use of plastic-based Safety Sleeves is still considered tolerable as long as they pass periodic feasibility testing in accordance with SPLN requirements, so layered supervision functions as a balancing mechanism to mitigate potential risks.

3.3.2. Implementation of the PPE Storage System in Work Units, Its Compliance with Established Standards, and the Person Responsible for Its Maintenance and Storage

Based on observations and interviews, PPE storage in the PDKB unit is divided into two types: mobile storage in operational vehicles and fixed storage at the basecamp. The PPE storage system within the PDKB unit faces challenges in meeting the ideal standards required. The ideal standards based on PLN standards (SPLN) and IEC require storage rooms with controlled temperature and humidity, separated from other equipment. However, the mobile nature of the work requires some PPE to be stored in operational vehicles, as explained by informants P-01 and T-02:

"…Ideally it should be stored in a controlled room, but because the work is mobile, PPE is stored in the vehicle. Due to limited facilities, it is not yet ideal…" (P-01)

"…The vehicle temperature is not always controlled; the risk is minimized through routine maintenance…" (T-02)

To address these limitations, the unit applies several adaptive compensation mechanisms. Rubber-based insulating PPE is stored in special boxes or packaging to prevent scratches, and the storage room at the basecamp is equipped with air conditioning to maintain temperature and reduce humidity. This was explained by informants P-01 and TL-01:

"…Rubber PPE is stored in boxes, and the storage room is air-conditioned…" (P-01)

"…Stored inside boxes to prevent scratches… installing air conditioning in the storage room as a preventive measure to prevent humidity…" (TL-01)

This statement was reinforced by KK-01:

"…In terms of storage at the basecamp, the standards have not yet been fully met because insulating and non-insulating PPE are still mixed, although we anticipate this with several measures. In principle, the storage conditions are not yet fully compliant with standards, but technically we are still making efforts to improve temperature and humidity control and maintain the quality…" (KK-01)

An important aspect of storage management is the individual responsibility system. Each personnel member has personal PPE that must not be exchanged or shared, creating a sense of ownership that encourages better care. This was explained by informants T-02 and T-01:

"The individual system builds a strong sense of ownership; technicians feel responsible." (T-02)

"Each personnel member has their own PPE and is responsible for it." (T-01)

PPE storage in the PDKB unit is therefore divided into two types: mobile storage in operational vehicles and fixed storage at the basecamp. Mobile storage has not fully met the ideal standards due to operational constraints, but fixed storage at the basecamp has implemented compensation mechanisms such as the use of special boxes, air-conditioned rooms, and periodic inspections to maintain PPE quality. The individual responsibility system also strengthens PPE maintenance and care. Thus, despite infrastructure limitations, risk control continues to be implemented systematically.According to PLN standards and IEC 61472, rubber insulating PPE must be stored under conditions that meet several criteria. First, it must be protected from direct sunlight, which can accelerate the degradation of rubber materials. Second, the room temperature must be controlled and should not exceed 35 degrees Celsius to prevent changes in the physical properties of the insulating material. Third, humidity must be controlled and should not exceed 70 percent to prevent mold growth and material damage. Fourth, PPE must be stored separately from other equipment that may cause scratches or mechanical damage. Fifth, it must not be bent or folded, as this may damage the insulating structure [17]. The Regulation of the Minister of Manpower Number 8 of 2010 Article 7 also mandates that PPE must be stored properly to remain suitable for use [3].

The research findings reveal a significant gap between ideal storage standards and field practices. The mobile characteristics of PDKB work require some PPE to be stored in operational vehicles. This condition exposes PPE to temperature and humidity fluctuations that are difficult to control, especially when vehicles are parked in open areas. Temperatures inside vehicles during the daytime can reach 38 degrees Celsius, exceeding the recommended maximum limit. In addition, limited facilities and temporary storage space at the basecamp also pose challenges in implementing ideal storage standards.To overcome these limitations, the unit applies several adaptive compensation mechanisms. Rubber insulating PPE is stored in boxes or special packaging to prevent direct contact with other equipment that could cause scratches. Storage rooms at the basecamp are equipped with air conditioning to maintain temperature and reduce humidity. For PPE stored in vehicles, inspections are conducted more frequently, particularly during extreme weather conditions. Periodic testing every six months in accredited laboratories also serves as a control mechanism to ensure that PPE remains safe to use despite suboptimal storage conditions. Non-compliant findings have been anticipated through these measures, as explained by TL-01:

"For rubber insulating PPE, we always try to store it in boxes to prevent scratches. In addition, we install air conditioning in the storage room to prevent humidity. In general, storage is already in accordance with standards, although it is not yet fully ideal due to the mobility of the work." (TL-01)

This statement was reinforced by P-01, who acknowledged that storage conditions at the basecamp still face certain challenges:

"The storage room is also equipped with air conditioning to maintain temperature and reduce humidity levels, but at the basecamp it still does not fully meet the standards because insulating and non-insulating equipment are still mixed. In the two racks, the arrangement is still messy and mixed. From the environmental aspect of storage, such as the temperature inside operational vehicles, it is indeed not yet fully ideal. Moreover, this is only a temporary base in the form of a house, so implementing regulations ideally is still difficult." (P-01)

The most interesting aspect of storage management is the individual responsibility system. Each personnel member has personal PPE that must not be exchanged or shared. This condition was explained by informant T-01:

"…Each personnel member is responsible for their own PPE; it is not exchanged. This individual system makes us feel that we know and are most responsible for our own safety equipment…" (T-01)

This system builds a sense of psychological ownership, which encourages better care and maintenance. This phenomenon confirms the findings of Pierce et al., who state that psychological ownership is positively correlated with asset maintenance behavior [21]. Anwar and Septyan also emphasize that psychological ownership encourages technicians to take greater responsibility for their safety equipment [12].The disparity between ideal storage standards and field practices can be understood as a form of street-level bureaucracy, as proposed by Lipsky, where frontline workers make adjustments based on operational

realities. Storing PPE in vehicles is not an intentional violation but rather an adaptation to work demands that require high mobility [22]. The compensation mechanisms implemented reflect a defense in depth approach, where failure in one layer of protection can be compensated by another. Limitations in physical infrastructure are offset by strong social capital through psychological ownership and collective supervision [9].

3.3.3. Monitoring Mechanism for the Use and Management of PPE

Based on observations and interview results, the supervision mechanism for the use and management of PPE within the PDKB unit is implemented through a multi-layered system involving various stakeholders. The supervision system operates through three main mechanisms: pre-job briefings, direct field observation, and periodic internal audits. As stated by informants KK-01 and P-01:

"Supervision is conducted through sampling and reported via a monitoring group." (KK-01)

"Verification from the preparator and supervisor before work begins, monitoring during work, and evaluation after work." (P-01)

The parties involved in supervision include OHS officers (K3L), team leaders, work supervisors, and fellow technicians through a horizontal monitoring mechanism. This was explained by informants KK-01 and T-02:

"OHS officers, team leaders, work supervisors, and fellow technicians through horizontal supervision." (KK-01)

"OHS supervisors, work supervisors, team leaders, and fellow technicians." (T-02)

Horizontal supervision among coworkers has proven to be the most effective mechanism in ensuring compliance with PPE usage. The strong culture of mutual reminders creates a supervision system that is not only top-down from supervisors but also bottom-up and horizontal from team members. As conveyed by informants T-02 and P-01:

"The culture of 'one notices, three remind'... supervision is not only top-down but also horizontal." (T-02)

"Mutual reminders among coworkers are very effective." (P-01)

Follow-up actions for any identified non-compliance are immediate and firm without compromise. When violations or discrepancies in PPE usage are detected, work is temporarily stopped, corrections are made directly on site, and the incident is recorded for evaluation purposes. If the issue involves damaged PPE, immediate replacement is proposed and the damaged equipment must not be used again. This was stated by informants TL-01 and P-01:

"...If the PPE is incomplete, the work is stopped. If any PPE is damaged during the job, the work is immediately halted, corrected, recorded, and if necessary, a replacement is requested. Periodic evaluation is very important..." (TL-01)

"Damaged PPE is immediately replaced and must not be used." (P-01)

This statement was reinforced by KK-01:

"Work is stopped, immediate correction is made, followed by coaching or performance evaluation." (KK-01)

Supervision of PPE usage in the PDKB unit is conducted through multiple layers, including initial briefings, field monitoring, and internal audits. The involvement of various stakeholders and the presence of horizontal supervision among technicians strengthen the effectiveness of the control system. Follow-up actions for non-compliance are carried out quickly and firmly without compromise, thereby supporting consistent implementation of workplace safety in the field.Regulations regarding OHS supervision have been comprehensively stipulated in Indonesian legislation. Government Regulation Number 50 of 2012 concerning the Occupational Safety and Health Management System mandates the implementation of periodic internal audits and OHS inspections as part of the evaluation of SMK3 implementation [16]. Minister of Manpower Regulation Number 8 of 2010 Article 6 explicitly requires company management to provide guidance and supervision regarding the use of PPE in the workplace [3]. Within PLN's internal framework, these policies are further elaborated in the PDKB SOP, which regulates a multi-layered

supervision mechanism involving K3L officers, work supervisors, and team leaders as operational supervisors.

Based on research observations, the supervision system in PDKB UP3 Sukoharjo is implemented at multiple levels through three primary mechanisms. First, pre-job briefings include verification of PPE completeness and condition by the preparator and supervisor before work begins. Second, direct field observation is conducted during the work process by OHS supervisors and team leaders. Third, periodic internal audits and post-work evaluations are conducted to identify potential improvements and ensure the effectiveness of the supervision system. Supervision is not always continuous but is conducted through sampling, with progress reports delivered via monitoring groups that allow rapid response when non-compliance is detected.The parties involved in supervision include K3L officers, team leaders, work supervisors, and all team members through horizontal supervision. The involvement of multiple actors creates a supervision system that is not solely top-down from supervisors but also bottom-up and horizontal from team members. This structure reflects the principle of multiple layers of defense in risk management, where gaps or weaknesses in one layer of supervision can be covered by other layers, thereby creating a stronger and more resilient protection system [9].The most distinctive and strongest aspect of the supervision system within the PDKB unit is the peer monitoring mechanism, manifested through the culture of mutual reminders among coworkers.

The principle of “one notices, three remind,” as expressed by informants, has become an unwritten norm consistently practiced by all team members. The effectiveness of this horizontal supervision exceeds that of formal supervision because it is based on trust, emotional closeness, and collective responsibility for shared safety. This finding aligns with the argument of Gunningham and Sinclair that in high-risk industries, trust and informal supervision are often more effective than formal supervision in fostering sustainable compliance, as they create internal commitment rather than merely external compliance [6].Follow-up actions for non-compliance are immediate and firm without compromise. When violations or discrepancies in PPE usage are identified, the mechanism applied includes temporary work suspension, direct on-site correction, documentation for evaluation purposes, and coaching or performance evaluation when necessary. If the issue concerns damaged PPE, an immediate replacement request is submitted and the damaged equipment must not be used until declared fit for use or replaced with new equipment. This mechanism ensures that potential hazards can be eliminated promptly before developing into more serious incidents. Such a multi-layered supervision system is consistent with the principles of integrated risk management, where hazard identification, risk assessment, and risk control must be conducted systematically and continuously to ensure optimal worker protection.

During the observation period, three near miss incidents were recorded: almost touching energized components due to improperly installed PPE, falling equipment from height because the safety tether was not correctly attached, and a technician nearly falling due to a full body harness that was not properly tightened. These incidents demonstrate that the supervision system functions effectively, as the hazards were detected before developing into fatal accidents due to rapid intervention from supervisors or coworkers. However, the fact that negligence in the double-checking process still occurred indicates the need to improve supervision quality, particularly in the technical verification of PPE installation to ensure it is conducted more carefully and systematically.Wulandari et al. emphasize that periodic evaluation of PPE management systems is crucial to detect potential weaknesses before they become real risks that could endanger worker safety [23]. This is consistent with findings that work supervision and OHS implementation significantly influence worker productivity, indicating that proper supervision and safe working conditions not only prevent accidents but also improve overall work efficiency and productivity [24]. Therefore, the multi-layered supervision system implemented in PDKB UP3 Sukoharjo functions not only as a control mechanism but also as an instrument of organizational learning for continuous improvement. The alignment between formal policy and field implementation confirms the findings of Smith et al. that adequate PPE provision, supported

by a strong safety culture, constitutes a fundamental foundation for OHS implementation in high-risk industrial sectors [4]

IV. CONCLUSION

This study concludes that the implementation of the Occupational Safety and Health (OHS) policy related to Personal Protective Equipment (PPE) among live-line maintenance workers (PDKB) at PT PLN (Persero) UP3 Sukoharjo has been carried out effectively. This is indicated by the company's strong commitment to providing internationally standardized PPE, certified training, periodic testing, and multi-layered supervision in accordance with the mandates of Law Number 1 of 1970, Government Regulation Number 50 of 2012, and Minister of Manpower Regulation Number 8 of 2010 [2], [3], [16].The level of compliance among workers is considered high due to their awareness of the risks associated with working with 20 kV electrical voltage and the deeply rooted safety culture embodied in the principle of "one notices, three remind," as well as the internalization of PPE as a "second life." The PPE usage system is implemented systematically in accordance with the working methods, including the application of stop work authority when negligence is identified.Although a disparity exists in the storage of PPE in operational vehicles, which does not yet fully meet the ideal standards of a controlled storage space, this condition is mitigated through adaptive mechanisms such as the use of dedicated storage boxes, air-conditioned rooms, routine inspections, periodic testing, and an individual responsibility system that fosters psychological ownership.

The multi-layered supervision system involving all team members, including horizontal supervision, has proven effective, as evidenced by three near-miss incidents that were successfully detected before escalating into fatal events. The researcher recommends three strategic measures to improve the effectiveness of Occupational Safety and Health (OHS) for PDKB personnel: accelerating the transition of PPE in accordance with regulatory standards, particularly replacing plastic safety sleeves with rubber insulation materials; improving storage facilities to maintain PPE quality, such as separating insulating and non-insulating equipment; and strengthening the quality of double-check procedures so that they do not merely become a formality. Furthermore, the researcher emphasizes that the effectiveness of OHS implementation cannot be achieved solely through formal compliance with regulations. It also requires the development of a strong safety culture, where every individual possesses awareness and concern for risks, as well as the synergy of social capital reflected in high levels of trust and cooperation among personnel. By integrating compliance with standards, a robust safety culture, and strong team relationships, the protection of workers from the risks of electric shock can be achieved optimally and sustainably.

V. ACKNOWLEDGMENT

The author expresses sincere gratitude to PT PLN (Persero) UP3 Sukoharjo and the PDKB Division for granting permission and providing support for this research; to all informants for their participation and openness; and to the supervisors, the academic community of the Faculty of Public Health and Health Sciences at Universitas Veteran Bangun Nusantara, family members, and colleagues for their guidance and support throughout the research process. The author acknowledges the limitations of this study and welcomes constructive feedback for future improvement. It is hoped that this research will contribute to strengthening occupational health and safety (OHS) policies, particularly in high-risk work within the electricity sector.

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