



Development of a Digital SIKA Dashboard to Replace Manual Systems for Optimizing Work Permit Supervision at ORF PT Pertamina Hulu Energi WMO

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ABSTRACT

Introduction: The manual Safe Work Permit (SIKA) system at the Onshore Receiving Facility (ORF) of PT Pertamina Hulu Energi West Madura Offshore (PHE WMO) faces challenges like lack of real-time status visibility, document misplacement, and disjointed information, potentially increasing occupational safety and health (OSH) risks. **Methods:** This applied research employed a Research and Development (R&D) approach using the ADDIE (Analyze, Design, Develop, Implement, Evaluate) model because of its systematic and iterative framework for designing, testing, and evaluating digital management systems. The study was conducted at the ORF PHE WMO from July to September 2025. Primary data came from field observations and interviews with HSSE personnel, while secondary data included company procedures and permit registers. **Results:** The study resulted in a web-based Digital SIKA Dashboard. Key features include digital permit submission, multi-level approval workflows (PTWC, AA, SC), an interactive site plot plan for real-time permit location visualization, and integration of supporting documents. The system centralizes data, replacing physical boards and manual registers. **Conclusion:** The Digital SIKA Dashboard effectively addresses the limitations of the manual system by providing real-time monitoring, enhancing transparency, reducing administrative errors, and supporting integrated OSH management. Its implementation requires user training and potential future integration with IoT for optimal effectiveness.

INTRODUCTION

Occupational Safety and Health (OSH) is a strategic element in the high-risk oil and gas industry (Salleh et al., 2024; Jamil et al., 2025). The oil and gas sector is associated with a significantly higher occupational fatality risk compared to many other industries. A study reported that occupational fatality rates in oil and gas extraction operations reached 27.1 deaths per 100,000 workers, approximately seven times higher than the average rate across other industries (CDC, 2013). In 2008 alone, 120 fatal occupational injuries were recorded in the oil and gas extraction industry, with transportation incidents, fires, explosions, and contact with heavy equipment identified as the leading causes (Bureau of Labor Statistics, 2010). The implementation of an effective OSH management system is not only a regulatory obligation based on national legislation such as the Occupational Safety Act No. 1 of 1970 and Government Regulation No. 50 of 2012, but also a prerequisite for achieving operational excellence. PT Pertamina Hulu Energi West Madura Offshore (PHE WMO) operates the West Madura Offshore Block by applying an integrated OSH policy through its Health, Safety, Security, and Environment (HSSE) Department. One crucial risk control instrument is the Safe Work Permit System (SIKA), a formal mechanism for hazard identification, risk assessment, determining control measures, and ensuring effective coordination before high-risk work is executed, guided by internal standards (Kołodziejcki, 2022).

However, the SIKA mechanism at the Onshore Receiving Facility (ORF) still relies on a manual system. Permits and supporting documents are monitored via physical information boards, leading to limitations in real-time status visibility, potential document misplacement, and

delayed information updates. Based on preliminary observations and internal permit records, the ORF processes dozens of work permits each week involving multiple operational zones and approval authorities. Manual monitoring frequently resulted in delays in permit status updates, incomplete supporting documents, and difficulties in tracking active permits in real time. Several permit approval processes also required repeated manual confirmation between PTWC, AA, and SC personnel, increasing administrative workload and communication inefficiencies. These conditions reduce field supervision effectiveness, increase human error risk, and weaken data integration with other HSSE programs, contravening the principles of continuous improvement required by modern OSH management systems (Wegner, 2022; AlMarri et al., 2025).

Information technology advancements offer opportunities for the digital transformation of the SIKA system. A digital dashboard can provide real-time permit monitoring, accelerate approval and reporting processes, facilitate integration with other HSSE modules, and offer a centralized database for risk analysis and OSH audits (Few, 2013). Recent studies in similar industrial settings have demonstrated the efficacy of such digital solutions in minimizing administrative errors and accelerating permit approval processes (Agustin et al., 2025; Sofia et al., 2025). However, previous studies have primarily focused on general digital reporting systems or administrative automation and have rarely addressed integrated digital permit-to-work monitoring systems specifically designed for high-risk oil and gas operations. In particular, limited studies have incorporated real-time interactive site visualization, multi-level permit authorization workflows, and

centralized HSSE documentation into a single integrated dashboard platform. Therefore, developing a Digital SIKA Dashboard is a strategic step to enhance work permit supervision effectiveness, optimize risk control, and support sustainable OSH target achievement.

METHOD

This study constitutes applied research utilizing a Research and Development (R&D) approach. The development model employed was ADDIE (Analyze, Design, Develop, Implement, Evaluate), chosen for its systematic stages in creating effective digital learning and management systems (Waruwu, 2025). The research was conducted at the Onshore Receiving Facility (ORF) of PT PHE WMO in Gresik, East Java, from July to September 2025.

The unit of analysis was the HSSE Department, focusing on personnel involved in the SIKA process: Site Controller (SC), Area Authority (AA), Permit To Work Coordinator (PTWC), and field workers. Informants were selected using a purposive sampling technique based on their direct involvement and responsibilities in the work permit process. A total of 10 informants participated in the study, consisting of HSSE supervisors, PTWC personnel, AA representatives, SC personnel, and field workers. Data collection involved mixed methods:

1. **Primary Data:** obtained through direct field observation of the manual SIKA process and structured interviews using an interview guideline instrument designed to explore system constraints, workflow inefficiencies, user needs, and expectations regarding digital permit management. Interview data validity was strengthened through source triangulation by comparing responses among

different personnel roles and cross-checking with operational documents and field observations.

2. **Secondary Data:** included internal policy documents (e.g., SIKA Guidelines, Organizational Work Procedures), historical Permit To Work registers, and relevant national (e.g., UU 1/1970, PP 50/2012) and international OSH standards (e.g., ISO 45001:2018).

The ADDIE stages were executed as follows:

- a. **Analyze:** Identifying problems and needs through observation and interviews.
- b. **Design:** Creating system models, including use case diagrams, Entity Relationship Diagrams (ERD), and user interface wireframes.
- c. **Develop:** Building the website dashboard using suitable web frameworks and technologies compatible with the company's IT infrastructure.
- d. **Implement:** Deploying the dashboard in a limited environment for controlled user testing with admins, supervisors, and permit users.
- e. **Evaluate:** Assessing system functionality, usability, and effectiveness based on user feedback through interviews and questionnaires, leading to revisions and refinements. System usability evaluation was conducted using the System Usability Scale (SUS), which measures user perceptions regarding system effectiveness, efficiency, ease of use, and interface satisfaction. The evaluation involved users representing PTWC, AA, SC, and field personnel after limited system implementation.

Questionnaire results and interview feedback were analyzed to identify system strengths, usability issues, and areas requiring revisions and refinements.

RESULTS AND DISCUSSION

The primary outcome of this R&D study is a functional prototype of the Digital SIKa Dashboard website. The system was designed to digitalize the entire work permit lifecycle.

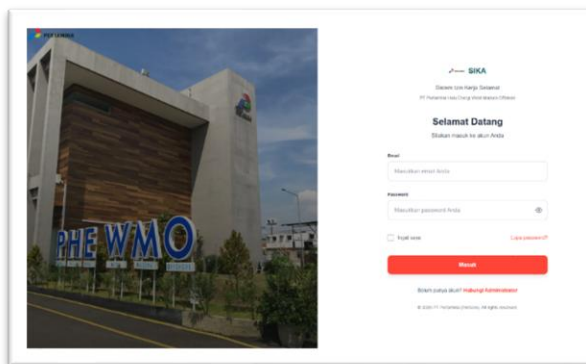


Figure 1. Digital SIKa Dashboard Website



Figure 2. Guidebook of Digital SIKa Dashboard Website

Key Features and Functionality:

1. **User-Specific Dashboards:** The system provides tailored interfaces for different roles (PTWC, AA, SC). The PTWC dashboard focuses on creating and submitting new permits, while the AA and SC dashboards

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display permits awaiting their approval or rejection

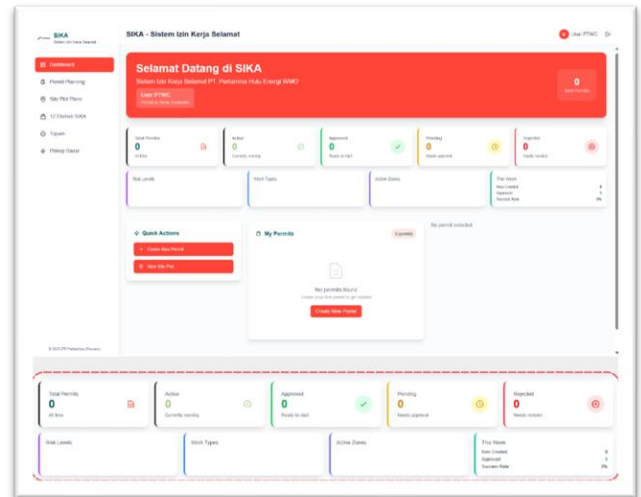


Figure 3. PTWC Dashboard

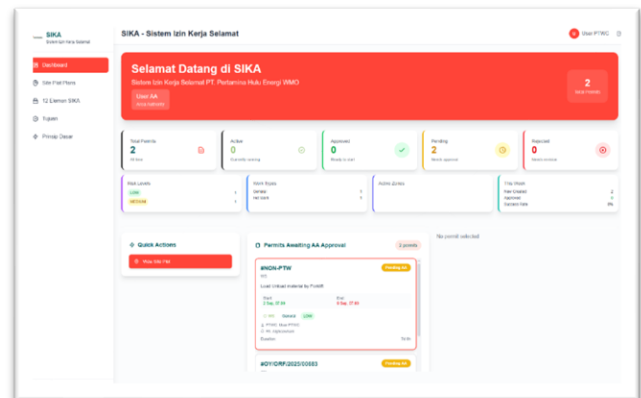


Figure 4. AA Dashboard

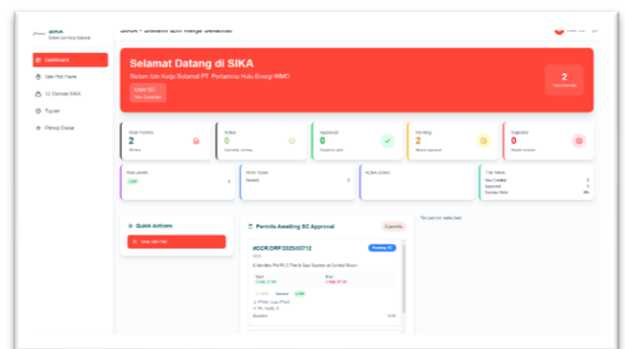


Figure 5. SC Dashboard

2. **Digital Permit Form:** A comprehensive online form replaces paper-based permits. It includes sections for basic information, risk level, work description, related documents (JSA, RA, ICC, CSEP), location details (with an interactive zone map), schedule, personnel involved, safety

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information (PPE, emergency contacts), and precise site plot coordinates

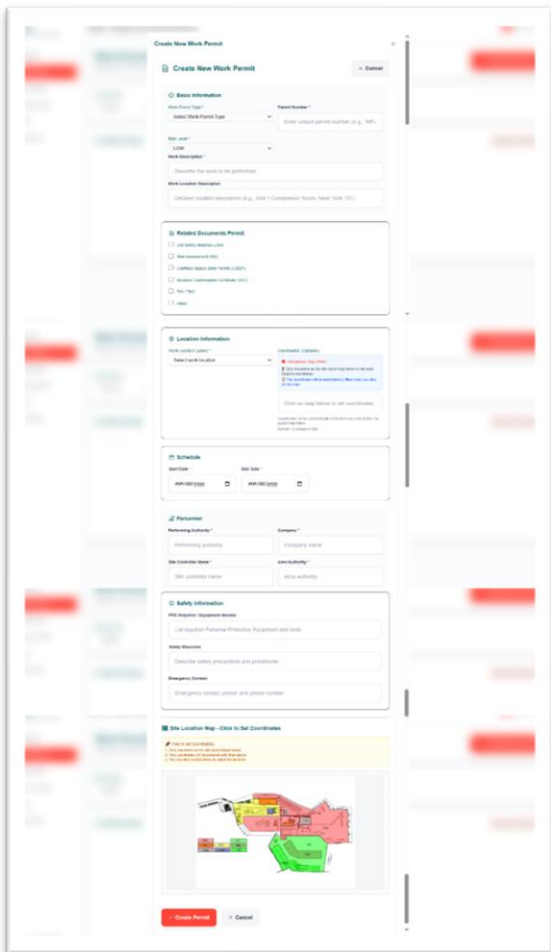


Figure 6. Digital Permit Form

3. **Automated Workflow:** The digital system enforces the official approval workflow. Permits submitted by the PTWC are routed to the relevant AA for initial approval and then to the SC for final authorization. Each action triggers status updates visible to all stakeholders.

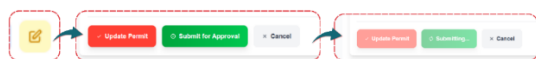


Figure 7. Submit for Approval via Permit Planning

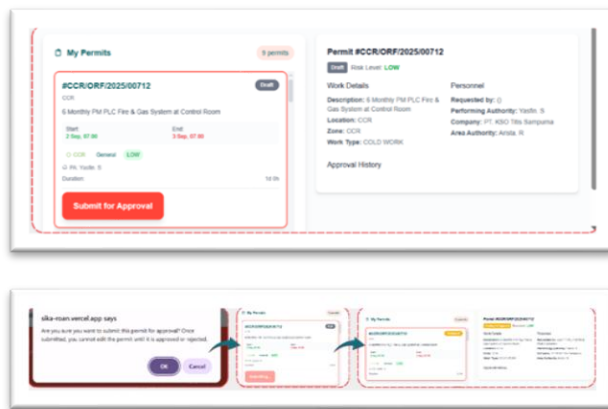


Figure 8. Submit for Approval via Dashboard

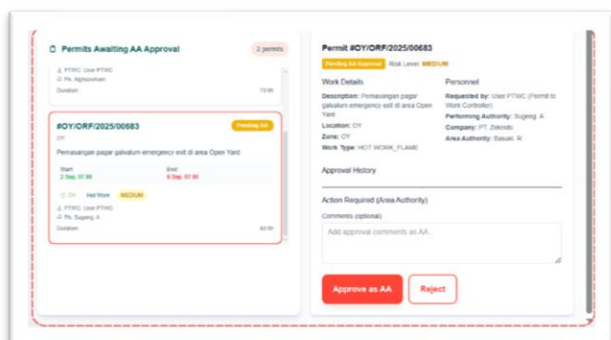


Figure 9. Permit Awaiting AA Approval



Figure 10. Approval Permit by AA

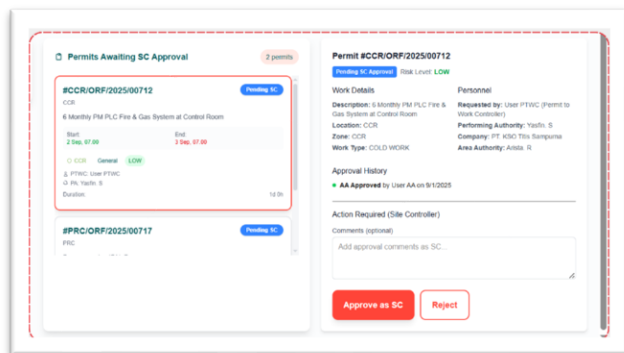


Figure 11. Permit Awaiting SC Approval

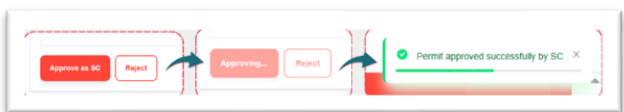


Figure 12. Approval Permit by SC

4. **Interactive Site Plot Plan:** This feature is a significant advancement over the manual pin board. It provides a visual, real-time map of the ORF, showing all active permits color-coded by their status (e.g., pending - yellow, in progress - green, completed - blue). This allows for instant overview and helps prevent conflicting work activities in the same location. Based on limited implementation observations, the digital plot plan reduced permit monitoring and location identification time compared to the manual board system, while also minimizing errors related to misplaced permit information and delayed status updates. Users reported that the centralized visual monitoring system improved coordination efficiency between PTWC, AA, and SC personnel, particularly during simultaneous high-risk work activities in multiple operational zones.

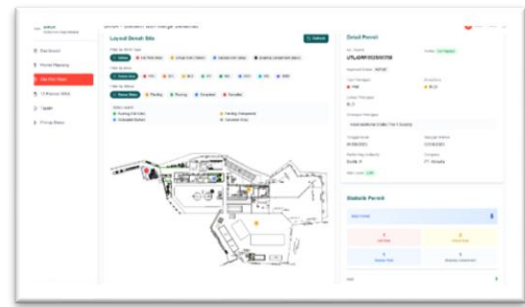


Figure 15. Site Plot Plans with On Progress Status

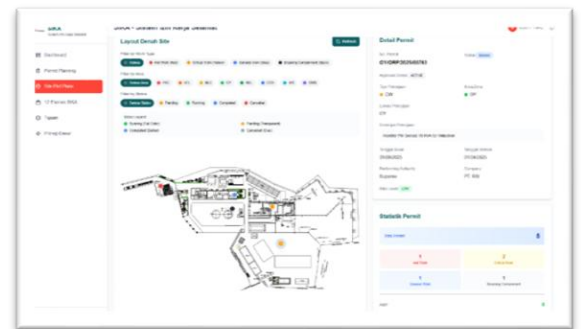


Figure 16. Site Plot Plans with Completed Status

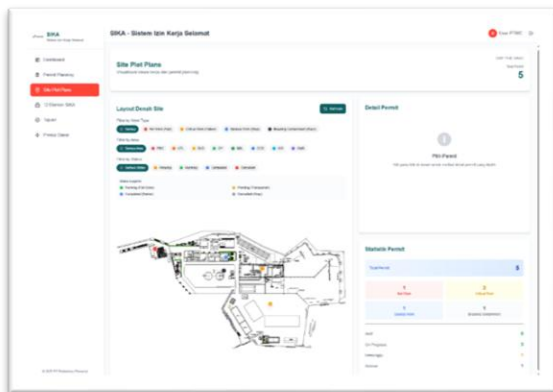


Figure 13. Site Plot Plans

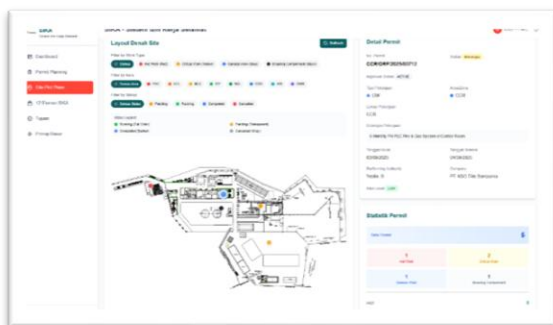


Figure 14. Site Plot Plans with On Going Status

5. **Transparent Communication:** The system provides clear notifications for approvals and, crucially, for rejections. If an AA or SC rejects a permit due to insufficient data or high risk, the reason is documented, and the PTWC is notified to make necessary revisions.

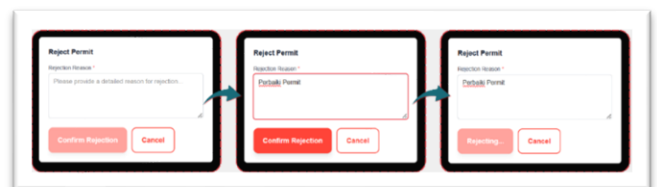


Figure 19. Reject Permit by AA or SC

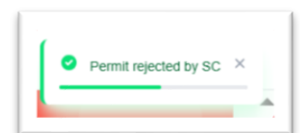
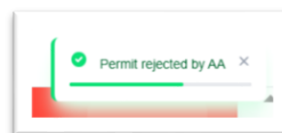


Figure 17. Notification of Reject Permit by AA

Figure 18. Notification of Reject Permit by SC

DISCUSSION

The development of this dashboard directly addresses the identified problems. The issue of document misplacement is eliminated as all permits exist centrally in the digital database. The inaccuracy in hazard selection is mitigated by structured digital forms that guide users through the process, thereby supporting a more systematic hazard identification and risk assessment process as advocated in OSH standards. The fragmentation of documents is resolved by integrating all permit data, related documents, and approvals into a single, accessible system.

The transition from a manual to a digital system aligns with the broader trend of digital transformation in HSSE, enhancing operational efficiency and decision-making speed (Osha, 2020). The real-time visibility provided by the dashboard empowers supervisors and managers with accurate data, facilitating proactive safety management and supporting the requirements for hazard control and operational planning as stipulated in national regulations. Furthermore, the centralized database opens possibilities for advanced data analytics, identifying trends in permits, common hazards, and approval timelines, which can inform future safety strategies and training programs.

These findings are consistent with previous studies reporting that digital permit management systems can improve administrative efficiency, reduce documentation errors, and accelerate approval processes in industrial environments (Agustin et al., 2025; Sofia et al., 2025). However, unlike previous systems that primarily focused on digital documentation and reporting, the developed Digital SIKA Dashboard integrates multi-level authorization workflows with an interactive real-time site plot plan, enabling more

comprehensive operational supervision in high-risk oil and gas activities. This integration represents a practical advancement in HSSE digital transformation by improving coordination among PTWC, AA, and SC personnel during simultaneous work activities.

While this dashboard represents a significant step forward, its success hinges on user acceptance and adherence to the new digital procedure. Comprehensive training and change management are essential, as highlighted in the suggestions from the internship report.

Despite these advantages, this study has several limitations. The system was implemented and evaluated within a limited operational environment and involved a relatively small number of users during the testing phase. In addition, the evaluation primarily focused on usability and operational functionality rather than long-term impacts on accident reduction or organizational safety performance. Future studies are recommended to conduct larger-scale implementation and integrate the system with IoT-based monitoring technologies and other HSSE digital platforms to enhance real-time risk management capabilities.

CONCLUSION

The manual SIKA system at PHE WMO's ORF, while functional, presented significant limitations in efficiency, accuracy, and real-time oversight, creating potential gaps in the OSH management system. This project successfully developed a Digital SIKA Dashboard prototype that effectively digitalizes the work permit process. The system enhances supervision by providing real-time status updates, ensures better compliance through structured digital forms, improves coordination via an interactive site plot

map, and centralizes data for improved accessibility and future analysis. The dashboard is a practical solution for optimizing work permit supervision, reducing administrative error potential, and supporting a stronger integrated OSH management system in line with both internal company standards and broader industry goals. For maximum impact, its implementation should be accompanied by structured user training and explored for further integration with IoT and other digital HSSE tools.

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