Evaluation of Watchroom Conditions in Supporting PKP-PK Preparedness as an Effort to Mitigate Risk and Aviation Safety

Kamal Abdiranata[1], Yeti Komalasari[1,*] Minulya Eska Nugraha[1], Ahmad Hariri[1], Direstu Amalia[1], Muhammad Rizki[1]

[1] Politeknik Penerbangan Palembang, Indonesia

[*]Corresponding email : yeti.komalasari@poltekbangplg.ac.id

The watchroom is a vital facility that supports the coordination and monitoring of emergency situations by the PKP-PK unit at the airport. This study aims to evaluate the condition of the watchroom in supporting PKP-PK preparedness for rapid response to emergencies through a gap analysis approach, in accordance with the provisions of PR 30 of 2022. This study used a qualitative descriptive method with a gap analysis approach, and data collection techniques were conducted through observation, interviews, and documentation. The results indicate that the watchroom is not yet functioning optimally because several key facilities have been moved to the guard room due to the room's unsuitable condition. This reflects a significant gap with the standards set in the regulation, necessitating comprehensive improvements that include room renovation, procurement of standard facilities, and placement of competent personnel to restore the watchroom's strategic function to its full potential. Indicators of success are demonstrated through the evaluation of watchroom facilities that meet standards, the room's proper condition, and the presence of personnel capable of effectively carrying out emergency coordination functions as a risk mitigation effort for aviation safety.

Keyword: Aviation Safety, Risk Mitigation, Watchroom, PKP-PK.

1. INTRODUCTION

In the era of globalization and high mobility, the existence of airports as vital infrastructure not only functions as a transportation gateway, but also as a guarantee of passenger safety and comfort[1]. As their roles become increasingly complex, airports are viewed as vital infrastructure that demands optimal management, particularly in terms of operational safety. This is in line with the view [2] which states that airports are locations with various activities that have the potential to pose risks, one of which is the risk of fire, so that safety facilities are needed. Radin Inten II Airport in Lampung is one of the flight terminals serving various domestic and international routes. With its large activity, this airport has a high potential risk of emergencies, especially fires, whether caused by human error, technical problems, or other external factors. The high intensity of aircraft movement, passengers, and operational activities at various points in the airport area increases the possibility of incidents that require rapid and coordinated response. These risks can have serious impacts on the safety of passengers, personnel, and asset losses if not optimally managed through an integrated monitoring and response system.

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Every airport is required to have a PKP-PK unit (Aviation Accident Rescue and Firefighting). At Radin Inten II Airport in Lampung, a category 7 PKP-PK unit is tasked with handling aircraft with a maximum length of 76 meters and a width of 7 meters. Based on Decree of the Director General of Civil Aviation Number PR 30 of 2022, the PKP-PK unit has obligations and benefits, including providing lifesaving services and protecting assets in the event of an aircraft accident at or near the airport. Furthermore, this unit is responsible for controlling and extinguishing fires and protecting individuals and property at airport facilities at risk of fire.

This unit is equipped with personnel, operational equipment, and special vehicles available at each airport to handle aviation and fire incidents[3]. The PKP-PK unit is also equipped with a fire station that serves as a strategic command center, including a storage warehouse, operational parking area, and watchroom. The watchroom serves as a monitoring and coordination center for PKP-PK officers, who must meet strict safety and operational standards[4], [5]. This research focuses on evaluating conditions, especially the watchroom as a function for monitoring aircraft movements without visual obstructions and the completeness of its supporting equipment.[6] emphasized that the watchroom, a vital part of the PKP-PK Unit within the airport environment, requires further attention to ensure compliance with applicable technical and operational standards. The existence of an adequate watchroom significantly impacts effective coordination, personnel preparedness, and the safety and comfort of those performing critical tasks related to handling airside emergencies.

Initial observations revealed several significant obstacles and discrepancies in the function and layout of the PKP-PK Unit watchroom. One key finding is that the watchroom currently lacks optimal visibility of the entire aircraft movement area. This is due to the presence of tall buildings surrounding the fire station, which obstruct direct visibility to most of the runway and surrounding areas. This situation can certainly hinder effective monitoring and rapid response to emergencies in the airside area. Furthermore, all key equipment that should be in the watchroom is currently still placed on standby and has not been moved or arranged according to its ideal function. Therefore, the operational function of the watchroom is not yet functioning as intended due to limited facilities and infrastructure.

These limitations not only impact technical aspects but also significantly impact the work performance of PKP-PK personnel. Lack of direct visibility to critical areas can also increase mental workload because officers must rely on indirect monitoring systems that are not always optimal, thus increasing the possibility of misperceptions or delays in decision-making. Furthermore, the facilities and infrastructure currently available in the PKP-PK Unit watchroom at Radin Inten II Airport, Lampung, do not fully meet the completeness standards stipulated in the Regulation of the Director General of Civil Aviation Number PR 30 of 2022 concerning Technical Guidelines for the Implementation of PKP-PK Unit Duties at Airports. This phenomenon reflects a mismatch between existing facilities and layouts and the operational requirements that must be met to support optimal PKP-PK services.

A quick response in a disaster response situation is an important thing for a first responder to do to minimize loss of life[7][8]. The incompatibility of the facilities and layout of the watchroom has the potential to hinder a quick response in dealing with emergency situations, thus creating risks to flight safety and accident handling[9]. This is increasingly important considering the strategic role of PKP-PK in handling aviation

incidents or accidents, where every second is very important in rescue efforts and handling critical situations [10]. In his research[11] stated that the current location of the watchroom at Class I Juwata Tarakan Airport does not support its strategic role in surveillance and emergency preparedness. Therefore, research was conducted with the aim of redeveloping the position and function of the room to comply with the provisions of the Indonesian National Standard (SNI) and to align it with the established airport development master plan.

The regulation emphasizes efforts to improve safety standards and preparedness in handling emergencies in aviation. This decree stipulates that all air transport operators are required to adjust their watchroom facilities to comply with established provisions. These adjustments cover various aspects, such as room layouts that support effective supervision and coordination, the use of building materials that meet safety standards, and the provision of adequate communication and monitoring equipment.

As an update from previous research, this study presents a more focused approach, namely on the physical facilities and layout of the watchroom space that functions as a monitoring and control center for emergency operations in the airport environment. While previous research emphasized the importance of the existence and strategic position of the watchroom in general, this study attempts to identify gaps between actual conditions and applicable technical standards, as well as formulate recommendations for improving spatial planning and facility completeness in order to improve the operational performance of PKP-PK as a whole.

2. METHODOLOGY

This research uses a qualitative method with a gap analysis approach. Qualitative research is research in which data is expressed verbally and analyzed without using statistical techniques based on qualitative data obtained through observation, interviews, and documentation[12]–[14]. In this study, the object of research is the watchroom. The research subjects consisted of three informants, namely Aditya Prastyo (Senior Airport Rescue and Fire Fighting), Elvin Chandra (Senior Airport Rescue and Fire Fighting), and Bayu Aswandono (Senior Airport Rescue and Fire Fighting). Data collection techniques were carried out through observation, interviews, and documentation. Data analysis techniques consisted of data reduction, data presentation, interpretation, and drawing conclusions. Gaps analysis was carried out by comparing the actual conditions of the watchroom at Radin Inten II Airport, Lampung, with the standards stipulated in the Decree of the Director General of Civil Aviation Number PR 30 of 2022 concerning the Manual of Standard CASR Part 139 Volume IV. The interview research instrument consisted of 4 instrument items, including the existing conditions of the watchroom at Radin Inten II Airport, Lampung, the impact of the current watchroom conditions, gap analysis of the existing conditions of the watchroom with the standards in PR 30 of 2022, and efforts to optimize the function of the watchroom in accordance with the standards in PR 30 of 2022.

3. DISCUSSION

This study aims to analyze the compliance of the PKP-PK unit watchroom facilities at Radin Inten II Airport, Lampung, with the standards stipulated in the Decree of the Director General of Civil Aviation Number PR 30 of 2022, and to analyze optimization efforts that have been and can be implemented to meet these standards. The research results were obtained through three data collection techniques: observation, interviews, and documentation.

Based on direct observations, it was discovered that the watchroom facilities at Radin Inten II Airport, Lampung, are currently inactive. The following table presents the results of observations of the PKP-PK Unit Watchroom at Radin Inten II Airport, Lampung, compiled based on the provisions of PR 30 of 2022.

Table 1. Observation Results

No.	*Watchroom* Components (PR 30 of 2022)	Current Conditions	Notes
1	Room free from visual obstructions to aircraft movement areas / CCTV if obstructed	*The watchroom* does not have a direct view and is not equipped with CCTV.	There is no direct visibility or CCTV system available.
2	Ventilation provided	Limited ventilation, less than optimal air circulation	Air circulation does not meet comfort standards
3	Air conditioning provided	No air conditioning (AC/not active)	There is no air conditioning
4	Soundproof room	Soundproof room	Acoustic quality does not meet requirements
5	Windows that can avoid the effects of direct exposure to the sun	No windows or special protection against light were found.	No protection from direct sunlight
6	The room lighting is sufficient	Poor lighting, dim room especially during the day	Lighting does not meet visual comfort
7	Equipped with an alarm system (crash bell)	Crash bell is not available in *watchroom*	The main alarm device is missing
8	Grid map provided	No grid map was found in the *watchroom* , but it was moved to the standby room.	Gridmap is in another space, not in the location according to function

9	Equipped with a public address system	There is no public address system available in the *watchroom* , but it has been moved to the standby room.	Public communication system is not provided, the equipment is in another room, not in the location according to function
10	Equipped with monitoring aids (voice and visual)	No monitors or other visual/audio aids are available, so the equipment is moved to a standby room.	The tool is in another room, not in the location according to its function
11	Radio communication is provided	Available in the guard room, not in the *watchroom* , the equipment is moved to the standby room	The tool is in another room, not in the location according to its function
12	Telephone provided (preferably direct telephone circuit/line)	Available in the guard room	Means of communication in another space, not at the location according to function

Interviews were conducted with three informants who were personnel from the Aviation Accident Assistance and Fire Fighting Unit (PKP-PK) at Radin Inten II Airport, Lampung, with the following interview results:

Table 2. Interview Results

No.	Indicator	Informant I	Informant II	Informant III
1	Existing condition of *the watchroom*	*The watchroom* is no longer active. The facility has been moved to a standby room that is not strategically located for monitoring.	*The watchroom* is not functioning optimally. Its location is obstructed by the terminal building, making visibility poor.	The location is not strategic, obstructed by the terminal building, hampering visual supervision and operational performance.
2	Impact	Response times to emergencies can be longer	Limited visibility hampers coordination in emergency	Delayed response to incidents such as fuel spills or

		due to suboptimal oversight.	situations, posing a risk to flight safety.	small fires due to obstructed visibility.
3	*Gap*	When compared to PR 30 of 2022, there are clear gaps. For example, the standard requires direct visibility or at least CCTV, but this is not available.	Referring to PR 30 of 2022, particularly Chapter 5, page 74, there are clearly many inconsistencies. For example, these include ventilation, communication systems, soundproofing, and personnel comfort. All of these are no longer met in the space currently in use.	Technically, the equipment in the guardroom wasn't designed to function as a command center like *a watchroom* . Therefore, if you compare each indicator in PR 30 of 2022 individually, it's safe to say that more than 50% of them haven't been met.
4	Optimization efforts	*The watchroom* function must be returned to a strategic location for direct, unhindered monitoring.	It is necessary to move the location and install CCTV with wide coverage as an alternative.	Building renovations, communication system improvements, and the addition of aids such as binoculars and radar.

To complement the observation and interview data, the researchers also documented the physical condition of the watchroom through photographs and notes. This documentation confirmed the finding that the watchroom was not currently functioning as intended. A gap analysis was then conducted. Gap analysis is an analytical method used to identify the gap between existing conditions (current conditions) and ideal conditions (standards or expected targets). The goal is to determine the extent to which a system, facility, or process meets certain standards and to determine necessary corrective measures.

Table 3. Gap Analysis

No.	**Aspect**	**Existing Conditions**	**Ideal Conditions**	**Gap**	**Recommendation**

1	Direct view of aircraft movement area / CCTV	No direct visibility or CCTV	There is a direct view of the aircraft movement area or the addition of CCTV	It is not in accordance with	Installation of a high-resolution CCTV (Closed Circuit Television) camera system that covers critical areas such as runways, aprons, taxiways, and airside parameters
2	Ventilation	Ventilation is not available	Ventilation available	It is not in accordance with	Complete ventilation system repair/installing a *turbine ventilator* on the roof of the *watchroom*
3	Air conditioner	No AC/Air Conditioner available	Adequate air conditioning	It is not in accordance with	Installation of an air conditioning system that is appropriate to the room volume capacity and operational needs.
4	Soundproof	Not soundproof	The room must be soundproof	It is not in accordance with	Renovating the ceiling and wall structures with soundproofing materials
5	Windows that can block direct sunlight	Translucent glass from exposure to sunlight	Window glass must be able to block direct sunlight.	It is not in accordance with	The use of window film with a certain level of density that still allows for outside visibility but is able to block UV rays and reduce glare.
6	Sufficient room lighting	Poor/damaged lighting	Sufficient room lighting	It is not in accordance with	Replacement and addition of lighting systems.
7	Alarm System	Crash bell is not available in *watchroom*	Alarm system / crash bell available	It is not in accordance with	Installation of crash bell alarm system in *watchroom*
8	Gridmap Provided	No grid map was found in the *watchroom* ,	Grid Map is available and clearly visible	Partially appropriate	If the *watchroom is planned* to be reactivated , the gridmap will need

		but it was moved to the standby room.			to be placed back in it, in a strategic location that is easily visible to all personnel.
9	Equipped with a public address system	There is no public address system available in the *watchroom* , but it has been moved to the standby room .	Public address system available	Partially appropriate	The recommendation that can be made is to return the public address system to the *watchroom.*
10	Equipped with monitoring tools	Monitoring aids are available, the equipment is moved to the standby room.	Equipped with monitoring aids (voice and visual)	Partially appropriate	The recommendation that can be made is updating the device with a more modern system, which can also be a long-term solution.
11	Radio communication is provided	Available in the guard room, not in the *watchroom* , the equipment is moved to the standby room	Radio communication is available in the *watchroom.*	Partially appropriate	Restoring the *watchroom* 's function as a communications control center is essential. Radio communications must be permanently integrated into the space, equipped with a main control panel, intercom headsets, and a logging system for all communications transmissions.
12	Telephone provided	Telephone available in	Telephones are available	Partially appropriate	Optimization efforts that can be made are by reinstalling

		the guard room	in the *watchroom.*		fixed-line telephone units in the *watchroom* which are connected to the airport's internal communication network and external emergency lines .

The existing watchroom at Radin Inten II Airport, Lampung, is currently not functioning as intended. Surveillance functions have been transferred to a standby room that was not specifically designed for monitoring activities. The room lacks direct visibility to the movement area due to obstruction by the terminal building. Therefore, the room cannot provide maximum support for oversight and operational safety activities.

This indicates that several aspects still do not comply with the provisions of PR 30 of 2022. The following corrective measures can be implemented to achieve compliance: The watchroom lacks direct visibility to the aircraft movement area due to obstruction by the terminal building. Functionally, the watchroom is designed to directly monitor all activities on the apron and runway[3]. This situation increases the risk of delayed response when an incident occurs. As a solution, the first step is to relocate the watchroom to a higher position and provide an open view of all aircraft movements. This will provide comprehensive, real-time surveillance and reduce reliance on information intermediaries. Second, if relocation is not possible due to structural or budgetary constraints, an alternative is to install a high-resolution closed-circuit television (CCTV) system covering critical areas such as the runway, apron, taxiway, and airside perimeter. CCTV is a video-based surveillance technology capable of recording and broadcasting live field conditions, allowing watchroom officers to monitor the entire operational area without having to be physically located in a strategic location. Amal & Nurpulaela (2023) explain that CCTV cameras are not merely passive surveillance tools but key components in airport control and security systems. The primary use of CCTV in this context is as an effective visual monitoring tool, enabling early detection of abnormal situations, such as fuel spills, small fires, perimeter violations, and suspicious vehicle or personnel movements. CCTV also acts as a documentation system that stores incident recordings as material for evaluation and incident reporting.

Ventilation facilities are also lacking in the watchroom, causing the room to feel stuffy and unhealthy. Ventilation is a crucial element in the design of operational spaces like watchrooms, as it ensures the exchange of fresh air from outside with the indoor air. The primary solution to this problem is a comprehensive improvement of the ventilation system. If natural ventilation systems such as windows or air ducts are not feasible due to soundproofing concerns, a mechanical ventilation system is recommended. One efficient option is to install a turbine ventilator on the roof of the watchroom. Turbine ventilators work by using wind energy to draw hot air from inside to the outside, thus eliminating the need for electricity and maintaining sound

insulation. The use of turbine ventilators is particularly suitable for tropical climates like Indonesia because they can reduce indoor temperatures and significantly improve air quality.

The absence of air conditioning causes high room temperatures, especially with malfunctioning ventilation, resulting in hot, stuffy conditions that are unsuitable for comfortable working conditions. The primary solution to this problem is installing an air conditioning system appropriate to the room's capacity and operational needs. The use of an inverter split AC unit is recommended because it is more energy efficient, has fast cooling performance, and can automatically maintain a stable temperature. With a suitable and well-maintained air conditioning system, the watchroom will not only be a physically suitable workspace but also support the professionalism and operational accuracy of PKP-PK personnel in carrying out their duties.

Soundproofing is also lacking, due to the lack of sound insulation on the doors, windows, and walls. One of the main causes is the severely damaged ceiling, which allows outside sounds to still be clearly audible inside. In the context of an operational space that requires high levels of concentration, this is a serious obstacle. Sounds from outside activities, such as operational vehicles, external radio communications, or even the noise of passing aircraft, can disrupt monitoring and communication in the watchroom. To address this situation, the recommended optimization step is to renovate the ceiling and walls with soundproofing materials. One recommended material is Polyethylene Terephthalate (PET) acoustic panels or acoustic foam. This material is capable of absorbing sound waves from low to high frequencies, thereby reducing sound resonance and maintaining silence in the workspace. PET panels combined with polyurethane (PU) have proven effective not only as soundproofing but also in maintaining room temperature and reducing energy costs. This material is also lightweight, durable, and easy to install on walls and ceilings. In addition to panel installation, doors and windows also need to be considered. Watchroom doors can be equipped with soundproof rubber seals or door sweeps to prevent sound from entering through the gaps under the door. If swing windows are still used, they can be replaced with fixed windows that cannot be opened, equipped with double laminated glass to simultaneously reduce external sound.

The windows used lack protective coatings such as UV-blocking window film or other thermal protection. As a result, sunlight can freely enter the room, causing glare, a significant increase in room temperature, and potential damage to electronic equipment due to excessive heat exposure. As an optimization measure, the recommended solution is the use of window film with a specific density level that still allows visibility while blocking UV rays and reducing glare. Window film with a maximum darkness level of 40% can be used on windows in operational buildings such as watchrooms. This density level is considered ideal because it minimizes the entry of excess light without impairing the visual visibility required for surveillance. By implementing this solution, the windows in the watchroom can meet occupational comfort and safety standards, support effective visual monitoring, and provide additional protection for the assets and human resources within.

The current lighting conditions in the watchroom are inadequate, as most of the indoor lamps are damaged. The watchroom, as a surveillance center, requires stable, even, and sufficiently bright lighting to allow officers to operate equipment optimally and read documents, maps, and visual displays without hindrance. As an optimization measure, replacing and upgrading the lighting system should be a priority. The watchroom is not equipped with a crash bell. The absence of this system is a serious shortcoming, considering that fast response time is crucial in the context of flight safety. The crash bell serves as a trigger signal for coordination across units, such as the PKP-PK, ATC, apron technicians, and security officers, to immediately act according to emergency procedures. To optimize its function, the procurement of an integrated crash bell system is urgently needed. This system can be connected to the control panel in the watchroom, and its alarm output is distributed to strategic points such as the fire department, ATC, and airport operations buildings. Modern crash bells can also be integrated with digital communication systems, thus providing a dual signal in the form of an alarm sound and a digital notification to the radio or monitor screen of the officer. The integration of intelligent alarm technology such as the crash bell into flight operations contributes significantly to accelerating coordination between related units. Therefore, the crash bell is not just an additional device, but a key component of the airport safety system that must be available in the watchroom.

The airport's gridmap, or sectoral map, is still available, but is currently located in the guard room instead of the watchroom. This is because the watchroom is no longer operationally used, so most of the equipment that should have been there has been moved to the guard room for continued use by officers. The gridmap serves an important function as a visual aid for identifying zones[15] and location sectors in the airport airside area, including runways, aprons, taxiways, and other important points. As an optimization effort, if the watchroom is planned to be reactivated, the gridmap needs to be placed back in it, in a strategic location that is easily visible to all personnel. In addition, to increase its effectiveness, it can be developed as an interactive digital map integrated with a real-time aircraft movement monitoring system. Thus, even though the gridmap has currently been moved to the guard room due to the watchroom's dysfunction, its placement must still consider the principles of ease of access and effectiveness in handling emergency conditions, as part of a visual information system supporting flight safety.

A public address system is available, but it is not located in the watchroom; it has been moved to a standby room. This relocation occurred because the watchroom is no longer actively used, so equipment still needed for daily operations has been moved to a room still actively used by PKP-PK personnel. Optimizations can be made by returning the public address system to the watchroom, especially if the room's function is reactivated. Furthermore, this system should be integrated with other communication devices such as crash bells, radio communications, and inter-unit intercoms, so that information delivery can be carried out simultaneously. Voice and visual monitoring aids that should be installed and operated in the watchroom have instead been moved to the guard room, following an internal decision stating that the watchroom is no longer functioning as an active control center. Optimizations that can be made include re-procurement or updating equipment with more modern systems, which can also be a

long-term solution. Systems such as video wall displays, multi-feed monitors, and noise-canceling headsets for voice monitoring can be integrated so that all movements, communications, and alerts can be monitored in a single control center.

In fact, radio communication equipment is available in personnel work areas, but its use is not centralized in the watchroom. This means that even though the equipment is physically present, the coordination and command functions of the watchroom as a communications center have not been optimally implemented. This situation creates an operational gap. When an incident or emergency occurs, communications are not integrated in a single center, but rather scattered among several work points. This has the potential to lead to miscommunication, delays in information delivery, and asynchronous decision-making among teams. As an optimization step, restoring the watchroom's function as a communications control center is imperative. Radio communication needs to be permanently integrated into the space, equipped with a main control panel, intercom headsets, and a logging system for every communication transmission. With this system, all ongoing communications can be documented and monitored in real time, which is very useful for operational evaluation and future incident tracking.Telephone facilities are not available in the watchroom at Radin Inten II Airport, Lampung. Consequently, the watchroom loses its function as an integrated control and communications center. The lack of telephones leaves officers without alternative routes if radio communications experience interference or overload, which is extremely risky in an emergency situation.

These conditions indicate a serious gap between the ideal function of the watchroom and the actual conditions on the ground. One optimization measure that can be taken is to reinstall fixed-line telephone units in the watchroom, connected to the airport's internal communications network and external emergency lines. The installed telephones should have a direct-dial feature to important units such as ATC (Air Traffic Control), other PKP-PK, security, referral hospitals, and other technical units. With adequate telephone facilities, the watchroom will again function as a redundant communications center, which is crucial for ensuring continuous coordination in various operational conditions and emergencies. Overall, the gap between the existing conditions and the ideal requirements for watchroom components is significant. The absence of most of these essential elements results in a low effectiveness of the watchroom's function as a center for monitoring and coordinating emergency situations. Therefore, comprehensive optimization measures are needed through physical improvements to the room, procurement of supporting equipment, and the systematic deployment of trained personnel. Without these improvements, the strategic function of the watchroom will not be achieved optimally, and this has the potential to lower operational safety standards at Radin Inten II Airport, Lampung.

4. CONCLUSION

The conclusion of this study is that the existing condition of the watchroom does not comply with the provisions of the Director General of Civil Aviation Regulation No. PR 30 of 2022. Of the 12 established standard components, all showed

inconsistencies in terms of visibility, ventilation, lighting, communication systems, and supporting equipment.

Efforts to optimize the watchroom's function require a comprehensive approach, as this space plays a strategic role as a monitoring and coordination center for emergency response at the airport. Revitalizing the space and adjusting technical facilities are key steps, given that the existing condition no longer meets the standards stipulated in PR 30 of 2022, both in terms of visibility, communication systems, and other supporting facilities.

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