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ANALYSIS OF THE IMPLEMENTATION OF THE COLD WORK PERMIT SYSTEM IN THE ABSORBER COLUMN DHU UNIT AT PT Z

Rezky Anugrah P[1], Adinda Dona P. H[2], Muhammad Fatih H[3], Nur Sadrina D[4]
Teknik Pengolahan Migas, PEM Akamigas
Email: rizkyanugrahpratama707@gmail.com

Abstract

This research analyzes the implementation of the Cold Work Permit system in the Dehydration Unit (DHU) of the absorber column at PT Z. This system aims to ensure work safety in high-risk activities, such as maintenance and cleaning that are associated with exposure to harmful gases, noise, and potential ergonomic hazards. These risks can be minimized through the implementation of the Safe Work Permit (SIKA) which serves as a risk control document and a medium for coordination between linked parties. This research uses a descriptive qualitative approach with field observation, interviews, and document analysis. The results of the research show that the cold work permit system at PT Z has been implemented quite well. Maintenance work such as replacement and cleaning of stack arresters in DHU units complies with occupational safety standards that link the measurement of hazardous gases, such as H_2S, CH_4 and oxygen. The permissible gas content is within safe limits, which is a minimum oxygen content of 19.5%, an optimal H_2S of 1 ppm, and CH_4 at a LEL value of 0%. However, carbon monoxide (CO) measurements have not been carried out entirely, which could increase the risk of harm to workers. Inadequate monitoring of CO can pose a risk of poisoning, shortness of breath, and even death if the concentration exceeds 25 ppm. The positive impact of the implementation of this system is an increase in work safety and a reduction in the risk of accidents in the DHU unit. However, the research also found that additional training is needed to improve workers' understanding of the importance of CO gas monitoring and the prevention of ergonomic hazards. An increase in work procedures through the improvement of SIKA documents and more intensive coordination between linked parties is also recommended.

Keywords: Cold Work Permit, Dehydration Unit (DHU), Job Safety Analysis (JSA), Occupational Safety and Health (K3), Safe Work Permit (SIKA)

Introduction

Every activity or work process has a potential risk of failure that can arise, either due to immature planning, inaccurate implementation, or external aspects such as weather or natural disasters. One of the forms of this risk is a work accident. Although the accident may occur on a small scale, the impact of the loss caused can be enormous. Therefore, prevention of work accidents or potential accidents must be carried out early, with efforts to eliminate or at least reduce their impact to minimize the dangers that may occur (Darmayani, S., 2023).

Workplace hazards can occur when environmental conditions cause injury, illness, or even death. These hazards can come from various aspects, including equipment, hazardous materials, production processes, and work procedures. Therefore, hazard risk management is very meaningful, which can be achieved by implementing the provisions and standards of Occupational Safety and Health (K3). K3 in the workplace is a condition that must be applied through various efforts based on scientific knowledge and thinking to protect the workforce, and comply with accident prevention technology in accordance with applicable regulations and laws (Marleno, Tjendani, & Bon, 2019).

The International Labour Organization (Kaushal, 2013) says that the number of workplace accidents reaches more than 250 million each year and more than 160 million workers suffer from workplace hazards. Around 1.2 million workers die as a result of accidents and illnesses at work. According to the Data and Information Center of the Ministry of Health of the Republic of Indonesia (Latief & Hasbi, 2019) on the occupational health situation in 2015, the number of cases of occupational accidents that occurred between 2011-2014 was 92,453 cases with the highest number of cases occurring in 2013 was 35,917 cases. Meanwhile, the data for cases of occupational diseases between 2011-2014 were 57,929 cases in 2011, 60,322 cases in 2012, 97,144 cases in 2013, and 40,694 cases in 2014. Then, according to Jahangiri et al., based on the investigations carried out on the industries that experienced accidents, human error played a major role in 90% of accidents in the nuclear industry, 80% in the chemical industry, 75% in the maritime industry, and 70% in the aviation industry. From these data, it can be concluded that the occupational health situation in Indonesia is still not good (Jahangiri, Hoboubi, Rostamabadi, Keshavarzi, & Hosseini, 2016).

One of the activities at PT Z is the elimination of impuritis in the form of H2O in natural gas using a *Dehydration Unit* (DHU). *Dehydration Unit* (DHU) is a system used to remove water content from natural gas or hydrocarbon liquids to meet product specifications and avoid operational problems such as hydration, corrosion, or blockages in pipes and equipment. In DHU, one of the main equipment is the absorber column (Harmianyanto, 2013).

In the absorber column, *the stack arrester* is installed in the exhaust gas vent line to avoid back-up that can endanger the system or other equipment. *Stack arrester* is a safety device used to avoid the spread of fire that may occur in industrial process systems, especially those involving flammable materials. Therefore, the *stack arrester* installed at the top of the absorber column functions to protect the system from the risk of explosion or fire that has the potential to occur due to external flames or unstable system conditions (Barfield, 2018).

Replacement and cleaning of stack *arrester* on absorber columns is an example of work that requires very careful procedures because it involves direct risks to operational safety, such as exposure to toxic gases or working at heights and tight spaces. Therefore, this work must be carried out by complying with strict procedures and implementing the right safety system, including the use of a Safe Work Permit (SIKA). SIKA is critical in this type of work to ensure that all potential risks have been identified and controlled before work begins. Not only that, the efficient application of Occupational Safety and Health (K3) principles is also needed to avoid accidents, defects, and deaths due to work accidents. By integrating good OSH risk control, it is hoped that workers can maintain maximum physical endurance and health, and ensure that work is carried out safely and under control (PT. Pertamina, 2010).

Therefore, this activity requires careful planning and strict security procedures. One of the important steps that must be taken is the issuance of a Work Permit. According to PT. Pertamina, a work permit is a document or form used to control potential hazards in a job as well as a medium of communication and coordination related to the HSSE (*Health, Safety, Security, Environment*) aspect between various levels of management, supervisors, workers, and work implementers. Sourced from Syakhroni's comments, the safe work permit system is a mandatory procedure that must be accompanied by all parties participating in the implementation of certain jobs (Nareshwari & Paskarini, 2018).

The Safe Work Permit (SIKA) Guidelines aim to assist supervisors in carrying out supervisory duties and ensuring that work implementers can carry out their work safely. These guidelines are applied to various types of work such as maintenance, repair of equipment and facilities, and construction activities, to ensure that work is carried out safely and controlled. A Comfortable Work Permit (SIKA) must be issued prior to commencement of certain work, which includes, but is not limited to, maintenance, inspection, construction, modification, equipment cleaning, work that falls under the *Life Saving Rules* (e.g. entering confined spaces, controlling, working at height, lifting, etc.), irregular work in supporting facilities, residential zones, or in waters within 100 meters of the limit jetty/SPM. Not only that, SIKA is also needed for work carried out by third parties in facilities located in the zone of the operating unit that is still the responsibility of the unit's top leadership, and routine work that does not have clear Work Procedures or Work Procedures (Hasheminasab, Kharrazi, Gholipour, Zolfani, & Streimikiene, 2024).

Especially in the context of Cold Work Permits. This permit controls and supervises work carried out in high-risk areas, such as those involving equipment that has been in operation for a long time, as well as environmental conditions that have the potential to contain harmful gases. This permit authorizes the execution of cleaning or replacement of *stack arresters* by ensuring that all safety measures are taken to avoid accidents, fires or explosions. This procedure often involves some steps such as emptying and ventilating the work area, checking safety equipment, and ensuring that workers are protected by appropriate Personal Protective Equipment (PPE) (Al-Dhuraibi, Y., Paraiso, F., Djarallah, N., & Merle, 2020)

Research Methods

This research method uses a descriptive qualitative approach that involves field observations, interviews, and document analysis to evaluate the implementation of

Occupational Safety and Health (K3) in the replacement and cleaning *of stack arresters* at the *Dehydration Unit* (DHU) PT Z. Field observation is carried out directly at the work site to observe the implementation of work procedures, including the implementation of the Safe Work Permit (SIKA), the use of Personal Protective Equipment (PPE), as well as risk control measures such as emptying work zones and checking environmental conditions. Not only that, interviews were conducted with supervisors, technicians, and workers who participated to explore information about work procedures, obstacles experienced, and the effectiveness of the implementation of K3, especially related to the use of SIKA(Hámor, Bódis, & Hámor-Vidó, 2021).

Document analysis was carried out to explore SIKA's guidelines, historical information on work accidents or near *miss* events, safety inspection reports, and standard operating procedures (SOPs) related to replacement and cleaning *of the arrester stack*. From the results of observations, interviews, and document analysis, risk capabilities were identified using a risk matrix that measures the severity and likelihood of events (*likelihood*). Next, an assessment of the K3 system is carried out to take into account compliance with safety procedures, the effectiveness of the use of SIKA, and the readiness of workers to face hazards at the work site (Asher, Dita, & Zen, 2018).

The results of this identification and assessment are used to develop recommendations aimed at improving occupational safety, such as improving work procedures, optimizing the implementation of SIKA, and additional training for workers and supervisors. With this procedure, it is hoped that research can contribute to the increase in the implementation of K3 in high-risk work at PT Z, especially in the replacement and cleaning *of stack arresters* at DHU (Prabumulih, 2017).

Results and Discussion

In one of the units that became the object of observation, the DHU unit had implemented a cold work permit system. In this DHU unit, *the work permit* used is a *work permit* for cold work. There are also some hazards in the DHU unit sourced from the *work permit* that are observed, including pressure, fire, electricity, noise, biological hazards and ergonomic hazards. Workers who work in this unit practice *work permits* from the beginning of application, to its implementation.

Identification of Related Parties in the Making of Safe Work Permits (SIKA)

A universal work permit is applied to work programs that meet the conditions of work such as work that involves more than one contractor, or work that consists of several types of work. In making a Safe Work Permit at PT Z, the involvement of various parties is needed to ensure security and safety from work. The permit applicant wants to submit an application for a work permit to the permit holder or HSE *Officer*. The task of the permit holder or the HSE *officer* himself is to approve the SIKA from the applicant so that the work can begin. Not only that, the task is also to evaluate the completeness of SIKA based on the safety aspect of the work to be done.

Types of Jobs That Require a Cold Work Permit

The implementation of the Cold Work Permit System prioritizes control measures against factors that can criticize worker safety, such as gas testing, temperature control, and protection against the potential hazards of flammable liquids. All work zones related to the maintenance or cleaning of DHU equipment, including places that have the potential to contain gas residues or hazardous liquids, require the implementation of a cold work permit system to ensure operational safety and reduce the risk of work accidents.

The Cold Work Permit at PT Z that is observed is a work permit where the work being done does not produce a heat source or rather a spark that has the potential to trigger a fire. Even though the work done does not create heat, there is still a risk of danger and it is necessary to carry out hazard control with SIKA. Some of the jobs that require cold SIKA are generally jobs that are done without the use of heat tools or welding. For example, such as inspection, cleaning, measurement, material transportation and so on.

Analysis of Safe Work Permit (SIKA) Procedures for Cold Work

One of the cold work permit systems implemented at PT Z is *a work permit*. *Work permits* are called Foreign Worker Work Permits (IKTA). There is also some information related to the use *of work permits* at PT Z sourced from observations made by researchers.

The procedure for a Safe Work Permit (SIKA) for cold work begins with a work supervisor who fills out the SIKA form. Permit applicants are required to attach HSE *plans* and JSA according to the type of work and the risks. If the work involves isolation or lifting activities, the plan must be included in the *Lifting Operation Plan form*.
After that, the permit applicant signs the SIKA form and sends it to the permittee. The SIKA form and its attachments are to be inspected by the permittee, as well as the condition of the workplace to ensure that risk control measures have been implemented appropriately. If all requirements have been met, the Safe Work Permit will be signed and returned to the permit requester.

After obtaining the signature of the permit holder, the work permit is returned to the lead permit requester to be distributed in accordance with SIKA's distribution flow procedures. The Safe Work Permit and JSA are then distributed to permit holders, permit applicants, HSSEs, and permit grantors, in accordance with the color that has been set.

Monitoring is carried out every day throughout the work and is carried out by the permittee. The closure of the work permit is carried out after the work ends. The permit applicant and the permit holder jointly submit an application for the closure of the Safe Work Permit to the permitter. When the work permit is closed, the permitter wants to ensure that the work site is in a safe state. After ensuring the safety of the site, the permit applicant and permit holder will sign a column stating that the work has ended on the Safe Work Permit form. Next, the licensor gives approval to close the permit by signing the permission closure column. The signed Work Permit Letter is to be prepared in copy and distributed to permit applicants and HSSE staff.

Based on the results of the observations made, SIKA is equipped with a *Job Safety Analysis* (JSA) made by permit applicants and permit holders and has been *reviewed* by the permitter. For work with medium and high risk categories carried out by contractors, the SIKA application must be completed with a K3LL plan adjustment document (*bridging document*), JSA, replacement application form F- 001/B-077/A2/EP3200/2019- S9 (if needed) and other documents in accordance with the work performed.

Analysis of the Implementation of the Cold Work Permit System

Sourced from the work system or *work permit* found in PT Z, the DHU unit uses *a cold* work permit.*The work permit* on this DHU unit is listed on the *special work permit*. In this DHU unit, gas checks with gas composition that needs to be tested, including the amount of oxygen, H_{2S} and *flamable gas* or CH_4. The minimum amount of oxygen allowed in this DHU unit is at least 19.5%. For the optimal amount of H_{2S} is 1 ppm or 1 per *million* units. As for *the flamable methane gas* with a LEL value of 0%. According to the observation results, the three gases measured have met the maximum and minimum permissible limits.

This oxygen content measurement needs to be done to ascertain the oxygen content present in the DHU unit. When the oxygen content is less than the minimum content, later it can risk causing dangers such as headaches, shortness of breath to loss of consciousness or even death. This danger will later pose a risk to workers who want to work.

Measurement of sulfur content or H_{2S} is carried out to ensure that the DHU unit area does not have a lot of sulfur, especially H_{2S}. This is due to the fact that$_{H2S \text{ is very}}$ risky when it enters the human body. H_{2S} itself is *toxic* or toxic, flammable and also produces odors. When humans are exposed to $_{H2S}$ continuously, they will experience poisoning. When they have experienced poisoning, humans who are exposed to H2S can experience central nervous system paralysis in the brain that controls the lungs, acid mixed in the lungs can attack blood vessels so that lung swelling occurs.

On the *work permit* of this DHU unit, there is a measurement of the amount of CO in the DHU unit. However, based on the information obtained, the measurement of the amount of CO was not carried out. Risk of harm may occur when this measurement is not taken. *Carbon Monoxide* gas itself can be more easily bound to hemoglobin or blood cells when entering through respiration. The optimal limit of CO itself is located at 25 ppm when viewed on work *permits*. The risk of danger that can arise when not checked and suspected to have a content of more than 25 ppm includes poisoning, headaches, shortness of breath, and can face loss of consciousness. When the concentration of CO is greater than 25 ppm, the risk of danger that can occur is death.

Sourced from the *work permit* obtained at this DHU unit, there is one of the jobs that is done is the replacement and cleaning *of* the DHU stack. In this work, it is necessary to use *a Cold Work Permit*. This *permit* is submitted by the permit applicant and will later be *reviewed* by the permit holder. On the *permit* obtained, it already has a permit to be used with the masses valid for 7 days with a total of 4 members. The validity of this *work permit* can be extended according to the work being done. The proposed extension must have been approved by the permit holder in order to continue its work.

In accordance with *this work permit*, there are some risks in replacing and cleaning the DHU stack even though it has complied with existing safety. Some of the hazard identification has been listed on the *DHU unit work permit*, including biological hazards, weather, noise, heat temperatures more than 27°C, equipment removal, fall hazards, pinch hazards, *toxic* poisoning, and ergonomic hazards. This danger can be minimized by using PPE, complete work equipment and supervision from the HSE.

Biological hazards that can be identified from microorganisms such as bacteria and viruses found in the DHU unit area. Not only that, there are other biology such as animals that can endanger workers in the DHU unit. This danger can be minimized by wearing PPE and carrying out *cleaning* in the DHU unit area. For the danger of wild animals, it can be prevented by installing several boundaries or fences that are difficult for wild animals to pass near the refinery [15].

Weather is an aspect that cannot be controlled but its impact can be minimized. The danger of this weather is such that during a storm, it is possible to be struck by lightning or hit by strong winds. This danger can be minimized by using lightning rods on buildings and by building using strong materials. The danger of noise will always be present in every industry because of the machine that runs continuously. The danger of this noise can be minimized by using ear protection such as *earmuff* or *earplugs*.

Ergonomic hazards may occur due to the work done is replacement and cleaning. These ergonomic hazards include the dangers of moving equipment, lifting and scaffolding. This ergonomic hazard can be minimized by using auxiliary equipment such as *lifting* equipment and *moving machines*.

Based on the results of the research, it is recommended that PT Z improve the implementation of the cold work permit system through some strategic steps. First, it is necessary to increase *regular monitoring* of carbon monoxide (CO) gas in the *Dehydration Unit* (DHU). Consistent and standard CO measurements will help avoid the risk of poisoning, shortness of breath, and death from exposure to this risky gas. Second, additional training for workers and supervisors is urgently needed, especially related to the identification and mitigation of risks in high-risk jobs. This training must include the use of appropriate personal protective equipment (PPE), ergonomic hazard control procedures, and emergency action in the event of a work accident.

Not only that, the improvement of the Safe Work Permit (SIKA) document is also recommended to increase efficiency and usefulness in managing risks. This document should be supplemented with more detailed guidance on the control of risky gases, heavy equipment lifting procedures, and other mitigation measures relevant to the working conditions in the field. Furthermore, supervision from the *Health, Safety, and Environment* (HSE) needs to be improved, most importantly in ensuring compliance with applicable safety procedures and standards.

Finally, closer cooperation between management teams, workers, and contractors is essential to create a better workplace safety culture. Integrated communication will minimize the potential for miscommunication that can increase the risk of accidents. By implementing these steps, it is hoped that the implementation of the cold work permit system at PT Z can continue to be improved, so that work safety and operational sustainability can be more guaranteed.

Conclusion

The implementation of the Cold Work Permit system in the *Dehydration Unit* (DHU) of PT Z's absorber column has been carried out adequately and in accordance with work safety guidelines. This system plays an important role in managing risks related to exposure to risky gases, ergonomic hazards, and other potential accidents. Work procedures that link Safe Work Permits (SIKA) are efficient in minimizing risks through the control of gases such as oxygen, H_2S, and CH_4 that have met safe limits. However, there are weaknesses in *carbon* monoxide (CO) gas monitoring, which need to be improved to avoid the risk of poisoning.

The results of the research show that the work procedures in the DHU unit are in accordance with the standards, with mitigation measures such as the use of Personal Protective Equipment (PPE), strict supervision, and daily monitoring. Not only that, the identification of hazards such as noise, extreme weather, and ergonomic risks has been carried out evenly. However, CO measurements that have not been fully implemented are an attention for future changes.

The impact of the implementation of this system is an increase in work safety, shrinking the risk of accidents, and creating a safer work area for workers. This system also helps ensure operations by reducing obstacles due to accidents or unsafe working conditions. Such additional training, improvement of procedural documents, and increased CO *gas monitoring* are expected to further maximize the implementation of this system.

With a more optimal implementation, this cold work permit system can continue to support the creation of occupational safety and health, avoid accidents, and improve operational efficiency and sustainability in high-risk work areas such as DHU units.

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