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GRAND ATYASA PALEMBANG

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The Work Place Initiative: Health, Safety and Wellbeing Regarding COVID-19

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The Work Place Initiative: Health, Safety and Wellbeing Regarding COVID-19

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PREFACE

On behalf of the organizing committee, I am delighted to welcome you to the 3nd Sriwijaya International Conference on public Health (SICPH 2021) during 21th october 2021 at Palembang South Sumatera, Indonesia. The SICPH 2021 is international conference organized by Faculty of Public Health, Sriwijaya University (UNSRI). I would like to extend my warmest welcome to all the participant of The SICPH 2021 under the theme ***"The Impact of Climate Change on Infectious Disease Transmission".***

The SICPH 2021 consists of keynote sessions from well known expert speakers in the field of public health, and academic paper sessions (oral presentations) who are coming from several region. This conference seeks to bring together academics, public health professionals, researchers, scientists, students and health stakeholders from a wide range of disciplines to present their latest research experience and further development in all areas of public health. We hoped that this conference will be usefull platform for researchers to present their finding in the areas on multidisciplinary realted to public health and health system issues.

This conference will provide opportunities to exchange ideas, knowledge, and development of the latest research among the participants. We will publish the paper as output from the SICPH 2021 in proceeding book with ISBN and selected paper will be published in Jurnal ilmu kesehatan masyarakat- SINTA 3 (a nationally-accredited journal). The SICPH 2021 is being attended by about 50 participants. I hope you enjoy the conference.

With regard to considerable conference agenda, we greatly appreciate any support and sponshorship derived from any govermental as well as private institutions for the success of the conference. Great appreciation is also handed to organizing committe of the conference for any voluntarily effort that bring to the succes of the conference.

The conference committee expresses its gratitude towards all the keynote speakers, authors, reviewers, and participanst for the great contribution to enssure the succes of this event. Finnally, I sincerely thank all the members of the organizing committee who have worked hard to prepare this conference.

Palembang, October 2021

Chair,

Anita Camelia, SKM., MKKK.

PREFACE

First of all, let us thank God, the Almighty, who has given His grace and guidance so that the 3rd Sriwijaya International Conference of Public Health (SICPH) with the theme of The Workplace Initiative: Health, Safety and Wellbeing Regarding Covid:19 can be held successfully. I welcome all of you to this seminar which has received great attention not only from university, but also other communities to submit papers to be presented in this seminar. I express my highest gratitude and appreciation the presenters.

The conference is divided in two session, the first session is speeches and the second session is round table discussion. In the first session, the invited keynote speakers were Prof. Dr. Tan Malaka, MOH, DrPH, SpOk, HIU (A Professor from Medical Faculty Universitas Sriwijaya), Prof. Dr. Retneswari Masilamani (University Tunku Abdul Rahman, Malaysia), Prof.Dr.Joselito L. Gapaz MD, M.PH(University of the Philippines) and Prof. Dr Tjandra Yoga Aditama, MHA,DTM&H, DTCE,SpP(C).FIRS (Professor from Griffith University, Australia)

Of course, this conference activity would not have succeeded without the support of all parties involved, as well as the presence of all participants in all regions in Indonesia and internationally. I especially thank to all the organizing committees for their hard work, perseverance, and patience in preparing and organizing this conference so that it can go well, smoothly and successfully.

Finally, through this conference let us extend the network and cooperation among all stakeholders of the public health sector, especially in Indonesia and in the world in general, to build a better public health world in Indonesia

Thank you for participating in this conference.

Dean of Public Health Faculty,

Universitas Sriwijaya

Dr. Misnaniarti, S.K.M, M.K.M

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HAZARD IMPLEMENTATION AND OPERABILITY STUDY (HAZOPS) IN THE PROCESS OF RISK ANALYSIS ON BOILER UNIT PEMBANGKIT TENAGA GAS DAN UAP (PLTGU) KERAMASAN PALEMBANG

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ABSTRACT

Background: *PLTGU Keramasan is a company engaged in electricity in South Sumatra with a total capacity of 1.082.12 MW. PLTGU Keramasan has an important component in power plant that is boiler, turbine and condenser. Boiler is part of PLTGU system as a water heater to drive turbines that generate electricity. Failure of the boiler may occur at any time leading to the cessation of the generating unit, so risk analysis is needed to identify risk assessment and risk evaluation with the Hazard and Operability Study (HAZOPS) method. The method of hazard identification and HAZOPS risk is syestematically review the process of the system and to determine the deviations that may lead to undesirable events.*
Method: *This research use qualitative design and presentation of data in the form of HAZOPS worksheet table.*
Result: *The result of risk analysis using HAZOPS method in PLTGU boiler is high and extreme risk on each node causing leaking boiler and fire.*
Conclusion: *It can be concluded for tackling hazards are routine calibration of the transmitter, redundant transmitter, instalation of pressure alarm and emergency responce plan (ERP) on boiler area.*

Keywords: *HAZOPS, Boiler, PLTGU*

ABSTRAK

Latar Belakang: PLTGU Keramasan merupakan perusahaan yang bergerak dalam bidang ketenagalistrikan di Sumatera Selatan, dengan total kapasitas 1.082,12 MW. PLTGU Keramasan memiliki komponen penting dalam pembangkit listrik yaitu boiler, turbin dan kondensor. Boiler merupakan bagian dari sistem PLTGU sebagai pemanas air untuk menggerakkan turbin yang menghasilkan listrik. Kegagalan pada boiler dapat terjadi kapan saja yang menyebabkan terhentinya unit pembangkit, sehingga perlu dilakukan analisis risiko untuk mengidentifikasi, menilai risiko dan evaluasi risiko dengan metode *Hazard and operability Study* (HAZOPS). Metode identifikasi bahaya dan risiko HAZOPS adalah meninjau proses pada sistem secara sistematis dan mampu menentukan penyimpangan yang dapat mendorong kearah kejadian tidak diinginkan.
Metode: Penelitian ini menggunakan desain kualitatif serta penyajian data dalam bentuk tabel *worksheet* HAZOPS.
Hasil Penelitian: Hasil analisis risiko menggunakan metode HAZOPS pada boiler PLTGU adalah bernilai *high* dan *extreme risk* pada setiap node yang menyebabkan boiler bocor dan kebakaran.
Kesimpulan: Dapat disimpulkan untuk menanggulangi bahaya adalah melakukan kalibrasi rutin pada transmitter, penambahan redundant transmitter, pemasangan pressure alarm dan pembuatan *emergency responce plan* (ERP) pada area boiler.

Kata Kunci: HAZOPS, Boiler, PLTGU

INTRODUCTION

Electrical energy is a basic need that can not be eliminated because each aspect can not be separated from the use of electric energy, electric energy if not then all the equipment and activities that depend on electrical energy does not have a high economic value. Consumption of electric energy in Indonesia each year continues to increase with national economic growth. [1]

Based on statistical data of electricity by 2016, an increase in demand for electricity to grow 6.5% year until 2020. The installed capacity of power plants in Indonesia until the end of 2016 up to 4.6% from the year 2015 to reach 55528.10 MW by the number of subscribers reached 61.167.980 customers, one power plant in South Sumatra is in charge of generating sector Keramasan overshadow all electricity in South Sumatra with a total installed capacity of 1082.12 MW by the number reaches 940.514 subscribers.

Keramasan plant has two units: Steam Power (power plant) units 1 and Power Gas (power plant) unit 2, which uses the system Combine Cycle, where exhaust (exhaust gas) power plant is used for heating water in the boiler to play steam turbine. The working principle is PLTGU Keramasan hot exhaust gases from the turbine to the relatively high temperatures used to heat water in the boiler, steam production will be used to propel the blades of the turbine generator so that electricity can be generated. PLTGU Keramasan have important components in power plants is the boiler, steam turbine and condenser.

The boiler is one of the important components in power plant construction Keramasan which consists of pipes that have a very important role, because in the boiler water is heating and distributed to produce steam which will drive the turbine.[2] On High Pressure Heater frequent breakdowns that cause leaks in the boiler, steam production is insufficient, demin water demand increases so that forced power plant unit will not operate. The leak occurred due to corrosion on water tube wall due to oxidation caused by oxygen bond with metal, deposition feed water or other minerals. Failures that occur during the operation will have a negative impact on the operator and the environment plant.[3]

Failure in work processes can not be known when it will happen and how many losses, risk management needs to be done to identify, quantify the risk assessment and risk control needs to be done to establish a risk management system that is intact. Proper risk management and optimal expected to anticipate as early as possible potential failure Possible risks facing the company.4 According to OHSAS 2010 to 2016 numbers work accidents in the world in the power generation industry is high, there were 98.711 cases of occupational accidents with 2,191 workers died, and raises a number of 6667 people permanently disabled.5 Data of occupational accidents in Indonesia at a power plant is high in the range of 57% per year based on data from the Manpower Ministry in 2012 until 2016. [6]

Accident prevention in the power plant can be determined by the risk management methods of identifying a hazard such as FTA (Faulth Tree Analysis), FMEA (Failure Modes and Effects

Analysis), HAZOPS (Hazard and Operability Study) and others. Each method for identifying hazards have their advantages and disadvantages so that how the company's efforts to perform optimally hazard identification.[8] Hazard and Operability Study (HAZOPS) is a method of identification and analysis of hazards on a systematic process to determine whether the irregularities in the process can encourage unwanted accidents. 8 According to research Health and Safety Executive (HSE) results HAZOPS method use in industrial plants electricity capable identify the hazards and risks involved in the operation of the system reached 89% in identifying hazards and risk of early development of the design to the operation of the process. The purpose of this research is to apply the methods HAZOPS on Keramasan power plant boiler.

METHOD

This study is a qualitative study conducted in PLTGU Keramasan, Kertapati Palembang. The informants are supervisor operation and maintenance, safety supervisor as a key informant after informant support coming from the boiler technician. The data used in this study are primary data obtained from interviews and identification of the dangers of using worksheet HAZOPS while secondary data is done by the study of documents belonging to PLTGU Keramasan, literature studies, and performing data processing to be examined. Data obtained from the study will be presented in tabular form the results and analysis of worksheet HAZOPS and equipped with a matrix of the interview.

RESULT

Table 1
Results of Hazard Identification and Risk in Boiler Area PLTGU Keramasan Activities

No	Activities	Hazard Sources	Potential Hazard
1.	Boiler repair spare parts (pumps, valves, pipes and drums associated with steam and water cycle)	Chemical : NO, NH3, H2S, Oxidizing Biocide, Corrosion Inhibitor, Scale	Absorb the skin and inhalation
		Manual job such as lifting /lowering inpinger box, vacuum pump, ice box	Muscle disorders when the position is not secure, slip stairs, tripped, hit tool
		Boiler Area	Radiation heat, noise, explosion, leakage, heat stress, exposure to the, gas and steam
		Machine	Radiation heat, gas leaks, welding sparks, hot water jets
2.	Auxilary do cleaning filter Cooling Water System (ACWP)	Stick heat (replacement filter, measure temperature and pressure)	Contact with hot object, the eyes exposed to dust, respirable dust and hot gas
		Rain and Lightning	Rain and lightning
3.	Perform maintenance and repair of motor pump	Boiler Area	Inhalation of dust and gas, heat stress, contact with hot objects, heat radiation,

		explosions, noise, leakage
	electricity	Shock

Based on the results of hazard identification in Table 1, there are several potential hazards to the power plant boiler Keramasan include the use of chemicals are inhaled, chemicals dripping with skin, disorders of the muscles, slipped, tripped, contact with hot objects, dust or gas inhalation, heat stress, lightning, radiation heat, sparks welding, spraying hot water, shock, explosion, leakage, noise and others.

Table 2
Results of Risk Assessment in Boilers PLTGU Keramasan

No	Component	Parameter	Guide Word	Deviation	Concequence	Safeguard	L	C	R	Recomendation
1.	*Superheater*									
50HAH51CT001		Temperature	Low High More	*Low Temperature* *High Temperature* *More Temperature*	Effect on the steam turbine when the set is not accordance with the set control	Visual inspection	A	2	H	Check temperature control
50LAE11AA101		Flow	Less More	*Less Flow* *More Flow*	leakage occurs when the pressure exceeds the limit and the water supply is impeded		A	2	H	Routine inspection in one week supply of water, check for leaks pipe.
50HAH71CT902		Flow	Less More	*Less Flow* *More Flow*	Corrosion of pipes and valves and leaking seals		D	3	M	Memperbaiki pipa yang korosi
50LBA10CP001		Pressure	High More	*High Pressure* *More Pressure*	Can damage to the HP turbine blade with a high flow / exceeds the set		E	3	M	Doing routine and periodic maintenance and calibration
50LBA30CF901		Temperature	Low High More	*Low Temperature* *High Temperature* *More Temperature*	BFP leaks at discharge and cause fire		B	4	E	installation at least 2 alarm on discharge BFB
50LBA30CP901		Flow	Less More	*Less Flow* *More Flow*	corrosion that causes leaks		A	2	H	Routine inspection on pipeline corrosion, rust, and leaks
2.	Desuperheater									

50LBC11CT 001	Temperat ure	Low High More	*Low Temperature High Temperature More Temperature*	affect the vapor that will enter into the turbine	Safety valve dan periodi c manite nance	D	2	L	temperature control once every hour
50LAF11AA 101	Flow	Less More	*Less Flow More Flow*	Corrosion of pipes and work uninterrupted suction valve		D	3	M	Perform routine inspections on the pipe and valve unit
50HAJ11CT 901	Temperat ure	Low High More	*Low Temperature High Temperature More Temperature*	water supply hampered if the temperature is too low		A	2	H	Perform temperature control once every hour
50HAJ12CT 901	Pressure	High More	*High Pressure More Pressure*	superhead steam flowing early when the flow exceeded the limit		B	2	H	Perform temperature control once every hour
3.	Preheater								
50LAC40CF 901	Pressure	*High More*	*High Pressure More Pressure*	leakage	Perawa tan rutin	B	3	H	Fix the leak
50LAB40CT 002	Flow	*Less More*	*Less flow More flow*	Suction valve works got interupted on CP		D	4	H	routine inspection on the suction valve
50LAB40CP 001	Temperat ure	*Low High More*	*Low Temperature High Temperature More Temperature*	Corrosion of pipes		C	2	M	Fix the corrosion
50LAB40AB 101	Reaction	*Less More*	*Less Reaction More Reaction*	The injection pump will leak and possible fire		A	3	E	Installation at least 2 alarm
4.	Economizer								
50LAC40CF 901	Temperat ure	*Low High More*	*Low Temperature High Temperature High Temperature*	Water supply hampered	Perawa tan rutin	B	3	H	Note the temperature
50LAB40CT 002	Pressure	*High More*	*High Pressure More Pressure*	The pump does not work optimally and occurs barriers		D	4	H	Checking stariner regularly
50LAB40CP 001	Flow	*Less More*	*Less Flow More Flow*	leak on HP ECO suction to HP drum		C	4	E	Fix the leak
50LAB40AB	Instruent	*Part of*	*Part of*	BFP charged to		A	4	E	Fix

101	ation		*Instruentation*	the HP drum flow decreased / stopped					discharge control and fix the minimum flow control

Based on table 2, the results of the risk assessment on power plant boiler superheater, desuperheater, preheater and economizer is there are some instruments which have a value high risk and extreme risk. The highest risk is a component keampat economizer, by category high risk on isntrumen 50LAC40CF901 and 50LAB40CT002 which causes the pump is inhibited and instruments by category extreme risk instruments 50LAB40AB101 and 50LAB40CP001 which could cause a fire due to HP drum decreased.

DISCUSSION

Hazard Identification and Risk On Boilers PLTGU Keramasan

Failure of the boiler can occur at any time, so when doing repairs boilers and boiler operating there are sources of potential hazards to workers and the boiler so it is necessary to identify hazards. [9] Maintenance activities Spare Part workers set up a tool used to repair or replace spare part boilers such as pumps, valves, pipes and drums associated with steam and water cycle, the potential danger to this activity one of which is when doing maintenance boiler can not be separated from the chemicals used, such as chemicals scale and biocide used to reduce corrosion and corrosion in boiler pipe, if the workers are not careful to inject chemicals in the chemical reaction will occur pipe water heater, causing an explosion or fire when perform maintenance. Based on previous studies, there was an explosion at the power plant when the officer PCU Cilimis do chemical injection The instrument valve LBQ80CT001.[10]

Construction of power plant boiler Keramasan very narrow and limited to workers who do the repairs, so the potential danger of falling, hit, tripping and slipping will occur if the worker does not act safely. Based on previous research in Cilegon power plant boiler attendant while doing welding pipes boiler, which causes the slip officer disharge control valve spinning parameters resulting in decreased flow at the valve. [11] Officers who do the cleaning filter Auxilary Cooling Water System (ACWP) to anticipate blockage in ACWP and make sure no foreign objects that enter the water in the boiler heating pipes, ACWP workers have the potential danger when work is contact with a hot object when the clerk to replace the filter after stick put stack flue boiler with a very high temperature (550 ° C). It can cause burns and inhalation of hot gas, to minimize the danger of the officer must use personal protective equipment in the form of bodyharnes safety, safety goggles, safety shoes, safety helmet, gloves and protective clothing when doing work in the area of the boiler, according to a study Ayu 2012, an explosion on the pipeline MAA22FG161 due time to replace the filter ACWP officer did not use a mask so that the workers

exposure to the gas boiler and unwittingly dropped officer stack which causes blockage in the flue gas boiler. [12]

The potential of a lightning strike occurs when a worker fell suddenly and has not completed his work on the boiler chimney. The potential of this highly fatal danger, workers can be seriously injured and megakibatkan death. If the officers are still doing work on the boiler chimney with rainy conditions then the officer should immediately descend. Based on research on power generation Oberhausen, officers improve boiler flue gas when it rains, before stuck was added to the boiler flue officer struck by lightning which caused an explosion in the boiler flue gases and extinguish all power plants in Oberhausen.[13]

Workers who perform maintenance and repair of motor pengerak pump in the boiler area of the potential accidents, the potential danger is noisy, heat radiation, explosions, and exposure to the gas. Potential noise caused by noise pollution generated by the boiler, so that workers required to wear ear muff to reduce noise. Noise not only affects the workers, if workers are not careful repair of the boiler pump pengerak will result in an explosion at pengerak pump turbine. Potential effects of heat radiation is a potential energy release heat from the engine boiler, so that the explosion due to improper engine performance adversely impact the performance of the machine. [14] Based on research on power plant Bangladesh, officials cleaning the boiler pump drive motor, one of the officers did not use ear muff correctly so that the workers uncomfortable doing his job, without realizing the officer threw a switch start up drive motor that causes the machine ejects hot water boiler. [15]

Risk Assessment Boiler PLTGU Keramasan

At the boilerPLTGU Keramasan, risk assessment to determine likelihood, concequency and total risk based methods HAZOPS conducted by supervisor Opersi and Maintenance and supervisor K3. Likelihood is the frequency of the possibilities which exist at each component based on the data maintenance that there is value Mean Time To Failure (MTTF), which is the average time a component failure. PLTGU Keramasan production run power plants for 24 hours without stopping, it is assumed the company runs production for a year of 365 days or 8760 hours/year. So the chances of failure frequency is 43800/MTTF. Determination criteria likelihood by control chart where the criteria likelihood above the bar to five in the category A (happens all the time), on the third bar in the category B (possibly happen often), over the bar into one and two in the category C (can happen once), and at the top of the bar 0 range bar to one and two in category D (possibility of rare). Rate consequences obtained from large losses arising from damage in terms of components, the influence of workers in an effort to repair and operations, due to the costs incurred as well as the observation sheet.

Instruments superheater 50HAH51CT001, 50LAE11AA101 and 50LBA30CP901 with results high risk where the temperature does not reach 511.4 /151°C at the time of entry into feedwater pump happen barriers so that the turbine does not rotate on its axis. Superheater with 50LBA30CF901 instruments in the category extreme risk with deviation more flow which causes the BFP discharge does not drain the water due to a leak, this has resulted in an explosion at the BFP discharge, that in line with the study in the power plant Nii Talasa that cause the components superheater exploded because the pipe BFP discharge leaked so hot out gushes other components and triggering an explosion who threw three workers. [16]

Desuperheater instruments and 50HAJ11CT901 50HAJ12CT901 category high risk where the temperature out of HRSG exceed a set of control 511.4 /151°C so that the water flow is not achieved leading to the suction pump. Preheater instruments and 50LAB40CT002 categorized 50LAC40CF901 high risk because of the pressure that exceeds the control set of 5.67 / 0.38 Mpa.g, resulting in work suction pump interrupted before it went into CPH, this instrument needs to be done routine maintenance and monitoring before and after pressure through CPH because this part is very susceptible to changes in a set of control making it easier explosions. Previous research on power generation in China, the flow of hot water gushed into cooling tower boiler before entering into suction pump, which causes the worker suffered burns and was an explosion on cooling tower boiler. The blast, which occurred in a steam power plant in China, a component desuperheater halted due to leaks that gush of hot water to all the pipes that cause heating at the other pipe. [17,18]

Preheter 50LAB40AB101 instruments with results extreme risk resulting in leakage before reaching LP drum, causing an explosion due to the temperature control set is below 1454 / 357.9 m^2, of course this is very detrimental to the generating unit or company. [19] Based on previous research in Taiwan power plant, a leak in the pipe leading to the LP drum resulting in workers inhaled steam boiler and hot water spilled before entering the LP drum. [20] Economizer on all the instruments are at risk high risk and extreme risk, because the HP economizer position adjacent to the drum toward the gas and steam turbines. If the pressure of ± 5.67 / 0.38 Mpa.g, flow ±43.9/8.85 ton/h and a temperature of ± 511.4/151° C will leak at some pipes to fire on the HP drum, it is in line with research in Indian power plants, which are not able to menampuang water economizer pressure that exceeds kontril set, resulting in leakage of pipes HP drum caused the fire at unit 1 generator. [21,22]

Risk Evaluation On Boilers PLTGU Keramasan

Hazard identification and risk assessment has been done on the boiler power plant Keramasan there is still potential hazards and failures that often inflicted on the boiler, so the next step is to do an evaluation of risk. [23] Risk evaluation carried out by the operations & maintenance supervisor and the supervisor K3 to analyze an analysis of the extent to which risk management is

done by PLTGU Keramasan successful, then the evaluation of input into how the risk management process should be improved. [24] A risk assessment of the boiler power plant can ditolerin Keramasan category, because the results of the identification and assessment of risks can still be mitigated by controlling risks to workers boilers and boiler systems. [25]

CONCLUSION

The conclusion is based on the results of this research is that identification of hazards and risks with methods HAZOPS there are some potential dangers is the use of chemicals that are inhaled, chemicals dripping with skin, slip, stumble, contact with hot objects, inhalation of dust or gas, a lightning strike , radiation heat, sparks welding, spraying hot water, shock, leakage, noise, explosions, and fires at the boiler. The risk assessment on power plant boiler HAZOPS method Keramasan with the greatest danger to the node economizer with an average risk of value high risk and extreme risk. Evaluation of risk based on the results of hazard identification and risk assessment at the power plant boiler can be categorized Keramasan ditolerin so that the company will conduct regular inspections at each transmitter boiler.

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