Universitas Sriwijaya

Faculty of Public Health

PROCEEDING BOOK

THE 3rd SRIWIJAYA INTERNATIONAL CONFERENCE OF PUBLIC HEALTH

Theme :

" The workplace Initiative : Health, Safety and Wellbeing Regarding COVID - 19 "

ISBN 978-623-399-020-2

GRAND ATYASA PALEMBANG

21st - 22nd OCTOBER 2021

PROCEEDING
THE 3rd SRIWIJAYA INTERNATIONAL CONFERENCE ON PUBLIC HEALTH

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

Grand Atyasa Palembang, 21st – 22nd October 2021
Publication Year : March 2022

This proceeding is published by:
Public Health Faculty Universitas Sriwijaya
Kampus FKM Unsri Indralaya, Jl. Raya Palembang-
Prabumulih KM.32 Indralaya, Ogan Ilir, Sumatera Selatan, 30662
Hotline : +62711580068
Fax : +62711580089

ISBN : 978-623-399-020-2

PROCEEDING
THE 3rd SRIWIJAYA INTERNATIONAL CONFERENCE ON PUBLIC HEALTH

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

EDITOR:

Dr. Rico Januar Sitorus, S.KM, M.Kes (Epid)
Dr. Haerawati Idris S.KM, M.Kes
Indah Purnama Sari, S.KM, M.KM
Inoy Trisnainy, S.KM, M.KL
Feranita Utama, S.KM., M.Kes
Fenny Etrawati, S.KM., M.KM
Ima Fransiska, S.Sos

This proceeding is published by:
Public Health Faculty Universitas Sriwijaya
Kampus FKM Unsri Indralaya, Jl. Raya Palembang-
Prabumulih km.32 Indralaya, Ogan Ilir, Sumatera Selatan, 30662
Hotline : +62711580068
Fax : +62711580089

ISBN : 978-623-399-020-2

TABLE OF CONTENTS

EXPOSURE RESIDUALS OF CIGARETTE SMOKE TO ACUTE RESPIRATORY INFECTION ON CHILDREN IN THE WORK AREA OF BOOMBARU HEALTH CENTER PALEMBANG

Nila Afifah, Amrina Rosyada*
Program Studi Ilmu Kesehatan Masyarakat, Fakultas Kesehatan Masyarakat, Universitas Sriwijaya, Jl. Palembang-Prabumulih KM 32 Ogan Ilir, 30662, Indonesia.
*Correspondence Email: amrinarosyada@unsri.ac.id

ABSTRACT

The incidence of Acute Respiratory Tract Infection (ARI) is still one of the most common public health problems found in toddlers. ARI can occur due to exposure to cigarette smoke residue and environmental factors in the house. The research objective was to analyze the relationship between exposure to cigarette smoke residue in the house and the incidence of ARI among children under five in the working area of Puskesmas Boom Baru Palembang. This research was conducted with a quantitative approach using a cross sectional study design. The research sample was toddlers aged 1-5 years. The technique of analyzing data was univariate, bivariate using the chi square test and multivariate analysis using multiple logistic regression tests of risk factor models. The univariate results showed that there were 67 toddlers diagnosed with ARI, the results of the bivariate analysis showed that there was a significant relationship between exposure to cigarette smoke residues and the incidence of ISPA in children under five (P value = 0.000), and the results of multivariate analysis showed a relationship between exposure to cigarette smoke residues in the house with the incidence of ARI in children under five in the working area of Puskesmas Boom Baru Palembang (P value = <0.0001) after being controlled by exclusive breastfeeding variables (PR 95% CI = 19.93 (4.32-91.91)). Suggested can be the basis for not smoking in the house and can be a reference for increasing health care efforts for toddlers in Palembang City.

Keywords: Cigarette Smoke, Residues, ARI, Children

ABSTRAK

Kejadian Infeksi Saluran Pernafasan Akut (ISPA) masih menjadi salah satu masalah kesehatan masyarakat paling banyak ditemukan pada Balita di Wilayah Kerja Puskesmas Boom Baru Palembang. ISPA dapat terjadi karena Paparan Residu Asap Rokok dan faktor lingkungan di dalam rumah dimana tempat balita tinggal. Tujuan penelitian untuk Menganalisis Hubungan Antara Paparan Residu Asap Rokok Di dalam Rumah Dengan Kejadian ISPA pada Balita di Wilayah Kerja Puskesmas Boom Baru Palembang. Penelitian ini dilakukan dengan pendekatan kuantitatif menggunakan desain studi *cross sectional*. Sampel penelitian yaitu pada balita usia 1-5 tahun. Teknik pengambilan sampel secara *Simple Random Sampling*. Teknik analisa data secara univariat, bivariat dengan melakukan uji *chi square* dan analisis mulitvariat menggunakan uji regresi logistik berganda model faktor resiko. Hasil univariat menunjukkan ada sebanyak 67 balita terdiagnosa ISPA, hasil analisis bivariat menunjukkan ada hubungan yang signifikan antara paparan residu asap rokok dengan kejadian ispa pada balita (P *value*=0,000), danhasil analisis multivariat menunjukkan ada hubungan antara paparan residu asap rokok di dalam rumah dengan kejadian ISPA pada balita di wilayah kerja Puskesmas Boom Baru Palembang (P value = <0,0001) setelah dikontrol oleh variabel ASI eksklusif (PR 95% CI = 19,93(4,32-91,91)). Disarankan dapat menjadi landasan untuk tidak melakukan aktivitas merokok di dalam rumah serta dapat menjadi acuan untuk peningkatan upaya pelayanan kesehatan untuk balita di Kota Palembang.
Kata Kunci : Asap rokok, residu, ISPA, Balita

Introduction

Third hand smoke is smoke contamination that remains in the air after tobacco smoke is released into the air and will settle on all objects around and can be toxic substance. The smoke will form a residue and will accumulate in confined spaces [1]. A researcher who studies residual exposure to cigarette smoke explained that soap will not remove nicotine residue and cannot successfully remove cigarette residue from carpets that have long-term exposure. Infants inhale a greater quantity of household dust than adults (perhaps 40 times more than adults). Babies also have contact with objects that can absorb more through ingestion and through inhalation. There are studies showing that Third Hand Smoke is potentially harmful to the health of fetuses, infants and young children, but no studies have directly examined the health outcomes in children or adults as a result of exposure to THS.[2].

ARI is an acute infectious disease that attacks one or more parts of the respiratory tract from the nose (upper respiratory tract) to the alveoli (lower respiratory tract). Acute infection is an infection that lasts up to 14 days. The causes of ARI are viruses, bacteria and fungi. The bacteria that cause ARI include Diplococcus pneumoniae, Pneumococcus, Streptococcus pyogenes, Staphylococcus aureus, Haemophilus influenzae and others. Viruses that cause ARI include the Influenzae class, Adenovirus[3].

The highest ARI sufferers in South Sumatra are in Palembang, reaching 106,550 people. The number of patients with ARI under five was 1128 as in the second week of September. In the third and fourth weeks, they were 1373 and 1398 respectively. Palembang has 41 health centers spread over 18 sub-district. One of them is the Boom Baru Health Center, this health center has a work area covering 2 villages, namely Lawang Kidul and 3 Ilir. Both of these villages have dense population, the distance from one house to another is not more than 1 meter and many houses have walls attached to each other. The level of cleanliness in this area is also very lacking, seen from the amount of garbage that is still scattered around the house. The highest prevalence of ARI disease in 2018 was in the working area of the Boom Baru Health Center at 91.7% with a total of 1549 patients from a total of 1689 toddler[4].

Based on the data above, we are interested in knowing the relationship between exposure to cigarette smoke residues in the house and the incidence of ARI among toddlers in the Work Area of the Boom Baru Health Center, Palembang.

Methods

This research was conducted with a quantitative approach using a cross-sectional study design of 132 samples. This study analyzed primary data by distributing questionnaires. The sampling

technique used is Probability Sampling with Simple Random Sampling technique. Data processing using statistical processing software. Statistical data processing through several stages, namely univariate, bivariate and multivariate.

Results

Table 1. Univariat Analysis

Variable		Frequency	Percent (%)
ARI			
-	Yes	67	50,8%
-	No	65	49,2%
Exposure Residuals Of Cigarette Smoke			
-	Yes	93	70%
-	No	39	30%
Sex			
-	Male	57	43,3%
-	Female	75	56,8%
Mother Education			
-	Low	27	20,5%
-	High	105	79,5%
Father Education			
-	Low	36	27,3%
-	High	96	72,7%
Exclusive Breastfeeding			
-	Yes	87	65,9%
-	No	45	34,1%
Nutritional Status			
-	Not Normal	17	12,9%
-	Normal	115	87,1%
Immunization			
-	Incomplete	53	40,2%
-	Complete	79	59,8%
Economic Status			
-	Low	69	52,3%
-	High	63	47,7%
Environtment			
-	Not Good	106	80,3%
-	Good	26	19,7%

Based on the results of univariate analysis, it is known that there are 67 children under five who experience ARI (50.8%), 93 children who are exposed to residue exposure from the father (70%), the majority of respondents in this study are female as many as 75 toddlers (56.8 %), while the male sex are 57 toddlers (43.3%), toddlers who have mothers with low education are 27 people (20.5%), toddlers who have fathers with low education are 36 people (27, 3%), there were 87 toddlers who were given exclusive breastfeeding (65.9%), 115 toddlers with normal weight status (87.1%), 53 toddlers who had

incomplete immunizations (40.2%), there were 69 families with low economic status (52.3%), and 106 children with an environment that did not meet the requirements (80.3%).

Table 2. Bivariate Analysis

Variable	ISPA				Total		P-*Value*	PR (95% CI)
	Ya		Tidak					
	n	%	N	%	N	%		
Exposure Residuals Of Cigarette Smoke								
Yes	61	65,6%	32	34,4%	93	100%	0,000	4,26 (2,01-9,03)
No	6	15,4%	33	84,6%	39	100%		
Sex								
Male	30	52,6%	27	47,4%	57	100%	0,842	1,06 (0,76-1,49)
Female	37	49,3%	38	50,7%	75	100%		
Mother Education								
Low	15	55,6%	12	44,4%	27	100%	0,731	1,12 (0,76-1,65)
High	52	49,5%	53	50,5%	105	100%		
Father Education								
Low	20	55,6%	16	44,4%	36	100%	0,631	1,13 (0,79-1,62)
High	47	49%	49	51%	96	100%		
Exclusive Breastfeeding								
No	36	94,7%	2	5,3%	38	100%	0,000	2,87 (2,13-3,86)
Yes	31	33,0%	63	67,0%	94	100%		
Nutritional Status								
Not Normal	13	76,5%	4	23,5%	17	100%	0,044	1,62 (1,17-2,26)
Normal	54	47%	61	53%	115	100%		
Immunization								
Incomplete	25	47,2%	28	52,8%	53	100%	0,619	0,88 (0,62-1,26)
Complete	42	53,2%	37	46,8%	79	100%		
Economy Status								
Low	39	56,5%	30	43,5%	69	100%	0,226	1,27 (0,90-1,79)
High	28	44,4%	35	55,6%	63	100%		
Environtment								
Not good	56	52,8%	50	47,2%	106	100%	0,458	1,24 (0,77-2,02)
Good	11	42,3%	15	57,7%	26	100%		
	Mean	**SD**	**Mean**	**SD**				
Age	2,6	1,42	2,5	1,31			0,518	(-0,31-0,62)

Based on the results of bivariate analysis, it is known that the variables of age, gender, mother's education, father's education, immunization status, economic status, and environment do not have a significant relationship with the incidence of ARI in children under five. While the variable exposure to cigarette residues (P-value = 0.000 ; PR = 4.26 CI = 2.01-9.03) and exclusive breastfeeding (P-value = 0.000; PR = 2.87 CI = 2.13-3, 86) has a significant relationship with the incidence of ARI in children under five.

Table 3. Final Model

Variable	P-*Value*	PR *Adjusted*	PR 95% CI
Exposure Residuals Of Cigarette Smoke	<0,0001	19,93	4,32 - 91,91
Exclusive Breastfeeding	<0,0001	64,82	10,14 - 414,12

Based on the results of the multivariate logistic regression analysis of the risk factor model, it was found that the p-value of exposure to cigarette smoke residues was <0.0001 (p-value <0.05) so it could be concluded that there was a relationship between exposure to cigarette smoke residues in the house and the incidence of ARI in toddlers in the working area of the Boom Baru Health Center Palembang after being controlled by the exclusive breastfeeding variable.

Disscussion

ARI is one in the 10 most common diseases in Indonesia. Based on the results of Riskesdas in 2013, the prevalence of ARI was found to be 25.0%. The characteristics of the population with the highest ARI occurred in the age group of 1-4 years, which was 25.8%. In 2014, cases of ARI among children under five were recorded at 657,490 cases (29.47%). Prevalence of ARI in 2018 at the Boom Health Center was only 91.7% while in 2020 by 86.5%. From 2018 to 2020 ARI at the Boom Baru Health Center has decreased by 5.2%[5,6].

Third Hand Smoke (THS) is considered to be potentially the greatest hazard to infants and young children as young children are more likely to put their hands in their mouths or be hugged by smokers with toxins on their skin and clothing. Babies also crawl on the floor and eat from their hands without washing them first, ingesting toxins into their still developing systems. There are many harmful health effects associated with exposure to Third Hand Smoke (THS).[7–9]. Cigarette smoke contents which cause ARI are ammonia, formaldehid, acetaldehyde and hydrogen cyanide which works by stopping the movement of respiratory cilia for 6-8 hours, with this condition resulting in inhibition of mucus secretion (fluid in the respiratory tract) and cell function. Cilia cells (vibrating hairs in the respiratory tract) so that they also inhibit the excretion of the respiratory tract walls[10].

Breast milk (ASI) is the most perfect, clean and healthy baby food and it is easy to give at any time. Breast milk can meet the needs of babies to grow and develop normally until the age of 6 months. Breast milk contains complete nutrition and immunity for the baby's immune system. The results of this study are the same as the research conducted by Agustin, Lealia and Idaningsih (2016) regarding the relationship between exclusive breastfeeding and the incidence of ARI (non-pneumonic cough) in toddlers in the UPTD Working Area of DTP Maja Health Center, Majalengka Regency in 2016, where it

was found that there was a relationship between between exclusive breastfeeding and the incidence of ARI (cough non-pneumonia) in toddlers (ρ value = 0.021). This can be caused because toddlers who do not get exclusive breastfeeding can cause their immune system to become weak so they will be susceptible to respiratory diseases or infections such as ARI. In this study, the history of exclusive breastfeeding is a confounding factor or variable, this is because exclusive breastfeeding is an intrinsic factor that affects the incidence of ARI. Exclusive breastfeeding given for 6 months can prevent the occurrence of ARI and pneumonia, because breast milk contains colostrum which is rich in antibodies called immunoglobulins, which are a group of proteins that provide immunity to disease, immunoglobulins are the highest concentration in breast milk that protects babies from attack by germs in the body. The mucous membrane area of the throat, lungs, also protects the baby's digestive system, including the intestines. Exclusive breastfeeding for babies prevent infectious diseases because breast milk has protective substances or immune substances[11–13].

Conclusion

It was found that the p-value exposure to cigarette smoke residues is <0.0001 (p-value <0.05) so it can be concluded that there is a relationship between exposure to cigarette smoke residues in the house and the incidence of ARI in children under five in the working area of the Boom Baru Health Center Palembang after being controlled by the exclusive breastfeeding variable. It is recommended not to smoke in the house and those who smoke either inside or outside the house to immediately change clothes, bathe and other self-cleaning activities before playing with children. It is recommended to clean the house from the dust that sticks.

Acknowledgement

The author is grateful to the Sriwijaya University

Conflict of Interest

The author declare there is no conlict of interest in writing this paper

References

1. Jacob P et al. Thirdhand Smoke: New Evidence, Challenges, and Future Directions. HHS Public Access 2017; 30: 270–294.

2. Haardörfer R, Berg CJ, Escoffery C, et al. Development of a scale assessing Beliefs about ThirdHand Smoke (BATHS). Tob Induc Dis 2017; 15: 1–8.
3. Abbas P, Haryati AS. Hubungan Pemberian ASI Eksklusif Dengan Kejadian Infeksi Saluran Pernapasan Akut (ISPA) Pada Bayi. 2011; 148–162.
4. Dinas Kesehatan Kota Palembang. Profil Kesehatan Kota Palembang. Palembang, Sumatera Selatan, 2015.
5. Dinas Kesehatan Provinsi Sumatera Selatan. Profil Kesehatan Provinsi Sumatera Selatan tahun 2015. Palembang, Sumatera Selatan, http://www.dinkes.palembang.go.id (2015).
6. Kementerian Pemberdayaan Perempuan dan Perlindungan Anak. Profil Anak Indonesia Tahun 2019. Kementeri Pemerdayaan Peremp dan Perlindngan Anak 2019; 378.
7. Acuff L, Fristoe K, Hamblen J, et al. Third-Hand Smoke: Old Smoke, New Concerns. Journal of Community Health 2016; 41: 680–687.
8. Ferrante G, Simoni M, Cibella F, et al. Third-hand smoke exposure and health hazards in children. Monaldi Arch Chest Dis - Pulm Ser 2013; 79: 38–43.
9. Rosyada A, Putri DA, Ermi N. Risk Model for Third Hand Smoke Against Health Problems in Children in Palembang City. Ber Kedokt Masy; 36.
10. Mata S, Prawesti D. Prevalensi ISPA pada anak dalam Keluarga yang Orangtuanya Perokok. J STIKES; 7.
11. Agustin RT, Laelia L, Idaningsih A. Hubungan Pemberian ASI Eksklusif dengan Kejadian ISPA (Batuk Non Pneumoni) pada Balita di Wilayah Kerja UPTD Puskesmas DTP Maja Kabupaten Majalengka Tahun 2016. J Kampus STIKes YPIB Majalengka 2016; 7: 99–108.
12. Delgado C, Matijasevich A. Breastfeeding up to two years of age or beyond and its influence on child growth and development: a systematic review. Cad Saude Publica 2013; 29: 243–256.
13. Kementerian Kesehatan RI. Infodatin ASI.

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

Sandra Apriliana LTC[1], Anita Camelia[2*], Dini Arista Putri[3], Novrikasari[4], Desheila Andarini[5], Mona Lestari[6], Poppy Fujianti[7]

[1]Fakultas Kesehatan Masyarakat Universitas Sriwijaya

[2]Bagian K3KL Fakultas Kesehatan Masyarakat Universitas Sriwijaya

Jln. Raya Palembang-Prabumulih KM. 32 Indralaya, Ogan Ilir, 30862

Correspondence Email: anita.camelia@gmail.com

ABSTRACT

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.This research use qualitative design and presentation of data in the form of HAZOPS worksheet table. The result of risk analysis using HAZOPS method in PLTGU boiler is high and extreme risk on each node causing leaking boiler and fire. 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

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. Penelitian ini menggunakan desain kualitatif serta penyajian data dalam bentuk tabel *worksheet* HAZOPS. Hasil analisis risiko menggunakan metode HAZOPS pada boiler PLTGU adalah bernilai *high* dan *extreme risk* pada setiap node yang menyebabkan boiler bocor dan kebakaran. 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*									
50HAH51CT 001		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
50LAE11AA 101		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.
50HAH71CT 902		Flow	Less More	*Less Flow* *More Flow*	Corrosion of pipes and valves and leaking seals		D	3	M	Memperbaiki pipa yang korosi

50LBA10CP 001	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
50LBA30CF 901	Temperat ure	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
50LBA30CP 901	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
50HAJ11CT9 01	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
50HAJ12CT9 01	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 101	Instruent ation	*Part of*	*Part of Instruentation*	BFP charged to the HP drum flow decreased / stopped		A	4	E	Fix 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 m², 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.

Bibliography

1. Simone. 2016. Real Time Monitoring Energy Efficiency And Performance Degradation Of Condensing Boilers. Netherlands. Energy Convertion and Management.
2. Erna Zulfiana. 2013. Analisis Bahaya dengan Metode HAZOP dan Manajemen Risiko pada Steam Turbine PLTU Unit 5 Pembangkit Listrik Paiton. Surabaya. Teknik Pomts. Vol.2. No.2
3. Alijoyo. 2015. Enterprice Risk Manajement, Pendekatan Praktis. Bandung. Jurnal ITS. Vol. 8. No.1
4. Ayu Nazir. 2012. Analisis Risiko pada Boiler PLTU Cilimus. Skripsi. Depok. Fakultas Kesehatan Masyarakat Universitas Indonesia.
5. Center for Chemical Proses (CCPS). 2016. Guidelines for Chemical Process Quantitative Risk Analysis. 2 edition. Emerica Institude of Chemical Engineers (AIChE). New York.
6. Theresia S, Triana . 2012. Identifikasi Risiko dan Pengalokasian Biaya Penanganan Risiko Dengan Simulasi Monte Carlo Pada Boiler dan Peralatan Bantu PLTU Sumbagsel. Yogyakarta.
7. Noman. 2014. Implementasi HAZOPS Pembangkit Listrik Tenaga Gas dan Uap PLTGU PJB. Paiton. Jakarta. Dian Rakyat.
8. Purnama.2013. Studi Evaluasi Tingkat Pemenuhan Sistem Manajemen Keselamatan dan Kesehatan Kerja (SMK3) Di China National Offshore Oil Corp. Depok. CNOOC.

9. Kotek. 2012. HAZOP study with qualitative risk analysis for prioritization of corrective and preventive actions. Prague Czech Republic. International Congress of Chemical and Process Engineering CHISA.
10. Nicolae A, Paul DS. 2016. Computational model for a condensing boiler with finned tubes heat exchanger. Romania. Sustainable Solutions for Energy and Environment.
11. Luluk. 2013. Analisis Safety SYStem dan Manajemen Risiko pada Steam Boiler PLTU di Unit 5 Pembangkit Paiton, PT, YTL. Surabaya. Teknik Pomnts. Vol.2. No.2.
12. Juliana. 2008. Implementasi Metode HAZOPS dalam Proses Identifikasi Bahaya dan Analisa Risiko Pada Feedwater System di Unit Pembangkit Paiton PT. PJN. Surabaya.
13. Kolloru. 2016. Risk Assasment and Management for Environmental Health and Safety Profesionals. New York. Mc Graw Hill.
14. Ramli, Soethatman. 2010. Pedoman Praktis Manajemen Risiko dalam Persfektif K3 OHS Risk Management. Jakarta: PT Dian Rakyat.
15. Burlian. 2013. Perancangan Ulang Heat Recovery Steam Generator Dengan Sistem Dual Pressure Melalui Pemanfaatan Gas Buang Sebuah Turbin Gas Berdaya 160 MW. Jurnal Rekayasa Mesin. Vol. 13. No. 1.
16. Health & Safety Executive (HSE). 2000. Risk Management. Uk Internal Labors Office. 2007. Guideline on Occupational Safety Management System ILO-OSH. Geneva.
17. IJOH. 2012. Application of Hazard and Operability Study (HAZOP) in Evaluation of Health, Safety and Environment (HSE) Hazards. Iran. IOHA. Vol.4. No.2.
18. Kolloru. 2016. Risk Assasment and Management for Environmental Health and Safety Profesionals. New York. Mc Graw Hill.
19. Munawir, A. 2010. HAZOP. HAZID. VS JSA. Migas Indonesia
20. Norman Denzin. 2014. Hand Book of Qualitatif Likehood Research. California. SAGE Publications.
21. Radja. 2013. Principles of Risk Management and Insurance. Eigh Edition. Person Education.
22. Render. 2015. Operations Managemen. Jakarta. Selemba Empat. Pearson Education Asia.
23. Budiman. 2010. Risk Assasment pada Boiler X Dengan Metode HAZOP. Vol. 01. UNDIP. Journal UNDIP.
24. Bambang, Setyoko. 2006. Analisa Efisiensi Performa HRSG (Heat Recovery Steam Generator) Pada PLTGU. Traksi. Vol.4. No.2.
25. Dhillon, B.S. 2005. Reliability , Quality , and Safety for Engineers. London. CRS Press.

Universitas Sriwijaya
Faculty of Public Health

ISBN 978-623-399-020-2