

Conference Paper

Risk Assessment Operation of Auxiliary Steam Boiler on Pertamina Tanker Vessel

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Abstract

Auxiliary steam boiler system is always included in hazard identification process and risk operation. Hazard is a source of the damage of the human, process, properties and environment. The risk is an explanation of advantage or disadvantage possibility such as financial, physical damage, or accident as activity consequence. In this case, risk is the appeared consequences and likelihood. HAZOP (Hazard and Operability Study) method was used to identify hazard potency at Auxiliary steam boiler. HAZOP identification was determined by 11 (eleven) study nodes on Auxiliary steam boiler system. HAZOP characteristic is systematic; it uses structured or higher arrangement based on the instructions and HAZOP team's idea to continue and make sure whether the safeguard is suitable for the object being tested. Further, two-sided risk computation was done on Auxiliary steam boiler system until the risk frequency and risk consequence were found. Research results indicated 11 (eleven) types of consequences with the highest level, which further needs mitigation process to decrease the risk level from Auxiliary steam boiler system. This is to prevent the change of risk of each study node for minimized risk.

Keywords: risk, HAZOP, guide words, likelihood, consequence.

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1. Introduction

Auxiliary steam boiler is one of the tools that assist in the assignment process of the ship's main drive engine and work sustainably safely and safely. This aircraft is a place that can be used with more than 1 atm by heating the air from the results of the combustion process in the kitchen. Steam used as a heater, both fuel oil, lubricating oil, dirty oil and necessities, is also used as a heating vessel. In addition, considering that it allows them to be susceptible to fire and explosion hazards, then lower the boiler which can be operated by operators (machinists) and all crewmen on board. The losses caused by this boiler failure are not only caused damage cannot transport additional costs and fees for additional costs, but also costs for the crew who have an accident. From the above process shows that steam steam equipment is a major addition to the heating process of fuel tanks and on MT. Pelita has 1 (one) steam boiler unit. If there is a failure in the steam steam system, there can be damage and other hazards such as fire, blasting

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and gas poisoning. The function of the auxiliary steam boiler is very necessary in the process so that it will produce potential in additional gas steam boilers that are needed to review, assess and prevent it. From some images of hazards that can be caused if a failure occurs in an additional steam boiler, the researcher can use this as a formulation of the problems to be carried out in this study. The technique used by the people involved in this study MT. Pelita. While the method that will be used in this study and use additional steam boilers using the Hazard and Operability Study (HAZOP) method. The method that can be used as a method of HAZOP is as an analytical technique that can be used to determine the possibility, HAZOP can also be used for various problems. As a final step, the researcher will calculate the average so that the existing assets can be used according to their function and in this research will be carried out to find out information from additional steam boilers.

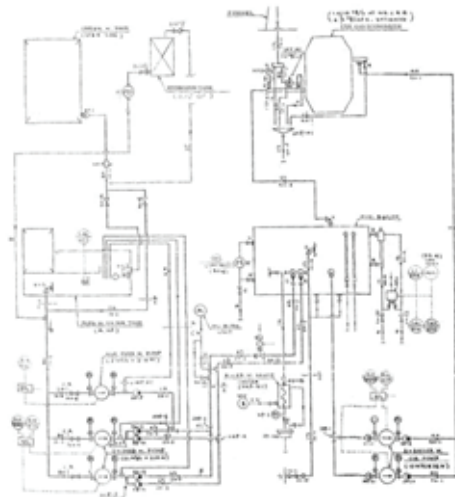


Figure 1: Aliran Auxiliary Steam Boiler.

2. Literature Review

2.1. Steam Boiler

Steam boiler is can produce steam which functions as a working auxiliary machine. That is a device that functions to convert water into steam. The condition of steam produced generally has a working pressure ranging from 15 kg / cm² at a temperature of 1250 C for a low power unit to 325 kg / cm² at a temperature of 6500 C for high power. The steam produced by the steam boiler then enters the turbine, where the steam energy is converted into mechanical energy. The power produced by the turbine can reach 100,000 pk while the working speed can reach 20,000 revolutions / minute. Steam

boiler is used to heat steam boiler water (feed water) to produce steam. The first energy is released by burning fuel in a steam boiler kitchen. In this kitchen steam can be produced. All types of steam boilers have a combustion chamber where fuel is burned to obtain energy. Then for the occurrence of combustion, a certain amount of air is supplied to the combustion chamber, so that by utilizing the extent of the heating surface, the heat allows the steam to be generated.

2.2. Risk Assessment

Risk assessment is a special application with the help of the decision making process. Just as freedom is evaluated, risk assessment is a critique for the level of risk analysis that is introduced with various choices. Analysis that is appropriate or suitable for these risks will provide information which is a good criticism for making decisions, and will clarify the decision. Risk assessment is the overall process of risk analysis and risk evaluation and a careful test of what is in our work that can cause harm to people, so that we can consider whether we have taken preventive measures or something that should be done to prevent these hazards. While the main objective is to ensure that no one has an accident. Risk is a combination of likelihood and consequence. Likelihood is a possibility that at the level of risk it will appear, usually used historical data to estimate the possibility. Calculation of possibilities or opportunities that are often used is frequency. Consequence is a result of an event or a risk, so consequence is calculated from the cost of losses experienced in a period of time from an event or a risk. Therefore, the risk calculation is done by multiplying the likelihood value with consequence.

2.3. Hazard and Operability Study (HAZOP)

HAZOP analysis was developed for evaluation of new designs or technologies, this method was applied in almost all phases of the process (Center for Chemical Process Safety, 1992). The Hazard and Operability Study is used in the preparation of the establishment of security in a new system or modification for the existence of potential hazards or operability problems. The HAZOP study was carried out by careful testing by a specialist group, in the part of a system about what would happen if the component was operated in excess of the normal existing component design models. The purpose of using HAZOP is to systematically review a process or operation on a system, to determine whether the deviation process can lead to unwanted events or accidents.

2.4. Mitigation

This stage is evaluated whether the risk is acceptable or not. If the risk is not acceptable then a mitigation process is carried out to reduce the risk level. The mitigation process is carried out by reducing the frequency that occurs or by reducing the consequences. If the risk is acceptable, the object can operate with the existing risks. Mitigation is carried out with the aim of reducing the level of risk of the equipment or system being analyzed.

3. Methods

3.1. Identification with HAZOP

Making HAZOP identification based on study node determined by the HAZOP team, so that there are several values of likelihood criteria, severity and risk and there are 11 (eleven) study points and the value of these criteria can be seen in the table below:

1. Angle Stop Valve KV-1	7. Feed Water Pump B
2. Globe Stop Valve KV-14	8. Feed Water Pump C
3. Globe Stop Valve KV-4	9. Regulating Valve KV-18
4. KV-3	10. Auxiliary Boiler
5. Pressure Safety Valve KV-5	11. Hose Angle Valve
6. Auxiliary Feed Water Pump A	

3.2. Risk Observation

In conducting a risk assessment the initial steps taken are defining likelihood and consequence criteria. The likelihood criterion used is the frequency in which the calculation quantitatively uses calculations on combinations of days in 1 year (365 days) and MTTF (mean time to failure). Consequences used are the effect or effect of component failure on the auxiliary steam boiler and the risk value is obtained from the combination of likelihood and consequence

TABLE 1: Grouping Stakeholder.

Class consequences		Letter code
Human/ personnel	Crew	C
Environment		E
Material/Asset	Company property/ Ship	S
	Down time	D

TABLE 2: Severity of Frequency.

Severity of Frequent		
Likelihood	Definition	
	occurrence	
Frequent (A)	Could be happen	> 0,5
Probable (B)	Often	> 0,5-0.05
Occasional (C)	Occurs several time	> 0.005 - 0,05
Remote (D)	Occuers sometimes	> 0.0005 - 0,005
Improbable (E)	The possibility of not happening, but if it happens it can be accepted	> 0.00005 - 0,0005

TABLE 3: Severity of Consequence.

Severity class		Minor 1	Major 2	Critical 3	Catastrophic 4
Human/ personnel	Crew (C)	Small Injuries	Serious Injuries	Death	Many of death
Environment (E)		Meaningless Pollution	Pollution effects are not to long	Pollution is reported to authorities limiting effects on recipients	Pollution is reported to authorities for the old pollution effect
Material/ Asset	Company Property / Ship (S)	A little damage may be repaired on the ship	Damage occurred requiring a review at the port long enough to repair	Large damage requires an area to repair	Lost the a ship
	Down time (D)	Meaningless Down time	Down time more than a day	Down time more than a week	Down time more than a week

TABLE 4: Risk Matrik.

	Catastrophic (4)	Critical (3)	Marginal (2)	Minor (1)
Frequent (A)	A	A	B	B
Probable (B)	A	B	B	C
Occasional (C)	B	C	C	C
Remote (D)	C	C	C	D
Improbable (E)	C	C	D	D

4. Result and Discussion

Analysis of the use of HAZOP in this study aims to systematically review a process in a system and determine whether the process of irregularities can lead to unwanted events or accidents. Components identified have a level of risk at the A & B level that is:

TABLE 5: Recapitulation of data in the highest risk category.

No.	Study node	Severity of class	Risk Level	No.	Study node	Severity of class	Risk Level
1	Globe Stop Valve KV-14	crew	B (2.5)	7	Regulating Valve KV-18	asset	B (9.1)
2	Globe Stop Valve KV-4	crew	B (3.5)	8	Auxiliary boiler	asset	B (10.1)
3	Regulating Valve KV-18	crew	A (9.1)	9	KV-3	down time	B (4.3)
4	Auxiliary boiler	crew	A (10.1)	10	Regulating Valve KV-18	down time	B (9.1)
5	Auxiliary boiler	environment	B (10.1)	11	Auxiliary boiler	down time	B (10.1)
6	Angle stop valve KV-1	asset	B (1.4)				

5. Conclusion

1. Using the Hazard and Operability study method (HAZOP) provides information about the components to be analyzed into the HAZOP study node. These components include several systems that are in the auxiliary steam boiler including the angle stop valve KV globe stop valve KV-14, globe stop valve KV-1, KV-4, KV-3, KV-5, auxiliary feed water pump A, feed water pump B, feed water pump C, regulating valve KV-18 and auxiliary boiler.
2. Prevention recommendations for the risk of workplace accidents are determined by mitigation techniques with the aim that the risks that cannot be accepted can be reduced.

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