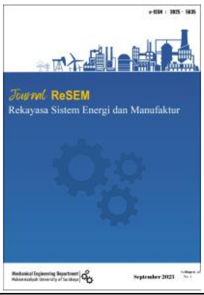

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SECURING THE RESTRICTED AREA AT INLET 491-AC1 FROM THE DANGER OF HOT MATERIAL DURING KILN UPSET BY INSTALLATION OF HEAT DETECTION EQUIPMENT AND MATERIAL SPILLAGE LEVEL

Rizkhi Dwi Nugroho[1]*, Hadi Kusnanto[2]

[1]Department of Mechanical Engineering, Engineering Faculty, Muhammadiyah University of Surabaya
Jl. Sutorejo No. 59, Surabaya, Indonesia
[2]Department of Mechanical Engineering, Engineering Faculty, Muhammadiyah University of Surabaya
Jl. Sutorejo No. 59, Surabaya, Indonesia

*email : corresponding rizkhi.dwi@sig.id
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Abstract

On February 18, 2023, an incident occurred at Tuban Plant factory. Namely a work accident that happened to a senior employee from the Fire & Rescue division. This incident occurred in a restricted area where evacuation access was limited and there was no telephone signal because it was located underground. Therefore, the author decided to make and install a safety device in the form of a temperature or heat detector and material level to provide warnings in the form of danger lights and sounds from horns in the area. After the tool is installed, temperature monitoring can be done on the local panel and also from the Technical Information System (TIS). After installation, from HIRAC calculations this tool succeeded in reducing the risk score by 95%, from initially 360 (high) to 18 (low). Apart from that, this tool can also save IDR 39,974,495 per hour from the initial handling time before the tool was 66.3 hours.

Keywords : *Incident, Temperature, Fabrication, Installation, Safety Device, Maintenance*

1. INTRODUCTION

PT Solusi Bangun Indonesia Tbk is an Indonesian public company where the majority of its shares (80.64%) are owned and managed by PT Semen Indonesia Industri Bangunan (SIIB) – part of the Semen Indonesia Group, the largest cement producer in Indonesia and Southeast Asia, PT Solusi Bangun Indonesia Tbk runs a ready-mix concrete and cement and aggregate manufacturing business. The company operates four cement factories in Narogong (West Java), Cilacap (Central Java), Tuban (East Java) and Lhoknga (Aceh), with a total capacity of 14.5 million tonnes of cement per year and provides employment for more than 2,500 people. PT Solusi Bangun Indonesia Tbk currently operates a network of building material providers which includes specialized distributors, building shops, company-assisted building experts and other value-added solutions.(PT. Solusi Bangun Indonesia, 2013)

Strongly encouraged by the incident that occurred at the Tuban Plant factory. Namely a work accident that happened to a senior employee from the Fire & Rescue division on February 18 2023. This incident occurred in a restricted area where access to barking was limited and there was no telephone signal because it was located underground. Workers who work in this area can only communicate using HT, which may be busy. This incident is an invaluable lesson and warning for all workers so that it does not happen again at other times and places. (Ferri, 2012; Granger et al., 2009; Haagsma et al., 2016; Herndon, n.d., 2012; Stokes & Johnson, 2017; Tintinalli et al., 2016; Vos et al., 2016)

The problem formulation in this final project is: Making a special tool to be a tool for measuring safety conditions in restricted areas? How does the detection tool work? How much does it cost to make the detection tool? Will having the tool help workers? be safe?

In order to be more focused and more precise in fulfilling the objectives for this final project, a problem definition was created including: Equipment installation at PT Solusi Bangun Indonesia Tbk Tuban Factory. The results of research analysis on making tools from heat sensors for the restricted inlet area 491-AC1 are as additional safety devices. (Keinsinyuran, 2018; Rivaldo et al., 2020) Does not display heat sensor readings.

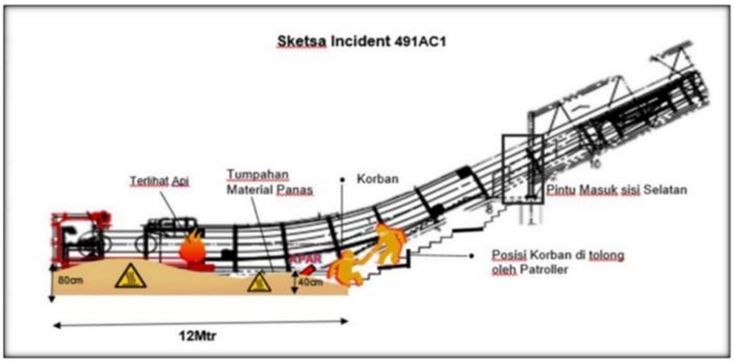

Figure 1. Incident Sketch of 491-AC1
Source : author's personal data

This research aims to: Provide danger warnings to workers in the area so that workers are always focused and more alert, Minimize hazards / potential dangers so that there are not many near misses (incidents that almost become accidents) in the field, Create an overview for readers with a design and bill of materials so you can know how much money is needed, creating a safe and controlled working atmosphere so that the production process runs smoothly.

The benefits that will be obtained are: As a safety device for the restricted inlet area 491-AC1 in the event of a kiln upset(Berger, 1929; Dylan Moore, 2010; Harley, 2007; Peray & Waddell, 1986; Polysius Asia Pasific Pte. Ltd., 2012), As a function tool to monitor conditions in the area without having to check in the field, Providing information on spillage material temperature for field workers and CCR, Providing danger warnings from the CCR to the production team, Providing information on the height of material spillage, Providing local danger warning lights and horns, Easy to clean and move, Resistant to high temperatures and dusty areas, There are improvements at PT. Solusi Bangun Indonesia Tbk. Tuban Factory to prevent further victims from occurring due to late information.

2. RESEARCH METHODOLOGY

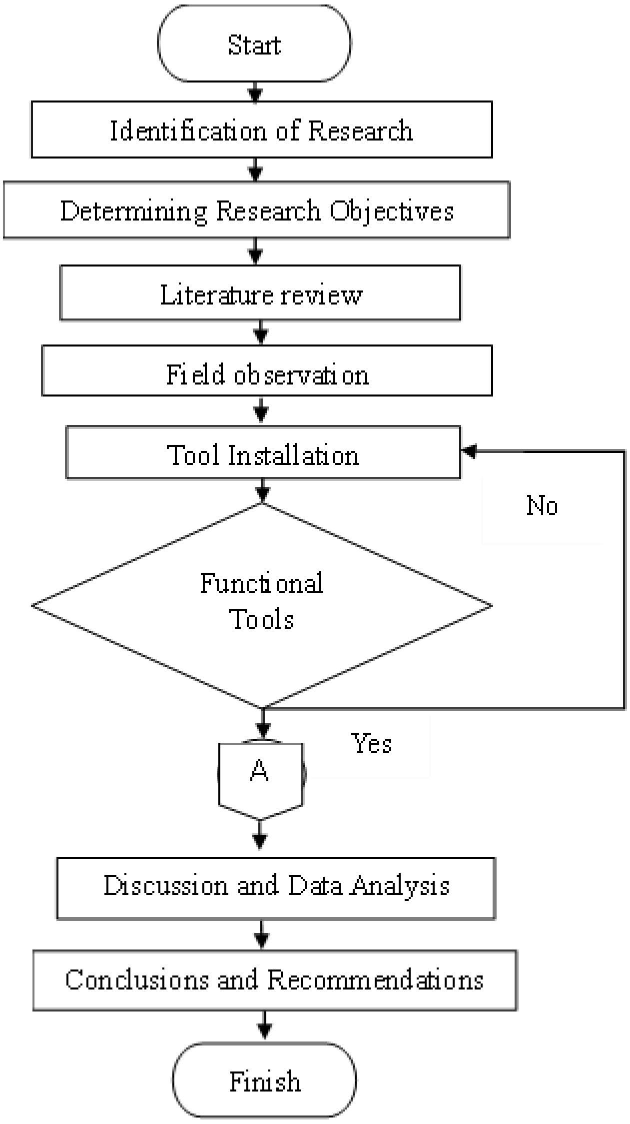

Figure 2. Flowchart Diagram
Source : author's personal data

This study uses an observational method, which is where observing the restricted area and its dangerous potential. Then by using engineering to eliminate a step of action we can improve the working condition at that place. As to how will be defined below this:

Step 1: Identification of Research Problems

The problem identification process was carried out to determine the initial background of the problem that occurred at inlet 491-AC1 PT Solusi Bangun Indonesia Tbk. The problem that arises in this research is the lack of vigilance in the 491-AC1 inlet area when a kiln upset occurs.

Step 2: Determining Research Objectives

After finding the problem, the next thing to determine the research objective is to install a temperature and material level detector for the 491-AC1 inlet at PT Solusi Bangun Indonesia Tbk.

Step 3: Literature review

Literature study is used as a theoretical basis and can support the work on the research carried out. In this stage the author uses books for research material, data records from the company's work directory and scientific journals such as final assignments/thesis from previous research.(Hargiyarto, 2003; Harley, 2007; Karyono, 2001)

Step 4: Field observation

Field observations in this research took the form of observations of the 491-AC1 inlet area. These observations were made to find out the list of requirements for making tools.

Step 5: Tool Installation

Collaborating with several other departments such as the workshop for fabricating sensor supports and support panels, and also the electrical department area for cable pulling and sensor termination. The research department which is an area mechanic was greatly helped by assistance with equipment installation in the field.(Autonics Corporations, 2023; Muhammad Nursayyidan, 2016)

Step 6: Functional Tools

Even though a test run and trial had been carried out beforehand, the tool was terminated in the workshop. However, whether the tool is successful or not, it must be proven in the field that the sensor reading is accurate and if it reaches the limit it will activate the horn and also the emergency lamp that has been installed.(Ferdyansyah & Rahmat, 2022)

Step 7: Discussion and Data Analysis

Discussion and data analysis were carried out after the functionality of the tool was proven. By socializing to other departments that this detection tool has been installed, a discussion forum has been created. Then data analysis is carried out after there are findings from users in the field that have been socialized or whether there is room for improvement from users and don't forget the criticism and suggestions.

Step 8: Conclusions and recommendations

This stage is a stage that explains the results of the equipment installation that has been carried out. This stage also provides suggestions to the company as input to increase awareness among workers so that incidents do not occur again in the future.

3. RESULT AND DISCUSSION

In preparing the project plan, the 5W+2H method was used. As described in the table below. 5W+2H consists of What (final solution), Where (location), Why (Goal), Who (Personnel), When (When), How (How), How Much (Estimated Cost).

Table 1. Project Plan

No	What	Where	Why	Who	When	How	How Much
1	Making of a Danger Warning Detection Device	*491-AC1*	✓ Provide spillage material temperature information for field workers and CCR ✓ Provide danger warnings from CCR to the production team. ✓ Provide information on the height of material spillage. ✓ Provide local danger warning lights and horns	*Rizkhi Dwi N.*	*Sept 2023*	Fabrication at SBI Workshop Using used or readily available materials	*IDR 5 Mio*
2	Membuat SOP baru	*Workshop*	Reduces potential hazards in the AC work area	*Rizkhi Dwi N.*	*Oct 2023*	*Develop New SOP/ SWP*	*N/A*
3	Create standards in the next priority areas	*492-AC1*	Improve Work Quality & Safety	*Rizkhi Dwi N.*	Nov *2023*	*New Fabrication – Instalation*	*N/A*

From the description in the table above, the project planning that will be carried out in making the tool can be obtained. With the assistance of several departments in the manufacture and installation of this tool, hopefully it will bring benefits to all who work at PT. SBI Tuban Factory.

Loss on consequences before the tool is available is at disaster level. The parts of the loss are people, where the loss can cause several deaths, then the second is the reputation loss, which can become a national issue and has the potential to have the company's license revoked, threatening to become a suspect in court.

Calculation of equipment and process losses is carried out in several aspects as follows:

- Clinker Production Losses (process)

Amount of unproduced clinker (Tons)
= number of stop hours (h)×production capacity (Ton/h)
An example is taken from the history of the kiln stop due to upset on February 18 2023. Namely the duration of the kiln stop was 66.3 hours
=66.3 (h)×275 (Tons/h)
=18,232.5 Tons
Total Production losses Cost (IDR)=18,232.5 (Ton)× 52000 (IDR/Ton)
= 948,090,000 IDR (provided that it is sold directly for export) = 14,300,000 IDR per hour

- Extra Electricity Cost (equipment)

SEEC (kWh/T)=(Total Electricity Consumption (kWh))/(Amount of clinker produced (Tons))
Power wasted without producing clinker (kWh)
= Amount of clinker that failed to produce (Tons) × SEEC (kWh/Ton)
Extra Electricity Cost (IDR)=646.5217 (kWh)×(1180 IDR/kWh)
Extra Electricity Cost (IDR)=IDR 762,895,606 per hour

- Extra Fuel Cost for Heating up (equipment)

Amount of IDO consumption (l)
= number of hours heating up (h)×avg IDO consumption (l/h)
= 1 (h)×2542 (l/h)=2542 l/hour
There are various heating up processes. Sometimes 8 hours, 12 hours, 10 hours, 24 hours and so on. Depends on the calciner temperature or because there are special conditions. Heating up is complete and the kiln feed enters at a calciner temperature of 850°C. At this temperature, the kiln is ready to feed, starting from 50 tph then 100 tph until the top feed is 275 tph.
Total IDO Cost (IDR)=Amount of IDO consumption (l)×IDO price per liter (9800 IDR/l)
=2542 (l/hour)×9800 (IDR/l)
=24,911,600 (IDR/l)
So the cost of heating up costs IDR 24,911,600 per hour.

From the 3 calculations above, you can get an idea of how big the financial loss will be if the same incident happens again, namely IDR 39,974,495 per hour. The hope is that with this tool, if there is an indication of an increase in temperature, the CCR engineer operator can condition it so that the impact of kiln upset does not get worse.

In this section reveals about research/model development result. It obtained in a systematic, constructive and comprehensive discussion that supports the research purpose and strengthen the conclusion.

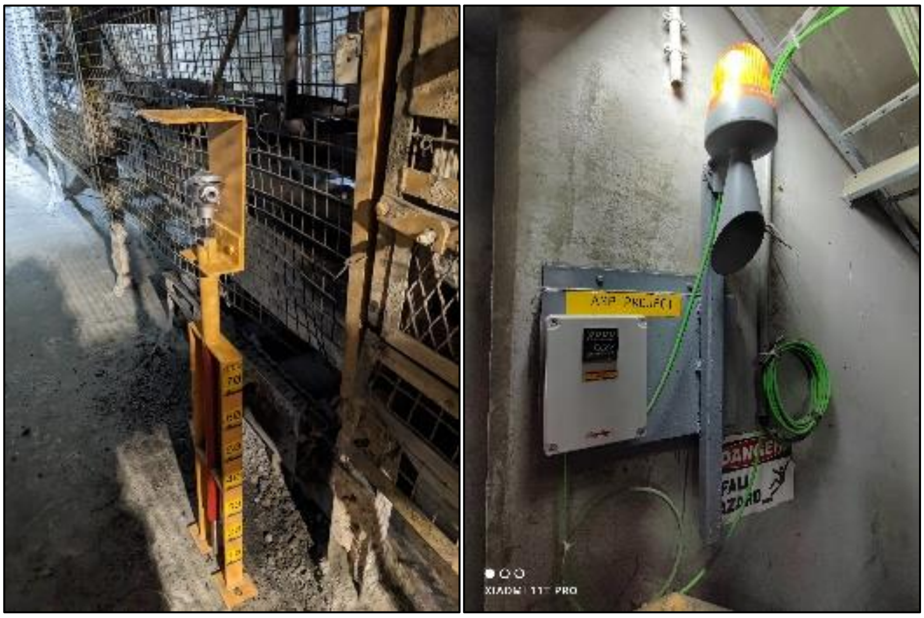

Figure 3. Temperature and material level detection tools
Source : author's personal data

From the history of the Kiln Upset Report that has been exposed and from the stop log data above, it can be calculated that the total stop duration is 265.78 hours with a frequency of stops of 19 times in the period from 2014 to 2023. So the average kiln stop due to upset occurs 1.9 times per year. So the probability before and after the tool will remain at the value 3 or unusual but possible. For exposure incidents occurring before the device is available are occasional (3). Once there is a tool, exposure to hazards will be reduced to infrequent (2). Then the consequences of exposure to hot material before the tool is installed are disaster (40) because the long kiln stop is caused by a fire in the sensor cables in the 491-AC1 inlet area. Consequences calculations will be discussed. Then after the presence of the tool the consequences decrease to importance (3) because this tool will notify the local CCR and patrollers if the hot material reaches a temperature of 70°C thereby preventing fires in the sensor cables at the 491-AC1 inlet.(Corporate OHS, 2020)

Table 2. Comparison Table

Hazard	Comparison	Existing Risk Control	Exposure (E)	Probability (P)	Consequences (C)	Risk score E x P x C	Risk Level
Exposed with Hot Material	Before	-	Occasionaly (3)	Unusual but possible (3)	Disaster (40)	360	high (200-400)
	After	Temperature and material level detection tools	Inrequent (2)	Unusual but possible (3)	Important (3)	18	low (<20)

From the results of the calculation of the risk level table before and after, there has been a significant reduction in risk level from 360 points to 18 points or 95%. So it can be concluded that this tool functions according to target and the restricted inlet area 491-AC1 is safe.

4. CONCLUSION

After installation and discussion, the following conclusions can be drawn:

1. With this tool, it can provide danger warnings to workers in the area so that workers are always focused and more alert.

2. This tool reads the temperature of hot material that is spilled if a kiln upset occurs and then displays it locally and on the CCR so that conditions inside can be monitored. If the temperature of 70°C PT100 has been reached it will activate the horn and danger lights.
3. Readers can implement this project with the drawing support that has been attached, and also regarding the costs that have been discussed in the bill of materials, namely Rp. 5,000,000,-
4. After this tool was installed, there was a significant reduction in risk level from 360 points to 18 points or 95%. Apart from that, this tool can also save a total cost of IDR 39,974,495 per hour from the initial handling time before the tool was available which was 66.3 hours. It can be concluded that this tool functions according to target and the restricted inlet area 491-AC1 is safe so that the production process can run smoothly.

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