e-ISSN: 2621-1971 | p-ISSN: 2088-7086

Failure Mode and Effect Analysis (FMEA) and Root Cause Analysis (RCA) for Urea Fertilizer Production Risk Mitigation

Aisya Qurratul A'yun[1*], Iriani[2]

[1,2]Universitas Pembangunan Nasional "Veteran" Jawa Timur, Jl. Rungkut Madya, Mount Anyar, Mount Anyar District, Surabaya, East Java 60294*

A R T I C L E I N F O

Correspondence Email:
irianiupn@gmail.com

Keywords:
Risk; Risk Managemen; FMEA; RCA

DOI:
https:doi.org/10.33096/jmb.v11i2.817

A B S T R A C T

The production of urea fertilizer is one of the most important processes in the agricultural industry, but it cannot be separated from various risks that can interfere with its smooth operation. This research aims to identify and mitigate the risks involved in urea fertilizer production using the Failure Mode and Effect Analysis (FMEA) and Root Cause Analysis (RCA) methods. The results show that some of the major risks in urea fertilizer production include equipment failure, raw material supply disruption, and operational errors. By applying FMEA and RCA, the company can identify the root causes of the problems and develop effective mitigation strategies. The implementation of these mitigation actions is expected to improve production efficiency and reduce downtime, thus ensuring better production continuity.

A B S T R A K

Produksi pupuk urea merupakan salah satu proses yang sangat penting dalam industri pertanian, namun tidak lepas dari berbagai risiko yang dapat mengganggu kelancaran operasionalnya. Penelitian ini bertujuan untuk mengidentifikasi dan memitigasi risiko-risiko yang ada pada proses produksi pupuk urea dengan menggunakan metode Failure Mode and Effect Analysis (FMEA) dan Root Cause Analysis (RCA). Hasil penelitian menunjukkan bahwa beberapa risiko utama dalam produksi pupuk urea antara lain kegagalan peralatan, gangguan pasokan bahan baku, dan kesalahan operasional. Dengan menerapkan FMEA dan RCA, perusahaan dapat mengidentifikasi akar penyebab masalah dan mengembangkan strategi mitigasi yang efektif. Penerapan tindakan mitigasi ini diharapkan dapat meningkatkan efisiensi produksi dan mengurangi waktu henti, sehingga menjamin keberlangsungan produksi yang lebih baik.

INTRODUCTION

Increasingly fierce business competition has led to competition between companies. Companies that want to survive in the competition must be able to improve targets in all aspects so as not to be left behind and lose in competition with other companies. In an effort to achieve goals, companies are always faced with various uncertain conditions both from internal factors and external factors (Anita et al., 2022). This uncertainty is often referred to as risk. The definition of risk according to Geofanny, et al (2022) is a situation that contains elements of uncertainty and is often associated with circumstances that can pose a threat in achieving organizational goals and objectives.

XYZ Company is a Holding Company that oversees five subsidiaries engaged in the international urea fertilizer industry. As a company that competes globally, the achievement of production targets is something that is expected by the company, because by achieving the target, it can be considered that the company's performance is very good. If the production target is not achieved, the company cannot meet market demand and cause a bad assessment of credibility and losses.

financially must be borne by the company (Alwi, 2022). One of the products that did not reach the company's target was urea fertilizer products.

In Table 1. 1 shows the percentage of production target fulfillment for urea fertilizer in 2022 and 2023. Based on the table, there are ten months, namely February, March, May, June, July, August, September, October, November, and December in 2022 where the total production realization did not meet the planned target. Meanwhile, for 2023 there are six months, namely March, June, August, October, November, and December, which show that the total production realization did not meet the planned target.

Table 1. Percentage of Urea Fertilizer Production Target Fulfillment in 2022 and 2023

UREA		2022			2023	
Month	**REAL**	**Target**	**%**	**REAL**	**Target**	**%**
January	594,073	590,659	101%	650,468	616,854	105%
February	591,748	633,068	**93%**	646,633	600,893	108%
March	624,888	642,428	**97%**	612,589	679,173	90%
April	674,857	656,720	103%	662,469	662,980	100%
May	699,885	741,180	**94%**	743,909	656,546	113%
June	667,904	719,908	**93%**	641,663	675,487	**95%**
July	653,661	661,380	**99%**	707,204	696,927	101%
August	568,381	697,080	**82%**	606,755	663,746	**91%**
September	605,962	697,608	**87%**	660,646	647,844	102%
October	557,847	666,880	**84%**	643,872	728,074	**88%**
November	563,292	639,608	**88%**	565,235	662,108	**85%**
December	664,691	722,680	**92%**	583,283	720,768	**81%**
TOTAL	**7,467,190**	**8,069,200**	**93%**	**7,724,725**	**8,011,400**	**96%**

Source: XYZ Company internal production report data (2023)

Various risks as a result of production uncertainty must be faced by the company. Therefore, risk management is needed to identify and analyze all risks that can hinder the achievement of production targets so that risk mitigation and control can be carried out so that the company's production targets can be achieved as set (Aisyah & Dahlia, 2022). From the company's problems regarding the non-achievement of the urea fertilizer production target, it is necessary to handle risks that provide direction for organizations or companies to implement risk management in various business situations to deal with risks that may arise in the activities of achieving the company's production targets.

The company realizes that in achieving production targets there are complex production activities and involve various departments within the company, accompanied by uncertain circumstances and resulting in obstruction of the company in achieving production targets. Until now, the company has not carried out systematic, structured, and well-documented handling to get treatment to improve the company's performance in achieving production target goals. So that the handling carried out at this time still cannot achieve the goals that have been set. This research is expected to provide suggestions for improvements that are more structured and systematic so that the company is able to manage risks well by achieving predetermined production targets. As researched by Anita Aisya Ulfa and Taufiq Immawan (2021) in the journal Risk Management Analysis with the Application of ISO 31000: 2018 to the Machining Process (Case Study: AB Company) by applying a combination of systematic risk identification methods, companies can reduce the risks that arise on machines in production units and improve the efficiency and quality of products produced.

According to Arta et al (2021)risk is defined as uncertainty caused by change. Risk is a deviation from something expected. This uncertainty factor ultimately causes risk in an activity. According to ISO 31000: 2018 risk is the impact of uncertainty to achieve company goals. Every activity always faces and relates to risk because risk is inherent in business processes and the potential for losses to occur (Hairul, 2020).

According to the International Standards Organization, risk management is defined as coordinated activities to direct and control companies (other users of the standard) with regard to risk. Risk management also provides tools for structured thinking about the future and for dealing with uncertainty (Prowanta, 2019).

Risk management processes implement systematic policies, guidelines, procedures and practices for communicating and consulting activities, setting context a n d reporting risks. The risk management process must be part of management and decision-making and integrated into the company's organizational structure, operations, and business processes (Prowanta, 2019). Here is the risk management process: 1) Communication and Consultation, the purpose of communication and consultation is to assist relevant stakeholders in understanding the risks, the basis for decision-making and the reasons why certain actions are required. 2.) Setting the Context, the external and internal context is the environment in which the organization seeks to define and achieve its objectives. The context of the risk management process should be established from an understanding of the external and internal environment in which the Company operates and should reflect the specific environment of the activities to which the risk management process will be applied. 3) Risk Identification, the purpose of risk identification is to find, recognize and explain the risks that prevent the company from achieving its goals. 4) Risk Analysis, the purpose of risk analysis is to understand the nature of risk and its characteristics and the level of risk. Risk analysis considers risk sources, consequences, likelihood, events, scenarios, controls and their effectiveness. 5) Risk Evaluation, the purpose of risk evaluation is to support decisions that have been made following a risk analysis. Risk evaluation compares the results of the risk analysis with the established risk criteria to determine where additional action is required and 6) Risk Mitigation, the purpose of risk mitigation is to select and implement options to address risks.

According to Alijoyo et al (2019) Failure Mode and Effect Analysis (FMEA) is a technique used to improve the reliability and safety of a process by identifying potential failures or so-called failure modes in t h e process. Each failure mode will be assessed using three parameters, namely severity (S), probability of occurrence (O), and probability of detection (D) (Firdaus & Widianti, 2021). The three parameters are then combined to determine the FMEA criticality significance of each failure mode. The combination of the three parameters is known as the Risk Priority Number (RPN). The S, O, and D values are obtained from an assessment using a measurement scale of 1-5.

The stages of problem solving begin with conducting an analysis (risk assessment) first. The analysis is carried out by looking at the RPN score in the FMEA table that has been made. From the results of the score, it is compiled in a risk matrix whose level is seen from two perspectives, namely likelihood and impact. The results of the scoring will be useful for determining the major risks in the potential risks that exist in each process step. The assessment results of the risk matrix are used as the basis for determining which factors are the major risks in the study, then these factors are analyzed in depth using the Root Cause Analysis (RCA) method for proposed risk mitigation actions (Jevon & Rahardjo, 2021).

This technique attempts to identify the root cause of the problem rather than just the symptoms of the risk. This technique is a correlative measure that is not always fully effective so continuous and continuous improvement is necessary. Root cause analysis is most often applied to the evaluation of large losses, but can also be used to analyze losses more globally to determine where improvements can be made (Prowanta, 2019).

RESEARCH METHOD

The process of this research uses the Failure Mode and Effect Analysis (FMEA) technique as risk analysis and Root Cause Analysis (RCA) as risk mitigation. Determining the risks that affect the achievement of production targets obtained from the monthly production performance report of the XYZ company so that it can be known how much the severity value (Severity), the possibility value (Occurence) and Detection (Detection) which results in the Risk Priority Number (RPN) value. Data collection is carried out by means of observation and interviews with experts from each of t h o s e involved in achieving the urea fertilizer production target. The Root Cause Analysis (RCA) approach is a useful process for understanding and solving problems. This method is useful for identifying the causes and sources of current problems to develop improvement strategies.

RESULTS AND DISCUSSION

Establishing the Risk Context

The context of internal and external risk indicators of risk management at XYZ Company is determined. The determination is carried out by brainstorming with experts in each department involved in achieving production targets, namely the production rendal, marketing and distribution departments. Risks are determined by classifying risks based on internal and external categories. The following are the risks that have been determined from the brainstorming results:

Table 2. Risk Context Determination Results

Department Operational	Category	ID	Risk
Production Rendal	*Internal*	R1	*Shutdown* due to operational issues
		R2	Damage to mechanical equipment
		R3	Repairs to *static* equipment
		R4	*Shutdown* due to *rotating* problem
		R5	Repairs to factory instrument equipment
	External	R6	*Electricity/power* interruption
		R7	Limited gas supply
		R8	CO2 supply limitation
		R9	Raw material limitation
		R10	Setting the operational pattern of the 1st line warehouse
Marketing	*Internal*	R11	Factory not operating due to economic (business) pace
		R12	Product exports are slow
	External	R13	Market competition
		R14	Lack of product absorption

Distribution	*Internal*	R15	Line 2 warehouse pattern arrangement
		R16	Failure in the bagging process
	External	R17	Inadequate condition of vendor's warehouse
		R18	Delivery delays
		R19	Limited supporting warehouse

Source: XYZ Company Internal Data (2023)

Risk Identification

Risk identification is carried out in the process of achieving the urea fertilizer production target. Identification is done by identifying risks that occur against potential effects, risk cause and current control obtained from brainstorming with experts from each department involved.

Table 3. Risk Identification Results

Category	ID	Risk	*Potential Effect*	*Risk Causes*	*Current Control*
		Production Rendal			
Internal	R1	Shutdown due to operational issues	Urea production rate drops	Shutdown of the factory ammonia	*Distributed control system*
	R2	Damage to mechanical equipment	Factory not operating	Leakage at the flange and flow pipe	*Distributed control system*
	R3	Repairs to static equipment	Factory not operating	Improvements to the vessel and tanks	*Distributed control system*
	R4	Shutdown due to rotating problem	Factory not operating	*Shutdown* due to damage gears	*Distributed control system*
	R5	Repairs to factory instrument equipment	Factory not operating	*Shutdown* due to high pressure during yhe process production	*Distributed control system*
Eksternal	R6	Electricity/power interruption	Raw material rate drops	Thrid parties limit the amount of supply electricity supply	*Distributed control system*
	R7	Limited gas supply	Raw material rate drops	Thrid parties limit the amount of supply LNG/Gas	*Distributed control system*
	R8	CO2 supply limitation	Raw material rate drops	Thrid parties limit the amount of supply CO2	*Distributed control system*
	R9	Raw material limitation	Raw material rate drops	*Shutdown* ammonia plant	*Distributed control system*
	R10	Pattern setting 1st line warehouse operations	*Overstock* products in line 1 warehouse	Product cannot be absorbed	*Distributed control system*

		Marketing			
Internal	R11	Factory not operating due to economic (business) pace	Overstock of products in line 2 warehouse and 3	Policy Changes	*Distributed control system*
	R12	Prodct exports are slow	Overstock of products in line 2 warehouse and 3	Policy Changes	Deection via inspection activities
Eksternal	R13	Market competition	Overstock of products in line 2 warehouse and 3	Competitor's price is cheaper	Deection via inspection activities
	R14	Lack of product absorption	Overstock of products in line 2 warehouse and 3	Lack of enthusiasts	Deection via inspection activities
		Distribution			
Internal	R15	Line 2 warehouse pattern arrangement	Decreasein production rate daily	*Overstock* production	Deection via inspection activities
	R16	Failure in the bagging process	Product realization is not in accordance with RKAP	Damege to bagging machine line 2	Deection via inspection activities
Eksternal	R17	Warehouse cndition inadequate vendors	Damege and product defects	Internal warehouse overstock	Deection via inspection activities
	R18	Delayed delivery	Complaints from consumers	Failure in the delivery process ship	Deection via inspection activities
	R19	Limited supporting warehosue	Urea production rate drops	Internal warehuse overstock	Deection via inspection activities

Risk Analysis

After all risks have been identified, risk causes, risk consequences and risk control. Then risk analysis is carried out by assessing the severity, occurrence and detection values for the risks that have been previously identified. The assessment is carried out by experts in each department. The following are the results of the assessment for severity, occurrence and detection:

Table 4. Severity, Occurance and Detection Values

ID	*Risk*	Severity	Occurrence	Detection
	Production Rendal			
R1	Shutdown due to operational issues	4	1	1
R2	Damage to mechanical equipment	4	1	2
R3	Repairs to static equipment	5	1	2
R4	Shutdown due to rotating problem	5	1	2
R5	Repairs to factory instrument equipment	4	1	1
R6	Electricity/power interruption	4	1	1
R7	Limited gas supply	4	1	1

R8	CO2 supply limitation	4	1	1
R9	Raw material limitation	4	1	1
R10	Pattern setting 1st line warehouse operations	3	1	3
	Marketig			
R11	Factory not operating due to economic (business) pace	3	1	1
R12	Prodct exports are slow	3	1	1
R13	Market competition	3	1	1
R14	Lack of product absorption	4	1	3
	Distribution			
R15	Line 2 warehouse pattern arrangement	3	1	3
R16	Failure in the bagging process	4	2	3
R17	Warehouse cndition inadequate vendors	2	1	2
R18	Delayed delivery	2	2	1
R19	Limited supporting warehosue	3	1	1

After knowing each assessment for severity, occurrence and detection values for previously identified risks, the next step is to determine the Risk Priority Number (RPN) value to determine the risk priority value of the risks that have been identified. Risk Priority Number (RPN) value. For the RPN assessment, it is obtained from the product of severity, occurance, and detection. After the RPN value is determined for each risk, the risk factor RPN crisis value is calculated. Risk results with RPN values above the crisis value require risk mitigation by providing proposed improvements.

Table 5. Results of Risk Priority Number (RPN)

ID	Risk	*Severity*	*Occurrence*	*Detection*	*Risk Priority Number*
	Production Rendal				
R1	Shutdown due to operational issues	4	1	1	4
R2	**Damage to mechanical equipment**	**4**	**1**	**2**	**8**
R3	**Repairs to static equipment**	**5**	**1**	**2**	**10**
R4	**Shutdown due to rotating problem**	**5**	**1**	**2**	**10**
R5	Repairs to factory instrument equipment	4	1	1	4
R6	Electricity/power interruption	4	1	1	4
R7	Limited gas supply	4	1	1	4
R8	CO2 supply limitation	4	1	1	4
R9	Raw material limitation	4	1	1	4
R10	**Pattern setting 1st line warehouse operations**	**3**	**1**	**3**	**9**
	Marketing				
R11	Factory not operating due to economic (business) pace	3	1	1	3
R12	Prodct exports are slow	3	1	1	3
R13	Market competition	3	1	1	3
R14	**Lack of product absorption**	**4**	**1**	**3**	**12**
	Distribution				

R15	Line 2 warehouse pattern arrangement	**3**	**1**	**3**	**9**
R16	Failure in the bagging process	**4**	**2**	**3**	**24**
R17	Warehouse cndition inadequate vendors	2	1	2	4
R18	Delayed delivery	2	2	1	4
R19	Limited supporting warehosue	3	1	1	3
	Total	**68**	**21**	**31**	**126**
	Average	**3,58**	**1,11**	**1,63**	**6,63**
	Risk RPN Crisis Value				**6,63**

Table 5 shows that the average RPN crisis value is 6.63. Therefore, risks with RPN values above 6.63 must be mitigated immediately by providing proposed improvements so as not to cause repeated failures in the future and the risk impact is not getting worse. Of the 19 risks, there are seven risks with values above the RPN crisis value, namely damage to mechanical equipment, repairs to static equipment, shutdown due to rotating problems, setting the operational pattern of warehouse line 1, lack of product absorption, setting the pattern of warehouse line 2 and failure in the bagging process.

Risk Evaluation

At this stage, risk mapping is carried out based on prioritization based on risk levels and risk matrix. Risk prioritization is made to determine the level of risk that must be prioritized for the provision of risk mitigation efforts. Furthermore, an evaluation is carried out using a risk matrix where the risk matrix is divided into four risk levels, namely low risk, moderate risk, high risk and extreme risk. The purpose of risk mapping is to determine the overall risk level.

Risk Prioritization

Risk prioritization based on risk level is made to determine the level of risk that takes precedence for providing risk mitigation efforts. Risk prioritization is made based on the RPN value obtained by sorting the highest RPN value to the lowest. Table 6 shows the risk priority based on the highest RPN value for achieving the urea fertilizer production process target:

Table 6. Risk Prioritization

ID	RISK	*RISK PRIORITY NUMBER* (RPN)
R16	Failure in the bagging process	24
R14	Lack of product absorption	12
R3	Repairs to static equipment	10
R4	Shutdown due to rotating problem	10
R10	Setting the operational pattern of the 1st line warehouse	9
R15	Line 2 warehouse pattern arrangement	9
R2	Damage to mechanical equipment	8
R11	Factory not operating due to economic (business) pace	6
R12	Product exports are slow	6
R13	Market competition	6

R19	Limited supporting warehouse	6
R5	Repairs to factory instrument equipment	5
R6	Electricity/power interruption	5
R1	Shutdown due to operational issues	4
R7	Limited gas supply	4
R8	CO2 supply limitation	4
R9	Raw material limitation	4
R17	Inadequate condition of vendor's warehouse	4
R18	Delivery delays	4

Risk Matrix

Based on the calculation of the risk matrix value (severity and occurrence) of each risk, a risk map is produced to map the risk into four risk levels, namely low risk, moderate risk, high risk, and extreme risk. The purpose of risk mapping is to determine the overall risk level. The following table 7 shows the results of the risk map for each risk:

Table 7. Risk Matrix

	Severity				
Likelihood	***Negligible***	***Minor***	***Moderate***	***Major***	***Catastrophic***
Improbable		**R18**	**R11, R12, R13, R19**	**R1, R5, R6, R7, R8, R9**	
Unlikely		**R17**		**R2**	**R3, R4**
Occasional			**R10, R15**	**R14, R16**	
Probable					
Frequent					

Low Risk	**Moderate Risk**	**High Risk**	**Extreme Risk**

The following table 8 shows the classification of each risk according to the risk map that has been made in table 7 :

Table 8. Risk Classification based on Risk Matrix

ID	RISK	RISK CLASSIFICATION
R16	Failure in the bagging process	*High Risk*
R14	Lack of product absorption	*High Risk*
R3	Repairs to static equipment	*High Risk*
R4	Shutdown due to rotating problem	*High Risk*

R10	Setting the operational pattern of the 1st line warehouse	*Moderate Risk*
R15	Line 2 warehouse pattern arrangement	*Moderate Risk*
R2	Damage to mechanical equipment	*Moderate Risk*
R11	Factory not operating due to economic (business) pace	*Low Risk*
R12	Product exports are slow	*Low Risk*
R13	Market competition	*Low Risk*
R19	Limited supporting warehouse	*Low Risk*
R5	Repairs to factory instrument equipment	*Low Risk*
R6	Electricity/power interruption	*Low Risk*
R1	Shutdown due to operational issues	*Low Risk*
R7	Limited gas supply	*Low Risk*
R8	CO2 supply limitation	*Low Risk*
R9	Raw material limitation	*Low Risk*
R17	Inadequate condition of vendor's warehouse	*Low Risk*
R18	Delivery delays	*Low Risk*

Risk Mitigation

The potential risks that are dominant in the process of not achieving the urea fertilizer production target have been determined using risk priorities and risk maps. Risks that are included in the high risk and moderate risk levels and have values above the RPN crisis value require mitigation actions to reduce the risk in the f u t u r e process. In this problem, mitigation is carried out using the root cause analysis method which is useful for finding the root cause of the problem in order to prevent the recurrence of the risk of not achieving the urea fertilizer production target. From table 6 and table 8, the most dominant value is obtained, namely the risk of damage to mechanical equipment, repairs to static equipment, shutdown due to rotating problems, setting the operational pattern of warehouse line 1, lack of product absorption, setting the pattern of warehouse line 2 and failure in the bagging process. This must be analyzed for the root cause of the occurrence with the risk register table first so that mitigation actions can be taken on target.

Table 9. Risk Register Root Cause Analysis

Dominant Risk	Root Cause	Risk Consequence
Damage to equipment mechanics	Leaks at flange and flow pipe	Factory not operating
Improvements at equipment static	Improvements to vessels and tank	Factory not operating
Shutdown due to problem rotating	Shutdown due to gear damage	Factory not operating
Setting operational patterns 1st line warehouse	Products not can absorbed	Overstock of products in the warehouse 1st line and production rate down
Lack of absorption products	Lack of interest	Overstock of products in the line 2 & 3
Line warehouse pattern arrangement 2	Overstock production	Decrease in production rate daily
Failure at process bagging	Damage at machine bagging line 2	Production realization is not inn line with RKAP

From the root cause in table 9 which shows the dominant risk of not achieving the urea fertilizer production target. So that risk mitigation proposals must be given which are brainstormed with experts from each department involved. The proposal is presented in the table below.

Table 10. Proposed Risk Mitigation based on RCA

Dominant Risk	Proposed Risk Mitigation
Damage to equipment mechanics	1. Conduct regular inspections on mechanical equipment to detect signs of damage 2. Conduct periodic equipment performance audits and evaluations to ensure safe and efficient operations. 3. Prepare an emergency response plan to address equipment failures due to turbine damage, including evaluation measures and fast handling
Improvements at equipment static	1. Conduct regular and periodic inspections and maintenance to detect signs of undetected damage 2. Using non-destructive methods such as magnetic particle tests to detect damage that is not visually apparent 3. Conduct periodic audits to evaluate equipment performance and worker compliance against the SOP
Shutdown due to problem rotating	1. Implementasi sistem pelumas otomatis untuk Implementation of an automatic lubrication system to ensure that the gears are always well lubricated. 2. Establish a strict preventive maintenance schedule to regularly inspect and maintain the gears 3. Setting up spare gears for avoid prolonged downtime when need replacement
Setting operational patterns 1st line warehouse	1. Implementation of warehouse system automation to improve the efficiency of product storage and retrieval 2. Adding an external warehouse with a vendors 3. Implemented a JIT strategy to reduce the amount of inventory held and ensure on-time delivery accordingly production needs
Lack of absorption products	1. Collect customer *feedback* to understand product needs, complaints and issues for the development of improved urea fertilizer quality and effectiveness. 2. Using digital *platforms* for marketing and sales so that products can be more easily accessed by the market 3. Conduct regular market analysis to understand demand trends and adjust

	production levels according to needs
Line warehouse pattern arrangement	1. Implementation of a warehouse management system (WMS) to monitor and manage stock in real-time, ensuring that stock is in line with market needs. 2. Adjusted distribution schedules based on the latest market demand analysis to reduce over-delivery to areas with low absorption 3. Conduct regular and periodic evaluations to identify potential problems in warehouse and distribution operational patterns
Failure at process bagging	1. Converting conventional bagging to automation and robotics technology to improve efficiency and reduce the risk of human error 2. Standardized the bagging process to reduce variability and improve consistency of operations. 3. Installing sensors on bagging machines to monitor performance in *real-time* and detect anomalies or potential damage

CONCLUSIONS

By brainstorming with experts and supported by literature data from each department involved in achieving urea fertilizer production targets, 19 risk contexts were obtained. Of the 19 risks, seven dominant risks were obtained with values above the RPN crisis value and are at the high risk and moderate risk levels. The first dominant risk is the failure in the bagging process with an RPN value of 24 and is at a high level of risk. The risk with the second highest RPN value is the lack of product absorption with an RPN value of 12 and is at a high risk level. The risk with the third highest RPN value is static equipment repair with an RPN value of 10 and is at a high risk level. The risk with the fourth highest RPN value is shutdown rotating problems with an RPN value of 10 and is at a high risk level.

The risk with the fifth highest RPN value is setting the operational pattern of warehouse line 1 with an RPN value of 9 and is at a moderate risk level. The risk with the sixth highest RPN value is setting the pattern of warehouse line 2 with an RPN value of 9 and is at a moderate risk level. The risk with the seventh highest RPN value is mechanical equipment damage with an RPN value of 8 and is at a moderate risk level. Previous research by Ulfa and Immawan (2021) shows that there are differences in the combination of methods with the addition of the RCA method in the risk mitigation section, so that the mitigation provided is in accordance with the real situation in the field and in accordance with the root cause of the risk problem.

REFERENCE

Aisyah, A. P., & Dahlia, L. (2022). Enterprise Risk Management Based on ISO 31000 in Measuring Operational Risk at Esti Specialist Clinic. Journal of Accounting and Management (JAM), 19(2), 78-90. https://doi.org/https://doi.org/10.36406/jam.v19i02.483

Alijoyo, A., Bobby, W., & Jacob, I. (2019). Failure Mode Effect Analysis. Center for Risk Management & Sustainability.

Alwi, A. (2022). Analysis of Achieving Paper Production Targets for Increasing Production Efficiency at PT OKI Pulp and Paper in Sungai Baung Ogan Komering Ilir. Dehansen Multi Discipline Journal (MUDE), 1(2), 20-26. https://doi.org/https://doi.org/10.37676/mude.v1i2.2061

Anita, S. Y., Kustina, K. T., Wiratikusuma, Y., Sudirjo, F., Sari, D., Rupiwardani, I., Ruswaji, Nugroho, L., Rakhmawati, I., Harahap, K. A., Anwar, S., Apriani, E., & Sucandrawati, S. A. K. L. N. (2022). Risk management. PT Global Executive Technology.

Arta, S. P. I., Satriawan, G. D., Bagiana, K. I., Loppies, Y., Shavab, A. F., Mala, F. M. C., Sayuti, M. A., Safitri, A. D., Berlianty, T., Julike, W., Wicaksono, G., Marietza, F., Kartawinata, R. B., & Utami, F. (2021). Risk Management Theoretical and Practical Review. Widina Bhakti Persada.

Geofanny, G. K., Tanaamah, A. R., Information, S., Information, F. T., Kristen, U., & Wacana, S. (2022). ISO 31000 Based Risk Management System: 2018 at PT. Bawen Mediatama. Journal of Informatics Engineering and Information Systems, 9(4), 2870-2878. https://doi.org/https://doi.org/10.35957/jatisi.v9i4.2484

Hairul. (2020). RISK MANAGEMENT. Deepublish.

Jevon, I., & Rahardjo, J. (2021). Application of Risk Management using the FMEA Method in the Suur Bor Excavation Project by CV. Tirto Kencana. Titra Journal, 9(2), 471-478. https://publication.petra.ac.id/index.php/teknik-industri/article/view/13052

Prowanta, E. (2019). Capital Market Risk Management (ISO 31000:2018). In Media.