

THE APPLICATION OF HAZARD IDENTIFICATION AND RISK ANALYSIS (HIRA) AND FAULT TREE ANALYSIS (FTA) METHODS FOR CONTROLLING OCCUPATIONAL ACCIDENTS IN MIXING DIVISION DEWA-DEWI FARM

Roberto Anthony and Sunday Noya

Industrial Engineering Study Program Ma Chung University

e-mail: sunday.alexander@machung.ac.id

ABSTRACT

Occupational accident is one thing that should be avoided, considering occupational accident has very harmful effects for both the company and the labours. Dewa-Dewi Farm is a poultry farm which has four main divisions, which is mixing division is one of them. There are 5 main activities in mixing division, such as receiving and testing, weighing, grinding, mixing and distributing the feed. All work activities work in mixing division potentially bring out accidents. Identify Hazards is necessary to minimize accidents. Hazard identification and risk analysis (HIRA) is a method of identifying hazards potential that may occur in a job. By using HIRA known that the five main activities potentially face risk of occupational accident such as earaches, muscle injury, shortness of breath, sore eyes, slipping, falling, striking, electric shock, burns and skin allergies. After identifying the problem with HIRA method is completed then carried out a risk assessment based on two criteria: likelihood (probability) and severity (impact) should be done. Based on the risk assessment there are 2 extreme-risk, 7 high risk, 4 medium-risk and 12 low-risk activities. The next method used is Fault Tree Analysis (FTA) which is a method of error analysis by direct observation and interviews, which then were visualized with a model of the fault tree. Analysis of the causes of accidents using FTA method shows the source of the risks posed by unsafe action and unsafe condition that is the wrong way of working and poor working environment. There are several recommendations given such as instructional the best way about manual lifting, provision of tools and personal protective equipment, and improve the working environment.

Keywords: Occupational Accident, HIRA, FTA, Unsafe Action, Unsafe Condition.

ABSTRAK

Kecelakaan kerja merupakan salah satu hal yang harus dihindari, mengingat kecelakaan kerja memiliki dampak yang sangat merugikan baik bagi pihak perusahaan maupun pihak pekerja. Dewa-Dewi Farm merupakan sebuah peternakan ayam petelur yang memiliki 4 divisi utama, salah satunya adalah divisi pencampuran pakan. Dalam divisi pencampuran pakan terdapat 5 aktivitas utama yang dilakukan antara lain menerima dan menguji, menimbang, menggiling, mencampur dan mendistribusikan pakan. Seluruh aktivitas kerja dalam divisi pencampuran pakan berpotensi menimbulkan kecelakaan kerja. Untuk meminimalisir terjadinya kecelakaan kerja perlu dilakukan identifikasi bahaya. Metode Hazard Identification and Risk Analysis (HIRA) merupakan salah satu metode identifikasi bahaya yang mungkin terjadi dalam suatu pekerjaan. Dengan menggunakan metode HIRA diketahui bahwa kelima aktivitas utama yang dilakukan berpotensi menghadapi risiko-risiko kecelakaan kerja seperti sakit telinga, cidera otot, sesak nafas, sakit mata, terpeleset, terjatuh, tertimpa, tersengat listrik, kulit terbakar dan alergi. Setelah identifikasi masalah dengan metode HIRA selesai dilakukan kemudian dilakukan penilaian risiko yang berdasarkan pada 2 kriteria yaitu likelihood (probabilitas) dan severity (dampak). Dari penilaian risiko yang dilakukan terdapat 2 aktivitas kerja berisiko ekstrim, 7 berisiko tinggi, 4 berisiko sedang, dan 12 berisiko rendah. Metode selanjutnya yang digunakan adalah Fault Tree Analysis (FTA) yaitu merupakan suatu metode analisis kesalahan dengan melakukan pengamatan dan wawancara secara langsung yang divisualisasikan dengan model pohon kesalahan. Analisis penyebab kecelakaan kerja menggunakan metode FTA menunjukkan sumber risiko muncul akibat unsafe action dan unsafe condition yaitu cara kerja yang salah dan lingkungan kerja yang buruk. Rekomendasi diberikan berupa pembelajaran manual lifting, penyediaan alat bantu dan alat pelindung diri, dan usaha peningkatan lingkungan kerja.

Kata Kunci: Kecelakaan Kerja, HIRA, FTA, Unsafe Action, Unsafe Condition.

INTRODUCTION

Occupational accidents often occur in Indonesia, due to the requirements in the implementation of occupational safety and

health is overlooked. Referring to the data in the Social Security and BPJS 2013, 9 people die every day as a result of workplace accidents in Indonesia. The lack

of Indonesian public awareness about safety as provided by the data that reveal no more than 2.1% of the 15,000 largest companies in Indonesia use safety management in their company [1]. Occupational accident can be caused by two things: unsafe condition and unsafe action [2]. Unsafe condition is work accidents caused by poor working environment, while unsafe action is a work accident caused by the actions of workers who are not safe [3]. Prevention and reduction of the risk occurring necessary to reduce accidents. Prevention and risk reduction begins with finding sources of workplace accidents.

Dewa-Dewi Farm is a poultry farm with a capacity of 13000 hens. At Dewa-Dewi Farm labor directly involved in the production process, where the production process is a manual activity, and semi-automatic (human as operator). However, risk management and safety management has never been applied to the Dewa-Dewi Farm, resulting in the high number of accidents. There are different types of methods of identification of potential hazards in the workplace such as hazard identification and risk analysis (HIRA) and fault tree analysis (FTA) where HIRA is a method of identifying potential hazards that might occur in a job and FTA is a method of analysis errors by making direct observations and interviews were visualized with a model of the fault tree [4,5] These methods are methods of identifying potential hazards that may occur in a working system.

Hazard identification is a systematic effort to identify all situations or events that have the potential to cause accidents that may occur in the workplace. There are various types of methods that can be used in identification of hazards. That methods are classified into three parts, they are the passive method, the semi proactive method, and proactive methods. Passive method is the identification of the hazards to which workers experience danger directly, semi proactive method is used based on the other workers experience, whereas a

proactive method is a method of identifying hazards carried out before workers experiencing accident [3].

Proactive hazard identification method is the best identifying hazards method compared to the others, because the workers do not experience the accident directly, but it is analyzed before the accident happen on workers. In the other words, proactive hazard identification method is preventive or prevent the occurrence of hazards in a work environment. There are several proactive hazard identification methods include the Job Safety Analysis (Job Safety Analysis), Preliminary Hazard Analysis, What-If Analysis, Fault Tree Analysis, Analysis of Hazard and Operability Study (HAZOP), Analysis of Hazard Identification and Risk Analysis (HIRA), and various other methods [3].

Fault Tree Analysis (FTA) FTA method often used to analyze the failure of the system. FTA is a method of analysis undesired event occurs in the system. and then the system is analyzed by environmental conditions and existing operasiobnal to find all the possible ways that lead to the occurrence of the undesired event [6]. Cause undesired event and the probability of occurrence can be determined by using the method of FTA. to find the cause of undesired event is with qualitative analysis, while searching for the probability, with quantitative analysis. Qualitative analysis is used to determine which parts of the system so that it can be repaired and prevention based on the failure of existing prevention so that similar events do not recur [7].

LITERATURE REVIEW

Symbols and Terminology in the Fault Tree. Fault tree is a tree in which the error is built on certain symbols that represent an event. To construct a fault tree there are three main symbols, they are symbols of events, symbols of gate, and symbol of transfer [7,8]. Symbol of event is a symbol which denotes an event or events. There are five event symbols in fault tree: basic event, undeveloped event, conditioning event, an incident.

T top event occurs if event A occurs or event B occurs. A basic event occurrence is not

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investigated the cause, while the incidence B is an intermediate event and occurs if the C and D events occur. C and D is a basic event. Set is the set of the smallest combination of events, whereby if the basic event occurred would cause the top event to occur [6].

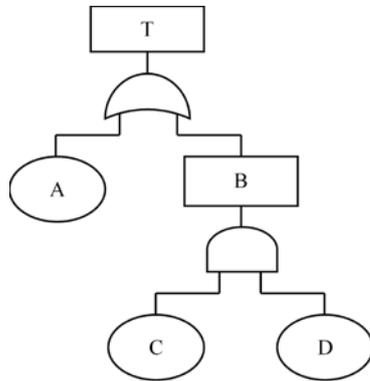


Figure 1. Simple Fault Tree [7]
T: Top Event, B: Intermediate Event,
A,C,D: Basic Events

Hazard Identification and Risk Analysis (HIRA) is a method of identifying potential hazards that might occur in a job [9]. In the method of information obtained HIRA is a description of each work activity, hazard, hazard classifications, as well as the impact of hazards [3]. There are three main points contained in the HIRA method is what is the cause of danger or accident, how big the impact of workplace accidents, work accidents and how often they occur.

Risk Assessment. HIRA method is very closely related to the risk assessment that the risk assessment would be a hazard in a work activity is very important to do. There are several factors is can be used to provide an assessment of the risk that the frequency of occurrence of hazards and the impact caused by the hazard [9]. The risk assessment is based on the frequency of occurrence

Table 1. Likelihood Criteria [1]

		Likelihood	
Level	Criteria	Description	
		Qualitative	Quantitative
1	Rarely	Can be thought of but not only the current state of extreme	Less than 1 time per year
2	Unlikely	Has not happened yet but could arise or occur sometime	Occur 1 to 3 times per year
3	Maybe	Should have happened and may have occurred here or elsewhere	Occur 3 to 5 times per year
4	Most likely	Can happen easily, it may appear in a state of the most common	Occur 5 to 7 times per year
5	Almost definitely	It often happens, is expected to appear in a state of the most common	More than 7 times per year

Table 2. Severity Criteria [9]

		Consequences/Severity	
Level	Level	Description	
		Severity	Work Day
1	Not significant	Genesis does not cause harm or injury to humans	Not causing lost workdays
2	Little	Cause minor injuries, a small loss, but did not cause serious impact on business continuity	Still can work on the same day or shift
3	Moderate	Weight injury and hospitalized, not cause permanent disability, financial losses	Lost work days under 3 days
4	Weight	Cause severe injury, permanent disability, huge financial losses, and a serious impact on business continuity	Lost work days 3 days or more
5	Disaster	Resulting in deaths and severe losses, even can stop business operations forever	Working days lost forever

The Method to get the value of risk is calculated by multiplying the likelihood with severity. The following is description of the risk matrix.

1. Yellow: low risk
2. Navy blue: moderate risk
3. Red: high risk
4. Light blue: extreme risk

Table 3 Risk Matrix [9]

		Risk Level				
		5	4	3	2	1
Likelihood	5	5	10	15	20	25
	4	4	8	12	16	20
	3	3	6	9	12	15
	2	2	4	6	8	10
	1	1	2	3	4	5
Scale		1	2	3	4	5
		Severity				

RESEARCH METHODS

This research features a number of data which is then analyzed and compared with the actual situation, so that from it can be given solving ongoing problems. hopefully can obtaining better results than before. This research carried out on a poultry farm called Dewa-Dewi Farm in Blitar, East Java and done within 2 months starting from January-February 2015 and March-April 2015. This research refers to the control of the level of work accidents by using HIRA and FTA

Data Collection Methods At this stage, the collection of data relating to accidents that occur on Dewa-Dewi Farm last year. Data used in this study are primary data and secondary data. Primary data is data obtained directly from the source, while the secondary data is data obtained through company documents as well as documents from outside the company related to the research. following explanation of the methods used, Interview, Focus Group Discussion, Documentary Studies, Literatures.

Data Processing: All data were obtained both primary data and secondary data further processed to achieve the research objectives have been determined. From these data to identify problems, risk analysis, and risk assessment. Step-by-step risk assessment described in section 2.7.2 of risk assessment. Risks classified as mild risk category is analyzed using methods HIRA, while the risks are classified as moderate and severe risk was analyzed by HIRA and FTA. In this study, the risk of a relatively mild risk was analyzed by using the method of HIRA. Data processing aims to determine the risks that may occur in any work activities in the company. Work activities were observed in the present study is the work activity feed raw material receiving section (receiving) in animal feed storage warehouses, as well as the activities of the production process (production) ie mixing several feed materials into ready-made fodder.

Table 4. Worksheet HIRA

Stage	Activity	Initial conditions	Description of failure	Potential Hazards
0	Receive feed			
1	Quality control of animal feed	Location acceptance of feedstuffs were open so sunlight coming directly	Failed to test the quality of animal feed	Sunburn, allergies
2	Lifting the feed material from the truck toward the scales	The burden is too heavy, location of the place-making raw materials open	Failed to lift the feed material, the worker fell	Sunburn, allergies, muscle injury,
3	Weighing the weight of the feed	The position of the scales are too low	Failed to put a feed on scales	Muscle injury
4	Moving the animal feed ingredients on the scales towards the storage shed with a carried	The position of the scales are too low and the lack of tools to move the trap fodder from the scales to the barn, feed a load that is too heavy	Workers fall, failed to move the chicken feed to the storage sheds	Slip, muscle injury
5	Arranging each feed raw material at a height of ± 2 m	Position piles of animal feed is too high, too narrow warehouse	Failed to arrange the feed with a height of ± 2 m stacks fall	Slipping, falling, muscle injury, a fall

- T : Workers muscle injury
- G1 : The workload is too heavy
- P1 : Primary event 1
- P2 : Primary event 2
- P3 : Primary event 3

From the images can be obtained Boolean equation is as follows:

$$T = P1 + G1$$

$$G1 = P2 + P3$$

Using a top-down approach is obtained

$$T = P1 + G1 \text{ (Because } G1 = P2 + P3)$$

$$T = P1 + P2 + P3$$

Minimal cut sets of picture above is {P1},{P2},{P3}

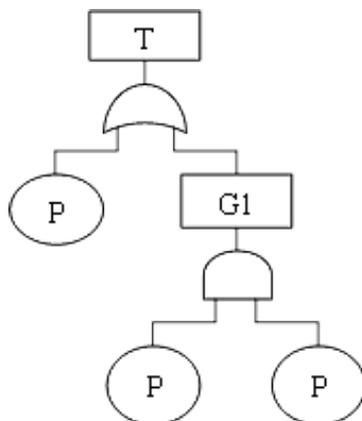


Figure 2. Fault Tree Trial

- Q: Worker injured when the muscle.
- P1: The workload is too heavy.
- G1: The absence of working tools.
- P2: Company does'nt provide working tools
- P3: There was resistance workers to use work tool.

Qualitative analysis is used to obtain a combination of failures that can cause the top event occurred on a system or a minimal cut set of this can be known how many basic event that could lead to the top event occurs. Please note if there are two basic event in a minimal cut set. Means both basic event affecting the top event occurs [7]. For example, the results of qualitative analysis in Figure 2.

Analysis of the results is based on the results of the implementation is done in the company. In this case analysis of the use of methods HIRA and FTA. From this analysis than if after the implementation of the company there is a decrease or increase in the number of

accidents at the company. Conclusions and suggestions The last stage of this study is to provide conclusions and recommendations on the overall report based on the results of the analysis in the field.

RESULT AND DISCUSION

Activities in Mixing Division Dewa-Dewi Farm. Receiving and Quality Testing. Weighing Feed Ingredients. Grinding Feed Ingredients. Mixing Feed. Feed distribution.

The Failure Identification of Work Activity Receiving And Quality Testing



Figure 4. Quality Controlling

The Failure Identification of Work Activity Distributing Food.



Figure 5. Distributing Food

Work Activity Risk Assessment HIRA method is closely related to risk assessment, risk assessment was conducted to determine the level of the possibility of accidents in a work activity. The risk assessment is based on

likelihood criteria (Table 1) and severity criteria (Table 2). Results of the assessment of risk based on both of these criteria is a risk matrix that shows the level of risk each work activity.

Table 5. Failure Identification of Work Activity Receiving and Quality Testing

Stage	Activity	Initial conditions	Description of failure	Potential Hazards
0	Receive feed			
1	Quality control of animal feed	Location acceptance of feedstuffs were open so sunlight coming directly	Failed to test the quality of animal feed	Sunburn, allergies
2	Lifting the feed material from the truck toward the scales	The burden is too heavy, location of the place-making raw materials open	Failed to lift the feed material, the worker fell	Sunburn, allergies, muscle injury,
3	Weighing the weight of the feed	The position of the scales are too low	Failed to put a feed on scales	Muscle injury
4	Moving the animal feed ingredients on the scales towards the storage shed with a carried	The position of the scales are too low and the lack of tools to move trap fodder from scales to barn, feed is heavy	Workers fall, failed to move the chicken feed to the storage sheds	Slip, muscle injury
5	Arranging each feed raw material at a height of ± 2 m	Position piles of animal feed is too high, too narrow warehouse	Failed to arrange the feed with a height of ± 2 m stacks fall	Slipping, falling, muscle injury, a fall

Table 6. Failure Identification of Work Activity Weighing

Stage	Activity	Initial conditions	Description of failure	Potential Hazards
0	Weighing			
1	Weighing feed ingredients	Dark room conditions because of low light, the rooms were dusty conditions, the stack is too high	One vote feed materials to be used,	Slip, crushed
	Choosing the feed material to be removed to the location of the scales	The burden is too heavy, location of the place making the feed material is too high	Failed to lift the feed from the barn into the scales	Muscle injury, dropped, crushed
	Lifting the feed material from the warehouse to the location of weighing	The position of the scales are too low	Failed to put the feed to the scales	muscle injury
	Put the feed material to the scales	The position of the scales are too low	Inaccurate scales	muscle injury

Table 7. Failure Identification of Work Activity Grinding

Stage	Activity	Initial conditions	Description of failure	Potential Hazards
0	Grinding the feed material			
1	powering a generator	Location generator narrow and slippery, peeling cables, generators are used already too obsolete	Failed to turn on the generator, sound noisy, smoke billowing, worker electrocuted	Electric shock, slip, shortness of breath, sore ears
2	Turning on milling machines	The sound of the engine is too noisy.	Failed to ignite milling machine	Earache
3	Lifting the feed material to milling machine	milling machine is too high, the burden is too heavy, the sound of the engine is too noisy	Failed to lift the feed material to the milling machine, workers exposed to noise machine	Muscle injuries, falls, slips, earache

Cont..Table 7. Failure Identification of Work Activity Grinding

4	Grinding the feed material	The sound of the engine is too noisy, dust generated from the milling process	Workers exposed to dust and noise, failed to grind the feed, working hard to breathe	Ear pain, eye pain, shortness of breath
5	Entering back feed material has been ground into sacks sacks	engine is too noisy, feed ingredients berpartikel very small so easy to fly	Workers exposed to dust and noise, working hard to breathe,	Ear pain, eye pain, shortness of breath
6	Deadly milling machine	The sound of the engine is too noisy.	Workers exposed to noise	earache
7	Move toward the mixing of feed ingredients feed ingredients	The burden is too heavy, the engine sound generator is too noisy	dust and noise, working hard to breathe, failing to move to the location of feed mixing	Muscle injury, slip, shortness of breath, sore eyes, sore ears

Table 8. Failure Identification of Work Activity Mixing

Stage	Activity	Initial conditions	Description of failure	Potential Hazards
0	Mixing			
1	Turn on the mixer machine	Sound generator is too noisy	Failed to turn on the generator, sound noisy, smoke billowing, electrocute	Ear pain, muscle injuries, eye pain, shortness of breath
2	Incorporate feed into the machine mixer	The sound of the engine is too noisy, the burden is too heavy	Failed to ignite milling machine	Ear pain, eye pain, shortness of breath
3	Turn off the mixer engine	The sound of the engine is too noisy, the mixing process generates dust particles floating	Failed to lift the feed material to the milling machine, workers exposed to noise machine	Electric shock, slip, shortness of breath, sore ears
4	Turn off generator	Location generator narrow and slippery, peeling cables, generators used were too worn out causing smoke, noise generator is very noisy	Workers exposed to dust and noise, failed to grind the feed, working hard to breathe	Eye pain, shortness of breath
5	Entering feed ingredients that are mixed into sacks	the feed material is very small so it is easy to fly	Workers exposed to dust and noise, working hard to breathe,	Muscle injury, slip
6	Moving the feed material into the cart	Burden	Workers exposed to noise	Ear pain, muscle injuries, eye pain,

Table 9. Failure Identification of Work Activity Distributing Food

Stage	Activity	Initial conditions	Description of Failure	Potential Hazards
0	distributing feed			
1	Push carts containing feed towards each cage	Sound generator is too noisy	Feed load that is too heavy, too old wagon so it is not feasible to use	Muscle injuries, sunburn, allergies
2	Distributing feed towards each cage	Feed load that is too heavy, too old wagon so it is unfit for use, the location of distribution were open so the sun enters directly	Failed to push carts, cart tire deflated, failed to distribute feed	Muscle injuries, sunburn, allergies

Table 10. Receiving and Quality Testing Risk Assessment

Stage	Activity	Risk Assessment		Risk rating
		Likelihood	Severity	
0	Receive feed ingredients			
1	To examine the quality of animal feed ingredients	2	3	medium
2	Lifting the feed material from the truck toward the scales	3	3	high
3	Considering the weight of the feed	2	2	low
4	Moving the animal feed ingredients on the scales towards the storage shed with a carried	3	3	high
5	Arranging each feed raw material at a height of ± 2 m	3	3	high

Table 11. Weighing Feed Risk Assessment

Stage	Activity	Risk Assessment		Risk rating
		Likelihood	Severity	
0	Considering feed ingredients			
1	Choosing the feed material to be removed to the location of the scales	2	3	medium
2	Lifting the feed material from the warehouse to the location of weighing	2	3	medium
3	Put the feed material to the scale	2	2	low
4	Considering feed ingredients	2	2	low
5	Move to the location of the mill feed material	2	2	low

Table 12. Grinding Feed Risk Assessment

Stage	Activity	Risk Assessment		Risk rating
		Likelihood	Severity	
0	Grinding the feed material			
1	Turn on generator	3	4	extreme
2	Turning on milling machines	2	2	low
3	Lifting the feed material to milling machine	3	3	high
4	Grinding the feed material	3	3	high
5	Entering back feed material has been ground into sacks sacks	3	3	high
6	Turn off milling machine	2	2	low
7	Move toward the mixing of food	2	4	high

Table 13. Mixing Feed Risk Assesment

Stage	Activity	Risk Assessment		Risk rating
		Likelihood	Severity	
0	mixing feed			
1	Turn on the mixer machine	2	2	low
2	Incorporate feed into the machine mixer	2	3	medium
3	Turn off the mixer engine	2	2	low
4	Turn off generator	3	4	extreme
5	Entering re-feed that is mixed into sacks sacks	2	2	low
6	Moving the feed material into the cart and ready to be distributed	2	2	low

Table 14. Distributing Feed Risk Assessment

Stage	Activity	Risk Assessment		Risk rating
		Likelihood	Severity	
0	distributing feed			
1	Push carts containing feed towards each cage	2	2	Low
2	Distributing feed towards each cage	2	2	Low

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Causes of Accidents. Through a risk assessment using the HIRA, it can be seen any occupational accidents that are often experienced by workers and occupational accidents anything that has not happened yet have a probability or likelihood would occur if not given special treatment.

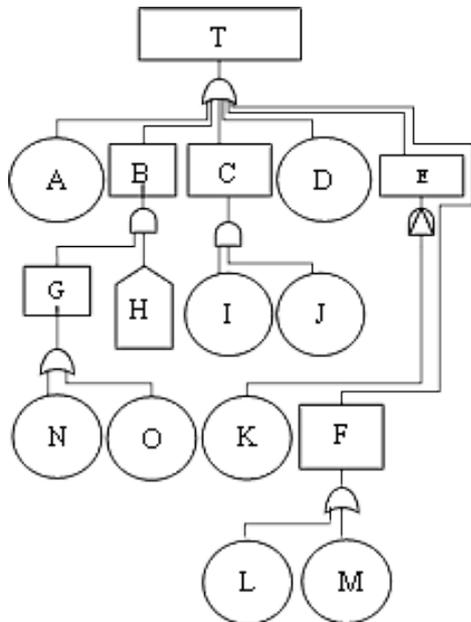


Figure 6. FTA Receiving and Quality Testing Activity

- T: Workers suffered sunburn, allergies, dehydration, fainting, muscle injury Slipping, falling.
- A: Feed mangandung chemicals harmful to humans
- B: Conditions workplaces open
- C: The lack or absence of tools in the enterprise work
- D: Heavy weight does not correspond to the ability or capacity of workers
- E: Stacks of feed is too high
- F: Poor lighting in the warehouse
- G: The absence of a roof is closed
- H: Erratic weather conditions and skin scorching sun
- I: There was resistance workers use work tool
- A: The absence of working tools
- K: The lack of capacity of the storage warehouse
- L: Lamp warehouse that has been worn out and unfit for use
- M: The absence of adequate lighting in the company
- N: The lack of funds to build a closed roof
- O: There is no corporate initiative to provide a closed roof

Minimal cut sets of the above equation is:
 $T = \{A\}, \{N\}, \{O\}, \{H\}, \{I\}, \{J\}, \{D\}, \{C\}, \{L\}, \{M\}$

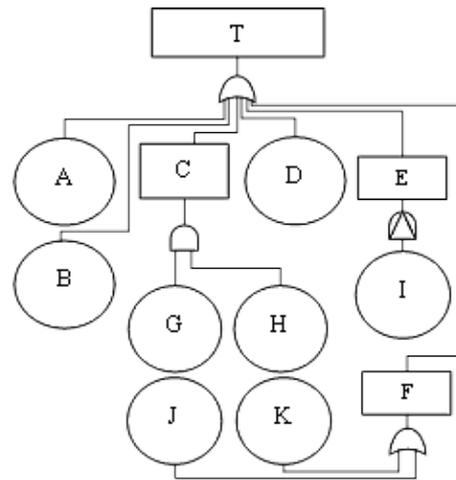


Figure 7. FTA Weighing Activity

- T: Workers slip, impaired vision, crushed, muscle injuries, falls, eye pain
- A: Feed mangandung chemicals harmful to humans
- B: Feed small berpartikel so easy diterbangkan by wind
- C: The lack or absence of tools in the enterprise work
- D: Heavy weight does not correspond to the ability or capacity of workers
- E: Stacks of feed is too high
- F: Poor lighting in the warehouse
- G: There was resistance workers use work tool
- H: The absence of working tools
- I: The lack of capacity of the storage warehouse
- A: The lights in the barn that has been worn out and unfit for use
- K: The absence of adequate lighting in the company

$$T = A + B + G + H + D + I + J + K$$

Minimal cut sets of the above equation is:
 $T = \{A\}, \{B\}, \{G\}, \{H\}, \{D\}, \{I\}, \{J\}, \{K\}$

Minimal cut sets of the above equation is:
 $T = \{A\}, \{G\}, \{H\}, \{I\}, \{J\}, \{D\}, \{C\}, \{L\}, \{M\}$

• **Recommendation for Reduce Muscle Injury:**

Provide referrals or information about how to manually lifting (lifting the load without the help of tools) are correct; provide tools such as wheelbarrows or forklifts for workers, Heavy loads are advised to be appointed 2 or more workers, Replace the existing payment system

• **Recommendation for Reduce Falling Accident:**

Provide tools for workers forklift, Heavy loads are advised to be appointed 2 or more workers, Replace warehouse lamp with a new

lamp, Provide shoe or anti-skid footwear so that workers do not fall from a height.

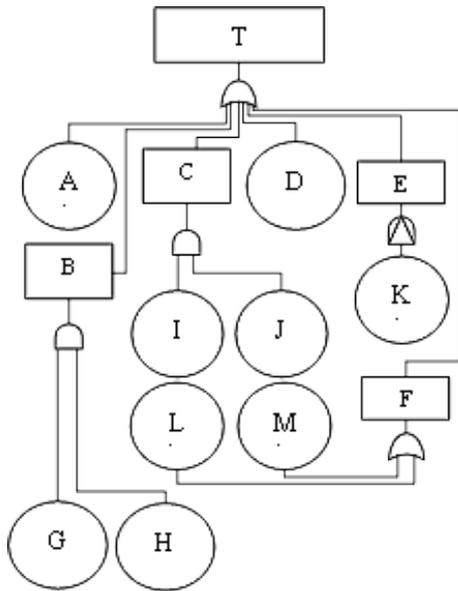


Figure 8. FTA Grindding and Mixing Activities

- T: Workers electric shock, slip, shortness of breath, earaches, muscle injury, illness eye
- A: Feed particles that are too small so easy to fly
- B: Engine generators are too old and using
- C: The lack or absence of tools in the enterprise work
- D: The burden is too heavy so it does not match the size of workers
- E: Cable peeling
- F: Poor lighting in the warehouse
- G: The sound engine is very noisy
- H: Time combustion of fuel in the form of carbon gas (CO)
- I: There was resistance from the workers using the new tool
- J: The Company does not provide the tools needed by workers working
- K: The cable used for too long without attention and care
- L: The lights used in warehouses unfit for use
- M: The Company does not provide adequate lighting

• Recommendation for Reduce Slip Accident:

Provide tools for workers forklift, Heavy loads are advised to be lifted two or more workers, Replace warehouse lamp with a new lamp Provide shoe or anti-skid footwear, Clean

the location where the generator is located at regular intervals, Provide symbols indicate floor slippery, Switch the generator location to location safer.

• Recommendation for Reduce Electric Shock Accident:

Perform regular maintenance, check the generator cord periodically, Provide hazard symbols such as "Beware of high voltage", Arrange the cable on the generator so it does not fall apart, Moving the location of the generator to the place safer

• Recommendation for Reduce Sunburn and Allergies:

To check the composition of chicken feed prior to the message, Building roof closed so workers are not exposed to direct sunlight, Apply sunscreen use for workers.

• Recommendation for Reduce Ear Ache:

Replace the old engine with a new engine which is more friendly noise pollution and air pollution, Provide ear protectors, Rearrange the machine that are not adjacent to one another, Provide a warning sign to the officer

• Recommendation for Reduce Sore Eyes:

Replace warehouse lamp with a new lamp Provide google or eye protection, Provide eye drug as first aid equipment, Provide warning signs using safety equipment.

• Recommendation for Reduce Breathless:

Provide a protective mask to protect the respiratory form of the workers, Replacing obsolete machines with new engines more environmentally friendly or gas combustion produces fewer, Provide a breathing apparatus such as an oxygen tank as a first aid worker who experience shortness of breath, Provide warning signs using safety equipment.

• Recommendation for Reduce Struck down Accident:

Provide tools for workers forklift, Provide

Table 16. Comparative Accident Before and After Implementation

Ear ache	Breathless	Sore eyes	Muscle injury	Slip	Struck Down	Electric Shock	Sun burn and Allergies
3,25	3,0	3	2	0,4	0,3	0,08	-
3	2	1	3	0	0	0	5

adequate rest periods for workers. Heavy loads are advised to be lifted two or more workers, Provide symbols indicate that watchful pile fell prone.

Implementation after giving a recommendation for any kind of work accident that the next thing is to compare results before and after the work accident implementasi done. In this situation given the limitations of time and expense it is not all the recommendations proposed research conducted by the company. In addition the results of the implementation will be compared with an average of workplace accidents in the period of 1 year. The following is a comparison of the risk assessment carried out before and after implementation.

CONCLUSION

Hazard identification by using HIRA, risk assessment, as well as analysis of the causes of accidents by using the FTA is an effort made to prevent and reduce accidents on the feed mixing division Dewa-Dewi Farm. Overall the dangers that occur due to the condition of the workers do its job in a way that is wrong or unsafe (unsafe action) and poor working conditions (unsafe condition) Analysis of the causes of accidents by using the FTA shows that each work activities have a source of risk is different. Based on the human error factor workplace accidents occur due to lack of knowledge workers in doing good manual lifting. While most of the accidents that occur due to environmental factors such as poor working conditions of the room without a ceiling, dark work space, work space slippery, noisy work space, work space dusty and smoky, and the machines are obsolete. Based on the results of the analysis are given recommendations for improvements to reduce and prevent the occurrence of occupational accidents in the feed mixing division Dewa-Dewi Farm. Extreme and high-risk activities should be carried out improvement considering the probability of occurrence and impact of occurrence is often very serious. How that is done to control workplace accidents in this research is to conduct administrative business with the notification correct way of working, a good manual lifting and suggested concentration and

adequate rest for the workers. Besides the provision of working tools such as wheelbarrows, mask, google, ear protectors is also an effort made to reduce and prevent accidents. Improvement and replacement and maintenance of some of the tools that have been unsuitable as a warehouse lamp replacement, generator cable is also an effort made.

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