JOURNAL OF SCIENTIFIC RESEARCH IN ALLIED SCIENCES

Contents available at: www.jusres.com

ACCIDENT CAUSES ANALYSIS IN INDUSTRY BY HYBRIDIZATION METHOD

Amit Kumar Gupta, Vijay Bhan Dinkar
Department of Mechanical Engineering, Rabindranath Tagore University, Bhopal

ARTICLE INFO

Article History
Received: February 2022
Accepted: April 2022
Keywords:
Machine accident, AHP, SAW, Safety Precaution

Corresponding Author
*A. K. Gupta

ABSTRACT

REVIEW ARTICLE

A systematic study of accidents in industries is expected to help in identifying the critical environment. Conventional machines are divided into groups which help the maintenance and safety department to focus their attention to the machine that has minimized the injuries of workers. In this work, accidental analysis of Conventional machines data is collected, investigated, and described of a few industries. The accidental case should have been divided into a few categories to obtain the problem. If the machine operation is inspected later will improve damage/accident caused. Analytic Hierarchy Process (AHP) and weighted product method (WPM) were used to find the weightage of the accident. Moreover, simple additive weight (SAW), the simplest and still the most widely used Multiple Attribute Decision Making (MADM) method, was used to identify accident causes in workshops. The results suggest that the proposed method helps to detect accident causes of conventional machines earlier hence taking the safety precaution according to the rank of accident causes.

1. INTRODUCTION

In addition to the losses due to downtime, costs for workers' compensation insurance, medical and administrative expenses resulting from disability, death and impaired productivity, they were liable to face serious monetary penalties and criminal sanctions from the government side, for non-compliance of law. Therefore, safety management became an important part of industrial management. The primary aim of safety management is to intervene in the causation process that leads to accidents. This includes above all, the active recognition of both visible and latent hazards. However, safety management is more than just a hazard identification system. It is an overall system for ensuring that safety activities are properly planned and effectively implemented, and that follow up system is arranged. Typically, safety management includes activities such as risk analysis, arrangement of safety training, accident and near-miss investigation, safety promotion and assessment of human reliability. Occupational accident and work-related diseases are a worldwide problem. It causes a lot of suffering as well as loss to individual, organization, community and society. Safe, healthy and environmentally sound work environment should be of extreme priority for any socially responsible employer. Such an environment helps to build an organization's public image and contribute to positive public relations. Yuvin et al. [1] researches on the study revealed that reduced-energy values

depend on many factors and that the wide variety of possible situations makes it necessary to conduct an in-depth risk analysis. Létourneau, & Potvin [2] Studied on worker was killed when she unjammed a trolley at the entrance to a shot-blasting machine. Selvam & Priyadarshini [4] Works on various safety and control measures (SCM) of accidents in building projects to minimize accidents' occurrence and consequent waste generation. Zhang et. al. [6] focused on the workers' safety behaviour in compliance with the workplace safety than determining actual hazardous scope of work and finding effective measures to reduce fatality at workplace.

2. GAP ANALYSIS

An important component of the accident because the analysis is a thorough understanding of "what happened". It begins by reviewing an "initial understanding" of the event and identifying unanswered questions and information gaps. The information-gathering process includes interviews with staff and workers who were, directly and indirectly, involved with the physical environment where the event and other relevant processes took place, along with observation of usual work processes. Most of the studies in the area of industrial safety have been reported from developed countries. India, being a large country with a high population and abundant skilled manpower, is a suitable place for safety-related research. A review of the literature reveals that there is not enough research evidence from India in the area of industrial safety. This information is synthesized into a "final understanding", which is further used by the team to begin the "why" portion of the analysis in a logical sequence to find the problem. It is one of the many brainstorming methodologies of asking "how much" five times repeatedly to help in identifying the accident cause of a problem. If a problem is repeatedly questioned, each time an alternative solution comes out which is linked to the accident cause in industry.

3. MULTI- CRITERIA DECISION MAKING

Multi-criteria decision making is the decision-making technique by considering some alternatives options. The Multiple Attribute Decision Making comes to elections, in which mathematical analysis is not needed. This type of MADM can be used for the election in which there is only a small number of alternative courses. The MADM is used to solve problems in discrete spaces, typically used to solve problems in the assessment and selection of limited number of alternatives. One of the most popular analytical techniques for complex decision-making problems is the analytic hierarchy process (AHP), which decomposes a decision-making problem into a system of hierarchies of objectives, attributes (or criteria), and alternatives. An AHP hierarchy can have as many levels as needed to fully characterize a particular decision situation. It was argued that SAW should be used only when the decision attributes can be expressed in identical units of measure (e.g., only dollars, only pounds, only seconds, etc.). However, if all the elements of the decision table are normalized, then SAW can be used for any type and any number of attributes. Factors that may lead a worker to seek employment in hazardous areas are poverty, high unemployment rate, increased population growth and a large number of accident dropouts. The various accident modes a relisted in table 1.

Table 1 Accident Symptoms and accident mode

S. NO.	Symptoms of Accident	ACCIDENT MODE

1	Loose cloth	
2	Incomplete rest	
3	Movement accident.	Skin diseases
4	Worker age	Injured
5	Unguarded machining Parts.	Burn
		Death
6	Chip ejection.	
7	Electric Short Circuit	

4. DATA COMBINATION

All data which are collected from industry with respect to workshop are arrange according to their cause and mode. Arranging mode is less than 1 average of accident is consider as low which is negligible in this case study and the maximum average value is consider are most high categories respectively. According to the lowest value and most high value mark their intermediate categories as per the average value in table 2.

Table 2 Average Accident of each mode

Accident Cause	Skin diseases	Injured	Burn	Death
Loose cloth	0.666667	3	4.666667	5.666667
Incomplete rest	0.333333	5	9.333333	6
Movement accident.	8.666667	9.666667	6	8.333333
Worker age	2.333333	2	11.33333	11.66667
Unguarded machining Parts.	13.33333	26.66667	4.666667	24.33333
Chip ejection.	11.66667	13.66667	15.66667	4.333333
Electric Short Circuit	18	19.33333	7.333333	6.333333

The seven accident indices of industries are converted according to severity table and given their indication qualitative measurement. These data are converted with respect to their mode. Analytical Hierarchy Process (AHP) as a well-known Multi-Attribute Decision Making method. In this thesis, AHP method is suggested for helping the decision maker to decide the relative importance weights of attributes in a systematic manner. The SAW method suggests that among the accident causes of industries is unguarded machine parts are most critical system. A set of alternatives is made in the descending order in this step, according to the value of P_i indicating the most preferred and least preferred feasible solutions. P_i may also be called as overall or composite performance. Greater the P_i weight shows the highest accident cause in industries are shown in Table 3.

Table 3 Accident Ranking by SAW Method

Accident causes	Weight (P_i)	Rank
Loose cloth	0.177222	7
Incomplete rest	0.289444	6
Movement accident.	0.520278	4
Worker age	0.457778	5
Unguarded M/C Parts	0.756667	1
Chip ejection.	0.612778	3
Electric Short Circuit	0.687222	2

5. DISCUSSION

The result obtained from SAW and WPM for accident indices are compiled and compared in fig 2, in this table shows that both have given similar rank for accident causes. As per the rank by both methods, unguarded Machining parts is responsible for the maximum accident. To avoid these accidents necessary to cover the unguarded rotation or motion parts.

- For the data obtained from the SAW method the most critical condition for accidents in descending order is unguarded Machining parts, Electric short circuit, chip ejection, movement accident, worker age, incomplete rest, and loose cloth.
- Obtained data from WPM method the ranking are similar to SAW method which is unguarded Machining parts, Electric short circuit, chip ejection, movement accident, worker age, incomplete rest, loose cloth.

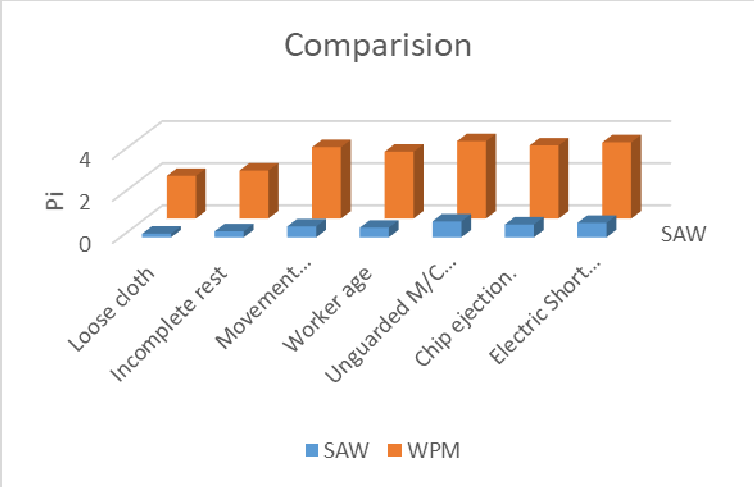

Fig 2 Comparison of Weighted

6. CONCLUSIONS

The critical accident causes have been identified for each type of accident happened based on accident mode. The most significant accident cause by "Uncovered machine parts" which is obtained highest weighted in both methods on both machines.

Accident Causes Rank

- SAW - Unguarded Machining parts, Electric short circuit, chip ejection, movement accident, worker age, incomplete rest, loose cloth.
- WPM - Unguarded Machining parts, Electric short circuit, chip ejection, movement accident, worker age, incomplete rest, loose cloth.

REFERENCES

[1]. Yuvin Chinniah Barthélemy Aucourt Réal Bourbonnière, (2017), Study of Machine Safety for Reduced-Speed or Reduced-Force Work, Institut de recherche Robert-Sauvé en santé et en sécurité du travail (IRSST), pp. 1-114, ISSN : 0820-8395.

[2]. Létourneau, D., Potvin, F., (2014) "Accident mortel survenu le 30 avril 2013 à une travailleuse de l'entreprise "Rio Tinto Alcan" 3000, rue des Pins Ouest à Alma," Commission de la santé et de la sécurité du travail, Québec, Canada, Rapport d'enquête RAP0957995,.

[3]. Abhang, L. B. & Hameedullah, Selection of Lubricate Using Combine Multiple Attribute Decision Making Method, Advance in Production Engineering & Management 7 (2012) 1, 39-50.

[4]. Selvam A , Priyadarshini K, (2012), Safety Management and Hazards Control Measures in Construction, IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE), pp. 97-101, ISSN: 2278-1684.

[5]. 138 Beriha, G.S., Patnaik, B. and Mahapatra, S.S. (2011). Measuring the perception of safety officers on occupational health in Indian industries. International Journal of Indian Culture and Business Management 4(1), 30-47.

[6]. Zhang, J., GAO S., TAO J. (2011). Study on Unsafe Behavior Pre-control Method Based on Accidents Statistic, Safety Science, 1964 – 1969.

[7]. Satapathy, S., Patel, S.K., Biswas, A., Mahapatra, S.S. and Beriha, G.S. (2010). A QFD and ISM approach to a service industry. International Journal of Advanced Manufacturing Systems 1(2), 191-196.

[8]. Vinodkumar, M.N., Bhasi, M. (2009). Safety climate factors and its relationship with Accidents and personal attributes in the chemical industry. Safety Science, 47, 659-667.