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Evaluation of Mechanical Risks in the Labor Activities of Washing and Lubricating Vehicles

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Abstract

This research is based on occupational risk factors to Those to which workers are exposed in vehicle washers and lubricators, risk components that correspond to a current problem where working conditions and various risk factors related to work in this type of activity are identified. The same can generate accidents or occupational diseases. Likewise, the need to take actions aimed at the prevention of this type of risk was seen, whose main objective was to identify, evaluate and propose a prevention plan, research that was carried out on two jobs, using the methodology of Willian T Fine. Where we proceeded with the direct observation of the jobs, taking photographs and filming, which allowed the application of the method. The results showed high levels of risk in both activities, both washing, and lubricating vehicles. This research instructs how primary actions can be carried out aimed at the prevention of occupational risks.

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1 Introduction

Work is a legal competence and creative freedom in which the individual uses efforts, obligation, transformation, creation of value and utility, contributing development to society. The human factor is an essential element in any working system (Real-Perez et al., 2019). In this sense, every person shall have the right to carry out their work in an adequate and conducive environment that guarantees their health, integrity, safety, hygiene, and well-being. The organization of work in Ecuadorian public and private institutions is adjusted to the variables of deconcentration and decentralization, ensuring that people work with order and rational use of resources (Asamblea Constituent del Ecuador, 2008), (Taylor et al., 2008).

The Ecuadorian Institute of Social Security (IESS) states that all work activities must have the prevention, reduction or elimination of risks and improvement (IESS, 1986). Occupational health and safety plans allow optimizing human personnel and guaranteeing their protection to avoid incidents and/or work accidents (Velásquez et al., 2018). According to the International Labor Organization (ILO, 2021), it indicates that every day 20 people die in the world due to occupational accidents and work-related diseases, which has caused more than 2.7 million deaths per year.

In Ecuador, each year the rate of occupational accidents and deaths increased, until 2018. According to the Ecuadorian Institute of Social Security (IESS, 2018), the figures were high at 1.0%, which is equivalent to 15,909 qualified accidents and 167 death certificates for deaths caused by work. Occupational risk prevention is the integrated management of a general system of companies, which in recent years has great relevance for organizations since it not only serves to reduce accident rates or accidents but also helps to have better results. economic and financial (Berbegal & Canntonet, 2014). Being evident that the working conditions generate risks to the health of the workers, it is necessary to adopt a series of measures –preventive techniques– that eliminate or mitigate the risks in the execution of the labor provision (Collado, 2008).

Because the health of workers is threatened by the activities they perform, the necessary precautions must be taken, taking or establishing preventions, thus being able to act on two areas, health or directly act on the conditions or the environment in which certain work is done. For (Sierra, 2015), the prevention of occupational risks is an essential part of any advanced labor legal system. This is due to the fact that the preventive obligation is part of the content of the employment relationship as it has a direct link with the right to life and physical integrity of the workers, which makes the employer a debtor of the safety and health of its workers. While (Pinos, 2017), as cited in (Derecho Ecuador, 2014) the importance of occupational risk prevention is based on avoiding social, labor, and human costs, caused by non-observance of the law, not having a preventive culture, and protection of rights.

An occupational risk prevention plan must contain the necessary information so that the company's administration and/or those responsible for ensuring occupational health and safety comply with what is established. (Ren & Feng, 2017; Croccolo et al., 2012; Carrera-Rodríguez et al., 2022). For this, it is recommended to consider: type of risk, definition; measures to eliminate or mitigate the risk; type of measures (preventive or corrective); actions to implement the measure; responsible for its application and control; implementation timeframe; cost; material and human resources (Litardo et al., 2020). The effectiveness of the development of a risk prevention plan for workers of washers and lubricators is given by identifying the risks to which workers are exposed and ensuring that working conditions are adequate, which is necessary for the performance of the rights of workers and their protection. Currently, the washers and lubricators do not have the requirements that the Ministry of Labor requires of both public and private companies, hence the proposal of this research is to create a plan for workers since it will be possible to integrate the preventive activities of the company to its general management system and establishes its own occupational risk prevention policy (Farr, 1975; Sutapa et al., 2022; Santiana et al., 2022).

2 Materials and Methods

The investigation was carried out in the vehicle washing and lubrication areas, in the activities carried out by the workers, the work was in the field with direct observation where each of the activities was photographed and filmed for a period of time. 10 minutes while the workers carried out their activities normally in the different workstations. The William T. Fine method was used, for the application of the tools, there was an informed consent document, which was socialized and signed by the workers in which they agreed to participate in the research and that the photographs and data could be used. to be published.

The method of William T. Fine is a quantitative method that allows knowing the degree of danger or the magnitude of the risk with the variables of probability, consequence, and exposure to said risks. This method, also known as Quantitative-Mixed due to its semi-quantitative nature, was developed by William T. Fine and published in 1971 by the North American Naval Ordnance Laboratory under the name "Mathematical Evaluation for controlling Hazards". to Control Risks). At that time, William T. Fine was the head of the Security Department of the Naval Ordnance Laboratory.

3 Results and Discussions

To develop the investigation, it began with the initial identification of the risks in the vehicle washing and lubrication areas in the Vehicle maintenance area, these results are shown in Table 1.

Table 1
Initial risk identification

INITIAL RISK IDENTIFICATION RECORD Business Name																
: Washer and Lubricator												Evaluation				
Area: Vehicle Maintenance												Initial				
Job position: Washing and lubricating vehicles																
Activity: Receive the service order to start the vehicle wash												Date of last evaluation				
Number of workers: 4 Exposure time h/day: 8 Number of Men: 4 Number of Women: 0																
#	RISK FACTOR	IDENTIFYING HAZARD	degree of danger formula: GP=C x E x P					Degree of repercussion formula= GR = GP x FP				Justification formula= J= GP/ CC x GC				
			C	E	P	GP	LEVEL GP	GP	FP	GR	LEVEL GR	GP	CC	GC	J	YES/NO
1	MECHANICAL	Fall of people at the same level														
2		People fall different level														
3		Falling objects due to handling														
4		Falling detached objects														
5		Collision with moving objects														
6		Collisions with stationary objects														
7		Hits or cuts by tool objects														
8		thermal contacts														
9		Particle projection														
10		Object Entrapments														
11		Vehicle rollover entrapments														
12		Work in confined spaces														
13		Work at heights														
14		Footsteps on objects														

These registered risks have consequences that affect the personnel that works in the installation. consequences are defined as the, most probable damage of an occupational hazard, due to the risk considered, including personal misfortunes and material damage, categorized according to the following table 2.

Table 2
Assessment of the Degree of Severity of the Consequences Method William T.

CONSEQUENCES CRITERIA	
VALUE	CONSEQUENCES
10	Death and/or damages greater than $500,000 dollars
6	Injuries with permanent disability and/or damages between $100,000 and $500,000 dollars
4	Injuries with temporary disability and/or damages between $ 10,000 and $100,000

	dollars
1	Minor injuries and/or damage between $1 and $10,000 dollars

Source: MRL, 2014

As can be seen, the highest value is related to death and/or major damage and the lowest coincides with minor injuries. Exposures are defined as the frequency with which the risk situation occurs, being a situation capable of triggering an accident, the greater the exposure, the greater the risk. The assessment of the risk situation according to the William T. Fine method is shown in Table 3.

Table 3
Assessment of the risk situation – William T. Fine Method

CRITERIA EXPOSURE	
VALUE	EXPOSURE
10	The risk situation occurs continuously or Many times a day.
6	Frequently, at least once a week.
4	Occasionally, or at least once a month or a year, irregularly
1	Remotely possible.

Source: MRL, 2014

Probability

It is the possibility that once the risk situation is presented, the accident originates, the values are shown in table 4.

Table 4
Probability criteria and values

PROBABILITY CRITERIA	
VALUE	PROBABILITY
10	It is the most probable and expected result if the situation of risk occurs, 100% certainty
6	It is completely possible, nothing unusual, with a probability of occurrence of 50%
4	It would be a rare coincidence, with a probability of 20%
1	It has never happened in many years of exposure to the risk, but it is conceivable to happen.

Source: MRL, 2014

Figure 1 shows the degree of danger according to the William T. Fine method.

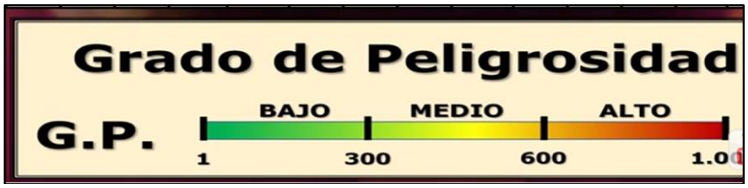

Figure 1. Degree of danger
Source: William T. Fine Method

Table 5 shows the weighting factor according to William T. Fine

Table 5
Weighting factor – William T. Fine Method

FACTOR PONDERACION	
VALOR (%)	PONDERACION
1 - 20	1
21 - 40	2
41 - 60	3
61 - 80	4
81 - 100	5

Source: William T. Fine Method

The value highest weighting factor is found between the parameters from 81 to 100%, with a weighting of 5. Figure 2 shows how the weighting factor is calculated by the William T. Fine Method

Figure 2. Weighting factor – William T. Fine
Source: William T. Fine method

Figure 3 shows the degree of impact based on the William T. Fine method.

Figure 3. Degree of repercussion – William T. Fine
Source: William T. Fine method

Table 6 shows the order of prioritization according to the William T. Fine method.

Table 6
Order of prioritization – William T. Fine Method

ORDER OF PRIORITIZATION	
Hazard (GP)	Repercussion (GR)
High	High
High	Medium
High	Low
Medium	High
Medium	Medium
Medium	Low
Low	High
Low	Medium
Low	Low

Source: William T. Fine

Method observes the dangerousness

Table 7 shows the scores according to the correction factor.

Table 7
Cost of correction – William T. F

Assessment of the cost factor Cost	
factor	Score
If it costs more than $100,000	10
If it costs between $20,000 and $100,000	6
If it costs between $5,000 and $20,000	4
If it costs between $1,000 and $5,000	3
If it costs between $500 and $1,000	2
If it costs between $50 and $500	1
If it costs less than $50	0.5

Source: William T. Fine Method

In this sense, the cost of correction presents values, noting the highest values high depending on the cost factor. Table 8 shows the assessment of the degree of correction according to the method studied

Table 8
Assessment of the degree of correlation – William T. Fine Method

ASSESSMENT OF THE DEGREE OF CORRELATION	
Degree of correction	Score
If the correction efficiency is 100%	1
yes the correction is up to 75%	2
if the correction is from 50% to 75%	3
if the correction is from 25% to 50%	4
if the correction is less than 25%	5

Source: Method William T.

The assessment of the degree of correction it is shown in percentages, noting that the highest values correspond to the lowest scores. Figure 4 shows the cost of correction and its selection depending on the justification, it is valued no when it is less than 20 and yes when it is greater.

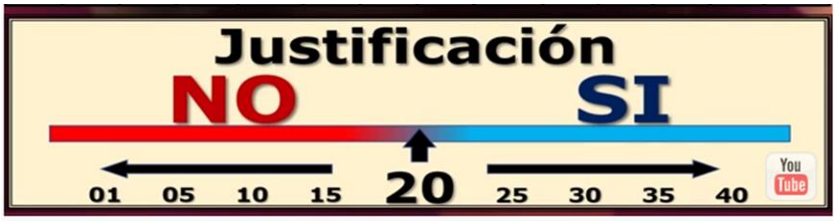

Figure 4. Correlation Cost Justification – William T. Fine
Source: William T Method

Table 9 shows the results of the final evaluation.

Table 9
Consolidated estimation of degree of danger

INITIAL RISK IDENTIFICATION RECORD Business Name																
: Washer and Lubricator Area: Vehicle Maintenance Job position: Washing and lubricating vehicles Activity: Receive the service order to start the vehicle wash Number of workers: 4 Exposure time h/day: 8 Number of Men: 4 Number of Women: 0											Evaluation Initial Date of last evaluation				
#	RISK FACTOR	IDENTIFYING HAZARD	degree of danger formula: GP=C x E x P					Degree of repercussion formula= GR = GP x FP				Justification formula= J= GP/ CC x GC				
			C	E	P	GP	LEVEL GP	GP	FP	GR	LEVEL GR	GP	CC	GC	J	YES/ NO
1	MECHANIC	order and cleanliness	4	10	0	400	MEDIUM	400	4	1600	MEDIUM	400	4	3	33	YES
2		work at heights	6	10	0	600	HIGH	600	4	2400	HIGH	600	4	3	50	YES
3		falling objects due to handling	1	6	6	36	LOW	36	4	144	LOW	36	1	3	12	NO
4		falling objects	1	6	6	36	LOW	36	4	144	LOW	36	1	3	12	NO
5		hitting moving objects	6	10	0	600	HIGH	600	4	2400	HIGH	600	4	4	38	YES
6		shocks against immobile objects	1	10	6	60	LOW	60	4	240	LOW	60	3	4	5	NO
7		blows or cuts by objects, tools	1	6	6	36	LOW	36	4	144	LOW	36	1	3	12	NO
8		thermal contacts	4	10	6	240	LOW	240	4	960	LOW	240	4	5	12	NO
9		projection of particles	1	6	6	36	LOW	36	4	144	LOW	36	1	3	12	NO
10		to rags by objects	4	4	6	96	LOW	96	4	384	LOW	96	3	1	32	YES
11		to rags by overturning of machines or v vehicles	6	10	0	600	HIGH	600	4	2400	HIGH	600	4	3	50	YES
12		work in confined spaces	6	10	0	600	HIGH	600	4	2400	HIGH	600	4	3	50	YES
14		stepped on objects	1	6	6	36	LOW	36	4	144	LOW	36	1	3	12	NO

In the activity of washing and lubricating vehicles, 11 types of mechanical risks that affect workers were contemplated, of this total of risk factors found, it is determined that order and cleanliness occur more frequently in this activity and he is at medium risk (Qamar et al., 2017; Salmeron et al., 2022; Subtil et al., 2017). And work at heights, falling objects due to detachment, entrapment due to overturning of machinery, vehicles, and work in confined spaces is presented as very high risk and their incidence in the evaluation is critical, therefore it is required immediate intervention before these materialize. On the other hand, other types of mechanical risks came out with low risks in the evaluation, therefore an immediate intervention is not justified, but it is necessary to consider them in the prevention plan.

The work (Sierra, 2015), where indicates that the prevention of occupational risks is an essential part of any advanced labor legal system. For the author, this indicates that because the preventive obligation is part of a worker's right, it is also true that it is a shared responsibility between worker and employer, in terms of the employment relationship, as it has a direct link with the right to life. and physical integrity of workers. However, it is necessary to

implement a technical control mechanism criterion that will minimize occupational accidents (Mohammed et al., 2013; Ali et al., 2019; Račić et al., 2019).

4 Conclusion

The application of William T Fine's method made it possible to identify the mechanical risks and the degree of danger to which the workers are exposed, as well as the consequence, exposure, and probability of an occupational accident materializing. In addition, the degree of repercussion that the accident may have on the worker was assessed and this was achieved through the weighting factor in conjunction with the degree of danger and the justification of the expense. timely intervention for each of the risks involved in the vehicle washing and lubrication process, which was carried out taking into account the degree of danger, correlation cost, and degree of correlation.

Conflict of interest statement
The authors declared that they have no competing interests.

Statement of authorship
The authors have a responsibility for the conception and design of the study. The authors have approved the final article.

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