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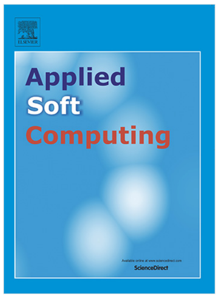

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Merve Karamustafa, Selcuk Cebi

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Highlights

1. The SCEA method is extended to Neutrosophic Sets to consider the inconsistencies
2. Incomplete, indeterminate, and inconsistent information is handled by the model
3. The indeterminacy parameter is defined based on truth and falsity definitions
4. Mamdani fuzzy inference system used in the SCEA is adapted to Neutrosophic Sets
5. Neutrosophic inference system which is firstly introduced to literature

Extension of Safety and Critical Effect Analysis to Neutrosophic Sets for the Evaluation of Occupational Risks

Merve Karamustafa[a], Selcuk Cebi[b*]

[a]Occupational Health and Safety Coordinatorship, Yildiz Technical University, Besiktas, Istanbul, Turkey

[b]Department of Industrial Engineering, Yildiz Technical University, Besiktas, Istanbul, Turkey

Abstract

Occupational health and safety applications require a comprehensive risk analysis to protect employees from accidents caused by various hazard sources in the workplace. Therefore, in the literature, there are various risk assessment methods utilizing various parameters. One of them is safety and critical effect analysis (SCEA) which is the method that calculates risk magnitude based on the highest number of parameters that are probability, severity, frequency, and detectability. However, the risk assessment phase includes uncertainties and inconsistencies caused by both evaluations of experts and the complex structure of the handled process. Therefore, we proposed a new risk assessment approach to cope with these uncertainties and inconsistencies by extending SCEA with the Neutrosophic sets. In this study, each parameter, probability, severity, frequency, and detectability, is defined by using truth membership function, falsity membership function, and indeterminacy membership function in Neutrosophic sets (NSs) to deal with incomplete, indeterminate, and inconsistent information existing in the expert preferences and complex structure of the handled process. It is the first time, the indeterminacy of NSs is defined based on truth and falsity definitions by using a rule-based system based on probability, severity, frequency, and detectability parameters. Furthermore, Mamdani fuzzy inference system used in the SCEA method is adapted to NSs. The proposed approach is applied to the metalworking and woodworking workshop of a university. The obtained results are compared with the results of the SCEA method. It is concluded that the proposed approach is better than SCEA method to consider inconsistencies in the risk evaluation.

Keywords: Risk analysis, Neutrosophic set theory, Fuzzy inference system, Mamdani, SCEA

1. Introduction

The efforts to ensure the sustainability of the production/service systems and to increase the efficiency of the production/service systems are increasingly important in order to protect the employees from the risk factors that may adversely affect the health of the employees in the working environment. In the occupational health and safety approach, it is necessary to apply a risk management process. This process includes four main sub-process; *(i)* identification of the potential hazards in the working environment, *(ii)* conduction of risk assessment, *(iii)* implementation of control measures (prevention and protection measures), and *(iv)* monitoring and reviewing the whole process. Moreover, documentation is also required for each step of the process. In other words, a cycle of the risk management process is begun with the identification of hazards and completed with the documentation and review steps. The main contribution of risk management is that possible events or situations that cause harm are determined and eliminated in advance. If and only if all steps of the risk management

* Corresponding author. Tel.: +90 212 383 28 66; Fax: +90 212 3832766
E-mail address: scebi@yildiz.edu.tr (S. Cebi)

process are implemented correctly and effectively, uncertainties disappear, and the possibility of future undesirable events and situations is eliminated. Since these studies are generally based on expert judgments and opinions, the success of the studies is directly proportional to the experience of the team members who take part in the risk assessment team. The identification of hazardous sources, determination of the risks arising from the related hazard source, estimation of the risk probability and the risk severity, and preventive measures to potential risks are the main expertise domains that require experience.

In the risk assessment phase of risk management, calculation of risk magnitude is the most critical activity in all. Most of the techniques in the literature calculate the risk magnitude depending on the probability and severity parameters. However, Failure Modes and Effects Analysis (FMEA) and Fine Kinney (FK) risk assessment methods define the risk magnitude based on three parameters. In the FMEA method, the risk magnitude is calculated based on the probability, severity, and detectability parameters whereas the FK method utilizes the probability, severity, and frequency parameters. Both detectability and frequency play an important role in determining the degree of risk. While detectability decreases the degree of risk associated with situations where forecasting a fault is easy, the frequency increases risk magnitude because it raises the probability of occurrence of an adverse situation. Therefore, Karasan et al. [16] proposed a new risk assessment method Safety and Critical Effect Analysis (SCEA) which consists of FK and FMEA parameters [16]. Furthermore, they extended the method to the fuzzy environment by using Pythagorean fuzzy sets.

However, the risk assessment phase includes uncertainties and inconsistencies caused both by evaluations of experts and the complex structure of the handled process. For instance, an accident may have resulted in a different manner from very low injury to lethal accidents or environmental disasters. These potential differences in the results of any accident show inconsistencies in the severity evaluation of risk based on expert preferences. Moreover, the usage frequency of a machine may differentiate based on handled jobs in the working period. This causes an inconsistency in the frequency of the machine based on the usage period. Furthermore, the detectability of a risk differentiates between during routine working period and maintenance period of the machine. And also, the occurrence probability of an accident may not be minimized or eliminated although the related control measures are taken. In addition, the risk magnitude is based on the probability of risk occurrence and the severity degree of a risk when the risk occurs and these parameters may vary depending on the expert assessment because of uncertainties in the evaluations. All of these situations create inconsistency and subjectivity in the risk assessment process and it is important to consider this variability to determine the risk magnitude more accurately. In the literature, there is not any risk assessment method to cope with these difficulties, simultaneously. Therefore, in this study, we extended the SCEA method to neutrosophic sets to consider inconsistencies and subjectivities in the risk assessment process. We use the SCEA method and neutrosophic sets (NSs) since SCEA has the highest number of parameters to calculate the risk magnitude and the NSs are proposed by Smarandache [34] to consider indeterminate, incomplete, and inconsistent information. NSs take into account the different dimensions of expert assessment on a case by using truth (T), indeterminacy (I), and falsity (F) membership degrees. For this, in the scope of the proposed study, we will extend SCEA with NST to consider truthness (T), indeterminacy (I), and falsity (F) in defining the parameters in the SCEA method while obtaining risk magnitude. Different from the literature, in this study, the indeterminacy of NSs is expressed by using a rule base based on the truth and falsity definition. Furthermore, it is the first-time mathematical operations of fuzzy Mamdani are adapted to NSs since SCEA uses the If-Then rules structure to obtain the risk magnitude.

The rest of this paper is organized as follows; In Section 2, a wide literature review is presented. The proposed risk assessment approach and its preliminaries are given in Section 3. An application of the proposed approach has been illustrated for service systems in Section 4. Section 5 presents the results obtained from the comparative analysis. Finally, concluding remarks are given in Section 6.

2. Literature Review

In the literature, there are many methods to assess risks in terms of occupational health and safety (OHS) in the working environment. Although the objective of these methods is the same, they utilize different parameters to analyze risk. In this section, we will present the most common risk assessment methods used in the application and their extensions. Then, we will discuss the deficiencies of these methods.

Failure Mode and Effect Analysis (FMEA) including the risk severity, the detectability, and the risk probability parameters, is one of the most used methods in the literature to obtain risk magnitudes. Considering the studies in the literature, the difficulties in defining the failure in the system one by one, the failure having more than one reason, and the multiple effects of a risk are the major weaknesses of FMEA. Besides, the ranking of failure modes based on the risk priority number (RPN) scores obtained by using the equal weighting of the parameters causes deficiencies in the evaluation of the risks. Furthermore, the uncertainty of the relative weights of risk factors, diversity of error types, and subjective evaluations of the decision-makers can be also added to this deficiency list. For this reason, Huang et al. [14], Liu et al. [21-23], Maheswaran, and Loganathan [24] used fuzzy logic and multiple criteria decision making (MCDM) techniques in the calculation of the parameters and the ranking of the risks. Zhu et al. [41] established a hybrid risk ranking model of FMEA via combing linguistic neutrosophic numbers, regret theory, and PROMETHEE approach. In the proposed approach, linguistic neutrosophic numbers are modified to overcome decision-makers evaluation regarding the failure modes on each risk, and PROMETHEE approach based on regret theory is presented. TOPSIS is used for deriving the weights of risk criteria and decision-makers. This method is applied to the supercritical water gasification system. Dabbagh and Yousefi [6] integrated FMEA, Fuzzy Cognitive Map (FCM), and Multi-Objective Optimization Method by Ratio Analysis (MOORA). After identifying the risks and determining the values of the risk assessment, the weights of criteria based on their causal relationships through FCM were determined. Then, the risk prioritization was carried out with MOORA. Fattahi and Khalilzadeh [8] proposed a new fuzzy hybrid model for FMEA. In the method, fuzzy weighted risk priorities were taken into consideration instead of the risk priorities for each failure. The weights of the factors and the weights of the failure modes were calculated by extended fuzzy AHP and fuzzy MULTIMOORA methods. Efe et al. [7] used fuzzy VIKOR and fuzzy AHP to determine the weight of the criteria since the importance of severity, probability, and detectability criteria of traditional FMEA were ignored in other articles. Sisman [32] integrated FMEA, fuzzy AHP, and fuzzy VIKOR methods to evaluate potential risks. Yerlikaya and Efe [38] used linguistic variables expressed in triangular fuzzy numbers to evaluate the weights of probability, severity, and detectability factors in traditional FMEA. Then, the fuzzy PROMETHEE (The Preference Ranking Organization Method for Enrichment Evaluation) method was utilized to determine the risk priorities of the previously diagnosed types of errors. Vahdani et al. [36] used the fuzzy TOPSIS method to overcome the weights of probability, severity, and detectability factors in the traditional FMEA method. Mandal and Maiti [25] used fuzzy logic in determining the weights of probability, severity, and visibility parameters in FMEA. Chen et al. [5] proposed a new methodology to evaluate the risks of an oxygen-enhanced combustor via combining FMEA and fuzzy fault tree risk analysis methods. Liu and Tsai [20] proposed a fuzzy risk assessment method including the FMEA, quality function deployment (QFD), and the fuzzy analytical network process (ANP) methods. In the method, QFD is used in two stages. The fuzzy ANP method was utilized to identify the degrees of hazards based on their severity potential. Abdelgawad and Fayek [1] integrated FMEA, Fuzzy Inference System (FIS), and fuzzy AHP methods to evaluate potential management risks in the construction industry. Fera and Macchiaroli [9] proposed a new approach, Scenario-Based Risk Assessment (SceBRA), by integrating AHP and Italian standard UNI 7249:2007 to the FMEA method. Fine Kinney method including the risk probability, risk severity, and frequency parameters is another method that is widely used in the literature. Similar to FMEA, the Fine Kinney method also considers equality among the parameters, probability, frequency, and detectability parameters while obtaining risk priorities. Furthermore, subjectiveness is also a big problem for the Fine Kinney method since statistical data are incomplete or generally incorrect in the working environment. For this purpose, Gul et al. [12] and Gul et al. [11] proposed a new integrated risk assessment method including Fine-Kinney, Fuzzy AHP, and Fuzzy VIKOR methods to consider differences among the importance degrees of Kinney parameters. In the study, the fuzzy AHP was used to obtain the importance degrees of the risk parameters while the fuzzy VIKOR method was utilized to put forward the priority order of hazards. Ilbahar et al. [15] proposed a new risk assessment method called as Pythagorean Fuzzy Proportional Risk Assessment method based on Fine Kinney, Pythagorean Fuzzy AHP, and the fuzzy inference system. In the proposed method, the likelihood and severity parameters were determined by using the Pythagorean fuzzy AHP (PFAHP) method while the frequency parameter was obtained directly from the experts. Then, the risk magnitude was obtained by the fuzzy inference system based on the likelihood, severity, and frequency parameters. Kokangul et al. [18] introduced an approach for risk assessment by integrating AHP and Fine Kinney methods. In the study, hazards were initially categorized, and these categories were prioritized by using the fuzzy AHP method. Then, the Fine Kinney method was used to determine risk categories such as acceptable risk, possible risk, etc. Korkmaz et al. [19] utilized the 5S workplace organization procedure with the Fine Kinney method for the effect of risk assessment.

In addition to the parameters mentioned above, some studies suggest adding new parameters to risk assessment methods. For instance, Yousefia et al. [39] proposed a new method based on the cost and duration of treatment parameters in addition to the risk probability, severity, and detectability in FMEA. Karasan et al. [16] proposed a new risk assessment method called Safety and Critical Effect Analysis (SCEA) by using the Pythagorean Fuzzy Sets and the fuzzy inference system. In their approach, the risk magnitude was obtained by using the risk probability, the risk severity, the detectability, and the frequency parameters. They integrated FMEA and Fine Kinney methods in SCEA. Guneri et al. [13] provided a fuzzy AHP for selecting the best risk assessment method in occupational safety operations for small and medium-sized enterprises. In the study, practicality, cost, and sensitivity criteria were taken into consideration.

Consequently, the risk assessment methods have been integrated with other techniques for the evaluation of occupational risks. In particular, fuzzy sets and fuzzy Mamdani are widely used methods for the evaluation of occupational risks recently. The integrated risk assessment approaches have been summarized in Table 1. In the table, the studies are grouped according to the risk assessment tool (RAT), multiple criteria decision-making methods (MCDM), modeling, and their application area.

The literature review shows that FMEA and Fine Kinney methods are the most used method among the risk assessment methodologies and the construction and manufacturing sectors are widely handled as the application area of these methods. Furthermore, researchers generally proposed a new risk assessment approach by integrating the well-known risk assessment methods with other tools. In addition, fuzzy models are widely used approaches to consider uncertainties in the applications. However, none of these studies considers the certain degree of truth, falsity degree, and indeterminacy degree of the risky activities in a working environment. The methods in the literature utilize expert judgment on any risk. In the proposed approach, any risky activity is analyzed, and the checkpoints are determined that cause loss then the conditions of these points are analyzed by considering the certainty degree of truth, falsity degree, and indeterminacy degree. Hence, the uncertainty and subjectiveness of expert judgments are clarified.

Table 1: The methodologies used for the integrated risk assessment approaches

Article	Risk Assessment Approaches				Application
	RAT	MCDM	Others	Modeling	
Fera and Macchiaroli (2010)[9]	FMEA	AHP	Scenario Based Risk Assessment	Crisp	Steel Industry and Logistic Services
Abdelgawad and Fayek (2010) [1]	FMEA	AHP		Fuzzy	Construction
Liu and Tsai (2012) [20]	FMEA	ANP	QFD	Fuzzy	Construction
Maheswaran and Loganathan (2013)[24]	FMEA	PROMETHEE, AHP		Crisp	Manufacturing
Chen et al. (2014) [5]	FMEA , Fault Tree			Fuzzy	Oxygen-Enhanced Combustor System
Mandal and Maiti (2014) [25]	FMEA	AHP		Fuzzy	Construction (Crane Operation)
Liu et al. (2015) [21]	FMEA	VIKOR, AHP		Fuzzy	Health Sector
Guneri et al. (2015) [13]	FMEA, Fine Kinney, Matrix	AHP		Fuzzy	
Vahdani et al. (2015) [36]	FMEA	TOPSIS		Fuzzy	Steel Industry
Yerlikaya and Efe (2016) [38]	FMEA	PROMETHEE		Fuzzy	Construction
Korkmaz et al. (2016) [19]	Fine Kinney			Fuzzy	Manufacturing
Sisman B. (2017) [32]	FMEA	AHP, VIKOR		Fuzzy	Automotive Industry
Kokangul et al.. (2017) [18]	Fine Kinney	AHP		Crisp	Manufacturing
Huang et al. (2017)[14]	FMEA	TODIM, Entropy Method		Fuzzy	Grinding Wheel System
Efe et al. (2017) [7]	FMEA	AHP, VIKOR		Fuzzy	Construction, Textile and Metal Industry
Liu et al. (2017a) [22]	FMEA	GRA	Cloud model theory		Paper Industry
Liu et al. (2017b) [23]	FMEA	PROMETHEE	Cloud model theory		Health Sector
Gul et al. (2017) [11]	FMEA	AHP, VIKOR		Fuzzy	Manufacturing
Karasan et al. (2018) [16]	FMEA, Fine Kinney			Fuzzy	Construction
Ilbahar et al. (2018)[15]	Fine Kinney	AHP		Fuzzy	Construction
Gul et al. (2018) [12]	Fine Kinney	AHP, VIKOR		Fuzzy	Weapons Production
Yousefi et al. (2018) [39]	FMEA		RDEA	Crisp	Automotive Industry
Fattahi and Khalilzadeh (2018) [8]	FMEA	AHP, MULTIMORA		Fuzzy	Steel Industry
Dabbagh and Yousefi (2019) [6]	FMEA			Fuzzy	Manufacturing
Zhu et al. (2020) [41]	FMEA	PROMETHEE	Neutrosophic Linguistic Numbers	Fuzzy	Supercritical Water Gasification (SCWG) System

3. Material and Method

The main purpose of the proposed approach is to extent SCEA including parameters of FMEA and Fine Kinney methods with the Neutrosophic Sets. Therefore, in this section, a brief explanation of the basic methods and the mathematical foundations of the proposed approach has been given.

3.1. Failure Mode and Effects Analysis

Failure mode and effects analysis (FMEA) is considered one of the best-built risk assessment techniques that have been in use since the late 1950s. Unlike the matrix method, the detectability parameter has been utilized besides the probability and severity parameters to obtain a risk magnitude. Figure 1 presents the linguistic scale for these parameters [42]. In the FMEA method, the risk magnitude resembles with risk priority number (RPN), and Eq. 1 is used to obtain RPN. It can be used only to identify individual error modes, not to define combinations of error modes.

$$RPN = Probability\ of\ Occurrence\ (P) \times Severity\ (S) \times Detectability\ (D) \quad (1)$$

Detectability		Occurrence		Severity	
10	Non- Detection	10, 9	Very High	10, 9	Very High
9	Very Low				
8, 7	Low	8, 7	High	8, 7	High
6, 5	Moderate	6, 5, 4	Moderate	6, 5, 4	Moderate
4, 3	High	3, 2	Low	3, 2	Low
2, 1	Very High	1	Remote	1	Minor

Figure 1: Linguistic Scale for FMEA parameters [42].

There are three categorizations for the risk priority number (RPN): *(i)* Critical risk, *(ii)* Moderate critical risk, *(iii)* Non-critical risk [28].

3.2. Fine Kinney

The Fine Kinney method was proposed by G. F. Kinney in 1976 as a Practical Risk Analysis for Safety Management [17]. It is one of the most preferred methods for risk assessment. In the method, three parameters which are likelihood (possibility of an accident or damage), frequency (frequency of occurrence of danger), and severity (severity of the consequences in case of an accident) are used to obtain risk magnitude. The risk magnitude is obtained by Eq.2 [10]. In Figure 2, the linguistic scales of these parameters are given [17].

$$\text{Risk magnitude (RM)} = \text{Likelihood (P)} \times \text{Frequency (F)} \times \text{Severity (S)} \quad (2)$$

Likelihood		Frequency		Severity	
10	Might well be expected	10	Continuos	100	Catastrophe
6	Quite possible	6	Frequent	40	Disaster
3	Unusual but possible	3	Occasional	15	Very Serious
1	Only remotely possible	2	Unusual	7	Serious
0.5	Conceivable but very unlikely	1	Rare	3	Important
0.2	Practically Impossible	0.5	Very rare	1	Noticeable
0.1	Virtually Impossible				

Figure 2: Linguistic scale for Fine Kinney parameter [17].

The risk level (R) is given with five categories from negligible level to the extreme level which requires interruption of work activities and instantaneous preventive actions. These categories are *(i)* Negligible Risk, *(ii)* Low Risk, *(iii)* Medium Risk, *(iv)* High Risk, and *(v)* Extreme Risk [35].

3.3. Safety and Critical Effect Analysis

Safety and Critical Effect Analysis (SCEA) was proposed by Karasan et al. [16] and the methodology obtains risk magnitudes based on the parameters used in both FMEA and Fine Kinney method. In other words, The SCEA method utilizes probability, severity, frequency, and detectability parameters to consider the combined effects of these parameters. Eq. 3 is used to obtain risk magnitude while Eq. 4 is used to consider the weighted parameters [16].

Risk magnitude (RM) = Likelihood (p) × Severity (s) ×Frequency (f) ×Detectability (d) (3)

$$RM = p^{w_p} \times s^{w_s} \times f^{w_f} \times d^{w_d} \times \quad (4)$$

where w_p, w_s, w_f, and w_d are the importance degree of the parameters.

Probability	Severity	Frequency	Detectability
9 Very High (VH)	9 Catastrophic (C)	9 Permanent (P)	9 Strongly Impossible (SI)
7 High (H)	7 High (H)	7 Regular (Re)	7 Impossible
5 Medium (M)	5 Moderate (M)	5 Occasional (O)	5 Possible
3 Low (L)	3 Significant (S)	3 Rare (Ra)	3 Strongly Possible (SP)
1 Very Low (VL)	1 Trivial (T)	1 Very Rare (VR)	1 Absolutely Possible (AP)

Figure 3: Linguistic scale for SCEA [16].

SCEA method classifies the potential risks into four categories concerning probability, severity, detectability, and frequency parameters. These are *(i)* Negligible (Ng), *(ii)* Minor (Mn), *(iii)* Major (Mj), and *(iv)* Critical (Cr). In this scale, the range of risk magnitude is between 1 and 6561. The upper limit of Critical (Cr) is obtained by the multiplication operation of using the highest value of each parameter. Similarly, the upper limit of Major (Mj) is obtained by 44 using the average value of each parameter and the upper limit of Minor (Mn) is obtained by 24. [16].

3.4. Preliminaries on Neutrosophic Set Theory

The neutrosophic set theory was introduced by Smarandache [34]. The theory is an extension of the intuitionistic fuzzy set (IFS) theory where incomplete information is represented by truth (T), falsity (F), and indeterminacy (I) degrees. Unlike the IFS theory, the total membership degree does not need to be equal to 1 in neutrosophic sets (NSs). In NSs, indeterminacy is quantified explicitly, and truth membership degree, indeterminacy membership degree, and falsity-membership degree are independently assigned so that their sum can be at most equal to 3 [34]. Mathematical definitions of NS are as follows:

Definition 1. Let X be a space of points (objects) and $x \in X$. A neutrosophic set A: $((T_A(x), I_A(x), F_A(x))$ in X [34].

$T_A(x)$: Truth membership function

$I_A(x)$: Indeterminacy membership function

$F_A(x)$: Falsity membership

$T_A(x)$, $I_A(x)$ and $F_A(x)$ are real standard or real nonstandard subsets of $]0^-, 1^+[$

$$T_A(x): X \rightarrow]0^-, 1^+[\quad (5)$$

$$I_A(x): X \rightarrow]0^-, 1^+[\quad (6)$$

$$F_A(x): X \rightarrow]0^-, 1^+[\quad (7)$$

There is not any restriction on the sum of $T_A(x)$, $I_A(x)$ and $F_A(x)$

$$0^- \leq sup\, T_A(x) + sup\, I_A(x) + sup\, F_A(x) \leq 3^+ \quad (8)$$

Definition 2. The intersection of two single-valued neutrosophic sets A and B; C, written as $C = A \cap B$, whose truth-membership, indeterminacy-membership, and falsity-membership functions are related to those of A and B [37]:

$$T_C(x) = \min(T_A(x), T_B(x)) \quad (9)$$
$$I_C(x) = \min(I_A(x), I_B(x)) \quad (10)$$
$$F_C(x) = \max(F_A(x), F_B(x)) \quad (11)$$

Definition 3. The union of two single-valued neutrosophic sets A and B; C, written as $C = A \cup B$, whose truth membership, indeterminacy-membership, and falsity membership functions are related to those of A and B [37]:

$$T_C(x) = \max(T_A(x), T_B(x)) \quad (12)$$
$$I_C(x) = \max(I_A(x), I_B(x)) \quad (13)$$
$$F_C(x) = \min(F_A(x), F_B(x)) \quad (14)$$

Definition 4 Let A and B be two SVN numbers, then summation between A and B is defined as follows [30]:

$$A + B = \langle T_A(x) + T_B(x) - T_A(x) \cdot T_B(x),\ I_A(x) \cdot I_B(x), F_A(x) \cdot F_B(x) \rangle \quad (15)$$

Definition 5. Let A be an SVNS numbers, then, the multiplication between A and k $(k > 0)$ can be written as [30, 34]:

$$k \times A = 1 - (1 - T_A(x))^k, (I_A(x))^k, (F_A(x))^k \quad (16)$$

Definition 6. Let A and B be two trapezoidal fuzzy number neutrosophic values ($TFNNV$) can be written as [3]:

$$A + B =$$

$$\left\langle \begin{array}{c} (T_{A1}(x) + T_{B1}(x) - T_{A1}(x) \cdot T_{B1}(x), T_{A2}(x) + T_{B2}(x) - T_{A2}(x) \cdot T_{B2}(x), T_{A3}(x) + T_{B3}(x) - T_{A3}(x) \cdot T_{B3}(x)), \\ (I_{A1}(x) \cdot I_{B1}(x), I_{A2}(x) \cdot I_{B2}(x), I_{A3}(x) \cdot I_{B3}(x)), \\ (F_{A1}(x) \cdot F_{B1}(x),\ F_{A2}(x) \cdot F_{B2}(x),\ F_{A3}(x). F_{B3}(x)) \end{array} \right\rangle \quad (17)$$

Definition 7. Let A be trapezoidal fuzzy number neutrosophic value ($TFNNV$) can be written as [3]:

$$k \times A = \left\langle \begin{array}{c} \left(1 - (1 - T_{A1}(x))^k, 1 - (1 - T_{A2}(x))^k, 1 - (1 - T_{A3}(x))^k\right), \\ ((I_{A1}(x))^k, (I_{A2}(x))^k, (I_{A3}(x))^k), \\ ((F_{A1}(x))^k, (F_{A2}(x))^k, (F_{A3}(x))^k) \end{array} \right\rangle \quad (18)$$

3.5. Fuzzy Inference System

Fuzzy inference systems (FISs) are also known as fuzzy rule-based systems, introduced by Mamdani [26], and the first structure of this technique was used in the control systems of the machines [33]. In the fuzzy inference system (FIS), two or more logical expressions such as AND, OR are combined using logical link processors. There is a conclusion stage at the end of each logical expression in the inference stage. The last set of results is achieved by combining these results. AND and OR logical link processors are effective in determining the threshold value for each rule. The threshold value is calculated according to the inference method used in the extraction phase. If the rule was created with AND logical connection processor, the intersection operation is applied, and the threshold value is equal to the smallest membership degree. If the rule was created with the OR processor, the join operation is applied, and the limit value is equal to the largest membership rating [27].

Although the Mamdani FIS method is used widespread, the Sugeno FIS is another well-known method which is introduced by Sugeno (1985). The main difference between the two methods lies in obtaining the consequence of fuzzy rules. Mamdani fuzzy systems use max-min operations whereas the Sugeno method employs linear functions. In addition, the Sugeno FIS method does not require a defuzzification process. However, the disadvantage of the Sugeno method is that it can be used for the solution of the problems including only limited variables [33].

Mamdani FIS has been used in different engineering systems, especially since the method used in modeling linguistic expressions is suitable for intuitionistic calculation based on expert opinion. In the Mamdani fuzzy model, the rule base consisting of IF-THEN characterizes the system. The general state of the IF-THEN structure under the rule base of the Mamdani fuzzy model is given by Eq. 19 [26].

$$\text{IF } x_1 A_{i1}\ AND\ x_2 A_{i2}\ AND\ x_3 A_{i3}\ AND \dots x_n A_{in}\ THEN\ y\ B_i \quad i = 1,2,3 \dots k \tag{19}$$

where k and x_r $(r = 1,2,3, \dots n)$ are the number of rules and input variable set, respectively. A_i and B_i are the linguistic variable of y output variable.

A real system is defined by a series of discrete rules, such as the rule defined in Equation 20. Rules are fired and output is achieved. Although there are many techniques used in the literature the MAX - MIN operator is the most common [26].

$$\mu_{Bk}(y) = \max[\min[\mu_{A1k}(x_1), \mu_{A2k}(x_2)]], k = 1,2,3, \dots n \tag{20}$$

where μ_{Bk}, μ_{A1k}, μ_{A2k} are the membership degrees of the y output value and x_1, x_2 are the membership degrees of input values. Figure 4 presents the graphical view of Mamdani FIS. In this figure, A_{i1}, A_{i2}, A_{i3}, and A_{i4} are the four fuzzy premises of the i^{th} rule. Since the logical connection "AND" is used in the first and third rule, the fuzzy output of the first rule, C_1, and the third rule, C_3 is equal to the minimum membership degree. Furthermore, C_2 is the output of the second rule is equal to the maximum membership rating since the OR logical connection is used.

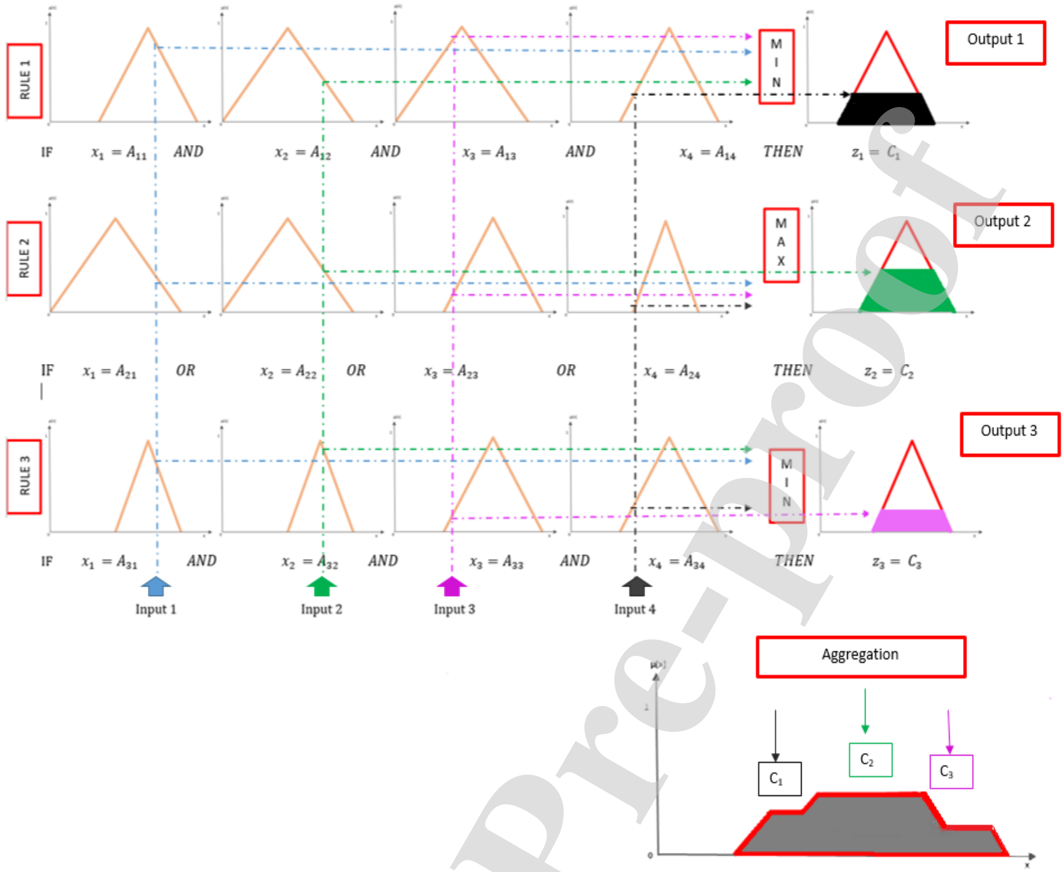

Figure 4: The rule structure for Mamdani fuzzy inference system

3.6. Proposed Approach

The proposed approach consists of six main phases as follows:

i. Determination of hazard sources for the sector,
ii. Identification of occupational risks for the sector,
iii. Defining the points that cause the risks to occur and defining the control points,
iv. Defining parameter values for each control point,
v. Calculation of risk magnitudes with neutrosophic set based inference system,
vi. Planning and monitoring control measures.

Step 1. Determination of hazard sources for the sector: In this step, potential situations which exist at the workplace or may arise from outside of the workplace to cause harm or damage which could affect the worker or the workplace are identified. In consideration of the provisions in legislation and regulations on occupational health and safety, hazards that may arise from physical, chemical, biological, psychosocial, ergonomic, and similar hazard sources in the working environment are determined.

Step 2. Identification of occupational risks for the sector: After determining the potential sources of hazard specifically for the company, the risks that loss, injury, or other harmful results are defined due to physical, chemical, electrical, mechanical, etc. hazards at this stage.

Step 3. Defining the points that cause the risks to occur and defining the control points: At this stage, the root causes that affect the emergence of risks are tried to be estimated with the questions of "why", "how", “what if” etc. Risk control points are determined via the preliminary risk analysis method.

The current control procedure is investigated to determine whether the hazard can be prevented with existing measures.

Step 4. Defining Parameter Values for Each Control Point

In this step, severity, probability, detectability, and frequency parameters are used to obtain risk magnitude and each parameter should be defined as neutrosophic sets [34, 44].

Definition 8. Let the universe of discourse U is discrete and finite. A neutrosophic set ℕ for $u_i \in U$ can be represented by a truth membership function T_i , an indeterminacy membership function I_i and a falsity membership function F_i , where T_i, I_i, F_i: U →]$0^-, 1^+$ [, $u_i \equiv u_i(T_i\,(u_i), I_i(u_i), F_i\,(u_i)) \in$ ℕ, and $0^- \leq T_i\,(u_i) + I_i(u_i) + F_i\,(u_i) \leq 3^+$. Then neutrosophic sets can be defined for the parameters severity (s), probability (p), detectability (d), and frequency (f) as

$$\mathbb{N} = \left\{\frac{\langle T_s\,(u_s), I_s(u_s), F_s\,(u_s)\rangle}{u_s}, \frac{\langle T_p\,(u_p), I_p(u_p), F_p\,(u_p)\rangle}{u_p}, \frac{\langle T_d\,(u_d), I_d(u_d), F_d\,(u_d)\rangle}{u_d}, \frac{\langle T_f\,(u_f), I_f(u_f), F_f\,(u_f)\rangle}{u_f}\right\},$$

$$u_s, u_p, u_d, and\ u_s \in U$$

where s, p, d, and f are severity, probability, detectability, and frequency, respectively.

The degree of severity, probability, detectability, and frequency of the risks that may arise in case of violation of checkpoints are defined by occupational health and safety specialists using a linguistic scale. The linguistic scale used by the specialists in the assessment is given in Table 2. When determining each value of the parameters, the specialists are asked to answer functional and dysfunctional questions as given in Table 3. Each parameter is defined by NSs with the truth (T), the indeterminacy (I), and the falsity (F) membership degrees. Functional questions define the truth while dysfunctional questions define the falsity of the experts' preference. For the probability parameter, T represents the probability of the risk occurrence for the current situation while F still represents the probability of the risk occurrence after the determined control measures are taken for the potential risk. For the severity parameter, T indicates the expected severity of risk occurrence while F indicates the rare severity of risk occurrence. For the frequency, T presents the average weekly usage frequency of the machine or equipment while F presents the annual average usage frequency of the machine or equipment. For the detectability, T presents the detectability of the control measure at the control stage or maintenance while F represents the detectability of the control measure in routine operation. Finally, the indeterminacy in specialists' preferences is measured by using Table 4 and Table 5 based on answers of experts for functional and dysfunctional questions. In another word, I is determined based on the differences between T and F for each parameter. The explanation of the abbreviations for the linguistic scale using in Table 4 and Table 5, is given in Table 6. For instance, let assume the probability of risk occurrence is evaluated by an expert, and let assume the preference of the expert for a functional question and a dysfunctional question be "very high" and "very low", respectively. The indeterminacy in the related evaluation for the probability is determined as "VL: Very Low Indeterminacy" by using Table 4. Similarly, for severity, detectability, and frequency, if the preferences of the expert for the functional question and the dysfunctional, are "very high" and "very low", respectively, the indeterminacy is determined as "VH: Very High Indeterminacy".

Table 2: Linguistic scales for the proposed method

Crisp	Fuzzy	Linguistic Variable	Severity(S) Meaning	Probability (P) Meaning	Detectability (D) Meaning	Annual Frequency (F) Meaning	Weekly Frequency (F) Meaning
1	(0,0,2.5)	Very Low	Very low injury, inexpensive circulation without loss of working days or affecting production downtime.	Almost impossible	Danger is not noticeable via taking measures	Once a year	Once a week
2	(0,2.5,5)	Low	Injury, minor damage that slows down the system operation or stops it for a short time	Remote probability (rare but can happen)	It is unlikely that the accident will be noticeable with the measures taken / Low control is applied	More than once a year	2 times a week
3	(2.5,5,7.5)	Moderate	Inpatient treatment / fracture / serious injury and / or damage affecting system performance	Medium probability	Moderate Control Applied	Once a month	3 times a week
4	(5,7.5,10)	High	Permanent injury / loss of limb / deadly disease and / or complete damage to the equipment	Quite possible	It is highly possible that the accident can be noticed by the measures taken / There is a remarkable warning before the accident occurs.	More than once a week	4 times a week
5	(7.5,10,10)	Very High	Lethal accident and / or environmental disaster	Expected / Certain	It is possible to notice / prevent the accident with the measures taken	One or more times a day	Every day of the week

Table 3. Functional and dysfunctional question types for the parameters

Parameter	Meaning	Neutrosophic variable	Question
Probability	It is determined individually for each control point. Indicates the probability of the risk occurrence.	*Truth*	If the employee has not taken the appropriate control measure, what is the probability of the risk happening?
		Falsity	If the employee took the relevant control measure, what is the probability of the risk occurrence?
Severity	It is calculated according to the risk. Indicates the severity of damage after the risk occurs.	*Truth*	What is the expected severity of risk?
		Falsity	What is the rare severity?
Frequency	It is determined based on the source of the hazard. Indicates the frequency of exposure to danger. It is calculated by considering the weekly and annual checks.	*Truth*	What is the weekly average usage frequency?
		Falsity	What is the annual average usage frequency?
Detectability	It is determined individually for each control point. Explains to what extent the danger can be prevented or detected with the current measures.	*Truth*	What is the detectability of the control measure at the control stage?
		Falsity	What is the detectability of the control measure in routine operation?

Table 4: Determination of indeterminacy value for probability parameter

		Preference for Dysfunctional Questions				
		Very Low	**Low**	**Moderate**	**High**	**Very High**
Preference for Functional Questions	**Very Low**	VL	-	-	-	-
	Low	VL	VH	-	-	-
	Moderate	VL	H	VH	-	-
	High	VL	M	H	VH	-
	Very High	VL	L	M	H	VH

Table 5: Determination of indeterminacy value for severity, detectability, frequency parameters

		Preference for Dysfunctional Questions				
		Very High	**High**	**Moderate**	**Low**	**Very Low**
Preference for Functional Questions	**Very Low**	VH	H	M	L	VL
	Low	H	M	L	VL	L
	Moderate	M	L	VL	L	M
	High	L	VL	L	M	H
	Very High	VL	L	M	H	VH

Table 6. Linguistic terms and triangular fuzzy numbers for indeterminacy parameter

Level of Indeterminacy	Abbreviation	Crisp	Triangular Fuzzy Numbers
Very Low Indeterminacy	VL	1	(0,0,2.5)
Low Indeterminacy	L	2	(0,2.5,5)
Moderate Indeterminacy	M	3	(2.5,5,7.5)
High Indeterminacy	H	4	(5,7.5,10)
Very High Indeterminacy	VH	5	(7.5,10,10)

After each parameter has been evaluated by each expert, the value of each parameter has been defined by a neutrosophic set. The linguistically determined neutrosophic probability, neutrosophic severity, neutrosophic detectability, and neutrosophic frequency values are converted to fuzzy values using the scales given respectively in Figure 5.

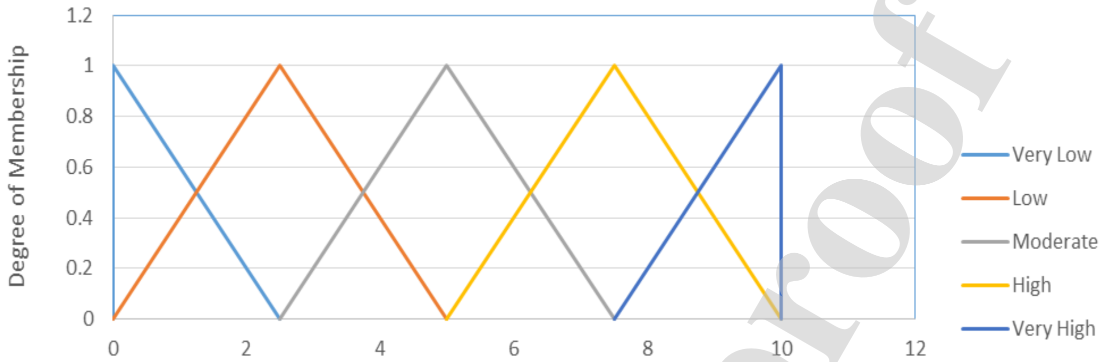

Figure 5: Membership functions for severity, probability, detectability, and frequency parameters

If there is more than one expert in the evaluation process, Eq. (17) and Eq. (18) are used to aggregate expert preferences [3].

Step 5. Calculation of risk magnitudes with Neutrosophic Set Based Inference System

After defining the probability, severity, frequency, and detectability parameters of each risk as a neutrosophic set, risk magnitude is obtained by using the neutrosophic inference system proposed in this study. When the techniques proposed in the literature on risk assessment are examined, many of them are based on experts' judgments. In these studies, the techniques are generally used as the combination of the severity and the risk occurrence probability to calculate the risk magnitude of any event. However, depending on expert judgments, the techniques that obtain the risk magnitude with a scalar product show that the distribution of the risk degrees varies inconsistently [29]. Therefore, the fuzzy set theory and fuzzy inference system are generally used to avoid uncertainty and subjective assessment while calculating risk magnitude [2, 15, 16, 29]. In this study, the risk magnitude (RM) is calculated by using the fuzzy inference system proposed by Mamdani [26] since it is an effective tool to deal with uncertainty. The main structure of the prosed approach is given in Figure 6.

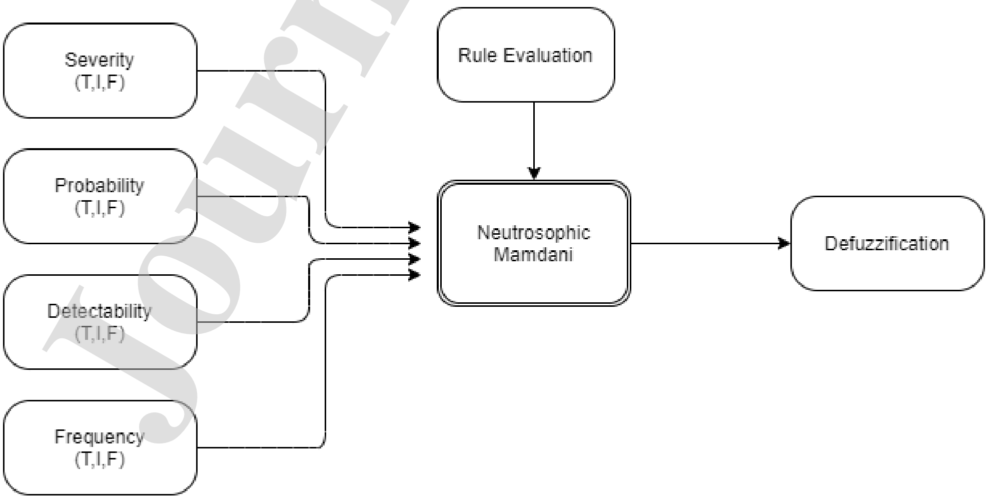

Figure 6: The structure of the neutrosophic set based inference system

In this step, the membership degrees of the parameters which are obtained in the previous step are used as input in fuzzy inference. Thus, the magnitude of the risk expressing the relevant situation is calculated. The fuzzy inference system is an IF-THEN rule-based structure that uses the data of 4 variables as to the input value and gives the risk magnitude as the output value. The inference system of the study is as follows:

$$R^k : \text{IF } \ \text{RS}(T,I,F) \text{AND } \ \text{RP}(T,I,F) \ \text{AND } \ \text{RD}(T,I,F) \ \text{AND } \ \text{RF}(T,I,F) \text{THEN } \ \text{RM}(T,I,F) \quad (21)$$

Where k, $\mu_{RS,}\mu_{RP}, \mu_{RD}, \mu_{RF}$, and μ_{RM} are the number of rules, membership degree of probability, membership degree of severity, membership degree of detectability, membership degree of frequency, and membership degree of risk magnitude, respectively. The fuzzy risk magnitude (RM) depends on the neutrosophic input values is calculated using the following equation:

$$T_{RM}^k(x) = \max\left[\min\left(T_{RS}^k(x), T_{RP}^k(x), T_{RD}^k(x), T_{RF}^k(x)\right)\right], \quad (22a)$$

$$I_{RM}^k(x) = \max\left[\min\left(I_{RS}^k(x), I_{RP}^k(x), I_{RD}^k(x), I_{RF}^k(x)\right)\right], \quad (22b)$$

$$F_{RM}^k(x) = \min\left[\max\left(F_{RS}^k(x), F_{RP}^k(x), F_{RD}^k(x), F_{RF}^k(x)\right)\right], \quad (22c)$$

Since the obtained output from the fuzzy inference system presents the dimension of risk magnitude, the risk magnitude is divided into four categories as negligible (N), minor (Mi), major (M), and catastrophic (C) as given in Table 7. Similar to input parameters, the output parameter, the risk magnitude, is described in NSs including truth membership degree ($T_{RM}(x)$), indeterminacy-membership degree ($I_{RM}(x)$) and falsity membership degree ($F_{RM}(x)$). The score function formula is used to obtain a single value to represent the membership degree of risk magnitude to each risk category. For this process, the score function (SF) formula, whose mathematical equation is given by Eq. 22, is used in neutrosophic clusters [30]. Then, to provide a ranking among the potential risky events, it is required to convert risk magnitude into a crisp value. For this process, the center of gravity method given by Eq. 24 [31] is used with the scale given in Figure 7 [40].

$$S(RM^k) = \frac{3+T_{RM}^k(x)-2I_{RM}^k(x)-F_{RM}^k(x)}{4} \quad (23)$$

Table 7: The categories of the risk magnitudes for the proposed method

Hazard Class	Abbreviation	Meaning
Negligible	N	Risk acceptable
Minor	Mi	Risk tolerable
Major	Ma	It is an important risk group. Measures must be taken.
Catastrophic	C	It is a highly important risk group. Work should be stopped and measures must be taken.

$$RM_i = \frac{\sum_{i=1} Z_i \mu_{RM}(y)}{\sum_{i=1} \mu_{RM}(y)} \quad (24)$$

where Z_i presents the center of the ith fuzzy term set of RM.

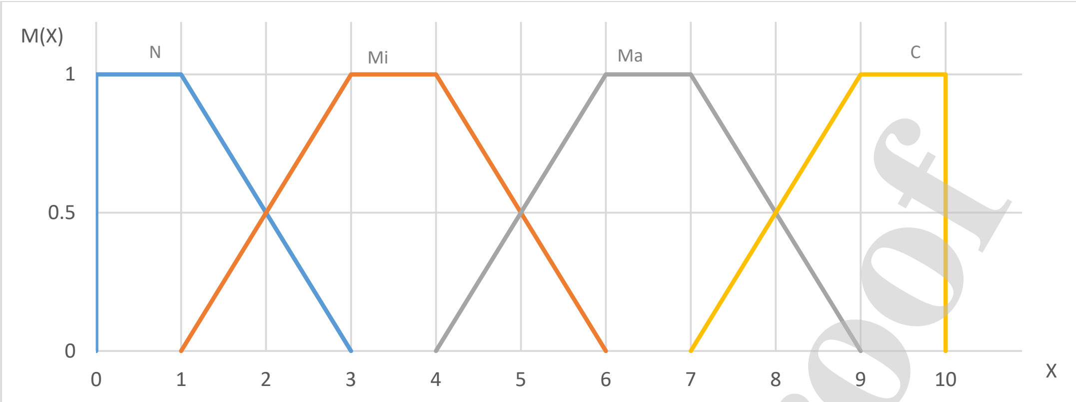

Figure 7: Membership function for the linguistic scale of risk magnitude

Step 6. Planning and monitoring control measures.

Control measures that eliminate the risks or reduce the risk magnitude to an acceptable level are planned and applied to the working environment. Then the adequacy of the planned measures is monitored.

4. Application of the proposed approach

According to Law No. 6331 on Occupational Health and Safety in Turkey, the service sector is one of the sectors where jobs considered as a less hazardous class are carried out. Education, banking, insurance, etc. activities are carried out in the service sector. Laboratories, R&D areas, and workshops used in the service sector are areas where dangerous work is present. These are places that can be exposed to negative situations such as a possible accident, seriousness, loss of limb, fire, explosion. In the scope of this paper, a machine-based risk assessment in a metalworking and woodworking workshop of a university has been considered in order to illustrate the proposed approach.

4.1. Determination of hazard sources for workshops

At this stage, surveillance of working conditions and the working environment of the metalworking and woodworking workshop was carried out. Devices and equipment used extensively in the workshop are listed in Table 8 as hazard sources.

Table 8: List of devices used for analysis

Usage Area	Hazard Source	Abbreviation
Woodworking Workshop	Planning Machine	P
Woodworking Workshop	Circular Saw Machine	C
Metal Working Shop	Upright Drilling Machine	D
Metal Working Shop	Grinding Machine	H
Metal Working Shop	Mitre Saw Machine	M
Metal Working Shop	Guillotine Machine	G

4.2. Identification of occupational risks for the sector

At this step, the potential risks caused by each hazard source are determined separately. The determined risks are given in Table 9.

Table 9: Risks and checklist for machines

Risk Code	Risk	Checkpoints	Hazard Sources and Checklist Codes					
			M	P	C	G	D	H
R1	Injury or amputation due to being caught by moving parts of the equipment	The moving parts in the power generating system and drive belt of the machine must be covered with suitable protection covers.	MC6	PC1	CC1	GC1	DC1	HC12
		Calibration, adjustment, or measurement should not be done on the bench or workpiece before the machine is stopped and secured.	MC1	PC2	CC2	GC2	DC2	HC13
		Instruction manual and personal protective equipment signs should be put on the apparent area	MC4	PC3	CC5	GC3	DC5	HC16
		Two hand control system should be utilized.				GC4		
		If more than one person is working on the same machine, a single person must be assigned to control the machine			CC6	GC5		
		The operator should be provided with suitable work clothes.	MC3	PC4	CC3	GC6	DC3	HC14
		The shortest and the longest parts that can be cut according to the specification of the machine should be determined and the workpiece should be selected accordingly	MC2	PC6		GC7		
		The emergency stop button must be easily accessible and in working order	MC5	PC5	CC7	GC8	DC4	HC15
		Foot pedal, side, and edge protection should be located and only be within the operator's reaching distance			CC4			
R2	Vision loss due to burr/chip splashes, injury	The tools used should not be left on the counter, the necessary ones should be arranged regularly on the work table or counter cabinet.		PC7	CC8	GC9		HC6
		The guard of the machine should be checked.			CC9		DC6	HC1
		Suitable blade must be attached to the counter (should not be stretched or loose)			CC10	GC12		
		Cutting should not be started before the saw reaches its adjusted speed.			CC11			
		The workpiece must be firmly attached to the machine	MC9	PC12	CC12	GC11	DC8	HC3
		Protective equipment must be handed to the employee and training on how to use should be delivered.	MC8	PC9	CC13	GC10	DC9	HC4
		The ventilation system of the engine should be cleaned up before the start and after the end of the work.	MC7					
		A transparent protective guard should be attached to the bench.		PC8				HC5
		The cutting tool should be bolted down to the machine.		PC10				
		Residual sawdust should be cleaned on the bench with the help of a brush.		PC11				
		Resin stuck on the spindle, blades, and table should be cleaned with a diesel brush before starting work.		PC13				
		It should be checked that there are no foreign objects such as stones, nails, etc. on the workpiece.		PC14				
		All adjustments and fixings should be checked before starting work.		PC15			DC7	HC2
R3	Serious injury/death from electric shock	In the situation of a power outage, power failure, etc., the machine must be switched off from the on / off button and the electrician must be notified immediately.	MC10	PC16	CC14	GC13	DC10	HC7
		Earth lines that can be inspected visually should be installed to the chassis of the counter.	MC11	PC17	CC15	GC14	DC11	HC8
		Residual current devices must be used on the system.	MC12	PC18	CC16	GC15	DC12	HC9
		The operator must be informed not to use rings, necklaces, etc. that may be conductive.	MC13	PC19	CC17	GC16	DC13	HC10
		Before starting the maintenance and repair, LOTO should be applied by de-energizing.	MC14	PC20	CC18	GC17	DC14	HC11
R4	Musculoskeletal Injuries	It should be ensured to work in an ergonomic body posture				GC18	DC15	HC19
		Heavy loads and workpieces must be lifted and transported using suitable equipment				GC19	DC16	HC20
R5	Skin irritation / occupational disease caused by chemical penetration	Operator should avoid the contact with grinding oils or metal particles.						HC17
		Before starting to grind, the ventilation system should be operated, periodic maintenance should be followed.						HC18
R6	Serious injury/death due to fire/explosion	Easily flammable objects should be removed from the workplace			CC19			HC21
		There should be a suitable type of fire extinguisher in the workplace and periodic maintenance should be done.			CC20			HC22

4.3. Defining the points that cause the risks to occur and defining the control points,

The checklists for each risk determined in the previous step were defined by taking the opinions of managers, occupational health and safety specialists, workplace support personnel, and operators. The checklists of the potential risks are given in Table 9.

4.4. Defining Parameter Values for Each Control Point

Frequency, severity, probability, and detectability parameters were used to determine the risk magnitude of each hazard source. The frequency parameter is defined by considering the weekly and annual usage frequency of a machine. Probability and severity parameters were defined by considering the judgments of 3 occupational health and safety specialists on the potential risk. Then, the detectability is determined based on the potential of whether the relevant deficiency caused potential risk is recognized during both inspection and routine activity. During data collection, judgments were asked using the question types in the questionnaire given in Table 3. The rule base in Table 4 and Table 5 is used to describe the inconsistency in judgments.

The collected linguistic data on the severity, probability, detectability, and frequency parameters are given in Appendix A1. These values are converted into fuzzy numbers by using the scales given in Table 2 and Table 6. Then, Eq. 17 and Eq. 18 were used to obtain a co-decision matrix on the severity and probability evaluations since data were obtained from 3 experts. For example; the preferences of the experts (Expert-1, Expert-2 and Expert-3) on probability of MC8 for the control point of mitre saw machine, are ((5,7.5,10), (0,0,2.5), (0,0,2.5)]; [(7.5,10,10), (0,0,2.5), (0,0,2.5)]; [(5,7.5,10), (2.5,5,7.5), (0,2.5,5)], respectively. Then, the co-decision value was obtained by using Eq 17 and Eq 18 as [(5.703, 8.245,10), (0.0, 4.528), [0.0, 3.149)] for the related evaluation. Like this, the fuzzy numbers for the linguistic data are obtained.

The next step is to obtain membership degrees of the fuzzy numbers obtained from linguistic evaluations. The membership degrees of the linguistic variables converted into fuzzy numbers were calculated using the scale given in Figure 5. Membership degrees of the truth value of the MC8 are shown in Figure 8 as an example. The membership degrees for each parameter are given in Appendix A2.

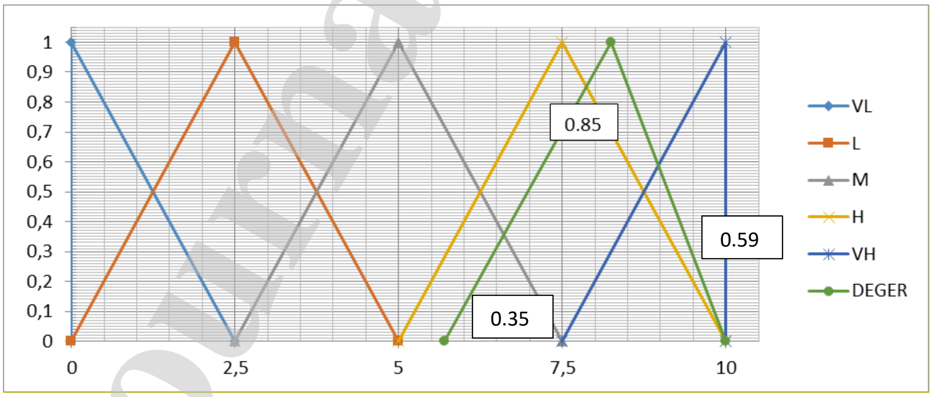

Figure 8: Calculation of the membership degree of the truth value of the mitre saw machine MC8

4.5. Calculation of risk magnitudes with Neutrosophic Set Based Inference System

During the calculation, four levels of risk consequence as negligible (N), minor (Mi), major (Ma), and catastrophic (C) were taken into consideration. The risk magnitude of each risk was calculated by using a neutrosophic-based inference system and the membership degrees of each risk to the probability, severity, frequency, and detectability parameters. In this study, the SCEA rule base, given in Table 10 is used for the rule base among these parameters [16].

Table 10: Fuzzy Inference System for SCEA

		Detectability (D)																								
		VH					**H**					**M**					**L**					**VL**				
Frequency (F)	**Severity (S)**	**Probability (P)**					**Probability (P)**					**Probability (P)**					**Probability (P)**					**Probability (P)**				
		VL	**L**	**M**	**H**	**VH**	**VL**	**L**	**M**	**H**	**VH**	**VL**	**L**	**M**	**H**	**VH**	**VL**	**L**	**M**	**H**	**VH**	**VL**	**L**	**M**	**H**	**VH**
VL	VL	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
	L	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Mi	Mi	Mi
	M	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Mi	Mi	Mi	Mi	Mi	Mi
	H	N	N	N	N	N	N	N	N	N	Mi	N	Mi	Mi	Mi	Mi	Mi	Mi	Mi	Mi	Ma	Mi	Mi	Mi	Mi	Ma
	VH	N	N	N	N	Mi	N	Mi	Mi	Mi	Mi	Mi	Mi	Mi	Mi	Mi	Mi	Mi	Ma	Ma	Ma	Mi	Mi	Mi	Ma	Ma
L	VL	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Mi	Mi	Mi	N	N	Mi	Mi	Mi
	L	N	N	N	N	N	N	N	N	N	N	N	Mi	Mi	Mi	Mi	N	Mi	Mi	Mi	Mi	Mi	Mi	Ma	Ma	Ma
	M	N	N	N	N	N	N	N	N	N	N	Mi	Mi	Mi	Mi	Mi	Mi	Mi	Mi	Mi	Ma	Mi	Mi	Ma	Ma	Ma
	H	N	N	N	N	N	N	N	N	N	Mi	Mi	Mi	Mi	Mi	Ma	Ma	Mi	Mi	Ma	Ma	Mi	Mi	Ma	C	C
	VH	N	N	N	N	Mi	N	N	N	Mi	Mi	Mi	Mi	Mi	Ma	Ma	Ma	Ma	Ma	Ma	Ma	Ma	Ma	C	C	C
M	VL	N	N	N	N	Mi	N	N	N	N	N	N	N	N	N	Mi	N	N	N	Mi	Mi	N	N	Mi	Mi	Ma
	L	N	N	N	N	Mi	N	N	N	Mi	Mi	N	N	Mi	Mi	Mi	Mi	Mi	Mi	Ma	Ma	Mi	Ma	Ma	Ma	Ma
	M	N	N	N	Mi	Mi	N	Mi	Mi	Mi	Mi	Mi	Mi	Ma	Ma	Mi	Mi	Mi	Ma	Ma	Ma	Mi	Ma	Ma	Ma	C
	H	N	N	N	Mi	Mi	N	Mi	Mi	Mi	Ma	Mi	Ma	Ma	Ma	Ma	Mi	Ma	Ma	Ma	Ma	Ma	Ma	C	C	C
	VH	N	N	N	Mi	Mi	Mi	Mi	Mi	Ma	Ma	Ma	Ma	Ma	Ma	Ma	Ma	Ma	Ma	C	C	Ma	C	C	C	C
H	VL	N	N	N	Mi	Mi	N	Mi	Mi	Mi	Mi	N	N	Mi	Mi	Mi	Mi	Mi	Mi	Mi	Ma	Mi	Mi	Mi	Mi	Ma
	L	N	N	Mi	Mi	Mi	N	Mi	Ma	Ma	Ma	N	Ma	Mi	Ma	Mi	Mi	Mi	Ma	Ma	Ma	Mi	Mi	Ma	Ma	Ma
	M	N	N	Mi	Mi	Mi	Mi	Ma	Ma	Ma	Ma	Ma	Ma	Ma	Ma	Ma	Mi	Ma	Ma	Ma	C	Mi	Ma	Ma	C	C
	H	N	N	Mi	Mi	Ma	Ma	Ma	Ma	Ma	Ma	Ma	Ma	Ma	Ma	Ma	Ma	Ma	Ma	C	C	Ma	Ma	C	C	C
	VH	N	Mi	Mi	Ma	Ma	Ma	Ma	Ma	Ma	Ma	Ma	Ma	Ma	C	C	Ma	Ma	C	C	C	Ma	C	C	C	C
VH	VL	N	N	N	N	Mi	N	N	N	N	Mi	N	N	N	Mi	Mi	N	Mi	Mi	Mi	Ma	Mi	Mi	Ma	Ma	Ma
	L	N	N	N	Mi	Mi	N	N	Ma	Ma	Ma	N	N	Mi	Ma	Ma	Mi	Mi	Mi	Ma	Ma	Ma	Ma	Ma	Ma	Ma
	M	N	N	Mi	Mi	Ma	Ma	Ma	Ma	Ma	Ma	Mi	Mi	Ma	Ma	Ma	Ma	Ma	Ma	C	C	Ma	Ma	Ma	C	C
	H	N	Mi	Mi	Ma	Ma	Ma	Ma	Ma	Ma	C	Ma	Ma	C	C	C	C	C	C	C	C	C	C	C	C	C
	VH	Mi	Ma	Ma	Ma	Ma	Ma	Ma	Ma	Ma	C	Ma	Ma	C	C	C	C	C	C	C	C	C	C	C	C	C

The neutrosophic-based inference system produces risk magnitude in the membership value of neutrosophic sets for each risk consequence. The score function formula in Eq 23 was used for converting neutrosophic risk magnitudes into a single value. At this step, the membership degree of each risk consequence for each risk category was converted to crisp values using the center of gravity method given in Eq 24, and the scale in Figure 7. For example; Neutrosophic sets of the risk consequence N, Mi, Ma, and C for the control point MC8 of the mitre saw machine are [(0.85,0.5,0.5); (0.5,1,0.5); (0,0.5,0.5); (0,0,0)] respectively. These values are converted to a single value by using the score function formula (Eq 23) as 0.588, 0.250, 0.375, and 0.750. These single values present the membership degrees of the risk consequence $N, Mi, Ma,$ and $C,$ respectively. Then, Eq 24 was used and a risk magnitude of MC8 was found as 5.968. The risk magnitudes of each risk determined in this study are given in Appendix A3.

4.6. Planning and monitoring control measures

Serious losses such as death or injury; financial losses such as production drop, service disruptions, compensation to be paid; moral losses such as image damage, and low motivation may be experienced as a result of an accident at work. For this reason, it is important to take the necessary precautions before an accident occurs in a workplace in terms of preventing a possible accident. In order to eliminate these accidents and minimize the negative outcomes of them, in this study, priority control points for possible risks in machines have been determined.

Critical risks in the study are found as follows,

- Injury, amputation due to being caught in moving parts of the equipment
- Serious injury/death from electric shock
- Vision loss due to burr/chip splashes, injury

There are basic points that should be checked first to avoid critical risks such as ensuring that the emergency stop button of all devices are easily accessible and operating, using personal protective equipment suitable for the work done, having a residual current device on the system, and operating it, having earth lining of the body and periodic checks on all devices is an example. After the related preventions are taken, controls and reviews on the activities should be continued until the existing risks are wholly eliminated from the working environment although the risk magnitude of risky operation is reduced as much as possible. In addition, in order to be successful in occupational health and safety studies, it is necessary to adopt a preventive approach to all employers and to ensure the participation of everyone in these studies.

5. Comparison of the results

In this part, we will compare the results obtained from the proposed method with the SCEA method. Both of them use the same parameters to obtain risk magnitude. Different from the SCEA method, the indeterminacy of the decision-makers is taken into consideration while calculating risk magnitude in the proposed method. Risk magnitude scores obtained from the SCEA method and the proposed method are listed in Appendix A3.

According to Appendix A3, there are differences in risk ranking between the SCEA method and the proposed method. The reason for these differences is that the proposed method considers the inconsistency in the expert evaluations. In other words, the proposed method considers inconsistent situations caused by the expert evaluation for risks under the parameters of the SCEA method by using indeterminacy definition in the neutrosophic sets. There can be different inconsistent situations on evaluations of the parameters. For instance, the detectability of a risk differentiates between during routine working period and maintenance period of the machine. The severity of an accident may vary from very low injury to lethal accident or environmental disaster. The usage frequency of a machine may be changed when we consider only one week or wholes year based on the handled jobs. The occurrence probability of an accident may not be minimized or eliminated although the related control measures are taken. All of them create inconsistency, and while calculating the risk magnitude of any risk, the proposed method considers these inconsistent situations by using the indeterminacy parameter in neutrosophic sets. Let us consider the risk "R1-Injury, amputation due to being caught by moving parts of the equipment" of the circular saw machine caused by the checkpoint "CC7-The emergency stop button must be easily accessible and in working order". The proposed method calculates the risk magnitude of R1 caused by CC7 as 6.978 while the SCEA method calculates the risk magnitude as 6.190. The risk magnitude obtained from the proposed method is bigger than the risk magnitude obtained from the SCEA method since there is a low probability of being detected off the emergency stop button in working order or not during routine working time and the proposed method considers this difference by using indeterminacy definition on detection. Similarly, let consider the risk "R2- Vision loss due to burr/chip splashes, injury" of the planning machine caused by the checkpoint "PC10- The cutting tool should be bolted down to the machine." The proposed method calculates the risk magnitude of R2 caused by PC10 as 5.710 while the SCEA method calculates the risk magnitude as 3.432. The risk magnitude obtained from the proposed method is larger than the risk magnitude obtained from the SCEA method since the probability of risk occurrence may not be decreased although the required risk control measure is applied. This causes an indeterminacy in the prediction of probability. So, the proposed method considers indeterminacy in the evaluation process.

6. Conclusion

Occupational health and safety applications require a comprehensive analysis to protect employees from occupational risks that might be caused by lots of hazard sources in the workplace. In this study, occupational health and safety risk assessment studies in the literature have been analyzed, and the deficiencies of both traditional risk analysis methods and also newly proposed risk assessment methods have been emphasized. The SCEA method considering 4 parameters, severity, probability, detectability, frequency, to calculate risk magnitude is one of the newly proposed risk assessment methods in the literature. In this study, we propose the extension of the SCEA method with the neutrosophic set theory to considers the inconsistency of the experts. In a risk assessment of an activity in terms of occupational health and safety, the judgments on the occurrence probability, severity, and detectability of risk may differentiate based on the expertise of occupational health and safety specialist. In addition to expert judgments, risk evaluation has complexity caused by its natural conditions. For instance, an accident may have resulted from very low injury to lethal accidents or environmental disasters and those prove that the severity of a risk. Moreover, the usage frequency of a machine may differentiate based on handled jobs in the working period. Furthermore, the detectability of a risk differentiates between during routine working period and maintenance period of the machine. And also, the occurrence probability of an accident may not be minimized or eliminated although the related control measures are taken. All of these situations create an inconsistency in the risk assessment. In the literature, there is not any risk assessment method to cope with these difficulties, simultaneously. Therefore, in this study, we extended the SCEA method with the neutrosophic sets to consider inconsistencies in the evaluation process of risk assessment. Neutrosophic sets are characterized by truth (T), indeterminacy (I), and falsity (F) membership degrees. In the study, we used the truth membership degree to present the current condition of the handled risk while the falsity membership degree is used to define deviation in the process. And finally, the indeterminacy parameter was used to reflect the inconsistency between the truth and the falsity membership degrees. Different from the neutrosophic sets, it is the first time the indeterminacy parameter is determined based on the falsity and truth membership degrees.

The application of the proposed approach has been conducted on the metalworking and woodworking workshop of a university. The risk magnitude of each checkpoint at the production process has been determined based on probability, severity, frequency, and detectability. And also, each of these parameters is defined by using truth, falsity, and indeterminacy parameters in neutrosophic sets. The membership degree for the truth and falsity are pulled from the process/experts while the indeterminacy parameter is defined based on the truth and the falsity degrees by using the rule base given in Table 4 and Table 5. The probability and severity parameters are collected from experts' evaluations while frequency and detectability are determined based on the operations in the process. Then, the risk magnitude for each risk is calculated based on these data by using a neutrosophic inference system including IF-Then rules including the relationship among the parameters. To compare the results obtained from the proposed method, the SCEA method is applied to the collected data. Finally, it is shown that the proposed method provides a higher risk score than SCEA for any risk if there is any inconsistency situation at the definition of probability, severity, detectability, and frequency parameters.

The contribution of the proposed risk model to the literature is that it is the first time the SCEA method using risk severity, probability, detectability, and frequency terms is extended to neutrosophic sets to consider the inconsistencies caused by expert evaluations and system deviations in the risk assessment. For this, each of the parameters of the SCEA method including probability, severity, frequency, and detectability is defined by truth membership degree, indeterminacy membership degree, and falsity membership degree. Then, the risk magnitude is obtained by using the neutrosophic inference system which is firstly introduced to literature by this study. Furthermore, it is the first time the indeterminacy parameter of neutrosophic sets is defined based on truth and falsity definitions in this study.

In this study, the proposed method provides an analysis for unsafe conditions and efficiency of precautions to be taken against these unsafe conditions in the working environment under both during routine working activities (by using functional question) and during extreme situations (by using dysfunctional question). Situations such as sudden shock, distraction, sabotage that may arise from the human factor, and psychological behavior of workers may affect the efficiency of the precautions in a working environment. Therefore, the psychological behaviors of workers under the stress are out of this research's scope and this is the limitation of the proposed method.

Since the proposed approach requires many complex calculations, for further study, a computer-based decision support system may be developed to facilitate the calculation process and provide decision support to experts. Furthermore, the proposed method can be improved by extending to type-2 neutrosophic-entropy-fusion proposed by Singh (2021) to consider uncertainties.

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Appendix A1: Linguistic evaluation for the determined risks caused by checklists.

Appendix A2: Membership degrees of the severity, probability, detectability and frequency

Appendix A3: Risk magnitude for proposed method (N-SCEA) and comparison with SCEA

Hazard Source	Risk	Checklist Code	Frequency			Severity- Expert 1			Severity- Expert 2			Severity- Expert 3			Detectability			Probability- Expert 1			Probability- Expert 2			Probability- Expert 3		
			T	I	F	T	I	F	T	I	F	T	I	F	T	I	F	T	I	F	T	I	F	T	I	F
C	R1	CC1	VH	VL	VH	M	L	H	M	L	H	M	L	H	H	L	M	H	M	L	H	M	L	H	M	L
C	R1	CC2	VH	VL	VH	M	L	H	M	L	H	M	L	H	H	M	L	H	H	M	H	H	M	H	M	L
C	R1	CC3	VH	VL	VH	M	L	H	M	L	H	M	L	H	VH	VL	VH	H	H	M	H	M	L	H	M	L
C	R1	CC4	VH	VL	VH	M	L	H	M	L	H	M	L	H	H	H	VL	H	M	L	VH	VL	VL	VH	L	L
C	R1	CC5	VH	VL	VH	M	L	H	M	L	H	M	L	H	H	L	M	H	H	M	H	H	M	H	H	M
C	R1	CC6	VH	VL	VH	M	L	H	M	L	H	M	L	H	VH	L	H	H	H	M	H	H	M	H	M	L
C	R1	CC7	VH	VL	VH	M	L	H	M	L	H	M	L	H	VH	H	L	H	VL	VL	VH	VL	VL	VH	VL	VL
C	R2	CC8	VH	VL	VH	M	L	H	L	M	H	L	M	H	H	L	M	H	H	M	H	H	M	H	H	M
C	R2	CC9	VH	VL	VH	M	L	H	L	M	H	L	M	H	M	M	VL	H	H	M	H	M	L	H	M	L
C	R2	CC10	VH	VL	VH	M	L	H	L	M	H	L	M	H	M	M	VL	H	M	L	H	M	L	H	M	L
C	R2	CC11	VH	VL	VH	M	L	H	L	M	H	L	M	H	H	L	M	H	H	M	H	H	M	H	H	M
C	R2	CC12	VH	VL	VH	M	L	H	L	M	H	L	M	H	H	L	M	H	M	L	H	M	L	H	M	L
C	R2	CC13	VH	VL	VH	M	L	H	L	M	H	L	M	H	VH	VL	VH	H	M	L	VH	VL	VL	VH	L	L
C	R3	CC14	VH	VL	VH	M	L	H	L	M	H	L	M	H	VH	M	M	H	M	L	H	M	L	H	M	L
C	R3	CC15	VH	VL	VH	M	L	H	L	M	H	L	M	H	H	H	VL	H	M	L	H	M	L	H	M	L
C	R3	CC16	VH	VL	VH	M	L	H	L	M	H	L	M	H	M	M	VL	VH	VL	VL	VH	VL	VL	H	VL	VL
C	R3	CC17	VH	VL	VH	M	L	H	L	M	H	L	M	H	VH	M	M	H	H	M	H	H	M	H	M	L
C	R3	CC18	VH	VL	VH	M	L	H	L	M	H	L	M	H	H	H	VL	H	M	L	H	M	L	H	VL	VL
C	R6	CC19	VH	VL	VH	L	M	H	L	M	H	L	M	H	VH	L	H	H	M	L	VH	L	L	H	M	L
C	R6	CC20	VH	VL	VH	L	M	H	L	M	H	L	M	H	VH	VL	VH	VH	M	M	VH	M	M	H	M	L
D	R1	DC1	VH	VL	VH	M	L	H	M	L	H	M	L	H	H	M	L	H	VL	VL	VH	VL	VL	VH	VL	VL
D	R1	DC2	VH	VL	VH	M	L	H	M	L	H	M	L	H	H	M	L	H	H	M	H	H	M	H	H	M
D	R1	DC3	VH	VL	VH	M	L	H	M	L	H	M	L	H	VH	VL	VH	H	M	L	H	M	L	H	M	L
D	R1	DC4	VH	VL	VH	M	L	H	M	L	H	M	L	H	VH	L	H	VH	VL	VL	VH	VL	VL	VH	VL	VL
D	R1	DC5	VH	VL	VH	M	L	H	M	L	H	M	L	H	VH	VL	VH	H	H	M	H	H	M	H	H	M
D	R2	DC6	VH	VL	VH	M	L	H	M	L	H	M	L	H	H	M	L	H	M	L	H	M	L	H	M	L
D	R2	DC7	VH	VL	VH	M	L	H	M	L	H	M	L	H	VH	H	L	H	M	L	H	M	L	H	M	L
D	R2	DC8	VH	VL	VH	M	L	H	M	L	H	M	L	H	H	H	VL	H	M	L	H	M	L	H	M	L
D	R2	DC9	VH	VL	VH	M	L	H	M	L	H	M	L	H	VH	VL	VH	H	M	L	VH	VL	VL	VH	VL	VL
D	R3	DC10	VH	VL	VH	M	L	H	L	M	H	L	M	H	VH	M	M	M	H	L	VH	L	L	VH	L	L
D	R3	DC11	VH	VL	VH	M	L	H	L	M	H	L	M	H	H	H	VL	H	M	L	VH	VL	VL	VH	VL	VL
D	R3	DC12	VH	VL	VH	M	L	H	L	M	H	L	M	H	M	M	VL	VH	VL	VL	VH	VL	VL	VH	VL	VL
D	R3	DC13	VH	VL	VH	M	L	H	L	M	H	L	M	H	VH	M	M	H	H	M	H	M	L	H	M	L
D	R3	DC14	VH	VL	VH	L	L	M	L	L	M	L	L	M	H	H	VL	H	M	L	H	M	L	H	M	L
D	R4	DC15	VH	VL	VH	L	L	M	L	L	M	L	L	M	VH	VL	VH	H	M	L	H	M	L	H	M	L
D	R4	DC16	VH	VL	VH	L	L	M	L	L	M	L	L	M	VH	L	H	H	M	L	H	M	L	H	M	L
G	R1	GC1	VH	VL	VH	M	L	H	M	L	H	M	L	H	H	L	M	H	M	L	VH	VL	VL	VH	L	L
G	R1	GC2	VH	VL	VH	M	L	H	M	L	H	M	L	H	H	M	L	H	M	L	VH	VL	VL	VH	L	L
G	R1	GC3	VH	VL	VH	M	L	H	M	L	H	M	L	H	H	M	L	H	H	M	VH	VL	VL	VH	L	L
G	R1	GC4	VH	VL	VH	M	L	H	M	L	H	M	L	H	VH	VH	VL	H	VL	VL	VH	VL	VL	VH	L	L
G	R1	GC5	VH	VL	VH	M	L	H	M	L	H	M	L	H	VH	L	H	H	M	L	H	M	L	H	M	L
G	R1	GC6	VH	VL	VH	M	L	H	M	L	H	M	L	H	VH	VL	VH	H	M	L	H	M	L	H	M	L
G	R1	GC7	VH	VL	VH	M	L	H	M	L	H	M	L	H	VH	M	M	H	M	L	VH	VL	VL	VH	L	L
G	R1	GC8	VH	VL	VH	M	L	H	M	L	H	M	L	H	VH	H	L	H	VL	VL	VH	VL	VL	VH	VL	VL
G	R2	GC9	VH	VL	VH	M	L	H	L	M	H	M	L	H	H	L	M	H	H	M	M	H	L	M	H	L
G	R2	GC10	VH	VL	VH	M	L	H	L	M	H	M	L	H	VH	VL	VH	H	M	L	VH	VL	VL	VH	VL	VL
G	R2	GC11	VH	VL	VH	M	L	H	L	M	H	M	L	H	H	L	M	H	M	L	H	M	L	H	M	L
G	R2	GC12	VH	VL	VH	M	L	H	L	M	H	M	L	H	VH	H	L	H	H	M	H	M	L	H	M	L
G	R3	GC13	VH	VL	VH	M	L	H	L	M	H	M	L	H	VH	M	M	H	M	L	H	M	L	H	M	L
G	R3	GC14	VH	VL	VH	M	L	H	L	M	H	M	L	H	H	H	VL	H	M	L	H	H	M	H	M	L
G	R3	GC15	VH	VL	VH	M	L	H	L	M	H	M	L	H	M	M	VL	VH	VL	VL	VH	VL	VL	H	VL	VL
G	R3	GC16	VH	VL	VH	M	L	H	L	M	H	M	L	H	VH	M	M	H	H	M	H	H	M	H	M	L
G	R3	GC17	VH	VL	VH	M	L	H	L	M	H	M	L	H	H	H	VL	VH	L	L	H	M	L	H	VL	VL
G	R4	GC18	VH	VL	VH	L	L	M	L	L	M	L	L	M	VH	VL	VH	H	M	L	H	M	L	H	M	L
G	R4	GC19	VH	VL	VH	L	L	M	L	L	M	L	L	M	VH	L	H	H	M	L	H	M	L	H	M	L
H	R1	HC12	M	L	H	M	L	H	M	L	H	M	L	H	H	M	L	H	M	L	H	M	L	H	M	L
H	R1	HC13	M	L	H	M	L	H	M	L	H	M	L	H	H	M	L	H	H	M	H	H	M	H	M	L
H	R1	HC14	M	L	H	M	L	H	M	L	H	M	L	H	VH	VL	VH	H	M	L	H	M	L	H	M	L
H	R1	HC15	M	L	H	M	L	H	M	L	H	M	L	H	VH	L	H	VH	VL	VL	VH	VL	VL	VH	L	L
H	R1	HC16	M	L	H	M	L	H	M	L	H	M	L	H	VH	VL	VH	H	H	M	H	H	M	VH	M	M
H	R2	HC1	M	L	H	M	L	H	M	L	H	M	L	H	VH	M	M	H	M	L	H	H	M	H	M	L
H	R2	HC2	M	L	H	M	L	H	M	L	H	M	L	H	H	M	L	H	H	M	H	H	M	H	M	L
H	R2	HC3	M	L	H	M	L	H	M	L	H	M	L	H	H	H	VL	H	H	M	H	VH	H	H	M	L
H	R2	HC4	M	L	H	M	L	H	M	L	H	M	L	H	VH	VL	VH	VH	L	L	VH	VL	VL	H	VL	VL
H	R2	HC5	M	L	H	M	L	H	M	L	H	M	L	H	VH	VL	VH	H	M	L	H	M	L	H	M	L
H	R2	HC6	M	L	H	M	L	H	M	L	H	M	L	H	VH	M	M	H	H	M	M	H	L	H	M	L
H	R3	HC7	M	L	H	M	L	H	L	M	H	L	M	H	VH	M	M	H	M	L	H	M	L	H	M	L
H	R3	HC8	M	L	H	M	L	H	L	M	H	L	M	H	H	H	VL	H	M	L	H	H	M	H	M	L
H	R3	HC9	M	L	H	M	L	H	L	M	H	L	M	H	M	M	VL	VH	VL	VL	VH	VL	VL	VH	VL	VL
H	R3	HC10	M	L	H	M	L	H	L	M	H	L	M	H	VH	M	M	H	H	M	H	H	M	H	H	M
H	R3	HC11	M	L	H	M	L	H	L	M	H	L	M	H	H	H	VL	H	M	L	H	M	L	H	M	L
H	R4	HC19	M	L	H	L	L	M	L	L	M	L	L	M	VH	VL	VH	H	M	L	H	M	L	H	M	L
H	R4	HC20	M	L	H	L	L	M	L	L	M	L	L	M	VH	L	H	H	M	L	H	M	L	H	M	L
H	R5	HC17	M	L	H	L	M	H	L	L	M	M	VL	M	H	M	L	H	H	M	VH	VL	VL	VH	L	L
H	R5	HC18	M	L	H	L	M	H	L	L	M	M	VL	M	VH	M	M	VH	L	L	H	M	L	H	M	L
H	R6	HC21	M	L	H	L	M	H	L	M	H	L	M	H	H	L	M	VH	L	L	VH	VL	VL	VH	VL	VL
H	R6	HC22	M	L	H	L	M	H	L	M	H	L	M	H	VH	L	H	VH	M	M	H	M	L	H	VL	VL
M	R1	MC1	VL	M	M	M	L	H	M	L	H	M	L	H	VH	L	H	H	M	L	VH	VL	VL	H	M	L
M	R1	MC2	VL	M	M	M	L	H	M	L	H	M	L	H	VH	M	M	H	H	M	H	M	L	H	M	L
M	R1	MC3	VL	M	M	M	L	H	M	L	H	M	L	H	VH	VL	VH	H	H	M	H	M	L	VH	L	L
M	R1	MC4	VL	M	M	M	L	H	M	L	H	M	L	H	VH	VL	VH	VH	M	M	H	H	M	M	H	L
M	R1	MC5	VL	M	M	M	L	H	M	L	H	M	L	H	VH	L	H	H	M	L	VH	VL	VL	H	VL	VL
M	R1	MC6	VL	M	M	M	L	H	M	L	H	M	L	H	VH	L	H	H	M	L	VH	VL	VL	H	VL	VL
M	R2	MC7	VL	M	M	M	L	H	M	L	H	M	L	H	H	H	VL	M	H	L	H	M	L	H	M	L
M	R2	MC8	VL	M	M	M	L	H	M	L	H	M	L	H	VH	L	H	H	VL	VL	VH	VL	VL	H	M	L
M	R2	MC9	VL	M	M	M	L	H	M	L	H	M	L	H	H	M	L	M	H	L	H	M	L	H	H	M
M	R3	MC10	VL	M	M	M	L	H	L	M	H	L	M	H	VH	M	M	H	M	L	VH	L	L	H	M	L
M	R3	MC11	VL	M	M	M	L	H	L	M	H	L	M	H	H	H	VL	H	M	L	VH	VL	VL	H	M	L
M	R3	MC12	VL	M	M	M	L	H	L	M	H	L	M	H	M	M	VL	VH	VL	VL	VH	VL	VL	H	VL	VL
M	R3	MC13	VL	M	M	M	L	H	L	M	H	L	M	H	VH	M	M	H	M	L	H	M	L	H	M	L
M	R3	MC14	VL	M	M	M	L	H	L	M	H	L	M	H	H	H	VL	H	M	L	H	M	L	H	VL	VL
P	R1	PC1	VL	M	M	M	L	H	M	L	H	M	L	H	VH	L	H	H	M	L	H	M	L	H	VL	VL

P	R1	PC2	VL	M	M	M	L	H	M	L	H	M	L	H	H	M	L	M	H	L	H	H	M	H	M	L
P	R1	PC3	VL	M	M	M	L	H	M	L	H	M	L	H	VH	VL	VH	VH	VL	VL	H	M	L	H	VL	VL
P	R1	PC4	VL	M	M	M	L	H	M	L	H	M	L	H	VH	L	H	H	M	L	VH	VL	VL	H	VL	VL
P	R1	PC5	VL	M	M	M	L	H	M	L	H	M	L	H	H	M	L	H	H	M	H	H	M	VH	L	L
P	R1	PC6	VL	M	M	M	L	H	M	L	H	M	L	H	VH	VL	VH	VH	M	M	H	H	M	M	H	L
P	R2	PC7	VL	M	M	M	L	H	M	L	H	M	L	H	H	L	M	M	H	L	M	H	L	H	M	L
P	R2	PC8	VL	M	M	M	L	H	M	L	H	M	L	H	H	L	M	H	M	L	H	M	L	H	M	L
P	R2	PC9	VL	M	M	M	L	H	M	L	H	M	L	H	VH	L	H	H	M	L	VH	VL	VL	H	M	L
P	R2	PC10	VL	M	M	M	L	H	M	L	H	M	L	H	H	M	L	H	M	L	H	M	L	VH	L	L
P	R2	PC11	VL	M	M	M	L	H	M	L	H	M	L	H	H	M	L	H	M	L	H	M	L	M	VL	VL
P	R2	PC12	VL	M	M	M	L	H	M	L	H	M	L	H	H	M	L	H	VL	VL	H	M	L	H	M	L
P	R2	PC13	VL	M	M	M	L	H	M	L	H	M	L	H	H	H	VL	H	M	L	H	M	L	H	VL	VL
P	R2	PC14	VL	M	M	M	L	H	M	L	H	M	L	H	H	H	VL	H	M	L	VH	VL	VL	H	M	L
P	R2	PC15	VL	M	M	M	L	H	M	L	H	M	L	H	M	M	VL	H	M	L	VH	VL	VL	H	M	L
P	R3	PC16	VL	M	M	M	L	H	L	M	H	L	M	H	VH	M	M	M	H	L	H	M	L	H	M	L
P	R3	PC17	VL	M	M	M	L	H	L	M	H	L	M	H	H	H	VL	H	M	L	VH	VL	VL	H	M	L
P	R3	PC18	VL	M	M	M	L	H	L	M	H	L	M	H	M	M	VL	VH	VL	VL	VH	VL	VL	H	VL	VL
P	R3	PC19	VL	M	M	M	L	H	L	M	H	L	M	H	VH	M	M	H	H	M	H	H	M	H	M	L
P	R3	PC20	VL	M	M	M	L	H	L	M	H	L	M	H	H	H	VL	H	M	L	H	M	L	H	VL	VL

Hazard Source	Risk Code	Checklist Code	Membership Degrees of Severity Parameters															Membership Degrees of Probability Parameters															Membership Degrees of Detectability Parameters															Membership Degrees of Frequency Parameters														
			VL			L			M			H			VH			VL			L			M			H			VH			VL			L			M			H			VH			VL			L			M			H			VH		
			T	I	F	T	I	F	T	I	F	T	I	F	T	I	F	T	I	F	T	I	F	T	I	F	T	I	F	T	I	F	T	I	F	T	I	F	T	I	F	T	I	F	T	I	F	T	I	F	T	I	F	T	I	F	T	I	F	T	I	F
Circular Saw Machine	R1	CC1	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5	0	0	0.5	0	0.5	1	0.5	1	0.5	1	0.5	0	0.5	0	0	0	0.5	0	0	1	0.5	0.5	0.5	1	1	0	0.5	0.5	0	0	0	1	0	0	0.5	0	0	0	0	0.5	0	0.5	1	0	1
		CC2	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5	0	0	0.38	0	0.21	0.77	0.5	0.69	0.79	1	0.81	0.3	0.5	0.32	0	0	0	0.5	0	0.5	1	0.5	1	0.5	1	0.5	0	0.5	0	0	0	1	0	0	0.5	0	0	0	0	0.5	0	0.5	1	0	1
		CC3	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5	0	0	0.44	0	0.36	0.88	0.5	0.85	0.63	1	0.64	0.14	0.5	0.15	0	0	1	0	0	0.5	0	0	0	0	0.5	0	0.5	1	0	1	0	1	0	0	0.5	0	0	0	0	0.5	0	0.5	1	0	1
		CC4	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5	0	1	1	0	0.64	0.61	0.19	0.28	0.22	0.69	0	0	0.73	0	0	0	0	1	0	0	0.5	0.5	0.5	0	1	1	0	0.5	0.5	0	0	1	0	0	0.5	0	0	0	0	0.5	0	0.5	1	0	1
		CC5	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5	0	0	0	0	0	0.5	0.5	0.5	1	1	1	0.5	0.5	0.5	0	0	0.5	0	0	1	0.5	0.5	0.5	1	1	0	0.5	0.5	0	0	0	1	0	0	0.5	0	0	0	0	0.5	0	0.5	1	0	1
		CC6	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5	0	0	0.38	0	0.21	0.77	0.5	0.69	0.79	1	0.81	0.3	0.5	0.32	0	0	0.5	0	0	1	0	0	0.5	0.5	0.5	0	1	1	0	0.5	0	1	0	0	0.5	0	0	0	0	0.5	0	0.5	1	0	1
		CC7	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5	0	1	1	0	0.5	0.5	0.19	0	0	0.69	0	0	0.73	0	0	0	0	0.5	0	0	1	0	0.5	0.5	0.5	1	0	1	0.5	0	0	1	0	0	0.5	0	0	0	0	0.5	0	0.5	1	0	1
	R2	CC8	0.1	0.38	0	0.83	0.77	0	0.62	0.79	0.5	0.13	0.3	1	0	0	0.5	0	0	0	0	0	0.5	0.5	0.5	1	1	1	0.5	0.5	0.5	0	0	0.5	0	0	1	0.5	0.5	0.5	1	1	0	0.5	0.5	0	0	0	1	0	0	0.5	0	0	0	0	0.5	0	0.5	1	0	1
		CC9	0.1	0.38	0	0.83	0.77	0	0.62	0.79	0.5	0.13	0.3	1	0	0	0.5	0	0	0.44	0	0.36	0.88	0.5	0.85	0.63	1	0.64	0.14	0.5	0.15	0	0	0	1	0.5	0.5	0.5	1	1	0	0.5	0.5	0	0	0	0	0	1	0	0	0.5	0	0	0	0	0.5	0	0.5	1	0	1
		CC10	0.1	0.38	0	0.83	0.77	0	0.62	0.79	0.5	0.13	0.3	1	0	0	0.5	0	0	0.5	0	0.5	1	0.5	1	0.5	1	0.5	0	0.5	0	0	0	0	1	0.5	0.5	0.5	1	1	0	0.5	0.5	0	0	0	0	0	1	0	0	0.5	0	0	0	0	0.5	0	0.5	1	0	1
		CC11	0.1	0.38	0	0.83	0.77	0	0.62	0.79	0.5	0.13	0.3	1	0	0	0.5	0	0	0	0	0	0.5	0.5	0.5	1	1	1	0.5	0.5	0.5	0	0	0.5	0	0	1	0.5	0.5	0.5	1	1	0	0.5	0.5	0	0	0	1	0	0	0.5	0	0	0	0	0.5	0	0.5	1	0	1
		CC12	0.1	0.38	0	0.83	0.77	0	0.62	0.79	0.5	0.13	0.3	1	0	0	0.5	0	0	0.5	0	0.5	1	0.5	1	0.5	1	0.5	0	0.5	0	0	0	0.5	0	0	1	0.5	0.5	0.5	1	1	0	0.5	0.5	0	0	0	1	0	0	0.5	0	0	0	0	0.5	0	0.5	1	0	1
		CC13	0.1	0.38	0	0.83	0.77	0	0.62	0.79	0.5	0.13	0.3	1	0	0	0.5	0	1	1	0	0.64	0.61	0.19	0.28	0.22	0.69	0	0	0.73	0	0	0	1	0	0	0.5	0	0	0	0	0.5	0	0.5	1	0	1	0	1	0	0	0.5	0	0	0	0	0.5	0	0.5	1	0	1
	R3	CC14	0.1	0.38	0	0.83	0.77	0	0.62	0.79	0.5	0.13	0.3	1	0	0	0.5	0	0	0.5	0	0.5	1	0.5	1	0.5	1	0.5	0	0.5	0	0	0	0	0	0	0.5	0.5	0	1	1	0.5	0.5	0.5	1	0	0	0	1	0	0	0.5	0	0	0	0	0.5	0	0.5	1	0	1
		CC15	0.1	0.38	0	0.83	0.77	0	0.62	0.79	0.5	0.13	0.3	1	0	0	0.5	0	0	0.5	0	0.5	1	0.5	1	0.5	1	0.5	0	0.5	0	0	0	0	1	0	0	0.5	0.5	0.5	0	1	1	0	0.5	0.5	0	0	1	0	0	0.5	0	0	0	0	0.5	0	0.5	1	0	1
		CC16	0.1	0.38	0	0.83	0.77	0	0.62	0.79	0.5	0.13	0.3	1	0	0	0.5	0	1	1	0	0.5	0.5	0.19	0	0	0.69	0	0	0.73	0	0	0	0	1	0.5	0.5	0.5	1	1	0	0.5	0.5	0	0	0	0	0	1	0	0	0.5	0	0	0	0	0.5	0	0.5	1	0	1
		CC17	0.1	0.38	0	0.83	0.77	0	0.62	0.79	0.5	0.13	0.3	1	0	0	0.5	0	0	0.38	0	0.21	0.77	0.5	0.69	0.79	1	0.81	0.3	0.5	0.32	0	0	0	0	0	0.5	0.5	0	1	1	0.5	0.5	0.5	1	0	0	0	1	0	0	0.5	0	0	0	0	0.5	0	0.5	1	0	1
		CC18	0.1	0.38	0	0.83	0.77	0	0.62	0.79	0.5	0.13	0.3	1	0	0	0.5	0	1	1	0	0.67	0.61	0.5	0.35	0.22	1	0.03	0	0.5	0	0	0	0	1	0	0	0.5	0.5	0.5	0	1	1	0	0.5	0.5	0	0	1	0	0	0.5	0	0	0	0	0.5	0	0.5	1	0	1
	R6	CC19	0.5	0	0	1	0.5	0	0.5	1	0.5	0	0.5	1	0	0	0.5	0	0.38	0.5	0	0.77	1	0.35	0.79	0.5	0.85	0.3	0	0.59	0	0	0	0.5	0	0	1	0	0	0.5	0.5	0.5	0	1	1	0	0.5	0	1	0	0	0.5	0	0	0	0	0.5	0	0.5	1	0	1
		CC20	0.5	0	0	1	0.5	0	0.5	1	0.5	0	0.5	1	0	0	0.5	0	0	0.38	0	0.5	0.77	0.19	1	0.79	0.69	0.5	0.3	0.73	0	0	0	1	0	0	0.5	0	0	0	0	0.5	0	0.5	1	0	1	0	1	0	0	0.5	0	0	0	0	0.5	0	0.5	1	0	1
Mitre Saw Machine	R1	MC1	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5	0	1	1	0	0.67	0.61	0.35	0.35	0.22	0.85	0.03	0	0.59	0	0	0	0.5	0	0	1	0	0	0.5	0.5	0.5	0	1	1	0	0.5	1	0	0	0.5	0.5	0.5	0	1	1	0	0.5	0.5	0	0	0
		MC2	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5	0	0	0.44	0	0.36	0.88	0.5	0.85	0.63	1	0.64	0.14	0.5	0.15	0	0	0	0	0	0.5	0.5	0	1	1	0.5	0.5	0.5	1	0	0	1	0	0	0.5	0.5	0.5	0	1	1	0	0.5	0.5	0	0	0
		MC3	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5	0	0.35	0.44	0	0.71	0.88	0.35	0.92	0.63	0.85	0.42	0.14	0.59	0	0	0	1	0	0	0.5	0	0	0	0	0.5	0	0.5	1	0	1	1	0	0	0.5	0.5	0.5	0	1	1	0	0.5	0.5	0	0	0
		MC4	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5	0	0	0.38	0.11	0.21	0.77	0.59	0.69	0.79	0.92	0.81	0.3	0.35	0.32	0	0	1	0	0	0.5	0	0	0	0	0.5	0	0.5	1	0	1	1	0	0	0.5	0.5	0.5	0	1	1	0	0.5	0.5	0	0	0
		MC5	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5	0	1	1	0	0.59	0.55	0.35	0.18	0.11	0.85	0	0	0.59	0	0	0	0	0.5	0	0	1	0	0.5	0.5	0.5	1	0	1	0.5	0	1	0	0	0.5	0.5	0.5	0	1	1	0	0.5	0.5	0	0	0

		MC 6	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5	0	1	1	0	0.59	0.55	0.35	0.18	0.11	0.85	0	0	0.59	0	0	0	0.5	0	0	1	0	0	0.5	0.5	0.5	0	1	1	0	0.5	1	0	0	0.5	0.5	0.5	0	1	1	0	0.5	0.5	0	0	0
	R 2	MC 7	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5	0	0	0.5	0.22	0.36	1	0.7	0.85	0.5	0.81	0.64	0	0.31	0.15	0	0	0	1	0	0	0.5	0.5	0.5	0	1	1	0	0.5	0.5	0	1	0	0	0.5	0.5	0.5	0	1	1	0	0.5	0.5	0	0	0
		MC 8	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5	0	1	1	0	0.59	0.55	0.35	0.18	0.11	0.85	0	0	0.59	0	0	0	0.5	0	0	1	0	0	0.5	0.5	0.5	0	1	1	0	0.5	1	0	0	0.5	0.5	0.5	0	1	1	0	0.5	0.5	0	0	0
		MC 9	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5	0	0	0.44	0.22	0.21	0.88	0.7	0.69	0.63	0.81	0.81	0.14	0.31	0.32	0	0	0	0.5	0	0.5	1	0.5	1	0.5	1	0.5	0	0.5	0	0	1	0	0	0.5	0.5	0.5	0	1	1	0	0.5	0.5	0	0	0
	R 3	MC 10	0.1	0.38	0	0.83	0.77	0	0.62	0.79	0.5	0.13	0.3	1	0	0	0.5	0	0.38	0.5	0	0.77	1	0.35	0.79	0.5	0.85	0.3	0	0.59	0	0	0	0	0	0	0.5	0.5	0	1	1	0.5	0.5	0.5	1	0	0	1	0	0	0.5	0.5	0.5	0	1	1	0	0.5	0.5	0	0	0
		MC 11	0.1	0.38	0	0.83	0.77	0	0.62	0.79	0.5	0.13	0.3	1	0	0	0.5	0	1	1	0	0.67	0.61	0.35	0.35	0.22	0.85	0.03	0	0.59	0	0	0	0	1	0	0	0.5	0.5	0.5	0	1	1	0	0.5	0.5	0	1	0	0	0.5	0.5	0.5	0	1	1	0	0.5	0.5	0	0	0
		MC 12	0.1	0.38	0	0.83	0.77	0	0.62	0.79	0.5	0.13	0.3	1	0	0	0.5	0	1	1	0	0.5	0.5	0.19	0	0	0.69	0	0	0.73	0	0	0	0	1	0.5	0.5	0.5	1	1	0	0.5	0.5	0	0	0	0	1	0	0	0.5	0.5	0.5	0	1	1	0	0.5	0.5	0	0	0
		MC 13	0.1	0.38	0	0.83	0.77	0	0.62	0.79	0.5	0.13	0.3	1	0	0	0.5	0	0	0.5	0	0.5	1	0.5	1	0.5	1	0.5	0	0.5	0	0	0	0	0	0	0.5	0.5	0	1	1	0.5	0.5	0.5	1	0	0	1	0	0	0.5	0.5	0.5	0	1	1	0	0.5	0.5	0	0	0
		MC 14	0.1	0.38	0	0.83	0.77	0	0.62	0.79	0.5	0.13	0.3	1	0	0	0.5	0	1	1	0	0.67	0.61	0.5	0.35	0.22	1	0.03	0	0.5	0	0	0	0	1	0	0	0.5	0.5	0.5	0	1	1	0	0.5	0.5	0	1	0	0	0.5	0.5	0.5	0	1	1	0	0.5	0.5	0	0	0
Upright Drilling Machine	R 1	DC 1	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5	0	1	1	0	0.5	0.5	0.19	0	0	0.69	0	0	0.73	0	0	0	0	0.5	0	0.5	1	0.5	1	0.5	1	0.5	0	0.5	0	0	0	1	0	0	0.5	0	0	0	0	0.5	0	0.5	1	0	1
		DC 2	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5	0	0	0	0	0	0.5	0.5	0.5	1	1	1	0.5	0.5	0.5	0	0	0	0.5	0	0.5	1	0.5	1	0.5	1	0.5	0	0.5	0	0	0	1	0	0	0.5	0	0	0	0	0.5	0	0.5	1	0	1
		DC 3	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5	0	0	0.5	0	0.5	1	0.5	1	0.5	1	0.5	0	0.5	0	0	0	1	0	0	0.5	0	0	0	0	0.5	0	0.5	1	0	1	0	1	0	0	0.5	0	0	0	0	0.5	0	0.5	1	0	1
		DC 4	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5	0	1	1	0	0.5	0.5	0	0	0	0.5	0	0	1	0	0	0	0	0.5	0	0.5	0	0	1	0.5	0.5	0.5	1	1	0	0.5	0	1	0	0	0.5	0	0	0	0	0.5	0	0.5	1	0	1
		DC 5	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5	0	0	0	0	0	0.5	0.5	0.5	1	1	1	0.5	0.5	0.5	0	0	1	0	0	0.5	0	0	0	0	0.5	0	0.5	1	0	1	0	1	0	0	0.5	0	0	0	0	0.5	0	0.5	1	0	1
	R 2	DC 6	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5	0	0	0.5	0	0.5	1	0.5	1	0.5	1	0.5	0	0.5	0	0	0	0	0.5	0	0.5	1	0.5	1	0.5	1	0.5	0	0.5	0	0	0	1	0	0	0.5	0	0	0	0	0.5	0	0.5	1	0	1
		DC 7	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5	0	0	0.5	0	0.5	1	0.5	1	0.5	1	0.5	0	0.5	0	0	0	0	0.5	0	0	1	0	0.5	0.5	0.5	1	0	1	0.5	0	0	1	0	0	0.5	0	0	0	0	0.5	0	0.5	1	0	1
		DC 8	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5	0	0	0.5	0	0.5	1	0.5	1	0.5	1	0.5	0	0.5	0	0	0	0	1	0	0	0.5	0.5	0.5	0	1	1	0	0.5	0.5	0	0	1	0	0	0.5	0	0	0	0	0.5	0	0.5	1	0	1
		DC 9	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5	0	1	1	0	0.59	0.55	0.19	0.18	0.11	0.69	0	0	0.73	0	0	0	1	0	0	0.5	0	0	0	0	0.5	0	0.5	1	0	1	0	1	0	0	0.5	0	0	0	0	0.5	0	0.5	1	0	1
	R 3	DC 10	0.1	0.38	0	0.83	0.77	0	0.62	0.79	0.5	0.13	0.3	1	0	0	0.5	0	0.41	0.5	0	0.82	1	0.46	0.73	0.5	0.93	0.25	0	0.42	0	0	0	0	0	0	0.5	0.5	0	1	1	0.5	0.5	0.5	1	0	0	0	1	0	0	0.5	0	0	0	0	0.5	0	0.5	1	0	1
		DC 11	0.1	0.38	0	0.83	0.77	0	0.62	0.79	0.5	0.13	0.3	1	0	0	0.5	0	1	1	0	0.59	0.55	0.19	0.18	0.11	0.69	0	0	0.73	0	0	0	0	1	0	0	0.5	0.5	0.5	0	1	1	0	0.5	0.5	0	0	1	0	0	0.5	0	0	0	0	0.5	0	0.5	1	0	1
		DC 12	0.1	0.38	0	0.83	0.77	0	0.62	0.79	0.5	0.13	0.3	1	0	0	0.5	0	1	1	0	0.5	0.5	0	0	0	0.5	0	0	1	0	0	0	0	1	0.5	0.5	0.5	1	1	0	0.5	0.5	0	0	0	0	0	1	0	0	0.5	0	0	0	0	0.5	0	0.5	1	0	1
		DC 13	0.1	0.38	0	0.83	0.77	0	0.62	0.79	0.5	0.13	0.3	1	0	0	0.5	0	0	0.44	0	0.36	0.88	0.5	0.85	0.63	1	0.64	0.14	0.5	0.15	0	0	0	0	0	0.5	0.5	0	1	1	0.5	0.5	0.5	1	0	0	0	1	0	0	0.5	0	0	0	0	0.5	0	0.5	1	0	1
		DC 14	0.1	0.38	0	0.83	0.77	0	0.62	0.79	0.5	0.13	0.3	1	0	0	0.5	0	0	0.5	0	0.5	1	0.5	1	0.5	1	0.5	0	0.5	0	0	0	0	1	0	0	0.5	0.5	0.5	0	1	1	0	0.5	0.5	0	0	1	0	0	0.5	0	0	0	0	0.5	0	0.5	1	0	1
	R 4	DC 15	0.5	0.5	0	1	1	0.5	0.5	0.5	1	0	0	0.5	0	0	0	0	0	0.5	0	0.5	1	0.5	1	0.5	1	0.5	0	0.5	0	0	0	1	0	0	0.5	0	0	0	0	0.5	0	0.5	1	0	1	0	1	0	0	0.5	0	0	0	0	0.5	0	0.5	1	0	1
		DC 16	0.5	0.5	0	1	1	0.5	0.5	0.5	1	0	0	0.5	0	0	0	0	0	0.5	0	0.5	1	0.5	1	0.5	1	0.5	0	0.5	0	0	0	0.5	0	0	1	0	0	0.5	0.5	0.5	0	1	1	0	0.5	0	1	0	0	0.5	0	0	0	0	0.5	0	0.5	1	0	1
Planing Machine	R 1	PC1	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5	0	1	1	0	0.67	0.61	0.5	0.35	0.22	1	0.03	0	0.5	0	0	0	0.5	0	0	1	0	0	0.5	0.5	0.5	0	1	1	0	0.5	1	0	0	0.5	0.5	0.5	0	1	1	0	0.5	0.5	0	0	0
		PC2	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5	0	0	0.44	0.21	0.21	0.88	0.7	0.69	0.63	0.81	0.81	0.14	0.31	0.32	0	0	0	0.5	0	0.5	1	0.5	1	0.5	1	0.5	0	0.5	0	0	1	0	0	0.5	0.5	0.5	0	1	1	0	0.5	0.5	0	0	0
		PC3	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5	0	0	0.38	0.11	0.21	0.77	0.59	0.69	0.79	0.92	0.81	0.3	0.35	0.32	0	0	1	0	0	0.5	0	0	0	0	0.5	0	0.5	1	0	1	1	0	0	0.5	0.5	0.5	0	1	1	0	0.5	0.5	0	0	0
		PC4	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5	0	1	1	0	0.	0.	0.	0.	0.	0.	0	0	0.	0	0	0	0.5	0	0	1	0	0	0.5	0.5	0.5	0	1	1	0	0.5	1	0	0	0.5	0.5	0.5	0	1	1	0	0.5	0.5	0	0	0

																					59	55	35	18	11	85			59																																	
		PC5	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5	0	0.32	0.38	0	0.64	0.77	0.35	0.97	0.79	0.85	0.56	0.3	0.59	0	0	0	0	0.5	0	0.5	1	0.5	1	0.5	1	0.5	0	0.5	0	0	1	0	0	0.5	0.5	0.5	0	1	1	0	0.5	0.5	0	0	0
		PC6	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5	0	0.32	0.38	0	0.64	0.77	0.35	0.97	0.79	0.85	0.56	0.3	0.59	0	0	0	0	0.5	0	0.5	1	0.5	1	0.5	1	0.5	0	0.5	0	0	1	0	0	0.5	0.5	0.5	0	1	1	0	0.5	0.5	0	0	0
	R2	PC7	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5	0	0	0.5	0.37	0.21	1	0.86	0.69	0.5	0.64	0.81	0	0.15	0.32	0	0	0.5	0	0	1	0.5	0.5	0.5	1	1	0	0.5	0.5	0	0	1	0	0	0.5	0.5	0.5	0	1	1	0	0.5	0.5	0	0	0
		PC8	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5	0	0	0.5	0	0.5	1	0.5	1	0.5	1	0.5	0	0.5	0	0	0	0.5	0	0	1	0.5	0.5	0.5	1	1	0	0.5	0.5	0	0	1	0	0	0.5	0.5	0.5	0	1	1	0	0.5	0.5	0	0	0
		PC9	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5	0	1	1	0	0.67	0.61	0.35	0.35	0.22	0.85	0.03	0	0.59	0	0	0	0.5	0	0	1	0	0	0.5	0.5	0.5	0	1	1	0	0.5	1	0	0	0.5	0.5	0.5	0	1	1	0	0.5	0.5	0	0	0
		PC10	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5	0	0.38	0.5	0	0.77	1	0.35	0.79	0.5	0.85	0.3	0	0.59	0	0	0	0	0.5	0	0.5	1	0.5	1	0.5	1	0.5	0	0.5	0	0	1	0	0	0.5	0.5	0.5	0	1	1	0	0.5	0.5	0	0	0
		PC11	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5	0	1	1	0.22	0.67	0.61	0.7	0.35	0.22	0.81	0.03	0	0.31	0	0	0	0	0.5	0	0.5	1	0.5	1	0.5	1	0.5	0	0.5	0	0	1	0	0	0.5	0.5	0.5	0	1	1	0	0.5	0.5	0	0	0
		PC12	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5	0	1	1	0	0.67	0.61	0.5	0.35	0.22	1	0.03	0	0.5	0	0	0	0	0.5	0	0.5	1	0.5	1	0.5	1	0.5	0	0.5	0	0	1	0	0	0.5	0.5	0.5	0	1	1	0	0.5	0.5	0	0	0
		PC13	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5	0	1	1	0	0.67	0.61	0.5	0.35	0.22	1	0.03	0	0.5	0	0	0	0	1	0	0	0.5	0.5	0.5	0	1	1	0	0.5	0.5	0	1	0	0	0.5	0.5	0.5	0	1	1	0	0.5	0.5	0	0	0
		PC14	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5	0	1	1	0	0.67	0.61	0.35	0.35	0.22	0.85	0.03	0	0.59	0	0	0	0	1	0	0	0.5	0.5	0.5	0	1	1	0	0.5	0.5	0	1	0	0	0.5	0.5	0.5	0	1	1	0	0.5	0.5	0	0	0
		PC15	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5	0	1	1	0	0.67	0.61	0.35	0.35	0.22	0.85	0.03	0	0.59	0	0	0	0	1	0.5	0.5	0.5	1	1	0	0.5	0.5	0	0	0	0	1	0	0	0.5	0.5	0.5	0	1	1	0	0.5	0.5	0	0	0
	R3	PC16	0.1	0.38	0	0.83	0.77	0	0.62	0.79	0.5	0.13	0.3	1	0	0	0.5	0	0	0.5	0.37	0.36	1	0.86	0.85	0.5	0.64	0.64	0	0.15	0.15	0	0	0	0	0	0.5	0.5	0	1	1	0.5	0.5	0.5	1	0	0	1	0	0	0.5	0.5	0.5	0	1	1	0	0.5	0.5	0	0	0
		PC17	0.1	0.38	0	0.83	0.77	0	0.62	0.79	0.5	0.13	0.3	1	0	0	0.5	0	1	1	0	0.67	0.61	0.35	0.35	0.22	0.85	0.03	0	0.59	0	0	0	0	1	0	0	0.5	0.5	0.5	0	1	1	0	0.5	0.5	0	1	0	0	0.5	0.5	0.5	0	1	1	0	0.5	0.5	0	0	0
		PC18	0.1	0.38	0	0.83	0.77	0	0.62	0.79	0.5	0.13	0.3	1	0	0	0.5	0	1	1	0	0.5	0.5	0.19	0	0	0.69	0	0	0.73	0	0	0	0	1	0.5	0.5	0.5	1	1	0	0.5	0.5	0	0	0	0	1	0	0	0.5	0.5	0.5	0	1	1	0	0.5	0.5	0	0	0
		PC19	0.1	0.38	0	0.83	0.77	0	0.62	0.79	0.5	0.13	0.3	1	0	0	0.5	0	0	0.38	0	0.21	0.77	0.5	0.69	0.79	1	0.81	0.3	0.5	0.32	0	0	0	0	0	0.5	0.5	0	1	1	0.5	0.5	0.5	1	0	0	1	0	0	0.5	0.5	0.5	0	1	1	0	0.5	0.5	0	0	0
		PC20	0.1	0.38	0	0.83	0.77	0	0.62	0.79	0.5	0.13	0.3	1	0	0	0.5	0	1	1	0	0.67	0.61	0.5	0.35	0.22	1	0.03	0	0.5	0	0	0	0	1	0	0	0.5	0.5	0.5	0	1	1	0	0.5	0.5	0	1	0	0	0.5	0.5	0.5	0	1	1	0	0.5	0.5	0	0	0
Guillotine Machine	R1	GC1	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5	0	1	1	0	0.64	0.61	0.19	0.28	0.22	0.69	0	0	0.73	0	0	0	0.5	0	0	1	0.5	0.5	0.5	1	1	0	0.5	0.5	0	0	0	1	0	0	0.5	0	0	0	0	0.5	0	0.5	1	0	1
		GC2	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5	0	1	1	0	0.64	0.61	0.19	0.28	0.22	0.69	0	0	0.73	0	0	0	0	0.5	0	0.5	1	0.5	1	0.5	1	0.5	0	0.5	0	0	0	1	0	0	0.5	0	0	0	0	0.5	0	0.5	1	0	1
		GC3	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5	0	1	1	0	0.67	0.64	0.19	0.33	0.28	0.69	0	0	0.73	0	0	0	0	0.5	0	0.5	1	0.5	1	0.5	1	0.5	0	0.5	0	0	0	1	0	0	0.5	0	0	0	0	0.5	0	0.5	1	0	1
		GC4	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5	0	1	1	0	0.55	0.55	0.19	0.11	0.11	0.69	0	0	0.73	0	0	0	0	1	0	0	0.5	0	0	0	0.5	0.5	0	1	1	0	0	1	0	0	0.5	0	0	0	0	0.5	0	0.5	1	0	1
		GC5	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5	0	0	0.5	0	0.5	1	0.5	1	0.5	1	0.5	0	0.5	0	0	0	0.5	0	0	1	0	0	0.5	0.5	0.5	0	1	1	0	0.5	0	1	0	0	0.5	0	0	0	0	0.5	0	0.5	1	0	1
		GC6	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5	0	0	0.5	0	0.5	1	0.5	1	0.5	1	0.5	0	0.5	0	0	0	1	0	0	0.5	0	0	0	0	0.5	0	0.5	1	0	1	0	1	0	0	0.5	0	0	0	0	0.5	0	0.5	1	0	1
		GC7	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5	0	1	1	0	0.64	0.61	0.19	0.28	0.22	0.69	0	0	0.73	0	0	0	0	0	0	0.5	0.5	0	1	1	0.5	0.5	0.5	1	0	0	0	1	0	0	0.5	0	0	0	0	0.5	0	0.5	1	0	1
		GC8	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5	0	1	1	0	0.5	0.5	0.19	0	0	0.69	0	0	0.73	0	0	0	0	0.5	0	0	1	0	0.5	0.5	0.5	1	0	1	0.5	0	0	1	0	0	0.5	0	0	0	0	0.5	0	0.5	1	0	1
	R2	GC9	0.42	0.44	0	0.79	0.88	0	0.78	0.63	0.5	0.3	0.14	1	0	0	0.5	0	0	0.44	0.37	0	0.88	0.86	0.5	0.63	0.64	1	0.14	0.15	0.5	0	0	0.5	0	0	1	0.5	0.5	0.5	1	1	0	0.5	0.5	0	0	0	1	0	0	0.5	0	0	0	0	0.5	0	0.5	1	0	1
		GC10	0.42	0.44	0	0.79	0.88	0	0.78	0.63	0.5	0.3	0.14	1	0	0	0.5	0	1	1	0	0.59	0.55	0.19	0.18	0.11	0.69	0	0	0.73	0	0	0	1	0	0	0.5	0	0	0	0	0.5	0	0.5	1	0	1	0	1	0	0	0.5	0	0	0	0	0.5	0	0.5	1	0	1
		GC11	0.	0.	0	0.	0.	0	0.	0.	0.5	0.3	0.	1	0	0	0.5	0	0	0.5	0	0.5	1	0.5	1	0.5	1	0.5	0	0.5	0	0	0	0.5	0	0	1	0.5	0.5	0.5	1	1	0	0.5	0.5	0	0	0	1	0	0	0.5	0	0	0	0	0.5	0	0.5	1	0	1

			42	44		79	88		78	63			14																																																
		GC 12	0.42	0.44	0	0.79	0.88	0	0.78	0.63	0.5	0.3	0.14	1	0	0	0.5	0	0	0.44	0	0.36	0.88	0.5	0.85	0.63	1	0.64	0.14	0.5	0.15	0	0	0	0.5	0	0	1	0	0.5	0.5	0.5	1	0	1	0.5	0	0	1	0	0	0.5	0	0	0	0	0.5	0	0.5	1	0	1
	R 3	GC 13	0.42	0.44	0	0.79	0.88	0	0.78	0.63	0.5	0.3	0.14	1	0	0	0.5	0	0	0.5	0	0.5	1	0.5	1	0.5	1	0.5	0	0.5	0	0	0	0	0	0	0.5	0.5	0	1	1	0.5	0.5	0.5	1	0	0	0	1	0	0	0.5	0	0	0	0	0.5	0	0.5	1	0	1
		GC 14	0.42	0.44	0	0.79	0.88	0	0.78	0.63	0.5	0.3	0.14	1	0	0	0.5	0	0	0.44	0	0.36	0.88	0.5	0.85	0.63	1	0.64	0.14	0.5	0.15	0	0	0	1	0	0	0.5	0.5	0.5	0	1	1	0	0.5	0.5	0	0	1	0	0	0.5	0	0	0	0	0.5	0	0.5	1	0	1
		GC 15	0.42	0.44	0	0.79	0.88	0	0.78	0.63	0.5	0.3	0.14	1	0	0	0.5	0	1	1	0	0.5	0.5	0.19	0	0	0.69	0	0	0.73	0	0	0	0	1	0.5	0.5	0.5	1	1	0	0.5	0.5	0	0	0	0	0	1	0	0	0.5	0	0	0	0	0.5	0	0.5	1	0	1
		GC 16	0.42	0.44	0	0.79	0.88	0	0.78	0.63	0.5	0.3	0.14	1	0	0	0.5	0	0	0.38	0	0.21	0.77	0.5	0.69	0.79	1	0.81	0.3	0.5	0.32	0	0	0	0	0	0.5	0.5	0	1	1	0.5	0.5	0.5	1	0	0	0	1	0	0	0.5	0	0	0	0	0.5	0	0.5	1	0	1
		GC 17	0.42	0.44	0	0.79	0.88	0	0.78	0.63	0.5	0.3	0.14	1	0	0	0.5	0	0.44	1	0	0.88	0.61	0.35	0.63	0.22	0.85	0.14	0	0.59	0	0	0	0	1	0	0	0.5	0.5	0.5	0	1	1	0	0.5	0.5	0	0	1	0	0	0.5	0	0	0	0	0.5	0	0.5	1	0	1
	R 4	GC 18	0.5	0.5	0	1	1	0.5	0.5	0.5	1	0	0	0.5	0	0	0	0	0	0.5	0	0.5	1	0.5	1	0.5	1	0.5	0	0.5	0	0	0	1	0	0	0.5	0	0	0	0.5	0.5	0	1	1	0	0	0	1	0	0	0.5	0	0	0	0	0.5	0	0.5	1	0	1
		GC 19	0.5	0.5	0	1	1	0.5	0.5	0.5	1	0	0	0.5	0	0	0	0	0	0.5	0	0.5	1	0.5	1	0.5	1	0.5	0	0.5	0	0	0	0.5	0	0	1	0	0	0.5	0.5	0.5	0	1	1	0	0.5	0	1	0	0	0.5	0	0	0	0	0.5	0	0.5	1	0	1
Grinding Machine	R 1	HC 12	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5	0	0	0.5	0	0.5	1	0.5	1	0.5	1	0.5	0	0.5	0	0	0	0	0.5	0	0.5	1	0.5	1	0.5	1	0.5	0	0.5	0	0	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5
		HC 13	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5	0	0	0.38	0	0.21	0.77	0.5	0.69	0.79	1	0.81	0.3	0.5	0.32	0	0	0	0.5	0	0.5	1	0.5	1	0.5	1	0.5	0	0.5	0	0	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5
		HC 14	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5	0	0	0.5	0	0.5	1	0.5	1	0.5	1	0.5	0	0.5	0	0	0	1	0	0	0.5	0	0	0	0	0.5	0	0.5	1	0	1	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5
		HC 15	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5	0	1	1	0	0.55	0.55	0	0.11	0.11	0.5	0	0	1	0	0	0	0	0.5	0	0	1	0	0.5	0.5	0.5	1	0	1	0.5	0	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5
		HC 16	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5	0	0	0	0	0.21	0.5	0.35	0.69	1	0.85	0.81	0.5	0.59	0.32	0	0	1	0	0	0.5	0	0	0	0	0.5	0	0.5	1	0	1	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5
	R 2	HC 1	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5	0	0	0.44	0	0.36	0.88	0.5	0.85	0.63	1	0.64	0.14	0.5	0.15	0	0	0	0	0	0.5	0.5	0	1	1	0.5	0.5	0.5	1	0	0	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5
		HC 2	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5	0	0	0.38	0	0.21	0.77	0.5	0.69	0.79	1	0.81	0.3	0.5	0.32	0	0.5	0	0.5	1	0.5	1	0.5	1	0.5	0	0.5	0	0	0	0	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5
		HC 3	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5	0	0	0.35	0	0.09	0.71	0.5	0.56	0.91	1	0.94	0.42	0.5	0.36	0	0.5	0	1	1	0	0.5	0.5	0.5	0	0	1	0	0	0.5	0	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5
		HC 4	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5	0	1	1	0	0.55	0.55	0.19	0.11	0.11	0.69	0	0	0.73	0	0	0	1	0	0	0.5	0	0	0	0	0.5	0	0.5	1	0	1	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5
		HC 5	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5	0	0	0.5	0	0.5	1	0.5	1	0.5	1	0.5	0	0.5	0	0	0	1	0	0	0.5	0	0	0	0	0.5	0	0.5	1	0	1	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5
		HC 6	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5	0	0	0.44	0.37	0.21	0.88	0.86	0.69	0.63	0.64	0.81	0.14	0.15	0.32	0	0	0	0	0	0.5	0.5	0	1	1	0.5	0.5	0.5	1	0	0	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5
	R 3	HC 7	0.1	0.38	0	0.83	0.77	0	0.62	0.79	0.5	0.13	0.3	1	0	0	0.5	0	0	0.5	0	0.5	1	0.5	1	0.5	1	0.5	0	0.5	0	0	0	0	0	0	0.5	0.5	0	1	1	0.5	0.5	0.5	1	0	0	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5
		HC 8	0.1	0.38	0	0.83	0.77	0	0.62	0.79	0.5	0.13	0.3	1	0	0	0.5	0	0	0.44	0	0.36	0.88	0.5	0.85	0.63	1	0.64	0.14	0.5	0.15	0	0	0	1	0	0	0.5	0.5	0.5	0	1	1	0	0.5	0.5	0	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5
		HC 9	0.1	0.38	0	0.83	0.77	0	0.62	0.79	0.5	0.13	0.3	1	0	0	0.5	0	1	1	0	0.5	0.5	0	0	0	0.5	0	0	1	0	0	0	0	1	0.5	0.5	0.5	1	1	0	0.5	0.5	0	0	0	0	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5
		HC 10	0.1	0.38	0	0.83	0.77	0	0.62	0.79	0.5	0.13	0.3	1	0	0	0.5	0	0	0	0	0	0.5	0.5	0.5	1	1	1	0.5	0.5	0.5	0	0	0	0	0	0.5	0.5	0	1	1	0.5	0.5	0.5	1	0	0	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5
		HC 11	0.1	0.38	0	0.83	0.77	0	0.62	0.79	0.5	0.13	0.3	1	0	0	0.5	0	0	0.5	0	0.5	1	0.5	1	0.5	1	0.5	0	0.5	0	0	0	0	1	0	0	0.5	0.5	0.5	0	1	1	0	0.5	0.5	0	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5
	R 4	HC 19	0.5	0.5	0	1	1	0.5	0.5	0.5	1	0	0	0.5	0	0	0	0	0	0.5	0	0.5	1	0.5	1	0.5	1	0.5	0	0.5	0	0	0	1	0	0	0.5	0	0	0	0	0.5	0	0.5	1	0	1	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5
		HC 20	0.5	0.5	0	1	1	0.5	0.5	0.5	1	0	0	0.5	0	0	0	0	0	0.5	0	0.5	1	0.5	1	0.5	1	0.5	0	0.5	0	0	0	0.5	0	0	1	0	0	0.5	0.5	0.5	0	1	1	0	0.5	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5
	R 5	HC 17	0.1	1	0	0.83	0.64	0.36	0.62	0.28	0.85	0.13	0	0.64	0	0	0.15	0	1	1	0	0.67	0.64	0.19	0.33	0.28	0.69	0	0	0.73	0	0	0	0	0.5	0	0.5	1	0.5	1	0.5	1	0.5	0	0.5	0	0	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5

		HC 18	0.1	1	0	0.83	0.64	0.36	0.62	0.28	0.85	0.13	0	0.64	0	0	0.15	0	0.38	0.5	0	0.77	1	0.35	0.79	0.5	0.85	0.3	0	0.59	0	0	0	0	0	0	0.5	0.5	0	1	1	0.5	0.5	0.5	1	0	0	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5
	R6	HC 21	0.5	0	0	1	0.5	0	0.5	1	0.5	0	0.5	1	0	0	0.5	0	1	1	0	0.55	0.55	0	0.11	0.11	0.5	0	0	1	0	0	0	0.5	0	0	1	0.5	0.5	0.5	1	1	0	0.5	0.5	0	0	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	0.5
		HC 22	0.5	0	0	1	0.5	0	0.5	1	0.5	0	0.5	1	0	0	0.5	0	1	1	0	0.67	0.64	0.35	0.35	0.28	0.85	0.03	0	0.59	0	0	0	0.5	0	0	1	0	0	0.5	0.5	0.5	0	1	1	0	0.5	0	0.5	0	0.5	1	0	1	0.5	0.5	0.5	0	1	0	0	F

Hazard Source	Risk	Checkpoint	N			Mi			Ma			C			Score Function				Risk Magnitude for N-SCEA	Ranking N-SCEA	Risk Magnitude For SCEA	Ranking SCEA
			T	I	F	T	I	F	T	I	F	T	I	F	c	Mi	Ma	C				
D	R1	DC4	0	1	0.5	0.5	0.5	0.5	1	0	0.5	0.5	0	0	0.125	0.5	0.875	0.875	7.158	1	7.000	1
C	R1	CC7	0.19	1	0.5	0.69	0.5	0.5	0.73	0.11	0.5	0.5	0	0	0.1725	0.5475	0.7525	0.875	6.978	2	6.190	13
G	R1	GC5	0.5	1	0.5	1	0.5	0.5	0.5	0.5	0.5	0.5	0	0	0.25	0.625	0.5	0.875	6.667	3	5.200	33
H	R2	HC3	0	0.94	0	0.5	0.5	0.5	1	0.5	0.5	0.5	0	0.5	0.28	0.5	0.625	0.75	6.568	4	7.000	2
D	R2	DC9	0.19	1	0	0.69	0.5	0	0.73	0.18	0.5	0.5	0	0	0.2975	0.6725	0.7175	0.875	6.540	5	6.190	14
D	R4	DC15	0.5	1	0.5	1	0.5	0.5	0.5	0.5	0.5	0	0	0	0.25	0.625	0.5	0.75	6.471	6	4.000	53
G	R4	GC19	0.5	1	0.5	1	0.5	0.5	0.5	0.5	0.5	0	0	0	0.25	0.625	0.5	0.75	6.471	7	4.000	54
C	R1	CC4	0.19	1	0	0.5	0.5	0	0.73	0	0.5	0.5	0	0.5	0.2975	0.625	0.8075	0.75	6.431	8	6.406	8
D	R1	DC1	0.19	1	0	0.5	0.5	0	0.73	0	0.5	0.5	0	0.5	0.2975	0.625	0.8075	0.75	6.432	9	6.406	9
G	R1	GC2	0.19	1	0	0.5	0.5	0	0.73	0	0.5	0.5	0	0.5	0.2975	0.625	0.8075	0.75	6.433	10	6.406	10
G	R1	GC3	0.19	1	0	0.5	0.5	0	0.73	0	0.5	0.5	0	0.5	0.2975	0.625	0.8075	0.75	6.434	11	6.406	11
D	R3	DC12	0.1	0.79	0	0.5	0.5	0	0.83	0.3	0.5	0.5	0	0	0.38	0.625	0.6825	0.875	6.403	12	6.689	4
D	R2	DC6	0.5	1	0	0.5	0.5	0.5	1	0	0.5	0.5	0	0.5	0.375	0.5	0.875	0.75	6.400	13	5.800	19
G	R1	GC1	0.19	1	0	0.5	0.5	0	0.73	0.28	0.5	0.5	0	0.5	0.2975	0.625	0.6675	0.75	6.397	14	6.406	12
C	R3	CC16	0.1	0.79	0	0.5	0.5	0	0.73	0.3	0.5	0.5	0	0	0.38	0.625	0.6575	0.875	6.398	15	6.672	7
G	R1	GC7	0.19	1	0	0.69	0.5	0	0.73	0	0.5	0.5	0	0.5	0.2975	0.6725	0.8075	0.75	6.386	16	6.190	15
G	R1	GC8	0.19	1	0	0.69	0.5	0	0.73	0	0.5	0.5	0	0.5	0.2975	0.6725	0.8075	0.75	6.386	17	6.190	16
D	R2	DC8	0.5	1	0	0.5	0.5	0.5	1	0.18	0.5	0.5	0	0.5	0.375	0.5	0.785	0.75	6.378	18	5.800	20
G	R3	GC15	0.42	0.88	0	0.5	0.5	0	0.73	0.14	0.5	0.5	0	0	0.415	0.625	0.7375	0.875	6.344	19	5.828	18
C	R2	CC10	0.1	0.79	0	0.5	0.5	0.5	0.83	0.3	0.5	0.5	0	0.5	0.38	0.5	0.6825	0.75	6.338	20	6.689	5
C	R2	CC9	0.1	0.79	0	0.5	0.5	0.5	0.83	0.3	0.5	0.5	0	0.5	0.38	0.5	0.6825	0.75	6.338	21	6.689	6
C	R1	CC1	0.5	1	0	0.5	0.5	0.5	1	0.5	0.5	0.5	0	0.5	0.375	0.5	0.625	0.75	6.333	22	5.800	21
G	R2	GC10	0.42	0.88	0	0.73	0.63	0	0.73	0.18	0.5	0.3	0	0	0.415	0.6175	0.7175	0.825	6.275	23	5.252	31
H	R5	HC17	0.5	1	0.36	0.73	0.5	0.5	0.5	0.28	0.5	0	0	0.5	0.285	0.5575	0.61	0.625	6.274	24	4.000	55
C	R2	CC13	0.19	0.77	0	0.73	0.79	0	0.62	0.3	0.5	0.13	0	0	0.4125	0.5375	0.63	0.7825	6.263	25	5.240	32
D	R2	DC7	0.5	1	0	1	0.5	0.5	0.5	0	0.5	0.5	0	0.5	0.375	0.625	0.75	0.75	6.250	26	5.200	35
C	R1	CC6	0.5	0.81	0.5	1	0.5	0.5	0.5	0.5	0.5	0.5	0	0.5	0.345	0.625	0.5	0.75	6.236	27	5.200	34
C	R1	CC5	0.5	1	0	0.5	0.5	0	1	0.5	0.5	0.5	0	0.5	0.375	0.625	0.625	0.75	6.211	28	5.800	22
D	R1	DC2	0.5	1	0	0.5	0.5	0	1	0.5	0.5	0.5	0	0.5	0.375	0.625	0.625	0.75	6.212	29	5.800	23
H	R2	HC2	0	0.5	0	0.5	0.81	0.5	1	0.5	0.5	0.5	0	0.5	0.5	0.345	0.625	0.75	6.196	30	7.000	3
G	R1	GC4	0.19	1	0	0.69	0	0	0.73	0	0.5	0.5	0	0.5	0.2975	0.9225	0.8075	0.75	6.171	31	6.190	17
C	R1	CC2	0.5	0.81	0	0.5	0.5	0.5	1	0.32	0.5	0.5	0	0.5	0.47	0.5	0.715	0.75	6.150	32	5.800	24
G	R3	GC14	0.5	0.85	0	0.5	0.5	0.5	0.79	0.14	0.5	0.3	0	0.5	0.45	0.5	0.7525	0.7	6.126	33	5.278	28
H	R3	HC9	0.5	0.77	0	0.83	0.79	0.5	0.5	0.3	0.5	0.5	0	0.5	0.49	0.4375	0.6	0.75	6.121	34	5.288	27
G	R4	GC18	0.5	0.5	0.5	1	1	0.5	0.5	0.5	0.5	0	0	0	0.5	0.375	0.5	0.75	6.118	35	4.000	56
G	R3	GC17	0.42	0.88	0	0.5	0.5	0	0.79	0	0.5	0.3	0	0.5	0.415	0.625	0.8225	0.7	6.116	36	5.448	26
D	R3	DC11	0.19	0.79	0	0.5	0.5	0	0.73	0	0.5	0.13	0	0.5	0.4025	0.625	0.8075	0.6575	6.070	37	5.548	25
G	R3	GC13	0.5	0.88	0	0.79	0.5	0.5	0.5	0.14	0.5	0.3	0	0.5	0.435	0.5725	0.68	0.7	6.067	38	4.861	46
G	R2	GC12	0.5	0.85	0	0.79	0.5	0.5	0.5	0.14	0.5	0.3	0	0.5	0.45	0.5725	0.68	0.7	6.035	39	4.861	47
C	R3	CC15	0.5	0.79	0	0.5	0.5	0.5	0.83	0	0.5	0.13	0	0.5	0.48	0.5	0.8325	0.6575	6.025	40	4.903	40
D	R3	DC14	0.5	0.79	0	0.5	0.5	0.5	0.83	0	0.5	0.13	0	0.5	0.48	0.5	0.8325	0.6575	6.025	41	4.903	41
P	R3	PC18	0.73	0.77	0	0.5	0.79	0.5	0.5	0.5	0.5	0	0	0	0.5475	0.355	0.5	0.75	6.024	42	3.601	72
M	R3	MC12	0.73	0.77	0	0.5	0.79	0.5	0.5	0.5	0.5	0	0	0	0.5475	0.355	0.5	0.75	6.024	43	3.601	71
H	R1	HC15	0.5	1	0	1	0.5	0.45	0.5	0.11	0.5	0	0	0.5	0.375	0.6375	0.695	0.625	6.019	44	4.000	57
C	R6	CC19	0.5	0.79	0.5	0.73	0.5	0.5	0.5	0.5	0.5	0	0.3	0	0.355	0.5575	0.5	0.6	6.005	45	4.000	58
D	R4	DC16	0.5	0.5	0.5	1	1	0	0.5	0.5	0.5	0	0	0	0.5	0.5	0.5	0.75	6.000	46	4.000	59
H	R5	HC18	0.83	0.79	0.5	0.62	0.64	0.5	0.5	0.3	0.5	0	0	0.5	0.4375	0.46	0.6	0.625	5.996	47	3.492	73
P	R1	PC5	0.85	0.5	0.5	0.5	1	0.5	0	0.5	0.5	0	0	0	0.5875	0.25	0.375	0.75	5.968	48	2.111	98
M	R1	MC6	0.85	0.5	0.5	0.5	1	0.5	0	0.5	0.5	0	0	0	0.5875	0.25	0.375	0.75	5.968	49	2.111	97
M	R2	MC8	0.85	0.5	0.5	0.5	1	0.5	0	0.5	0.5	0	0	0	0.5875	0.25	0.375	0.75	5.968	50	2.111	96
G	R2	GC11	0.5	0.88	0	0.5	0.5	0.5	0.79	0.5	0.5	0.3	0.14	0.5	0.435	0.5	0.5725	0.63	5.961	51	5.278	29
G	R2	GC9	0.5	0.88	0	0.5	0.5	0.5	0.79	0.5	0.5	0.3	0.14	0.5	0.435	0.5	0.5725	0.63	5.961	52	5.278	30
G	R1	GC6	0.5	0.5	0	1	1	0	0.5	0.5	0.5	0.5	0	0	0.625	0.5	0.5	0.875	5.950	53	5.200	36
D	R1	DC3	0.5	0.5	0	1	1	0	0.5	0.5	0.5	0.5	0	0	0.625	0.5	0.5	0.875	5.950	54	5.200	37
D	R1	DC5	0.5	0.5	0	1	1	0	0.5	0.5	0.5	0.5	0	0	0.625	0.5	0.5	0.875	5.950	55	5.200	38
H	R4	HC19	1	0.5	0.5	0.5	1	0.5	0.5	0.5	0.5	0	0	0	0.625	0.25	0.5	0.75	5.941	56	3.250	82
M	R1	MC1	0.85	0.5	0.5	0.5	1	0.5	0	0.5	0.5	0	0.03	0	0.5875	0.25	0.375	0.735	5.937	57	2.111	99
P	R2	PC9	0.85	0.5	0.5	0.5	1	0.5	0	0.5	0.5	0	0.03	0	0.5875	0.25	0.375	0.735	5.937	58	2.111	100
C	R3	CC18	0.5	0.79	0	0.5	0.5	0	0.83	0	0.5	0.13	0	0.5	0.48	0.625	0.8325	0.6575	5.928	59	4.903	42
C	R1	CC3	0.5	0.5	0	1	0.85	0	0.5	0.5	0.5	0.5	0	0	0.625	0.575	0.5	0.875	5.893	60	5.200	39
D	R3	DC10	0.46	0.79	0	0.83	0.5	0.5	0.5	0.3	0.5	0.13	0	0.5	0.47	0.5825	0.6	0.6575	5.877	61	4.469	49
C	R3	CC14	0.5	0.79	0	0.83	0.5	0.5	0.5	0.3	0.5	0.13	0	0.5	0.48	0.5825	0.6	0.6575	5.856	62	4.398	50
D	R3	DC13	0.5	0.79	0	0.83	0.5	0.5	0.5	0.3	0.5	0.13	0	0.5	0.48	0.5825	0.6	0.6575	5.856	63	4.398	51
C	R3	CC17	0.5	0.79	0	0.83	0.5	0.5	0.5	0.32	0.5	0.13	0	0.5	0.48	0.5825	0.59	0.6575	5.851	64	4.398	52
P	R2	PC14	0.85	1	0	0.5	0.5	0.5	0.5	0.5	0.5	0	0	0.5	0.4625	0.5	0.5	0.625	5.850	65	3.432	78
P	R2	PC15	0.85	1	0	0.5	0.5	0.5	0.5	0.5	0.5	0	0	0.5	0.4625	0.5	0.5	0.625	5.850	66	3.432	79
P	R2	PC11	0.81	1	0	0.5	0.5	0.5	0.31	0.5	0.5	0	0	0.5	0.4525	0.5	0.4525	0.625	5.847	67	3.074	87
P	R1	PC1	1	0.5	0.5	0.5	1	0.5	0	0.5	0.5	0	0.03	0	0.625	0.25	0.375	0.735	5.844	68	2.000	105
G	R3	GC16	0.5	0.85	0	0.79	0.5	0.5	0.5	1	0.5	0.3	0	0.5	0.45	0.5725	0.25	0.7	5.825	69	4.861	48
M	R3	MC11	0.85	0.5	0.5	0.5	1	0	0	0.59	0.5	0	0	0	0.5875	0.375	0.33	0.75	5.825	70	2.562	93
M	R3	MC14	0.83	0.79	0	0.5	0.67	0.5	0.13	0.5	0.5	0	0	0.5	0.5625	0.415	0.4075	0.625	5.825	71	2.562	92
P	R1	PC4	0.85	0.5	0.5	0.5	1	0	0	0.59	0.5	0	0	0	0.5875	0.375	0.33	0.75	5.825	72	2.111	101
P	R3	PC20	0.83	1	0	0.5	0.5	0.5	0.13	0.5	0.5	0	0	0.5	0.4575	0.5	0.4075	0.625	5.809	73	2.562	94
H	R2	HC1	0.5	0.5	0.5	1	0.85	0.5	0.5	0.5	0.5	0	0	0.5	0.5	0.45	0.5	0.625	5.807	74	4.000	60
M	R1	MC5	0.85	1	0	0.5	0.5	0.5	0	0.5	0.5	0	0	0.5	0.4625	0.5	0.375	0.625	5.777	75	2.111	102
H	R1	HC14	0.5	0.5	0.5	1	0.5	0.5	0.5	1	0.5	0	0	0	0.5	0.625	0.25	0.75	5.765	76	4.000	61
H	R2	HC5	0.5	0.5	0.5	1	0.5	0.5	0.5	1	0.5	0	0	0	0.5	0.625	0.25	0.75	5.765	77	4.000	62
P	R2	PC12	1	1	0	0.5	0.5	0.5	0.5	0.5	0.5	0	0	0.5	0.5	0.5	0.5	0.625	5.765	78	3.250	83
P	R2	PC13	1	1	0	0.5	0.5	0.5	0.5	0.5	0.5	0	0	0.5	0.5	0.5	0.5	0.625	5.765	79	3.250	84
H	R3	HC11	0.5	0.79	0	0.83	0.5	0.5	0.5	0.5	0.5	0	0	0.5	0.48	0.5825	0.5	0.625	5.742	80	4.000	63
H	R3	HC8	0.5	0.79	0	0.83	0.5	0.5	0.5	0.5	0.5	0	0	0.5	0.48	0.5825	0.5	0.625	5.742	81	4.000	64
M	R2	MC7	0.81	0.85	0	0.5	0.64	0.5	0.31	0.5	0.5	0	0	0.5	0.5275	0.43	0.4525	0.625	5.732	82	3.074	88
H	R2	HC4	0.5	0.5	0	0.73	0.55	0.5	0.5	0.5	0.5	0	0	0	0.625	0.5325	0.5	0.75	5.713	83	4.000	65
P	R2	PC10	0.85	0.77	0	0.5	0.79	0.5	0.5	0.5	0.5	0	0	0.5	0.5775	0.355	0.5	0.625	5.710	84	3.432	80
H	R4	HC20	1	0.5	0.5	0.5	1	0.5	0.5	0.5	0.5	0	0	0.5	0.625	0.25	0.5	0.625	5.688	85	3.250	85
H	R3	HC7	0.83	0.5	0.5	0.62	0.79	0.5	0.5	0.5	0.5	0	0	0.5	0.5825	0.385	0.5	0.625	5.674	86	3.492	74
H	R2	HC6	0.86	0.5	0.5	0.64	0.81	0.5	0.5	0.5	0.5	0	0	0.5	0.59	0.38	0.5	0.625	5.661	87	3.460	76
P	R1	PC6	0.85	0.64	0	0.5	0.97	0.5	0.5	0.5	0.5	0	0	0.5	0.6425	0.265	0.5	0.625	5.635	88	3.432	81
P	R3	PC17	0.83	0.79	0	0.5	0.67	0.5	0.13	0.5	0.5	0	0	0.5	0.5625	0.415	0.4075	0.625	5.634	89	2.562	95
C	R2	CC12	0.5	0.79	0	0.5	0.5	0.5	0.83	0.5	0.5	0.13	0.3	0.5	0.48	0.5	0.5825	0.5075	5.620	90	4.903	43
H	R1	HC12	0.5	0.5	0	1	1	0.5	0.5	0.5	0.5	0	0	0.5	0.625	0.375	0.5	0.625	5.588	91	4.000	66

M	R3	MC10	0.83	0.77	0.5	0.13	0.77	0.5	0	0.79	0.5	0	0.3	0.5	0.4475	0.2725	0.23	0.475	5.542	92	1.406	108
C	R2	CC11	0.5	0.79	0	0.5	0.5	0	0.83	0.5	0.5	0.13	0.3	0.5	0.48	0.625	0.5825	0.5075	5.527	93	4.903	44
C	R2	CC8	0.5	0.79	0	0.5	0.5	0	0.83	0.5	0.5	0.13	0.3	0.5	0.48	0.625	0.5825	0.5075	5.527	94	4.903	45
H	R1	HC13	0.5	0.5	0	1	0.81	0.5	0.5	0.5	0.5	0	0	0.5	0.625	0.47	0.5	0.625	5.520	95	4.000	67
H	R6	HC21	0.5	0.5	0	1	1	0.5	0.5	0.5	0.5	0	0.11	0.5	0.625	0.375	0.5	0.57	5.471	96	4.000	68
H	R3	HC10	0.83	0.5	0	0.62	0.79	0.5	0.5	0.5	0.5	0	0	0.5	0.7075	0.385	0.5	0.625	5.410	97	3.492	75
M	R1	MC2	1	0.5	0.5	0.5	0.85	0.5	0	0.5	0.5	0	0.15	0.5	0.625	0.325	0.375	0.55	5.360	98	2.000	106
H	R6	HC22	0.85	0.5	0.5	0.59	1	0.36	0.5	0.5	0.5	0	0.35	0.5	0.5875	0.3075	0.5	0.45	5.321	99	3.459	77
H	R1	HC16	0.5	0.5	0	0.85	0.5	0.5	0.5	0.81	0.5	0	0.32	0	0.625	0.5875	0.345	0.59	5.257	100	4.000	69
C	R6	CC20	0.69	0.5	0	0.73	1	0	0.5	0.5	0.5	0	0.5	0	0.6725	0.4325	0.5	0.5	5.179	101	3.703	70
P	R3	PC16	0.83	0.5	0.5	0.13	0.77	0.5	0	0.79	0.5	0	0.3	0.5	0.5825	0.2725	0.23	0.475	5.149	102	1.406	109
M	R3	MC13	0.83	0.5	0.5	0.13	0.77	0.5	0	0.79	0.5	0	0.3	0.5	0.5825	0.2725	0.23	0.475	5.149	103	1.406	110
P	R3	PC19	0.83	0.5	0.5	0.13	0.77	0.5	0	0.79	0.5	0	0.32	0.5	0.5825	0.2725	0.23	0.465	5.118	104	1.406	111
M	R1	MC3	0.85	0.5	0.5	0.5	0.5	0.5	0	0.92	0.5	0	0.42	0	0.5875	0.5	0.165	0.54	5.100	105	2.111	103
P	R2	PC8	1	0.5	0.5	0.5	1	0.5	0.5	0.5	0.5	0	0.5	0.5	0.625	0.25	0.5	0.375	5.071	106	3.250	86
M	R2	MC9	0.81	0.5	0	0.5	0.81	0.5	0.31	0.5	0.5	0	0.32	0.5	0.7025	0.345	0.4525	0.465	5.038	107	3.074	90
P	R1	PC2	0.81	0.5	0	0.5	0.81	0.5	0.31	0.5	0.5	0	0.32	0.5	0.7025	0.345	0.4525	0.465	5.038	108	3.074	89
P	R1	PC3	0.92	0.5	0.5	0.35	0.5	0.5	0	0.81	0.5	0	0.5	0	0.605	0.4625	0.22	0.5	5.032	109	2.111	104
M	R1	MC4	0.92	0.5	0.5	0.35	0.5	0.5	0	0.81	0.5	0	0.5	0	0.605	0.4625	0.22	0.5	5.032	110	1.827	107
P	R2	PC7	0.86	0.5	0.5	0.5	0.69	0.5	0.15	0.81	0.5	0	0.5	0.5	0.59	0.405	0.2575	0.375	4.770	111	2.589	91

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Signed by all authors as follows:

Merve Karamustafa

Occupational Health and Safety Coordinatorship, Yildiz Technical University, Besiktas, Istanbul, Turkey
E-mail address: merve.karamustafa@gmail.com

Selcuk Cebi

Department of Industrial Engineering, Yildiz Technical University, Besiktas, Istanbul, Turkey

Corresponding author.
E-mail address: scebi@yildiz.edu.tr

cebiselcuk@gmail.com

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Authors:

Merve Karamustafa,

Occupational Health and Safety Coordinatorship, Yildiz Technical University, Besiktas, Istanbul, Turkey

Selcuk Cebi,

Department of Industrial Engineering, Yildiz Technical University, Besiktas, Istanbul, Turkey