

Identification of Occupational Safety and Health Hazards at Paint and Welding Workshop using the HIRARC Method

Elma Nurul Amalia¹, Berliana Noor Tianisa¹, Luvi Lia Nursucilowati^{1*}, M. Ditra Rizallihadi¹, Ardheta Heru Mahartiko¹, Firda Aliya Sabriyanti², Aulia Febrianti³, Delyanti Pare Sanda³, Muhammad Fakrul Nizam⁴, Evi Widowati¹, Umami Nur Laila Sulistyani⁵

¹Department Public Health Science, Faculty of Medicine, Universitas Negeri Semarang, Indonesia

²Department Public Health Science, Faculty of Public Health, Universitas Sumatera Utara, Indonesia

³Nutrition Department, Faculty of Sport and Health Sciences, Universitas Negeri Makassar, Indonesia

⁴Electrical Engineering, Faculty of Engineering, Universiti Malaya, Malaysia

⁵English Education Study Programme, Languages and Arts Faculty, Universitas Negeri Semarang, Indonesia

*Correspondence to: luvilian@students.unnes.ac.id

Abstract: Occupational Health and Safety (OHS) is important for every company to pay attention to. Preventing work accidents can be done by knowing the existing risks, one of which is through the Hazard Identification, Risk Assessment, and Risk Control (HIRARC) method. Body Repair, Paint, and Welding Workshop "Family 99" is a small to medium-sized entrepreneurship that operates in car repair, paint, and welding services. The research aims to analyze the potential dangers found in the Body Repair, Paint and Welding Workshop "Family 99". Hazard identification was conducted in the workshop work area, with research respondents totaling three active workers. The data collection employed observation and interviews with a descriptive approach. According to the research results obtained from a total of 14 work stages analyzed, two stages had the highest risk value, namely the paint peeling stage with a risk value of 12, and the first, second, and third sanding stages with a risk value of 9. Controls that can be carried out to reduce risks include administrative controls and the use of Personal Protective Equipment (PPE) for workers to work safely and comfortably.

Keywords: hazard; hirarc method; risk; safety; workshop.

INTRODUCTION

Industrial Revolution 4.0 is driving everyone to work to meet their livelihood needs. In carrying out their work, humans, as workers, require occupational safety and health protection. Occupational safety and health (OSH) protection aims not only to safeguard workers but also to protect the work environment. All types of work cannot be separated from the work environment. The work environment includes everything around the worker that can affect the worker's performance (Sofyan, 2013). Therefore, the condition of the work environment will depend significantly on the types of activities carried out. One form of the modern work environment is a workshop.

A workshop is a building that provides space and equipment for construction, manufacturing, and/or repairing objects (Politeknik Kesehatan Denpasar, 2016). A workshop is a place where a mechanic performs their work, providing repair and maintenance services for vehicles (Kulkarni, 2013). Meanwhile, a car paint workshop is a place where cars and other public vehicles can be repainted (Admin, 2023). The services provided by a painting workshop generally involve replacing or repairing damaged vehicle parts. For example, damaged body panels may be caused by an accident. In the process of creating, shaping, transforming, assembling, or repairing, workshop workers are constantly confronted with both hand tools and machine tools, as well as hazardous chemicals that expose workers to threats and potential dangers in the workplace. According to International Labor Organization (ILO) data, more than 250 million workplace accidents occur yearly (Haworth, Nigel & Hughes, 2012). This is proportional to the high number of deaths due to work accidents. ILO data shows that every year, 2.78 million workers die from work-related accidents and diseases (International Labor Organization, 2018). Moreover, the workplace also has potential hazards that can result in losses for employees, companies, and the surrounding community (Laali, 2021).

Work accidents are accidents that occur within the scope of the work environment due to unsafe environmental conditions (unsafe conditions) or due to human error (unsafe action) (Nur & Gusena, 2019). To overcome this problem, every company must implement SMK3 in running its business. This regulation is stated in Government Regulation of the Republic of Indonesia No. 50 of 2012, Article 5. This effort is made because occupational safety and health is an effort to protect workers so that workers can carry out work safely and comfortably and achieve work productivity (Pisceliya, D.M.R., & Mindayani, 2018). This is in accordance with Law Number 1 of 1970, which states that every worker is entitled to safety in carrying out work for welfare and increasing national productivity.

The existence of a high number of occupational accidents in the workplace needs to be suppressed. To reduce and eliminate hazards in the workplace, it is necessary to analyze occupational safety and health. One of the tools used to recognize and identify potential hazards is Hazard Identification, Risk Assessment, and Risk Control (HIRARC). HIRARC is one of the methods for preventing and minimizing work accidents. HIRARC begins with determining the type of work activity and then identifying the source of the hazard so that the risk can be known for further risk assessment and control to reduce exposure to hazards from each job (Ramadhan, 2017). HIRARC is grouped into three stages, namely hazard identification, risk assessment, and risk control (Santoso et al., 2022).

This research was conducted at the Body Repair, Paint, and Welding Workshop "Family 99", a small to medium-sized entrepreneur engaged in car repair, paint, and welding services. "Family 99" Body Repair, Paint, and Welding Workshop is located at Jalan Dewi Sartika No. 100f, Sukorejo, Gunungpati, Semarang City, Central Java. Occupational safety and health in the Body Repair, Paint, and Welding workshop "Family 99" still does not pay attention to K3 aspects which can affect the safety and productivity of workers. Therefore, research was conducted to analyze the potential hazards in the Body Repair, Paint, and Welding Workshop "Family 99."

METHODS

This research employs a descriptive approach with data collection through observation and semi-structured interviews (Notoatmodjo, 2018). The data sources utilized are both primary and secondary data obtained at the research location. The study sample is selected using a saturated sampling method, where the entire population becomes part of the research sample. This method was chosen to achieve precise representation with a very high level of accuracy. The respondents are three workers, each an expert in vehicle repair, painting, and finishing. Data analysis is conducted using the HIRARC method (Hazard Identification, Risk Assessment, and Risk Control).

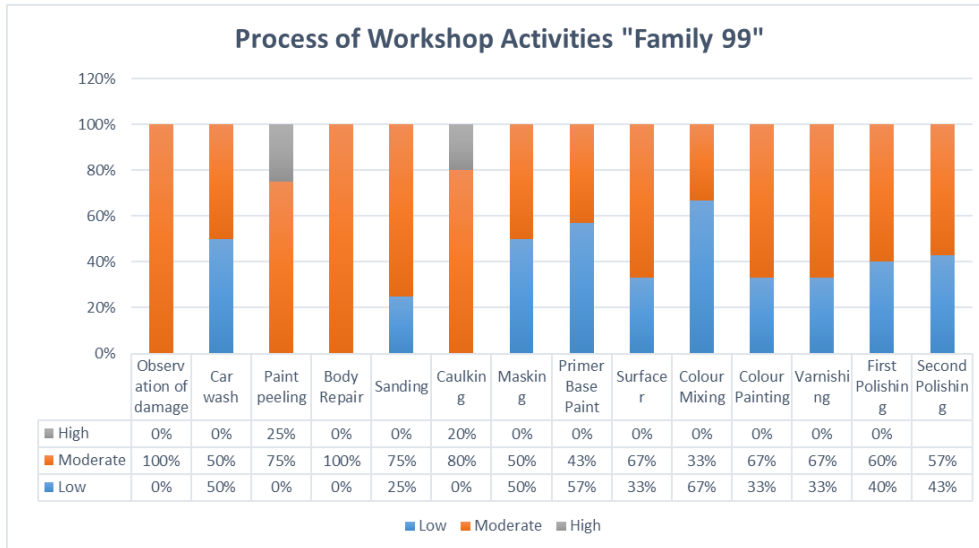
The stages of composing HIRARC adhere to the AS/NZS 4360:2004 standard matrix, commencing with identifying risks by determining the sources of hazards from the observed activities (Triwananda, I.W.G.E., & Armaeni, 2020). Subsequently, risks are assessed by categorizing them based on their respective probability [Table 1] and severity [Table 2]. If both subjects are multiplied, it will result in a single value of risk that can be categorized into low-risk, moderate-risk, high-risk, and even very high-risk levels [Table 3]. The resulting risk assessment serves as the basis for determining the most suitable risk control measures aligned with the objectives.

RESULT AND DISCUSSION

The analysis was conducted using interview and observation methods, resulting in respondent data gathered from three workers in the Family 99 workshop. There are 22 work stages identified in the Family 99 workshop. Out of these 22 stages, some were repetitive, resulting in only 14 work stages suitable for analysis with HIRARC. These fourteen stages include damage observation, car washing, paint stripping, body repair, sanding (first, second, and third), filling (first, second, and third), masking, primer application, surfacer, color mixing, painting, varnishing, first polishing, and second polishing. The work at the Family 99 workshop is carried out in a semi-indoor space, where daily operations heavily rely on sunlight as the primary illumination source. Additionally, the drying process during the painting stages also greatly depends on sunlight. Consequently, the work at Family 99 Workshop is also subject to weather conditions. Tasks take longer if the weather is cloudy or during the rainy season.

Identification was carried out using the HIRARC method, which involved hazard identification, risk assessment, and risk control. Hazard identification is the process of identifying unwanted occurrences that may lead to undesired events and pose a threat. Risk assessment, on the other hand, is a systematic process used to measure risks associated with processes, substances, actions, or hazardous activities (Rout, B.K., & Sikdar, 2017).

The presence of potential hazards in the workplace poses risks to both workers and the environment. Risk represents the possibility of something harmful occurring. Risk can be controlled through risk assessment and identification. Risk assessment is a comprehensive review effort within the workplace to identify processes, substances, factors, and situations that may lead to losses. The results of the risk assessment conducted in the Family 99 welding and painting workshop are depicted in the following bar diagram.



Based on the table above, it's evident that each job process involved in car painting and body repair carries different levels of risk, ranging from low, moderate, and high. The assessment table reveals no car painting or body repair tasks with a very high (V. High) risk level. The average risk value for these tasks falls within the low (Low) and moderate (Moderate) risk categories. However, some tasks present a high (High) risk. In summary, the highest risk values arise from the car paint stripping process, scoring 12 in risk, and the first, second, and third sanding stages, each scoring 9 in risk. This information is illustrated in Table 4 in the appendix. Given these high-risk values, it becomes a top priority to implement control measures to prevent workplace accidents and improve worker health.

Risk control efforts are a crucial step in mitigating hazards. This condition can be achieved by applying a hierarchy of controls. The control hierarchy comprises five levels of action to reduce or eliminate hazards: elimination, substitution, engineering controls, administrative controls, and the use of personal protective equipment (PPE) (The National Institute for Occupational Safety and Health, 2020). The most effective control measure is elimination, which involves removing the hazard source and associated risks. Elimination may involve removing unused chemicals. However, the elimination stage is easier to implement in the early stages of workplace planning, such as designing machines to produce minimal noise (University of Wollongong, 2011). The second stage involves substitution, which means replacing hazardous materials or equipment with safer alternatives (Sari, D.N.I., & Saptaji, 2023). For instance, substituting noisy workshop machines with quieter ones. The third stage includes engineering controls like using trolleys to move heavy items and installing ventilation for adequate lighting and fresh air supply. The fourth stage involves administrative controls by providing work procedures and instructions to workshop employees. The final stage involves the use of personal protective equipment that can limit workers' exposure (University of Wollongong, 2011).

Welding and painting workshops are among the work environments prone to accidents. Workshop occupations bear various risks of exposure to physical, chemical, mechanical, and ergonomic hazards. Physical hazards may include noise and slippery floors, while chemical hazards include solvents, dust, airborne particles, paint, and putty. Mechanical risks include falling, slipping, injuries, and heavy equipment falling, while ergonomic risks involve awkward postures, repetitive tasks, overwork, and improper tool usage (Sehsah et al., 2020). These hazards are prevalent, especially in the body repair and painting stages. These processes involve materials that can negatively impact workers' health. Chemicals used in body repair and painting processes include paint, thinner, Aliflaglos polyester putty (plastic putty base), polyester putty hardener (plastic putty), and varnish. These substances contain hazardous compounds like Toluene (C6H5CH3), Epoxy, Acetylene (C2H2), Butane (C4H10), Polyurethane (Synthetic Polymer), Lead (Pb), and Mercury. Long-term exposure to these chemicals in workshops can lead to lung function

impairment. Painting processes involve chemicals like chromium, lead, cadmium, isocyanates, toluene solvents, mercury, and acrylic resin (Erdinur et al., 2021). This exposure risks lung function impairment. Moreover, using too many products can result in the vehicle's paint peeling and scratching too easily.

The choice of personal protective equipment (PPE) should derive from a comprehensive assessment of job hazards via job hazard analysis. This analysis includes evaluating potential risks, specific tasks, procedures, and work practices. Collaboration with area supervision and EH&S (Environmental Health and Safety) is crucial throughout this process (Environmental Health & Safety Department & University of Washington, 2020). Daley and Ames (2015) highlighted the necessity of using personal protective equipment (PPE) when handling materials containing lead. This equipment encompasses various items such as disposable work gloves, coveralls made of Tyvek or similar material with foot protection, safety glasses, goggles, or face shields, as well as adequately fitted half-face respirators equipped with HEPA filters.

In the welding and painting workshops, efforts towards hazard control, including the use of personal protective equipment, are essential. Recommendations from the module "Protective Solutions for Automotive Industry Applications Because everyone has someone depending on them to get home safely." (2021) include the use of safety gloves with cut-resistant specifications made of lightweight material with Kevlar and a nitrile foam layer on the palm, along with protective clothing made of polyethylene to guard against chemicals, hazardous particles, and liquid aerosols. The use of safety gloves and protective clothing in workshop processes is valuable in safeguarding against various hazards, including chemical and physical risks.

Extended exposure to chemical substances can lead to health disturbances (Cindy, D., Anggraini, P., Tualeka, A. R., Jalaludin, J., & Ahsan, 2022). Therefore, workers are mandated to wear respiratory masks. Respiratory masks are designed to shield the user from airborne contaminants, are classified as PPE, and are widely used, especially by health professionals, particularly during aerosol generation procedures (Fangueiro et al., 2020). In the painting process, respirators such as the 3M Paint Project Respirator R6211 are utilized to maximize breathing during painting, offering optimal respiratory capability, or the 3M Particulate Respirator P100. Moreover, using equipment such as air compressors can pose physical hazards in the form of noise. Continuous noise exposure can result in stress, depression, anxiety, heart disease, high blood pressure, and other health issues (CDC, 2020). Control measures can be implemented through the use of ear protection like earplugs or earmuffs with a Noise Reduction Rating (NRR) of at least 22 db. Commonly used products include 3M™ E-A-R™ Classic Earplugs (NRR 29) for earplugs and 3M™ Peltor™ H7 Deluxe Earmuffs (NRR 27) for earmuffs, which, when combined can result in a Noise Reduction Rating of approximately 34 Decibels (Prihastuti, 1996).

Improper footwear often leads to various problems. Non-slip shoes are crucial in environments prone to slipping hazards. Safety shoes should be provided if there's a risk of crushing injuries, impact by objects, or entanglement in machinery. If the possibility of stepping on nails or sharp objects exists, puncture-resistant soles should be provided (The Society of Chiropractors and Podiatrists, 2007). Additionally, employees exposed to corrosive or toxic materials must have protective equipment covering exposed body parts, including legs and feet. Some safety shoes have metal soles to protect against puncture wounds. Safety shoes can also be conductive to prevent the accumulation of static electricity in explosive atmospheres or non-conductive to protect employees from electrical hazards in the workshop (Sharman & Mahon, 2023). Control measures can be applied through the use of safety shoes, like safety-purpose shoes with special waterproof designs (Occupational Safety and Health Administrations, 2020).

Employees may face various hazards that cause eye and facial injuries. OSHA requires employers to shield the eyes from potential exposure to flying particles, molten metals, liquid chemicals, corrosive acids or liquids, chemical gases or vapors, potentially infectious materials, or mild radiation (Sharman & Mahon, 2023). Control measures can be implemented using laser safety goggles that protect workers' eyes from splashes, dust, and light emissions during welding (Occupational Safety and Health Administrations, 2020).

Work aprons aid in protecting workplaces, equipment, and workers from liquids such as powders and shavings, as well as from splashes and dirt generated during work activities. Workshop aprons come with pockets facilitating quick access to essential tools while working, eliminating the need to move back and forth between the tool desk and project area. This saves time and energy, enhancing workflow productivity. Additionally, workshop aprons also help minimize scattered equipment, preventing workers from tripping over workshop gear.

Fire hazards exist during machine operation, electrical leakage, or when materials are stored. Fire prevention measures are crucial in workshops. In the event of a fire, pre-planned evacuation procedures should be in place. Planning and practicing evacuations periodically are necessary to ensure a swift evacuation if needed. The requirement for a fire extinguisher depends on the type of fire. The types of fire extinguishers that can be used include water-type extinguisher (Color coded red, for use on solid fires only, not to be used on electrical or chemical fires) and Carbon Dioxide Extinguisher [CO₂] (Color coded red with a black band, for use on electrical and flammable liquids fire. It should be noted that this extinguisher can be safely used on all types of fires, however when gas dissipates, re-ignition can take place) (University of Wollongong, 2011).

CONCLUSION

A workshop that provides space and equipment for the construction, manufacturing, or repairing objects. In their processes of making, shaping, altering, assembling, or repairing, workshop employees are constantly exposed to both hand and machine tools, as well as hazardous chemicals. This exposure results in workplace threats and potential dangers for the workers.

Through analysis conducted via interviews with Family 99 workshop employees and observations, it was discovered that there are 22 work stages in the Family 99 workshop. Out of these 22 stages, some were repetitive, resulting in only 14 work stages suitable for analysis using HIRARC (Hazard Identification, Risk Assessment, and Risk Control). After identification via hazard identification, risk assessment, and risk control, it was found that each job process in car painting and body repair carries various levels of risk, ranging from low, to moderate, to high. The average risk level for these tasks falls within the low and moderate categories, but some tasks pose a high level of risk.

The International Organization for Standardization (ISO) in ISO 45001 establishes that a control hierarchy is a system to manage workplace hazards. Based on observations, it's apparent that the Family 99 workshop hasn't taken any measures to prevent workplace accidents. No visible preventive steps have been implemented, such as safety training, regular equipment inspections, or the provision of adequate Personal Protective Equipment (PPE). This lack of preventive initiative can heighten the risk of workplace accidents.

The suggestions that can be offered in this study related to the readiness of the Body Repair, Paint and Welding Workshop "Family 99" to deal with work-related accidents and industrial disasters in the form of risk control in workshop jobs involve implementing the five hierarchies of actions to reduce or eliminate hazards. Control efforts applicable to workshop jobs include enforcing the use of Personal Protective Equipment (PPE) for workers and implementing administrative controls. A recommendation for further research is to conduct further observations on the risk control processes that have been implemented by the workshop.

REFERENCES

- Admin. (2023). *Pengertian Bengkel Cat dan Macam Tekniknya*. BengkelCat.Com. <https://bengkelcat.com/pengertian-bengkel-cat-dan-macam-tekniknya/#:~:text=Pengertian bengkel cat adalah tempat pengecatan ulang kendaraan%2C khususnya kendaraan,atau mengubah tampilan warna kendaraan.>
- CDC. (2020). *Too Loud! Too Long!: Loud Noise Damage Hearing*. Centers for Disease Control and Prevention.
- Cindy, D., Anggraini, P., Tualeka, A. R., Jalaludin, J., & Ahsan, A. (2022). *Hubungan Paparan Toluena di Udara dengan Gangguan Fungsi Ginjal Pada Pekerja Bengkel Pengecatan Mobil Surabaya Relationship Of Toluene Exposure In Air With Disorders Of Kidney Function In Car Painting Workers Surabaya*. 2(6).
- Environmental Health & Safety Department, & University of Washington. (2020). *Guidelines for Personal Protective Equipment (PPE)*. June, 40. www.ehs.washington.edu
- Erdinur, E., Muslim, B., & Zicof, E. (2021). *Risiko Paparan Bahan Pencemar Terhadap Pekerja Pengecatan Mobil Di Pt.Steelindo Motor Kota Padang*. *Jurnal Sehat Mandiri*, 16(1), 105–114. <https://doi.org/10.33761/jsm.v16i1.330>
- Fangueiro, R., Ferreira, D. P., Silva, P., & Silva, C. (2020). *Protective Masks*. July.
- Haworth, Nigel & Hughes, S. (2012). *The International Labor Organization*. In *Handbook of Institutional Approaches to International Business* (M. Wood, Geoffrey & Demirbag (ed.)). Edward Elgar Publishing. <https://doi.org/10.4337/9781849807692.00014>
- International Labor Organization. (2018). *Meningkatkan Keselamatan dan Kesehatan Pekerja Muda*. Kantor Perburuhan Internasional, CH-1211 Geneva 22, Switzerland.
- Laali, R. S. (2021). *Analisis Kecelakaan Kerja Pada Bengkel Bubut dan Las Wijaya dengan Metode Job safety Analysis*

- (JSA) dengan Pendekatan Failure Mode and Effect Analysis (FMEA). *Jurnal Ilmiah Indonesia*, 6(4), 1967–1976.
- Notoatmodjo, S. (2018). *Scribd.Vdownloaders.Com_Metodologi-Penelitian-Kesehatan-Notoatmodjo.Pdf*. In *Metodologi penelitian kesehatan* (p. 110).
- Nur, M., & Gusena, Z. (2019). Analisis Kecelakaan Kerja dengan Menggunakan Metode Hazard and Operability Study. *Jurnal Teknik Industri Terintegritas*, 3(2), 30–37. <http://repo.unida.gontor.ac.id/id/eprint/1013>
- Occupational Safety and Health Administrations. (2020). *Personal Protective Equipment*. Department of Labor: Occupational Safety and Health Administrations.
- Pisceliya, D.M.R., & Mindayani, S. (2018). Analisis Kecelakaan Kerja Pada Pekerja Pengelasan di CV. Cahaya Tiga Putri. *Jurnal Riset Hesti Medan Akper Kesdam I/BB Medan*, 3(1).
- Politeknik Kesehatan Denpasar. (2016). *Bengkel Kerja*. Politeknik Kesehatan Denpasar.
- Prihastuti, S. (1996). *Pengaruh Kebisingan Mesin Kompresor Terhadap Jarak Aman Kebisingan dan Upaya Pengendaliannya The Effect of Compressor Engine on Noise 's Safe Distance and Control*. 2(1), 27–35.
- Ramadhan, F. (2017). Analisis Kesehatan dan Keselamatan Kerja (K3) menggunakan metode Hazard Identification Risk Assessment and Risk Control (HIRARC). *Seminar Nasional Riset Terapan, November*, 164–169.
- Rout, B.K., & Sikdar, B. . (2017). Hazard Identification, Risk Assessment, and Control Measures as an Effective Tool of Occupational Health Assessment of Hazardous Process in an Iron Ore Pelletizing Industry. *Indian Journal Occupational Med*, 2, 56–76.
- Santoso, D. O., Kurniawan, M. D., & Hidayat, H. (2022). Analisa Risiko Keselamatan dan Kesehatan Kerja Menggunakan Metode HIRARC di PT. INHUTANI 1 UMI GRESIKHUTANI 1 UMI GRESIK. *Jurnal Media Teknik Dan Sistem Industri*, 6(1), 12. <https://doi.org/10.35194/jmtsi.v6i1.1580>
- Sari, D.N.I., & Saptaji, J. . (2023). Analisis Risiko K3 pada Aktivitas Pembuatan Pagar di Bengkel Las Makmur Jaya Kabupaten Cilacap. *Lentera Masyarakat*, 1.
- Sehsah, R., El-Gilany, A. H., & Ibrahim, A. M. (2020). Personal protective equipment (Ppe) use and its relation to accidents among construction workers. *Medicina Del Lavoro*, 111(4), 285–295. <https://doi.org/10.23749/mdl.v111i4.9398>
- Sharman, M., & Mahon, H. S. Mac. (2023). Personal protective equipment. *Infection Control in Small Animal Clinical Practice*, 94–111. <https://doi.org/10.1079/9781789244977.0006>
- Sofyan, D. K. (2013). Pengaruh Lingkungan Kerja Terhadap Kinerja Kerja Pegawai BAPPEDA. *Malikussaleh Industrial Engineering*, 2(1), 18–23.
- The National Institute for Occupational Safety and Health. (2020). Contact Dermatitis. *CDC Government*, 3(6), 321–326.
- The Society of Chiropractors and Podiatrists. (2007). Working Feet. *Working Feet: A Practical Guide to Looking after Your Feet at Work*, 16. www.feetforlife.org Copyright
- Triwananda, I.W.G.E., & Armaeni, N. . (2020). Penilaian Resiko K3 Konstruksi dengan Metode HIRARC. *Jurnal Universitas Kadirri Riset Teknik Sipil*, 4(1), 97–108.
- University of Wollongong. (2011). Engineering Workshop Safety Manual. *Workshop Safety Guidelines*, 1–12. <https://doi.org/10.1038/093108do>

Appendix

Table 1. Probability Scale

Value	Category	Description
1	Rare	Likely to occur only in specific conditions or after an annual occurrence.
2	Unlikely	Could happen in certain conditions but with Low probability.
3	Possible	May occur in certain conditions.
4	Likely	Could occur in almost all conditions.
5	Almost Certainly	Expected to occur in all conditions.

Table 2. Severity Scale

Value	Category	Description
1	Insignificant	No loss, very minor material loss.
2	Minor	Minor injuries requiring immediate first aid can be handled at the incident site, Moderate material loss.
3	Moderate	Lost workdays, requiring medical treatment, significant material loss.
4	Major	Injuries resulting in disability or complete loss of bodily function, significant material loss.
5	Extreme	Causes a significant disaster.

Table 3. Australia - New Zealand Standard Risk Assessment Matrix

AS/NZS 4360 : 2004		SEVERITY					Value
		Insignificant	Minor	Moderate	Major	Extreme	
PROBABILITY	Almost certainly	Moderate	High	High	V. High	V. High	5
	Likely	Moderate	Moderate	High	High	V. High	4
	Possible	Low	Moderate	High	High	High	3
	Unlikely	Low	Low	Moderate	Moderate	High	2
	Rare	Low	Low	Moderate	Moderate	High	1
Value		1	2	3	4	5	

Table 4. HIRARC Risk Assessment Analysis

Process	Identification the Danger	Risk	P	S	Risk Ratings	Risk Control	Hierarchy of Control
Observation of Damage	Non-ergonomic Position	Musculoskeletal disorders	2	3	Moderate	Take a 5-minute break after doing work in the same position for 30-60 minutes	Administrative
car wash	slippery floor	Slip (Swollen and bleeding)	2	2	Low	Improve floor layout, provide work instructions and HSE information to workers, and use safety shoes	Engineering Control, Administrative, PPE
	Hard car panel	bumped, (Swollen)	2	2	Low	Provide work instructions and HSE information to workers, using PPE in accordance with applicable SOPs	Administrative and PPE
	Toxic materials (soap)	Ingestion, poisoning	2	3	Moderate	Provide work instructions and HSE information, wear a mask	Administrative and PPE
	Non-ergonomic Position	Musculoskeletal Disorders (MSDs)	2	3	Moderate	Take a 5-minute break after doing work in the same position for 30-60 minutes	Administrative
Paint peeling	Sharp Material (scrapper)	Scratched, punctured (irritation, infection, and bleeding)	3	2	Moderate	Provide work instructions and HSE information to workers, using gloves in accordance with applicable SOPs	Administrative and PPE
	Fire Source (torch)	Burn (Burns, bleeding, irritation, or infection)	3	4	High	Provide work instructions and HSE information to workers, provide Light Fire Extinguishers, use PPE in accordance with applicable SOPs (wear packs, goggles, fireproof gloves, masks with gas filters).	Administrative and PPE
	Hazardous materials (Propanobutane, butane, propane, 1,3 butadiene, ethyl mercaptan)	Irritant, flammable, toxic, carcinogenic, neurotoxic, germ cell mutagenicity, central nervous system depression	3	4	High	Addition of Room Ventilation in the paint storage room, medical check-up, providing Light Fire Extinguishers using PPE in accordance with applicable SOPs (wear packs, goggles, fireproof gloves, masks with gas filters).	Engineering Control, Administrative and PPE

Process	Identification the Danger	Risk	P	S	Risk Ratings	Risk Control	Hierarchy of Control
Restoration of the original shape (Body Repair)	Damaged and rusty car panels	Hit, scratched (Swollen and bleeding)	3	2	Moderate	Provide work instructions and HSE information to workers, using PPE in accordance with applicable SOPs	Administrative, PPE
	Sharps	Scratched, injured	3	2	Moderate	Provide work instructions and HSE information to workers, using gloves in accordance with applicable SOPs	Administrative and PPE
	Heavy objects	Stricken, hit	3	2	Moderate	Conducting operational training of tools to workers, wearing full PPE	Administrative and PPE
	electric current	Electrocuted	2	3	Moderate	Provide information and HSE information to workers, using gloves in accordance with applicable SOPs	Administrative and PPE
	Sparks	Burn	3	2	Moderate	Provide information on work instructions and HSE to workers, using gloves, clothes, and fireproof helmets in accordance with applicable SOPs	Administrative and PPE
First, Second, and Third Sanding	Rough car panels	Scratches (peeling and bleeding skin)	2	2	Low	Using PPE in accordance with applicable SOPs	PPE
	Coarse object (sandpaper)	Scratched, bleeding, punctured	3	2	Moderate	Using PPE in accordance with applicable SOPs	PPE
	Non-ergonomic Position	Musculoskeletal Disease (MSDs)	2	3	Moderate	Take a 5-minute break after doing work in the same position for 30-60 minutes	Administrative
	Dust	Disturbed breathing, shortness of breath, eye irritation	3	2	Moderate	Adding Room Ventilation in the paint storage room, Using PPE in accordance with applicable SOPs	Engineering Control and PPE

Process	Identification the Danger	Risk	P	S	Risk Ratings	Risk Control	Hierarchy of Control
First, Second, and Third Caulking	Hazardous chemicals	Inhalation of chemicals (shortness of breath)	3	2	Moderate	Using PPE in accordance with applicable SOPs	PPE
	Nephrotoxin	Kidney damage	2	4	Moderate	Perform medical check-ups to check health, provide MSDS education, use double cartridge masks, rubber gloves, wear packs, safety goggles	Administrative and PPE
	Irritant	Eye and skin irritation	2	3	Moderate	Perform medical check-ups to check health, provide MSDS education, use double cartridge masks, rubber gloves, wear packs, safety goggles	Administrative and PPE
	Allergens	Arise dust allergy	2	3	Moderate	Perform medical check-ups to check health, provide MSDS education, use double cartridge masks, rubber gloves, wear packs, safety goggles	Administrative and PPE
Masking	Sharp objects (scraper)	Scratched	2	2	Low	Provide work instructions and HSE information to workers, using gloves in accordance with applicable SOPs	Administrative and PPE
	Stairs (height hazard)	Falling downstairs (swelling, cracks and fractures, and bleeding)	1	3	Moderate	Using PPE in accordance with applicable SOPs	PPE
	Sharp object (cutter)	Scratched, punctured, injured	2	2	Low	Provide work instructions and HSE information to workers, using gloves in accordance with applicable SOPs	Administrative and PPE
	Hard car panel	Bumping (swelling and bleeding)	2	2	Low	Using PPE in accordance with applicable SOPs	PPE
	Non-ergonomic position	Musculoskeletal Disorders (MSDs)	2	3	Moderate	Take a 5-minute break after doing work in the same position for 30-60 minutes	Administrative

Process	Identification the Danger	Risk	P	S	Risk Ratings	Risk Control	Hierarchy of Control
Primer Base Paint	Hazardous chemicals	Disturbed breathing and occurs for a long time, causing shortness of breath, eye irritation, disturbed breathing, and lung damage	1	3	Moderate	Adding Room Ventilation in the paint storage room, Using PPE in accordance with applicable SOPs	Engineering Controls, PPE
	Cable strands	Tripping over wires (bleeding and swelling)	2	2	Low	Adding a stop-contact in a more affordable and safe area, using cable ties so as not to be scattered carelessly, Using PPE according to applicable SOPs	Engineering Controls, PPE
	Heavy equipment	Stricken (swollen)	2	2	Low	Conducting operational training of tools to workers, wearing full PPE	Administrative, PPE
	Electric current	Electrocuted	2	3	Moderate	Adding a stop-contact in a more affordable and safe area, using cable ties so as not to be scattered carelessly, Using PPE according to applicable SOPs	Engineering Control, PPE
	Nephrotoxin	Kidney Damage	1	4	Low	Perform medical check-ups to check health, provide MSDS education, use double cartridge masks, rubber gloves, wear packs, safety goggles	Administrative and PPE
	Neurotoxin	Nerve damage	1	4	Low	Perform medical check-ups to check health, provide MSDS education, use double cartridge masks, rubber gloves, wear packs, safety goggles	Administrative and PPE
	Non-ergonomic position	Musculoskeletal Disorders (MSDs)	2	3	Moderate	Take a 5-minute break after doing work in the same position for 30-60 minutes	Administrative
Surfacer	Noise (wind compressor)	Deaf	1	4	Moderate	Wearing ear muff	PPE
	Electric current	Electrocuted	2	3	Moderate	Adding a stop-contact in a more affordable and safe area, using cable ties so as not to be	Engineering Controls, PPE

Process	Identification the Danger	Risk	P	S	Risk Ratings	Risk Control	Hierarchy of Control
	Cable strands	Tripping over wires (bleeding and swelling)	3	2	Moderate	scattered carelessly, Using PPE according to applicable SOPs Provide HSE information and work instructions, wear PPE (safety shoes, safety helmet)	Administrative, PPE
	Nephrotoxin substances	Kidney Damage	1	4	Low	Perform medical check-ups to check health, provide MSDS education, use double cartridge masks, rubber gloves, wear packs, safety goggles	Administrative and PPE
	Neurotoxin substances	Nerve damage	1	4	Low	Perform medical check-ups to check health, provide MSDS education, use double cartridge masks, rubber gloves, wear packs, safety goggles	Administrative and PPE
	Non-ergonomic position	Musculoskeletal Disorders (MSDs)	2	3	Moderate	Take a 5-minute break after doing work in the same position for 30-60 minutes	Administrative
Color Mixing	Nephrotoxin substances	Kidney damage	1	4	Low	Perform medical check-ups to check health, provide MSDS education, use double cartridge masks, rubber gloves, wear packs, safety goggles	Administrative, PPE
	Neurotoxin substances	Nerve damage	1	4	Low	Perform medical check-ups to check health, provide MSDS education, use double cartridge masks, rubber gloves, wear packs, safety goggles	Administrative, PPE
	Non-ergonomic position	Musculoskeletal Disorders (MSDs)	2	3	Moderate	Take a 5-minute break after doing work in the same position for 30-60 minutes	Administrative
Color painting	Noise (wind compressor)	Deaf	1	3	Moderate	Wearing ear muff	PPE
	Electric current	Electrocuted	2	2	Moderate	Adding a stop-contact in a more affordable and safe area, using cable ties so as not to be	Engineering Controls, PPE

Process	Identification the Danger	Risk	P	S	Risk Ratings	Risk Control	Hierarchy of Control
	Cable strands	Tripping over wires (bleeding and swelling)			Moderate	scattered carelessly, Using PPE according to applicable SOPs Provide HSE information and work instructions, wear PPE (safety shoes, safety helmet)	Administrative, PPE
	Nephrotoxin substances	Kidney damage			Low	Perform medical check-ups to check health, provide MSDS education, use double cartridge masks, rubber gloves, wear packs, safety goggles	Administrative and PPE
	Neurotoxin substances	Nerve damage			Low	Perform medical check-ups to check health, provide MSDS education, use double cartridge masks, rubber gloves, wear packs, safety goggles	Administrative and PPE
	Non-ergonomic position	Musculoskeletal Disorders (MSDs)			Moderate	Take a 5-minute break after doing work in the same position for 30-60 minutes	Administrative
Varnishing	Noise (wind compressor)	Deaf	1	4	Moderate	Wearing ear muff	PPE
	Electric current	Electrocuted	2	3	Moderate	Adding a stop-contact in a more affordable and safe area, using cable ties so as not to be scattered carelessly, Using PPE according to applicable SOPs	Engineering Controls, PPE
	Cable strands	Tripping over wires (bleeding and swelling)	3	2	Moderate	Provide HSE information and work instructions, wear PPE (safety shoes, safety helmet)	Administrative, PPE
	Nephrotoxin substances	Kidney damage	1	4	Low	Perform medical check-ups to check health, provide MSDS education, use double cartridge masks, rubber gloves, wear packs, safety goggles	Administrative and PPE
	Neurotoxin substances	Nerve damage	1	4	Low	Perform medical check-ups to check health, provide MSDS education, use double cartridge	Administrative and PPE

Process	Identification the Danger	Risk	P	S	Risk Ratings	Risk Control	Hierarchy of Control
	Non-ergonomic position	Musculoskeletal Disorders (MSDs)	2	3	Moderate	masks, rubber gloves, wear packs, safety goggles Take a 5-minute break after doing work in the same position for 30-60 minutes	Administrative
First polishing	Sparks	Causes fires, burns to the skin or other parts of the body.	3	2	Moderate	Provide work instructions and HSE information to workers, using PPE in accordance with applicable SOPs	Administrative and PPE
	Specific target organ toxicity	Damage to specific organs	1	4	Low	Perform medical check-ups to check health, provide MSDS education, use double cartridge masks, rubber gloves, wear packs, safety goggles	Administrative and PPE
	Carcinogenic	Cancer	1	4	Low	Perform medical check-ups to check health, provide MSDS education, use double cartridge masks, rubber gloves, wear packs, safety goggles	Administrative and PPE
	Electric current	Electrocuted	2	3	Moderate	Provide MSDS work and educational instruction information, wear rubber gloves	Administrative and PPE
	Heavy equipment	Overlapped tools	2	3	Moderate	Provide work instructions and HSE information to workers, provide equipment training to workers, and use safety shoes and safety helmets.	Administrative and PPE
Second polishing	Sparks	Causes fires, burns to the skin or other parts of the body.	3	2	Moderate	Provide work instructions and HSE information to workers, using PPE in accordance with applicable SOPs	Administrative and PPE
	Specific target organ toxicity	Damage to the liver	1	4	Low	Perform medical check-ups to check health, provide MSDS education, use double cartridge masks, rubber gloves, wear packs, safety goggles	Administrative and PPE

Process	Identification the Danger	Risk	P	S	Risk Ratings	Risk Control	Hierarchy of Control
	Electric current	Electrocuted	2	3	Moderate	Provide work instructions and HSE information to workers, wearing rubber gloves	Administrative and PPE
	Sharps	Scratched	2	2	Low	Provide work instructions and k3 information to workers, wearing rubber gloves	Administrative and PPE
	Harmful irritant	Irritation of digestion, dry eyes, blockage of the oil glands of the eye	2	3	Moderate	Provide MSDS information to workers, using safety goggles in accordance with applicable SOPs	Administrative and PPE
	Noise (wind compressor)	Deaf	1	4	Low	Wearing ear muff	PPE
	Heavy equipment	Overlapped tools	2	3	Moderate	Provide work instructions and HSE information to workers, provide equipment training to workers, and use safety shoes and safety helmets.	Administrative and PPE