EXPLORING THE PREVALENCE AND RISK FACTORS OF NOISE-INDUCED HEARING LOSS AMONG ELECTRONICS MANUFACTURING WORKERS: A QUALITATIVE PERSPECTIVE

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Exploring The Prevalence And Risk Factors Of Noise-Induced Hearing Loss Among Electronics Manufacturing Workers: A Qualitative Perspective

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Abstrak

Kehilangan Pendengaran Akibat Bunyi (Noise-Induced Hearing Loss, NIHL) kekal sebagai salah satu masalah paling signifikan dalam kesihatan pekerjaan di seluruh dunia, namun sektor pembuatan elektronik yang terdedah kepada bunyi sederhana tetapi berterusan masih kurang diberi perhatian. Kajian ini meneliti prevalens NIHL dalam kalangan pekerja pembuatan elektronik serta menilai faktor risiko pekerjaan seperti fungsi tugas, tempoh perkhidmatan, dan pendedahan kepada bunyi. Pendekatan deskriptif kualitatif digunakan, disokong oleh ujian audiometri dan pengesahan oleh Pegawai Kesihatan Pekerjaan (OHD). Daripada 500 pekerja, seramai 12 dikenal pasti terdedah kepada bunyi melebihi 85 dB(A) dan 5 didapati mengalami NIHL. Temu bual separa berstruktur dijalankan dengan 4 daripada 5 pekerja tersebut untuk mengenal pasti faktor penyumbang NIHL berdasarkan persepsi mereka. Data audiometri dianalisis menggunakan pendekatan deskriptif, manakala data temu bual dianalisis melalui kaedah analisis tematik. Dapatan menunjukkan peserta mempunyai kecenderungan untuk menormalkan pendedahan mereka kepada bunyi. Selain itu, peserta mengalami kelewatan yang ketara dalam menyedari simptom awal NIHL. Pendedahan bunyi yang berlebihan menjejaskan keupayaan peserta untuk menumpukan perhatian dan berkomunikasi, serta kesihatan dan kesejahteraan keseluruhan mereka. Namun begitu, kesedaran kendiri peserta terhadap kesihatan pendengaran meningkat selepas menjalani ujian audiometri. Dalam kalangan peserta, operator mengalami pendedahan bunyi yang berterusan manakala jurutera mengalami pendedahan berselang-seli. Faktor risiko utama yang dikenal pasti termasuk tempoh perkhidmatan yang lama, kemerosotan peralatan, ketidakpatuhan penggunaan PPE, ketidakselesaan, dan kekurangan kawalan organisasi. Latihan yang kerap, praktikal, dan khusus mengikut tugas dilaporkan lebih berkesan oleh pekerja. Dapatan ini turut menekankan keperluan penambahbaikan kawalan kejuruteraan, pengurusan PPE yang lebih berkesan, serta latihan dan pemantauan penyeliaan yang lebih baik. Secara keseluruhan, hasil kajian ini dapat membantu meningkatkan perancangan dan pelaksanaan program pemeliharaan pendengaran dalam industri pembuatan elektronik.

Kata kunci: Kehilangan Pendengaran akibat Bunyi Bising, Pendedahan kepada Bunyi Bising, Ujian Audiometri, Program Pemeliharaan Pendengaran, Alat Perlindungan Pendengaran

Abstract

Noise-Induced Hearing Loss (NIHL) is still one of the most significant problems in occupational health worldwide, but little attention has been paid to the electronics manufacturing sector, which has moderate but continuous noise exposure. This study investigated the prevalence of NIHL in electronics manufacturing employees and assessed the occupational risk factors of job functions, tenure, and exposure to noise. A qualitative descriptive approach was utilized that was supplemented by audiometric testing and verification by an Occupational Health Doctor (OHD). Out of 500 employees, 12 workers were identified as being exposed to noise levels greater than 85 dB(A) and 5 were found to have NIHL. Semi-structured interviews were conducted with 4 out of the 5 workers to elicit perceived NIHL contributing factors. A descriptive approach was employed to analyze the audiometric data, whereas the data from the interviews were subjected to thematic analysis. The findings revealed that the participants exhibited a common tendency to normalize their exposure to noise. Moreover, participants experienced a significant delay in recognizing the early symptoms of NIHL. Impaired noise exposure influenced the participant's ability to concentrate and communicate, as well as their overall health and well-being. However, participants have enhanced their self-awareness regarding their hearing health due to audiometric testing. Of the participants, operators experienced continuous noise exposure while spotty exposure to noise was reported by the engineers. The main contributing risk factors were long tenure, equipment degradation, poor compliance to PPE, discomfort, and lack of organizational control. Frequent, hands-on, and task-specific training is reported by employees to be more effective. These reports also emphasize the need for improved engineering controls, more effective management of PPE, and more training and supervisory oversight. Overall, the findings of this study can facilitate better planning and implementation of hearing conservation programs for the electronics manufacturing industry.

Keywords: Noise-Induced Hearing Loss, Noise Exposure, Audiometric Testing, Hearing Conservation Program, Personal Hearing Protector.

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List of Abbreviations

Abbreviations	Definition
dB	Decibel
DOSH	Department of Occupational Safety and Health
HCP	Hearing Conservation Program
ICOP	Industry Code of Practice
JDC	Job Demand Control
MFG1	Manufacturing 1
MFG2	Manufacturing 2
NIDCD	National Institute on Deafness and Other Communication Disorders
NIHL	Noise-Induced Hearing Loss
NIOSH	National Institute for Occupational Safety and Health
NRA	Noise Risk Assessment
OHD	Occupational Health Doctor
OSH	Occupational Safety Health
OSM	Occupational Stress Model
PE	Production Engineer
PHP	Personal Hearing Protectors
PLD	Personalized Listening Devices
RO1	Research Objective 1
RO2	Research Objective 2
RQ1	Research Question 1
RQ2	Research Question 2
SHO	Safety Health Officer

CHAPTER ONE
INTRODUCTION

1.1 Background of the Study

The increasing incidence of Noise Induced Hearing Loss (NIHL) among industrial workers globally presents major difficulties for the field of occupational health, remaining the most common occupational disease worldwide. NIHL is a lifelong and irreversible condition brought on by extended noise levels above 85 dB(A). (Natarajan et al., 2023). Though workplace rules and hearing protection initiatives help, they account for 16% of adult-onset debilitating hearing loss globally (Silva et al., 2020). If ignored, NIHL causes permanent hearing loss, higher compensation costs, and lower output. Key ideas in controlling NIHL are workplace noise exposure expressed in decibels (dB(A)), and HCPs (Setyawan, 2021).

In Malaysia, NIHL accounts for approximately 70% of all reported work-related diseases, making it the most prevalent occupational ailment (Yasin et al., 2024). Though current HCPs exist, worker compliance and enforcement flaws help to explain consistently high NIHL rates. Workers' sensitivity to hearing loss (Easwaran & Yahya, 2024) is raised by their ignorance of NIHL hazards or neglect of hearing protection guidelines. Research shows that efforts at noise control in Malaysia concentrate more on compliance than on worker education, therefore lowering their general efficacy. Data on workplace monitoring also indicate that numerous electronics manufacturing facilities exceed the 85 dB(A) standard, thereby posing a risk to employees (Si et al., 2020). Strengthening workplace policies and regulatory enforcement is crucial to mitigating NIHL and increasing worker safety.

According to the Department of Statistics Malaysia (DOSM, 2024), the Occupational Disease and Poisoning Statistics 2023 recorded 6,754 cases under the occupational noise-related hearing disorder category, marking it as the highest reported occupational disease. Referring to Figure 1.1, this indicates a statistic of occupational disease and poisoning for the year 2023.

Figure 1.1
Occupational Disease and Poisoning Statistics 2023
Source: Occupational Disease and Poisoning Statistics 2023

If left untreated, NIHL will continue to harm worker health, leading to lasting disability and diminished quality of life (Le Prell, 2022). Workers with hearing loss struggle with communication, cognitive health, and overall well-being, which can impair job performance. Workplace noise exposure is also connected to reduced productivity, more absenteeism, and increased compensation claims due to occupational hearing damage (Mutthumanickam et al., 2024). In Malaysia, NIHL remains the most reported occupational disease and a considerable financial burden on both businesses and healthcare systems. Addressing NIHL is therefore vital to enhancing worker safety, minimizing economic expenses, and implementing hearing conservation programs (HCPs) efficiently (Si et al., 2020).

1.2 Problem Statement

Although NIHL related cases are well-documented in high-noise industries, its prevalence and risk factors in electronics manufacturing remain little studied (Xie et al., 2023). For example, Lu et al. (2021) conducted an occupational health study in an electronics manufacturing setting that assessed exposure to multiple hazards including noise, but did not examine the association between workplace noise exposure and audiometric hearing outcomes. Most NIHL research focuses on heavy sectors (>95 dB(A)), creating a gap in knowing the impacts of moderate yet continuous exposure

(85-90 dB(A)) on electronics workers. For instance, Electronics workers may not experience severe noise levels, but long-term exposure to moderate noise can nevertheless contribute to hearing loss (Halim et al., 2022). The limited availability of sector-specific studies poses challenges in evaluating the effectiveness of hearing conservation strategies in this industry. Addressing this gap is critical to developing NIHL prevention techniques in electronics manufacturing.

Previous studies assess workplace noise levels but do not undertake audiometric testing of workers, limiting awareness of the true impact of noise exposure on hearing health (Abdul Rahim et al., 2022). The uneven usage of PHPs among electronics workers significantly raises their chance of developing NIHL. Workers may underestimate the risk or find PHPs uncomfortable to wear, leading to inconsistent use (Green et al., 2021). Additionally, insufficient long-term surveillance of hearing degradation makes early intervention challenging (Mutthumanickam et al., 2024). Therefore, research is needed to determine sector-specific hazards, worker compliance, and the effectiveness of noise regulations in electronics production (Mutthumanickam et al., 2024). These gaps are summarized in Table 1, which highlights key limitations in existing NIHL literature, particularly regarding electronics manufacturing workers. By addressing these research gaps through qualitative exploration, this study aims to provide deeper insights and practical recommendations for improving NIHL prevention efforts

Table 1.1
Identified Research Gaps in Existing NIHL Literature

Gap Identified	Source
Lack of correlation between measured noise and audiometric data	Lu et al., 2021
Minimal focus on the electronics sector with moderate noise exposure	Xie et al., 2023
Insufficient data on hearing protection compliance	Green et al., 2021
Limited long-term surveillance in NIHL management	Mutthumanickam et al., 2024

Existing research often depends on noise level measurements or biomarkers but lacks direct insight into worker experiences and perceptions of NIHL risk factors, a gap that

quantitative inquiry can address (Ismail & Kamely, 2025). Some studies estimate environmental noise exposure without evaluating individual risk variables, such as occupational positions, tenure, and hearing protection practices, that may contribute to NIHL (Xie et al., 2023). Other research focuses on biomarkers of noise exposure rather than detecting NIHL cases using audiometric data verified by OHDs (Lu et al., 2021). This presents a research gap concerning how workers perceive NIHL risks and which employment-related factors may contribute most to hearing loss, particularly in moderate-noise workplaces such as electronics manufacturing, necessitating further investigation to inform targeted prevention strategies.

The existing literature lacks extensive investigations on NIHL in electronics manufacturing workers, leaving a gap in understanding the long-term effects of moderate noise exposure (Masterson & Themann, 2024). While electronics production is not categorized as a high-noise business, exposure to noise exceeding 85 dB(A) nevertheless offers a considerable danger. Studies reveal that many electronics companies reach 85 dB(A) in important employment positions, although few reviews have evaluated HCP effectiveness in this sector (Li et al., 2024). This study intends to establish NIHL prevalence and its important risk variables, such as employment role, years of service, and PHP compliance, which may influence workers' exposure to hazardous noise and the occurrence of NIHL. An important study topic is: What is the prevalence of NIHL in electronics manufacturing workers, and what occupational factors lead to hearing loss? The findings were used in assessing whether present noise control methods are successful and provide evidence-based recommendations for strengthening workplace laws and enforcement (Green et al., 2021).

1.3 Research Questions

1. What is the prevalence of NIHL among electronics manufacturing workers across different job roles?
2. Which occupational risk factors (e.g., job role, tenure, noise exposure level) significantly contribute to NIHL in electronics manufacturing?

1.4 Research Objectives

1. To determine the prevalence of NIHL among electronics manufacturing workers in different job roles.
2. To identify the occupational risk factors contributing to NIHL, including job role, tenure, and noise exposure levels, in electronics manufacturing workers.

1.5 Significance of the Study

NIHL is one of the most common occupational disorders; however, its influence on electronics manufacturing workers remains underexplored. Unlike construction and mining, which are classified as high-noise industries, electronics production routinely exposes workers to moderate but constant noise levels above 85 dB(A). Studies confirm that prolonged exposure to noise above 85 dB(A) can lead to irreversible hearing impairment (NIDCD, 2022). Despite this, research on hearing loss in moderate-noise situations is sparse, exposing a major gap in occupational safety information. Addressing this issue is crucial, as NIHL accounts for roughly 16% of adult-onset debilitating hearing loss worldwide (Zhou et al., 2020). By researching NIHL prevalence and risk factors, this study intends to bridge the knowledge gap and improve workplace hearing conservation initiatives.

This study provides evidence-informed qualitative insight into NIHL risk factors in electronics manufacturing, helping employers and policymakers enhance noise control measures. Research indicates that simply having an HCP is insufficient, as about 18% of overexposed workers still develop NIHL despite preventive measures (Śliwińska-Kowalska, 2020). Many workers underuse or inconsistently wear hearing protection, especially in industries where noise hazards are underestimated (Green et al., 2021). This study identified barriers to effective HCP implementation and provided recommendations to strengthen compliance. Ensuring that regulations such as OSH (Noise Exposure) Regulation 2019 are fully enforced can significantly reduce NIHL risks. By improving noise exposure monitoring and preventive strategies, this research aims to reduce occupational hearing loss and enhance worker well-being.

The significance of this research extends beyond the workplace, as NIHL severely affects communication, quality of life, and job performance. Workers with hearing

impairment often have difficulty interpreting speech in noisy situations, leading to social isolation and lower working productivity (Śliwińska-Kowalska, 2020). Unaddressed hearing loss raises workplace accident risks, as workers may fail to hear alarms or approaching machinery, rising injury rates (Mutthumanickam et al., 2024). NIHL-related communication disruptions led to greater incident rates, compromising both worker safety and overall productivity. Research demonstrates that workers with hearing loss require more task repetitions, making training and daily operations less efficient (Mutthumanickam et al., 2024). Addressing these concerns through efficient noise management solutions can boost worker safety, productivity, and economic sustainability.

1.6 Scope of Study

This study studies the prevalence and risk factors of NIHL among electronics manufacturing workers exposed to noise levels surpassing 85 dB(A). It focuses on workers in manufacturing areas and machine rooms, where noise exposure routinely surpasses occupational restrictions. Audiometric test data were obtained from company records with appropriate permission and analysed to determine NIHL prevalence, based on confirmation by OHDs. The study identified which workers were diagnosed with NIHL and examined its variation across different job roles. However, it excludes workers from non-manufacturing industries such as construction, mining, and automotive, where noise exposure levels differ dramatically. Additionally, it does not address the psychological or social implications of hearing loss, as the focus is on the occupational elements of NIHL.

The study included NIHL identification based on audiometric test results and noise exposure analysis. From the identified NIHL cases, interviews were undertaken to evaluate risk factors related to employment roles, tenure, and noise exposure levels. The research used thematic analysis to uncover patterns from interview responses, ensuring a full evaluation of NIHL risk variables. However, it does not contain longitudinal research, meaning it will not examine changes in hearing loss over numerous years. Psychosocial implications of NIHL, such as mental health affects or quality of life alterations, are also outside the study's scope. By keeping a concentrated approach, the study ensures practical applicability and workplace relevance.

While the study is well-defined and viable, it acknowledges significant constraints that may affect its findings. One restriction is the sample size and generalizability, as research is limited to specific electronics production facilities. Data availability may also be hampered if audiometric test records or noise exposure data are insufficient or subject to confidentiality policies. Additionally, the study depends on self-reported compliance with HCPs, which may introduce reporting bias. Workplace noise control measures may be altered during the study period, impacting outcomes. Since this study adopts a cross-sectional qualitative design, it does not track long-term NIHL growth, making future longitudinal research important. This scope ensures that both the prevalence of NIHL (RO1) and the contextual occupational risk factors (RO2) are addressed cohesively through qualitative interpretation.

The chosen scope is justified based on practicality, relevance, and practical application. By focusing on NIHL prevalence and risk factors in electronics production, the study provides significant information for safety practitioners, legislators, and employers. The research aligns with occupational safety rules and supports the need for improved hearing conservation programs. Findings will be particularly advantageous for companies with moderate but prolonged noise exposure, which are generally disregarded. Industry-specific data will guarantee that recommendations are suitable for workplace interventions. By maintaining a systematic and targeted approach, this study intends to promote workplace safety and contribute to NIHL prevention in electronics production.

1.7 Definition of Key Terms

Noise-Induced Hearing Loss (NIHL) is referred to as a type of hearing impairment resulting from prolonged or intense exposure to hazardous noise levels (ICOP Noise Exposure, 2019). Noise Exposure is defined as the level of sound pressure that reaches an individual's unprotected ears during occupational activities (ICOP Noise Exposure, 2019). Audiometric Test refers to the process of determining an individual's hearing threshold through monoaural pure-tone air conduction testing (ICOP Noise Exposure, 2019). Hearing Conservation Program (HCP) is defined as a structured initiative developed by an organisation to prevent hearing disorders caused by occupational noise exposure (ICOP Noise Exposure, 2019). Personal Hearing Protectors (PHP) are devices

worn to protect individuals from harmful auditory effects caused by excessive acoustic stimuli (ICOP Noise Exposure, 2019).

1.8 The Organisation of the Study

This thesis is organised into six chapters to present the research in a clear, systematic manner. Each chapter is structured to build upon the previous one, ensuring a logical flow from introduction to conclusion. The study begins with the foundation of the research, followed by a review of related literature, the research methodology, findings and discussion, and finally, the conclusion and recommendations. This structure allows for comprehensive coverage of the research objectives and supports a coherent understanding of the subject matter. The organisation also ensures that the study remains focused on addressing the research questions effectively.

Chapter 1 introduces the background of the study, highlighting the significance of NIHL in the electronics manufacturing sector. It outlines the problem statement, research objectives, and research questions that guide the study. This chapter also explains the scope and significance of the research in contributing to occupational health knowledge. Additionally, key terms used throughout the thesis are defined to ensure clarity and consistency. The content in this chapter establishes the foundation upon which the remaining chapters are developed.

Chapter 2 provides a review of empirical literature relevant to NIHL, particularly within industrial and manufacturing settings. The review explores the prevalence, risk factors, and health implications associated with occupational noise exposure. It also identifies gaps in existing research and supports the need for further investigation within the electronics manufacturing industry. This chapter establishes a strong contextual basis for the research by linking past studies to the current investigation. The insights gained help justify the direction and focus of the study.

Chapter 3 explains the research methodology employed in the study. It outlines the qualitative approach, research design, sampling method, and data collection techniques, including interviews and audiometric record analysis. The data analysis process, involving thematic and descriptive analysis, is also described. Ethical considerations

observed during the study are addressed to ensure research integrity and participant confidentiality. This chapter ensures transparency in how the research was conducted.

Chapter 4 findings remain indicative of the persistence of NIHL among workers in the electronics manufacturing industry, mainly those working in high-noise environments for extended periods. Within the range of audiometric assessments, several individuals exhibited varying degrees of hearing impairment, from mild to profound, with a considerable number being oblivious to the early signs of NIHL. Thematic analysis illustrated the lack of awareness of hearing conservation strategies, along with the sporadic use of hearing protective equipment. In conclusion, the findings reinforce the assumption that the persistence of NIHL within this occupational setting is primarily attributable to a combination of workplace practices, as well as individual occupational behaviors.

In Chapter 5, the findings are interpreted against the background of literature and theory. Normalization of noise exposure, the lack of training, and poor enforcement of measures aimed at hearing conservation were important barriers to effective prevention. Workers' perceptions indicated awareness did not always lead to protective behaviour, signalling a knowledge to practice gap. These findings resonate with the literature, reinforcing the need for cultural change within the organization to prevent the occurrence of NIHL.

Chapter 6 concludes that NIHL remains a significant challenge to occupational health within the electronics manufacturing industry because of the combined environmental and behavioural risk factors. The reduction of exposure and the reinforcement of protective behaviours among employees necessitate the implementation of comprehensive and ongoing hearing conservation initiatives. The enhancement of training within a positive safety culture, whereby the monitoring and enforcement should be encouraged, is suggested to the management. The use of diverse participant samples and mixed-method strategies will address the gaps in the literature on the impacts of time and the effectiveness of interventions.

CHAPTER TWO
LITERATURE REVIEW

2.1 Introduction

This chapter includes an empirical review focused on the association between noise exposure and NIHL in the manufacturing and industrial sectors. Several studies demonstrate that factory workers, especially those exposed to noise levels over 85 dB(A), have a considerable incidence of NIHL. Nevertheless, limited research explores their personal perceptions of noise risk or protective practices. Studies in areas including electronics, textiles, and metallurgy demonstrate that extended exposure to industrial noise considerably boosts the risk of hearing loss. The study shows that, although existing legislation and hearing conservation initiatives exist, NIHL is still the most typically reported occupational ailment in Malaysia. It also emphasizes worldwide evidence demonstrating that manufacturing workers experience more NIHL than those in low-noise industries. These results give a strong basis for exploring NIHL, particularly in electronics production contexts.

The second portion of the review addresses the link between noise exposure levels and the severity of NIHL, highlighting the dose-response relationship. Studies demonstrate that as noise intensity and exposure time rise, so does the likelihood and severity of hearing loss. Apart from sound intensity, major risk components are occupational function, years of service, gender, and adherence to hearing protection rules. Research also suggests that behavioral and lifestyle decisions like smoking and non-use of hearing protection equipment exacerbate the impact of noise exposure. Compounding dangers are also described as co-exposure to ototoxic chemicals and age-related sensitivity. Collectively, the empirical research underscores the need for deeper qualitative exploration of workers' opinions of these risk variables within electronics manufacturing contexts and examination of workers' perceptions of various risk elements within electronics production facilities.

2.2 Empirical Review

2.2.1 Noise Exposure and NIHL in Manufacturing and Industrial Sectors

NIHL is a serious occupational health hazard in manufacturing and industrial sectors, where prolonged exposure to high noise levels increases the risk of permanent hearing impairment. Despite regulatory restrictions, NIHL prevalence continues to be significant due to poor noise reduction tactics and variable compliance with hearing conservation initiatives. A study on Malaysian industrial workers indicated that 49.7% of employees suffered from NIHL, showing the significant impact of extended noise exposure (Mustafa et al., 2023). Similarly, a study conducted in palm oil mills revealed that 42.7% of workers experienced hearing damage due to excessive working noise (Hassan et al., 2022).

Large-scale research from the United States NIOSH found that 18% of manufacturing workers struggle with hearing issues, a higher prevalence than in other sectors (Masterson et al., 2021). Comparative studies found that high-risk industries such as mining and oil extraction report 23% of workers with hearing impairments, further stressing the occupational dangers linked with excessive noise exposure (Themann et al., 2021). These findings highlight that NIHL is not limited to a specific region but is a global occupational health concern, especially in sectors with constant exposure to high-decibel environments.

Furthermore, in 2022, DOSH Malaysia estimated that NIHL accounted for 69% of all reported occupational health cases in Malaysia in 2021, underlining the critical need for stronger noise control policies. The data repeatedly reveal that NIHL remains a dominating occupational disease in industrial sectors, notably in manufacturing and high-risk situations where noise levels are inadequately managed. Despite the existence of regulatory frameworks, loopholes in enforcement and worker compliance hamper the effectiveness of hearing conservation programs. Strengthening noise control strategies, enhancing training on hearing protection, and ensuring consistent regulatory enforcement are critical steps in decreasing the long-term burden of occupational hearing loss. The findings capture the extent and prevalence of NIHL quantified

through statistical analysis, but do not capture the personal and organizational context behind the figures. This gap is qualitatively addressed through this study.

2.2.2 Noise Exposure Levels and NIHL Correlation

Empirical investigations consistently reveal a robust dose-response association between noise exposure levels and the occurrence of NIHL. Higher noise intensity and prolonged exposure duration considerably enhance the chance of lasting hearing damage, necessitating better control measures in industrial situations. Zhang et al. (2020) reported that workers exposed to noise levels above 85 dB(A) had a significantly greater risk of hearing damage, with exposure length magnifying the severity. A systematic analysis of industrial workers in China showed an average workplace noise level of 98.6 dB(A), resulting in a 21.3% NIHL prevalence (Zhang et al., 2020).

Moreover, for every 10 dB(A) increase in noise exposure, the probability of developing NIHL climbed by about 5.63 times, showing the cumulative impact of noise exposure over time (Zhang et al., 2020). Hassan et al. (2022) discovered that Malaysian production sites surpassing 85 dB(A) revealed NIHL prevalence in 73% of workers, confirming the need for tougher exposure limits. Basner et al. (2023) observed that impulse noise exposure, such as sudden loud bursts from industrial equipment and induced more severe high-frequency hearing loss than continuous noise exposure of the same intensity. These findings demonstrate that both the intensity and the nature of noise exposure influence the severity of NIHL.

Mustafa et al. (2023) noted that noise environments with high kurtosis (i.e., unpredictable noise fluctuations) were linked to more severe NIHL outcomes, indicating that real-time noise monitoring and adaptive hearing protection programs should be implemented. The data collectively show that noise exposure levels and patterns play a critical role in NIHL risk, with both protracted and impulsive noise exposure contributing to irreversible hearing loss. Standard noise restrictions alone may not be sufficient to safeguard workers, as unpredictable noise fluctuations can worsen hearing harm. To decrease NIHL risk effectively, enterprises must use dynamic noise monitoring, stronger exposure control measures, and adaptive hearing protection strategies tailored to variable noise situations. While a number of these studies quantify

the dose-response relationship, only a few examine how the employees evaluate noise risk, the risk duration, and the severity of exposure. This shows a need for qualitative research.

2.2.3 Key Risk Factors for Occupational NIHL

NIHL is influenced not only by noise level but also by various occupational and personal risk factors. While noise exposure remains the primary cause, characteristics such as employment type, exposure length, age, gender, and behavioral habits significantly influence NIHL risk. Studies reveal that individuals in high-noise job roles, such as metal production and assembly, face a 4.2 times higher risk of NIHL compared to those in administrative positions (Mustafa et al., 2023). However, some research indicates that total exposure duration may be an even stronger predictor, as even workers in moderately noisy environments can develop hearing loss over time (Hassan et al., 2022).

A systematic study revealed that workers exposed to occupational noise for more than 10 years had a 75% greater likelihood of developing NIHL compared to those with shorter exposure periods (Zhang et al., 2020). Age is another significant factor, as older employees often exhibit higher NIHL prevalence due to accumulated exposure and diminished auditory resilience (Masterson et al., 2021). Additionally, male workers are found to be at greater risk than females, possibly due to the predominance of men in high-noise industries and roles (Zhang et al., 2020). These demographic trends reinforce the need to tailor prevention strategies according to job function, tenure, and workforce composition.

While noise exposure is the primary predictor in NIHL, findings also highlight the critical role of behavioral and lifestyle factors. Non-compliance with PHP usage, exposure to ototoxic chemicals, and other workplace conditions further increase the risk. These factors collectively complicate prevention efforts, as they require a combination of engineering, administrative, and behavioral interventions. A comprehensive NIHL prevention strategy should incorporate effective workplace noise control, robust hearing conservation programs, and targeted educational efforts to promote protective behaviors and reduce the long-term burden of occupational hearing

loss. These findings indicate that NIHL is influenced not merely by the exposure itself, but also by the cognitive aspects regarding how the workers apprehend, interpret, and react towards the threats posed by noise. It reaffirms the importance of examining these aspects qualitatively.

2.2.4 Worker Perceptions and Experience of NIHL

Perceptions among workers of noise hazards and hearing protection significantly influence the adoption of protective behaviours. Nonetheless, erroneous assessments of noise exposure and diverse personal and social impediments sometimes lead to irregular utilisation of hearing protection devices. Nearly one-third of miners underreported their exposure to hazardous noise, according to Shkembi et al. (2023), who also found that such misperceptions greatly raised the probability of not utilising earplugs during work shifts. In the same way, Naicker (2024) discovered that although 95% of coal mine workers recognised the need for hearing protection in preventing hearing loss, lower education levels were connected to greater susceptibility to NIHL, implying that knowledge by itself does not ensure behavioural compliance.

Furthermore, though high noise exposure levels seemed to diminish these impacts, Chong et al. (2022) found in a qualitative analysis that personal noise sensitivity and a favourable safety climate affected protective actions among Chinese construction workers. Lee et al. (2023) underlined further that many studies on workplace noise continue to be focused only on auditory results, therefore ignoring more general lived experiences, including stress, emotional pain, and cardiovascular effects. Naicker (2024) also pointed out that although people had good views on hearing protection, actual use was constrained by discomfort, lack of understanding, and inadequate enforcement, hence highlighting a discrepancy between knowledge and practice in high-risk work settings.

Overall, the examined research regularly demonstrates that although awareness of hearing risks may be present, perceptual gaps, social dynamics, and environmental factors do not always translate into persistent preventive activity. Many current research emphasises quantitative hearing loss while neglecting workers' personal experiences and decision-making processes. This underlines the significance of qualitative methods

such as the present one in capturing the deeper cultural and behavioural aspects of NIHL prevention.

2.2.5 Effectiveness and Limitations of Hearing Conservation Program

When correctly carried out, HCPs are essential in lowering the risk of occupational noise-induced hearing loss. Although organisational and behavioural issues frequently restrict programme success, key elements, including training, monitoring, and enforcement define their general efficacy. Short-term noise exposure reduction is positively impacted by educational interventions, including appropriate earplug insertion training (Tikka et al., 2020). Successful HCPs have also been shown to include audiometric monitoring, which allows continuous assessment of programme efficacy and early identification of hearing loss (V & Kumaraswamy, 2023).

Moreover, a 4.5 dB(A) drop in occupational noise exposure was linked to the application of more rigorous laws and enforcement, implying that HCP results are much improved by regulatory support (Tikka et al., 2020). However, Weinstein and Cheddie (2021) reported that many programmes fail due to minimal support from senior management, leading to poor prioritisation and limited allocation of resources. Efforts such as the Bisinglah BEB! campaign have been created in Malaysia to raise awareness in moderate-noise sectors by informing employees on the consequences of noise and promoting behavioural change (Ishak et al., 2021).

In addition, West (2022) also discovered that adding statistical fit-testing and training raised the proportion of employees obtaining efficient hearing protection; personal attenuation rates rose from 71% to 91% after intervention. The examined research indicates that HCPs are most successful when constant application of thorough policies, including instruction, testing, and enforcement, is observed. Strong management support and employee involvement, however, may impair programme efficacy. Especially in moderate-noise sectors like electronics manufacturing, our results highlight the need for customising HCP deployment to both organisational culture and worker behaviour.

2.2.6 Regulatory Framework and Policy Gaps

Regulatory frameworks play a crucial role in establishing permissible exposure limits and guiding the implementation of hearing conservation programs. Nonetheless, overall efficacy is hampered by shortcomings in enforcement, workplace compliance, and communication of regulations. In line with ISO 1999:2013, which acts as a worldwide reference for calculating NIHL risk and guiding HCP solutions, Miočinović (2025) said NIOSH advises an occupational noise exposure limit of 85 dBA for an 8-hour shift and an action level set at 80 dBA. Park et al. (2020), on the other hand, discovered that the manufacturing industry's most often reported OSHA violation was connected to standard 1910.95, especially with regard to the lack of engineering or administrative noise controls and HCP maintenance.

Furthermore, Floyd (2023) underlined that in many sectors, including electronics, the prevailing compliance-based culture often leads to minimalist efforts that satisfy merely regulatory standards, without considering holistic noise management techniques. Moreover, Bramati et al. (2022) showed that educational initiatives such as Dangerous Decibels® Brazil have raised workers understanding of noise risks and protection rights, implying the necessity of comparable awareness campaigns in industrial sectors. Though there are policies and standards in place, inadequate enforcement and communication continue to be major obstacles to efficient hearing loss prevention.

Overall, these results show that if workplace practices differ from robust standards, having them by themselves is inadequate. Especially in moderate-noise industries, compliance without genuine involvement offers only limited protection for employees. Therefore, regulatory enforcement and worker education have to be strengthened urgently so that both companies and workers not only follow but also grasp and appreciate the regulations.

2.2.7 Psychosocial and Occupational Impacts of NIHL

Besides affecting auditory health, NIHL causes major occupational and psychological effects. NIHL is a major issue in workplace health management since its effects include job performance, mental health, safety awareness, and more general health concerns. Abbasi et al. (2024) observed a negative association between NIHL and personal job

performance (coefficient of -0.575) and work-related quality of life, suggesting that hearing loss causes decreased job satisfaction and output. NIHL, according to Santos and Andrade (2024), creates significant communication problems, particularly in loud settings, which can lead to misunderstandings and poor collaboration.

Furthermore, the same study underlined that employees with NIHL are more likely to suffer workplace mishaps because of their compromised capacity to notice alarms and warning signs, hence generating major safety issues. Psychologically, Manohar et al. (2022) showed that NIHL can cause chronic stress by disturbing auditory input to the brain, especially the hippocampus, thereby extending stress reactions. Jayakody et al. (2022) also discovered a close link between hearing loss and sadness, pointing out that untreated hearing loss's emotional loneliness greatly raises the likelihood of mental health problems.

Moreover, Eichwald et al. (2022) underlined the importance of treating NIHL as a multifaceted occupational risk since extended noise exposure causes sleep difficulties, hypertension, and heart issues. These results show that NIHL's effects extend far beyond hearing loss; they also influence mental health, social interaction, occupational safety, and physical well-being. This underlines the need to put proactive hearing conservation measures into effect, particularly in sectors with moderate and persistent noise exposure. Occupational health strategies can be more thorough, durable, and worker-centered by tackling both the physical and emotional consequences of NIHL.

2.2.8 Methodological Gaps in NIHL Research

Hearing thresholds are often measured and hearing loss found using audiometric testing. It might not always show latent hearing loss, though, which calls for more sensitive testing (Dhrruvakumar et al., 2021). This emphasises a drawback in utilising conventional audiometry by itself to detect modest or early-stage hearing impairment. Cross-sectional designs are used in several studies, including those among industrial workers in South Punjab, Pakistan, and the automobile manufacturing sectors in China, to evaluate the frequency and risk variables of NIHL. To determine the degree of hearing loss and associated occupational factors, these investigations collect data on hearing thresholds and noise exposure histories (Sheikh et al., 2020; Ruan et al., 2024).

Such designs, meanwhile, miss worker impressions or long-term hearing loss. Over 20 years, this Norwegian large-scale longitudinal study followed hearing loss among several occupational categories. Workers in building frame and associated trades had a greater hearing loss than clerks, implying that occupational noise exposure was a key influence. The variations, however small, suggested possible progress in preventive actions throughout the last two decades (Qodiraliyeva, 2022). Longitudinal designs still get misused in NIHL studies, hence reducing knowledge of long-term exposure impacts.

To evaluate the likelihood of hearing loss and perceptions of noise exposure among Florida firemen, the study used a mixed-methods approach comprising audiometric testing and surveys. Nearly 30% of firefighters had mild to severe hearing loss, according to this study; many were ignorant of the hazards linked with occupational noise exposure (Millet et al., 2023). Though they help to highlight knowledge and behavioural gaps, such integrated strategies are still uncommon in NIHL research. Similarly, a qualitative study performed at Sultan Thaha Airport in Jambi, Indonesia, investigated the hearing damage marshallers suffered from noise exposure. Using a descriptive qualitative method, the study evaluated workers' hearing situations and found that two out of three marshallers had hearing loss: one with bilateral hearing impairment and the other with unilateral hearing loss.

Consistent use of PPE was stressed in the study to avoid hearing injury (Putri et al., 2021). Still, in occupational NIHL research, such qualitative investigations are few. A cross-sectional descriptive approach combining quantitative data with qualitative insights from questionnaires and physical examinations was used in a study of PT Chitose Cimahi furniture factory employees in Indonesia. Workers in the study showed a high incidence of NIHL with notable auditory symptoms including tinnitus and non-auditory complaints including sleep problems. The mixed-method approach gave a thorough picture of the workers' experiences and the elements causing NIHL (Nurrokhmawati et al., 2022).

This emphasises the need to integrate clinical evaluations with worker viewpoints to gain a more holistic understanding of NIHL. Many current NIHL research use cross-

sectional methods and conventional audiometric testing, which hinders knowledge of long-term consequences and worker experiences. Though they are useful for capturing behavioural and environmental elements, qualitative and mixed-method techniques are still underused. Studies integrating OHD-verified audiometric data with workers' viewpoints are also lacking. This paper uses a triangulated method combining both objective audiometric data and semi-structured interviews to fill in these gaps. By connecting clinical results with the lived experiences of electronics manufacturing workers, this design offers a more complete picture of NIHL.

2.3 Conceptual Framework

2.3.1 Key Concept – Perceived Impact of Job Role on NIHL

The specific job role or department of a worker significantly influences their perceived noise exposure and their experience NIHL. Workers in high-noise job roles are perceived to have greater exposure and may report a higher risk or awareness of developing NIHL compared to those in quieter environments. In manufacturing settings, noise exposure varies by task; accordingly, workers in the loudest roles have higher rates of NIHL than those in quieter positions (Chen et al., 2022). Empirical data support this variance: in one study, employees working in a polishing department (a high-noise task) had over four times the odds of NIHL compared to those in other departments (Samsuddin et al., 2021).

Furthermore, job role dictates both the intensity and duration of noise a worker faces—a person stationed all day in a high-noise area (e.g., metal stamping) has a greater cumulative exposure than someone in a low-noise assembly job. Industrial workers, oil refinery workers, and airport employees are among those at higher risk due to their occupational environments (Aliyeva & Sarı, 2024; Nasri, 2022). A study on Iranian industrial workers found that NIHL negatively impacts job performance, correlating with a significant decline in work-related quality of life and an increase in aggression, highlighting the broader consequences beyond hearing loss (Abbasi et al., 2024).

Identifying high-risk roles allows for targeted interventions, such as implementing additional noise controls or mandatory hearing protection for workers in high-exposure tasks. This aligns with the conceptual framework, as job role is a key determinant of an individual’s noise exposure level and NIHL risk. By prioritizing noise control and tailored

hearing conservation programs, organizations can reduce the prevalence of NIHL and mitigate its negative impacts on both health and job performance. This study qualitatively explores how workers in different job roles perceive their exposure and risk, providing contextual understanding that complements existing quantitative evidence.

2.3.2 Key Concept – Perceived Impact of Tenure on NIHL

The duration of work in noisy environments is perceived by workers as influencing their vulnerability to hearing loss. Participants often associate longer tenure with cumulative noise exposure and potential auditory damage, although other modifying factors may influence this perception. Studies show that NIHL prevalence rises with increasing years of exposure, with the majority of damage occurring within the first 10 years of high-noise work (Chen et al., 2022). Each additional year of exposure has been linked to approximately a 7% increase in the odds of developing hearing loss (Chen et al., 2022).

However, findings from specific industries present mixed results; for instance, a study at PT. Kayu Perkasa Raya found no significant relationship between work tenure and NIHL, with 33.3% of workers with ≥5 years of service experiencing NIHL compared to 11.1% with <5 years (Sari et al., 2024). Similarly, research on airport employees revealed no significant correlation between length of service and NIHL, despite the majority having over 5 years of experience (Ali et al., 2024). These findings suggest that while tenure influences NIHL risk, factors such as noise intensity, protective measures, and individual susceptibility may modify the relationship.

The relationship between tenure and NIHL varies across occupational settings, demonstrating that while cumulative exposure increases risk, it is not the sole determinant. Factors such as noise intensity, job role, and compliance with hearing protection programs influence how tenure translates into NIHL risk. Therefore, tenure remains a relevant concept in NIHL studies, as it helps to understand cumulative exposure while considering modifying influences. Through interviews, this study explores how tenure influences workers' perceptions of vulnerability and risk, extending existing findings that are mostly quantitative.

2.3.3 Key Concept – Perception of Noise Exposure Severity

The prevalence and severity of NIHL is a significant public health concerns, particularly among specific occupational groups and demographics. Various studies indicate that NIHL affects a substantial portion of individuals exposed to high noise levels, with prevalence rates varying widely based on occupation and environmental factors. A study found that 33% of medical students using PLDs experienced hearing loss, with a notable correlation between PLD usage duration and hearing impairment (Gajendran et al., 2024). In Bangladesh, 41.6% of industrial workers exhibited hearing loss, with 62.4% of these cases being bilateral (Rahman et al., 2023). Similarly, sawmill workers in Ghana showed a prevalence of 37.5% in the right ear and 43.3% in the left ear (Yawson et al., 2024).

In Malaysia, NIHL prevalence varied from 5.0% to 82.6% across different industries, highlighting the widespread nature of the issue (Razak & Aris, 2024). Regarding severity levels, among industrial workers, 52.9% had mild hearing loss, while 3.8% experienced profound hearing loss (Rahman et al., 2023). In the sawmill study, 57.5% of workers self-reported hearing loss, indicating a significant awareness gap (Yawson et al., 2024). These statistics collectively demonstrate that NIHL remains pervasive across occupations and regions, emphasizing the need for effective hearing conservation measures.

Age and exposure also play a critical role in determining NIHL prevalence. Older workers (over 35 years) showed a higher incidence of NIHL, with severity increasing with prolonged exposure to high noise levels (Saha et al., 2023). Despite the alarming prevalence and severity of NIHL, there is a growing recognition of the need for preventive measures, including education on safe listening practices and the implementation of occupational safety regulations. However, some argue that the focus on prevention may overlook the need for better treatment options for those already affected by NIHL. Addressing both prevention and treatment strategies is critical for mitigating the long-term burden of NIHL in occupational settings. This study complements prior quantitative findings by qualitatively examining how electronics workers perceive and respond to noise exposure severity.

2.4 Theoretical Framework

2.4.1 Job-Demand Control Model

The JDC model, introduced by Karasek, posits that workplace stress results from the interaction between job demands and job control. High psychological demands combined with low decision latitude (control) create “job strain,” a state linked to poor well-being, burnout, and health problems. In occupational settings, the JDC model helps explain how noise acts as a stressor combined with job design factors. Chronic noise exposure is a significant physical demand that elevates workers' stress levels, as seen in a 2020 study in textile manufacturing, which found a direct correlation between noise exposure and increased job stress (Granberg et al., 2024).

If workers have little control over their noisy environment, stress outcomes are exacerbated, leading to burnout and sick leave (Kim et al., 2021). Bouillon-Minois et al. (2023) reported that jobs characterized by high workload and low control resulted in increased stress, reinforcing JDC’s applicability in industrial settings. In particular, the inability to control exposure (e.g., machinery volume, shift rotation) aligns with the low control-high demand quadrant of the JDC model, heightening psychological distress (Abbasi et al., 2020).

Conversely, increasing job control, such as providing hearing protection training or worker participation in noise control measures, can reduce stress and improve workplace well-being (Bouillon-Minois et al., 2023). The JDC model provides a useful framework for understanding how noise-related stress interacts with job autonomy and control. Studies consistently show that jobs with noise exposure and low autonomy result in increased stress, burnout, and sick leave, making noise reduction and worker involvement in safety decisions crucial (Granberg et al., 2024; Kim et al., 2021). This perspective justifies further qualitative inquiry regarding how employees cope with and perceive the behavioral challenges associated with working in high-noise conditions. Such inquiry is crucial in understanding the occupational and contextual factors that drive deviation from expected safe behaviors in relation to NIHL risk.

2.4.2 NIHL Risk Model

The NIHL Risk Model describes the relationship between occupational noise exposure and hearing loss, focusing on dose-response effects and modifying risk factors. This model accounts for noise level, exposure duration, and individual susceptibility, providing a structured approach to assessing and preventing NIHL in workplace settings. Heinonen-Guzejev et al. (2023) highlighted that noise exposure is the dominant risk factor for NIHL, with prolonged exposure leading to significant hearing impairment, even in younger workers. Zhou et al. (2020) found that co-exposure to ototoxic chemicals such as organic solvents and welding fumes significantly amplified NIHL risk among industrial workers.

Stankovic et al. (2023) emphasized the importance of noise control measures, stating that NIHL accounts for approximately 16% of global adult hearing loss and is largely preventable with effective interventions. Sun (2021) reiterated that NIHL remains a major occupational health issue, calling for stricter implementation of noise exposure regulations and comprehensive hearing conservation programs. A study conducted at an international airport by MDPI (2022) confirmed that NIHL prevalence strongly correlates with noise intensity and duration, reinforcing the need for exposure limits and proactive workplace monitoring.

The NIHL Risk Model effectively demonstrates how workplace noise exposure interacts with additional risk factors such as age, genetic predisposition, and chemical co-exposures, compounding the risk of hearing impairment. The literature underscores that while NIHL is preventable, inconsistent use of PHP and inadequate regulatory enforcement continue to contribute to high prevalence rates. To mitigate NIHL risks in electronics manufacturing, comprehensive noise management strategies, including exposure monitoring, engineering controls, and worker education, are crucial for long-term hearing conservation.

2.4.3 Occupational Stress Model

The OSM explains how work-related factors, including noise exposure, contribute to stress and affect employee health. It considers stressors such as workload, noise, role conflict, and interpersonal issues, and how these impact mental and physical well-

being. Noise exposure serves as a physical stressor that triggers physiological and psychological strain, including increased heart rate, blood pressure, and stress hormone release (Miyanda et al., 2024). Chronic noise annoyance has been linked to elevated risks of depression and anxiety, demonstrating how noise exposure contributes to long-term stress (Gong et al., 2022).

Heinonen-Guzejev et al. (2023) found that noise-sensitive workers are more prone to occupational stress, as their heightened perception of noise stressors exacerbates psychological strain. Monazzam et al. (2022) revealed that industrial workers exposed to high noise levels experience significant declines in work capacity, reinforcing that noise exposure impacts both mental and occupational performance. Abbasi et al. (2020) identified that workers with low hearing protection compliance experience higher stress levels due to a perceived lack of control over their noise environment.

The studies indicate that occupational noise exposure is not only a physical hazard but also a significant contributor to workplace stress, reinforcing the relevance of the Occupational Stress Model in understanding the psychosocial impact of noise. Addressing both noise exposure and stress-related factors in workplace interventions is essential for enhancing worker well-being, as mitigating noise-induced stress can improve compliance with hearing protection measures and reduce job-related burnout. Therefore, integrating stress management strategies alongside noise control efforts can create a healthier and more productive work environment, reducing both NIHL and occupational stress.

2.5 Summary of Chapter

This chapter explored both theorical and empirical research regarding NIHL, found within manufacturing and industrial settings. It analyzed the interplay between noise exposure and the severity of hearing loss, determining job role and tenure. This examined both occupational and behavioral interactions. The psychological pressure of noise exposure and the physical consequences were examined and explained through The JDC Model, NIHL Risk Model, and the OSM. NIHL continued despite HCPs and regulations built around PHPs, due to weak enforcement, low awareness, and inconsistent use. The review identified gaps within the methodology, particularly the

limited qualitative and longitudinal research, and developed the conceptual framework that this qualitative study would build around, focusing on the role, tenure, and perceived exposure within electronics manufacturing.

CHAPTER THREE
RESEARCH METHODOLOGY

3.1 Introduction

This chapter explained the methodological strategy adopted to evaluate the prevalence and occupational risk variables linked with NIHL among electronics manufacturing workers in Beranang, Selangor. The study utilized a qualitative research strategy to analyze participants' perspectives and experiences about NIHL risk factors. Prevalence (RO1) was established descriptively from OHD-verified audiometric records to identify confirmed NIHL cases, while interviews qualitatively explored the occupational risk factors (RO2). The research methodology was selected to offer a greater understanding of how employment position, tenure, and noise exposure levels contribute to NIHL. This technique was particularly effective for addressing complicated occupational health issues that incorporate both environmental and personal effects. Data were acquired through semi-structured interviews with workers diagnosed with NIHL, as validated by OHD. The merging of confirmed audiometric test findings and worker testimonies allowed a more comprehensive assessment of the research problem.

In addition to interviews, secondary data from audiometric screening were employed to identify eligible individuals and establish credibility in the selection process. The methodology section explained the research concept, study population, sampling strategy, data gathering tools, and data analysis procedures. Ethical considerations were also reviewed to ensure that the study followed research integrity standards and safeguarded participant anonymity. By merging multiple data sources and keeping transparency in operations, the study attempted to create credible and useful insights. This chapter served as the foundation for understanding how data were acquired, analyzed, and interpreted to answer the study questions. Ultimately, it guaranteed that the findings represented the realities of NIHL risk in the electronics production environment.

3.2 Research Design

3.2.1 Types of Research

This study adopted a qualitative research design, focusing on researching workers' experiences and perceptions of NIHL. The qualitative technique allowed for an in-depth knowledge of the issues experienced by affected workers through semi-structured interviews. The research did not rely on numerical data analysis but instead gathered descriptive insights from workers diagnosed with NIHL. Audiometric data were used solely to identify and describe verified NIHL cases (context for RO1) and to purposefully select interview participants; no inferential statistics were performed. Instead, the principal data collection consisted of interviews, allowing participants to share their ideas on workplace noise exposure, safety practices, and coping mechanisms. By using a qualitative strategy, this study presented a full grasp of how NIHL influences workers beyond quantitative hearing thresholds, focusing on their lived experiences.

3.2.2 Types of Research Design

This study adopted a qualitative, cross-sectional, descriptive design. OHD-verified audiometric records were used to identify and describe NIHL cases within the site (addressing RO1 at a descriptive level), after which semi-structured interviews explored workers' experiences and perceptions of occupational risk factors (addressing RO2). The design did not test cause–effect; rather, it documented real-world perceptions and contexts of confirmed NIHL cases. Through structured interviews, participants gave firsthand perspectives concerning their occupational noise exposure, protection methods, and work environment. This technique provided a complete exploration of NIHL prevalence and important workplace variables, providing significant information for future interventions for workers' hearing loss and their perceptions of workplace noise exposure.

3.2.3 Justification of Research Design

This study was conducted at an electronics manufacturing facility where workers are subjected to occupational noise levels above 85 dB(A). The research setting involves both audiometric test data from a qualified OHD and on-site interviews with impacted

personnel. The chosen setting is noteworthy because the company operates in a high-noise industrial environment, making it an appropriate setting to identify OHD-verified NIHL cases for descriptive context (RO1) and to explore risk factors qualitatively (RO2). Employees undergo mandatory audiometric testing as per the Occupational Safety and Health (Noise Exposure) Regulations 2019, giving access to verified NIHL cases. The study setting delivers direct insights into workers' noise exposure scenarios, workplace noise control approaches, and hearing protection habits. By conducting interviews on-site, the research ensures a real-world perspective on NIHL experiences, highlighting the issues workers confront in their routine responsibilities.

3.3 Population and Sampling Design

3.3.1 Define Target Population

The study focused on workers in a specific electronic manufacturing industry located in Beranang, Selangor, who were exposed to noise levels of 85 dBA and above, as specified in the Noise Risk Assessment Report. These personnel were at risk of developing NIHL due to extended exposure to hazardous noise levels. To be included in the study, participants had to be diagnosed with NIHL, as confirmed through audiometric data collected during occupational health examinations. This guaranteed that only those who had experienced detectable hearing loss due to occupational noise exposure were selected. However, workers with pre-existing hearing problems that were unrelated to occupational noise exposure were excluded. This included individuals with inherited hearing abnormalities, age-related hearing loss, or hearing impairments induced by medical conditions or accidents unrelated to workplace noise, in order to minimise confounding and ensure accurate estimation of NIHL prevalence.

3.3.2 Population Size

The site employed about 500 workers. The NRA records indicated that 12 of these workers were exposed to noise levels ≥85 dB(A). These 12 workers performed a range of tasks in identified high-noise areas as specified in the NRA. While many employees experienced some level of noise exposure, only a subset met the diagnostic criteria for NIHL. OHD review of audiometric records identified five workers who met the inclusion criteria for NIHL attributable to occupational noise. These workers had OHD-

verified audiometric diagnoses of NIHL with no pre-existing non-occupational hearing conditions. All five eligible workers were invited to participate, but only four consented and were interviewed. Information power and saturation were achieved by the fourth interview (Hennink et al., 2022). The small interview sample reflected the limited number of OHD-verified NIHL cases in a regulated workforce and underscored the need for early intervention and prevention in noise-exposed settings.

3.3.3 Sampling Frame

Participants were selected based on audiometric screening results conducted by a recognized centre licensed by DOSH Malaysia. The screening results were reviewed by an OHD to confirm NIHL cases. Only people who met the clinical criteria for NIHL diagnosis based on audiometric testing were included in the study. The participants were sourced from the NRA records, which were maintained in line with the Occupational Safety and Health (Noise Exposure) Regulations 2019. This regulation required that all employees exposed to noise levels of 85 dB(A) and above undertook periodic audiometric testing. By applying these legally mandated tests, the study assured that only workers with documented noise exposure and proven NIHL were selected for participation.

3.3.4 Sampling Technique

This study used non-probability purposive sampling to select participants. Purposive sampling was appropriate because the study targeted workers diagnosed with NIHL based on OHD-verified audiometric results. This strategy ensured that only individuals meeting the inclusion criteria were selected, keeping the sample directly relevant to workplace NIHL cases. From the exposed cohort (≥85 dB(A), n=12), five (n=5) workers were OHD-verified as NIHL cases and formed the eligible pool for interviews. All five were invited; four (n = 4) consented and were interviewed based on willingness and availability. This sample was suitable for a qualitative interview study exploring workers' experiences, perceptions, and occupational factors related to NIHL.

3.3.5 Justification of Population Design

This population was highly relevant to the study as it comprised workers diagnosed with NIHL in an electronics manufacturing context, where occupational noise exposure was a recognised workplace hazard (Muzakir & Lorenzo, 2025). By focusing on individuals who had already developed NIHL, the study assured that the analysis was directly applicable to real-world job situations where noise risk was prevalent. Selecting individuals from high-noise exposure employment (≥85 dBA) enabled an in-depth examination of the occupational aspects contributing to NIHL. This group helped answer the research issue by providing direct insights into the work conditions, occupational functions, and noise exposure levels linked with NIHL development. Since these individuals had firsthand experience with workplace noise and hearing loss, their viewpoints shed light on the unique risk factors, safety practices, and problems in hearing conservation efforts. Additionally, examining individual experiences assisted in creating targeted interventions to minimize NIHL prevalence in similar work situations.

3.4 Data Collection Method

3.4.1 Data Sources

The core data for this study were acquired through semi-structured interviews with workers who had been diagnosed with NIHL. These interviews focused on workers' opinions of risk factors, workplace noise exposure levels, and the effectiveness of preventive measures. The qualitative data acquired provided in-depth insights into workers' perspectives, contributing to a better understanding of NIHL risk factors. The secondary data were gathered from audiometric records checked by an OHD, ensuring that only confirmed NIHL patients were included in the study. Additionally, noise risk assessment reports were analyzed to identify the levels of noise exposure inside the workplace. These secondary data sources addressed RO1 descriptively (identification/description of NIHL cases) and provided contextual support for RO2, guiding participant selection and interpretation of interview findings.

3.4.2 Data Collection Technique

This study utilized semi-structured interviews to evaluate workers' opinions of risk factors contributing to NIHL. This technique allowed for flexibility, enabling participants to comment on their experiences while ensuring crucial subjects were consistently covered. The interviews were conducted in person at a private location within the workplace to ensure confidentiality and minimize external distractions. Each session was audio-recorded with participants' consent to facilitate accurate data transcription and analysis. The interview questions focused on workers' perceptions of occupational risk factors, including noise exposure levels, use of hearing protection, and workplace safety culture. Additional questions explored workers' awareness of NIHL prevention strategies and their perceived barriers to effective hearing conservation.

Semi-structured interviews were employed to explore how employees perceive, experience, and identify occupational risk factors associated with NIHL. The interviews were conducted face-to-face in a private room on site, recorded in audio format (with permission), and held in Bahasa Malaysia to aid comfort and expression. The researcher performed the transcription and translation into English for analysis while retaining the tone, intent, and meaning; checks for Bahasa Malaysia–English equivalence were completed prior to coding. On average, each interview was 30–45 minutes long. The interview guide addressed patterns of exposure to noise, the interviewee's job role and tasks, tenure, use of PHPs, training and awareness, organizational culture on safety, impacts of hearing loss, and suggestions for prevention.

3.4.3 Sampling and Participant Selection

The study focused on workers diagnosed with NIHL in an electronics manufacturing environment. Participants were selected based on audiometric test results verified by an OHD, ensuring that only cases attributable to occupational noise exposure were included. The target group comprised personnel working in high-noise locations (≥85 dBA) who had undertaken mandatory audiometric testing as per the Occupational Safety and Health (Noise Exposure) Regulations 2019. Participants were recruited by the company's SHO, who assisted in identifying eligible personnel and facilitating the invitation process. The researcher presented an information sheet explaining the study's

aims, confidentiality measures, and voluntary participation conditions before gaining informed consent. Workers were offered the option to participate during working hours in a private setting to guarantee comfort and openness in responses. In total, five OHD-verified NIHL cases were identified; four consented and were interviewed.

3.4.4 Ethical Consideration

Before participation, all personnel received a thorough description of the study's aims, procedures, and potential dangers. Participants were required to sign an informed consent form, guaranteeing that their involvement was voluntary and that they could withdraw at any moment without consequences. The study also underlined that participation would not affect their employment status or workplace benefits. All collected data were kept confidential, and no personally identifiable information was disclosed. Interview responses were anonymised and tagged, guaranteeing that individual participants could not be traced back to their answers. Audio recordings and transcripts were retained securely, accessible only to the researcher, and were permanently erased after data processing was completed.

3.4.5 Interview Protocol

A qualitative study data collection method was guided by a designed interview protocol. This technique guaranteed uniformity throughout all interviews, kept attention on the study goals, and improved the general credibility and openness of the qualitative method. The seven theme domains included noise exposure perception, job role and task exposure, tenure and work duration, use of hearing protection, awareness of hearing risks, perception of hearing loss, and prevention recommendations. Every interview domain was directly linked to the study’s aims, with RO2 (risk factors, behaviours, exposure conditions) addressed through interviews. RO1 (prevalence) was addressed descriptively via OHD-verified audiometric records, not through interviews.

To guarantee analytical alignment, each interview domain and the questions that went with it were also mapped to particular research questions. RQ1 involved questions about the impacts of NIHL, whereas RQ2 concerned questions about risk factors, protective behaviours, and exposure conditions. Data collection was made purposeful, comprehensive, and based on the study's main focus due to this dual alignment with the

objectives and research questions. Under each domain, probing questions were also added to encourage participants to expand on their answers, offer real-life examples, and provide more in-depth analysis of their personal experiences.

The protocol was pilot-tested with two workers outside of the main study population to guarantee clarity and flow. The table presented below was the full interview protocol with the primary and probing questions linked to the research objectives.

Table 3.1
Primary and Probing Questions

Domain	Main Interview Question	Linked Research Objective	Probing Question
Perception of Hearing Loss	How has hearing loss affected your job or personal life?	RO1	Did you notice symptoms before your audiometry? How did it affect your daily routine?
Noise Exposure Perception	Can you describe the type of noise you are exposed to during your shift?	RO2	When is the noise most noticeable? Does it affect your ability to focus or communicate?
Job Role & Task Exposure	What is your job role and what tasks do you perform during a typical workday?	RO2	Are there parts of your job that expose you to louder noise? How often do you rotate tasks?
Tenure and Work Duration	How long have you been working in this company or in similar noise-exposed roles?	RO2	Has the noise level or your work environment changed over the years?
Use of Hearing Protection	Do you regularly wear hearing protection devices (PHPs)? Why or why not?	RO2	Are there any challenges using them consistently? Do they interfere with your work?
Awareness of Hearing Risk	Were you informed about noise-related hearing risks during your training?	RO2	What kind of training was provided? Did it change how you behave at work?
Suggestions for Prevention	What changes do you think could help reduce the risk of	RO2	What could the company do better? What would motivate you or others to use

	hearing loss at your workplace?		PPE more consistently?

Prior to the commencement of primary data collection, the interview protocol underwent pilot testing. Two workers from the same organization, who met the eligibility criteria but were ultimately excluded from the final sample, were recruited for this pilot exercise. This ensured that clarity of language, flow, and sequence of the questions, overall interview duration, and potential for the questions to trigger substantial answers were gauged. Evidence from the pilot exercise demonstrated that the interview guide was suitable, thus requiring no modifications. This exercise also aided the researcher in the refinement of questions, in terms of delivery, pace, and overall timing, which subsequently enhanced the researcher's confidence for the actual interviews.

3.5 Data Analysis Technique

3.5.1 Thematic Analysis

Thematic analysis was utilized to evaluate interview data by identifying patterns and repeating themes in workers' views of NIHL risk factors. This method allowed for an in-depth examination of how workers comprehended their noise exposure and its influence on hearing health. The analysis began with familiarization, where interview transcripts were reviewed to acquire an early understanding of the data. Next, important phrases and sentences relevant to NIHL risk factors were coded to detect emergent themes. These themes were developed by examining their relevance and coherence throughout several interviews, ensuring that they accurately portrayed the workers' perspectives. Finally, the themes were grouped and evaluated to provide insights into the workers' perceived risk factors, helping to contextualize their understanding of occupational noise exposure. The thematic grouping was determined by comparing codes across all interviews and clustering those that reflected similar ideas, frequency patterns, and relevance to the research objectives.

3.5.2 Qualitative Data Integration

The integration of audiometric report findings with interview data allowed a thorough understanding of NIHL risk factors from both objective and subjective perspectives.

The audiometric results helped corroborate participant selection, while interviews provided insights on workers' assessments of the contributing factors to their hearing loss. Data integration was performed by employing audiometric reports to validate the presence of NIHL, ensuring that interview participants had documented hearing loss before probing their perspectives. This allowed for a targeted qualitative approach where workers' life experiences and views were studied in depth. By connecting audiometric confirmation with interview insights, the study assured that discussions on risk variables were founded on actual NIHL instances, rather than speculation. This qualitative-driven method strengthened the trustworthiness of findings, delivering a complete picture of how workers perceived their exposure and preventative actions.

3.6 Ethical Consideration

3.6.1 Informed Consent

Participants were required to provide informed consent before participating in the study. This assured that participants understood the aim, procedure, and potential hazards involved in their involvement. Before conducting interviews, participants were given a full information sheet detailing the study's aims, procedures, and their right to withdraw at any moment without penalties. The consent form detailed their voluntary participation, emphasizing that their replies would be utilized strictly for research purposes. The form also indicated that no physical, psychological, or professional harm was expected. Participants were required to sign the consent form before data collection began to ensure ethical compliance.

3.6.2 Confidentiality and Anonymity

Confidentiality and anonymity were maintained throughout the research process to protect participants' privacy. Identifiable information was not disclosed in any reports or presentations. To protect confidentiality, participant names and workplace data were not recorded in interview transcripts or research conclusions. Instead, unique identifiers (e.g., "Participant A") were assigned to each respondent. All data, including audio recordings and transcripts, were securely saved on password-protected devices. Only the researcher had access to the data, and it was permanently removed after the study's completion, following ethical data management norms.

3.6.3 Avoiding Harm to Participants

Efforts were made to prevent any type of harm, distress, or discomfort to participants. The study focused on gathering perceptions rather than subjecting participants to physically or emotionally uncomfortable events. Since the research entailed discussing workplace noise exposure, the interview method was organized to prevent generating anxiety or discomfort. Questions were worded impartially and professionally, allowing participants to express their views freely. If any participant felt uneasy throughout the interview, they had the freedom to halt or withdraw. Additionally, information on workplace health resources was supplied if needed.

3.6.4 Data Storage and Retention

Data security and adequate retention procedures were enforced to protect acquired information. All data were handled securely and were disposed of appropriately after the study. Interview recordings and transcripts were saved on encrypted and password-protected devices to prevent unwanted access. Only the researcher had access to this data, ensuring anonymity was maintained throughout the project. Data were maintained for a specific duration in case verification was required, after which they were permanently erased. Proper disposal techniques, such as secure file deletion software, were utilized to ensure no data were recoverable.

3.7 Summary of Chapter

This chapter describes the qualitative and descriptive research design utilized to examine the experiences and perceptions of workers regarding NIHL in electronics manufacturing. Data collection involved audiometric reports and face-to-face, in-depth interviews conducted in Bahasa Malaysia. Workers who had been exposed to noise levels above 85 dB(A) were intentionally selected using the purposive sampling technique. The structured interview framework, which was pilot-tested to ascertain its conciseness, spanned the topics of noise exposure, job role, tenure, hearing protection, awareness, and prevention across seven themes. Thematic analysis was used to identify key patterns which were corroborated with the audiometric data. Ethical standards were maintained by ensuring informed consent, data confidentiality, and secure data storage.

CHAPTER FOUR
RESULTS

4.1 Introduction

The findings from the research conducted on interviews with workers in electronics manufacturing is summarized in this chapter. The analysis addresses the research objectives regarding the extent of NIHL and the factors contributing to it. This involved four participants who were machine operators of different types and lengths of service. Each of the interviews which were in Bahasa Malaysia, were conducted for 30 to 45 minutes. All the interviews were subsequently transcribed and translated to English, as the analysis required it. The analysis was thematic, and the findings are organized according to themes with supporting direct participant quotations.

4.2 Profile of Participant

4.2.1 Demographics & Job Roles

The study comprised four respondents, equally split between males and females. These included two engineers from the Product Engineering (PE) department and two operators, one each from the MFG1 and MFG2 production areas. They were selected to illustrate different positions and varying levels of noise exposure in the manufacturing of electronics. All four respondents also worked a typical shift from 8 a.m. to 6 p.m. The engineers designed and fabricated jigs, while the operators worked on component cutting and wire welding. This mix of participants was selected to gain insights into different workplace experiences associated with NIHL.

4.2.2 Noise Exposure and Safety Practices

Noise from milling machines, saw cutters, fuse clip machines, and air vacuum systems falls within the scope of the participants' occupational exposure. These machines are commonly associated with elevated noise levels due to high-speed mechanical operations, cutting and impact processes, and continuous motor-driven functions typical of industrial manufacturing activities (Beskopylny et al., 2023). Engineers had daily exposure to noise, but not for the whole shift, while operators were exposed to noise for the entire shift on machine operation days. Hearing protection was used by all

participants as engineers used earmuffs and operators used earplugs. Some of the female participants, particularly those wearing headscarves, complained about discomfort caused by earplugs. All participants were exposed to audiometric assessments, received training, and had hazard posters which described noise and increased their awareness, and they were effective in taking precautionary measures. The different experiences provide insights into the extent to which varying job roles and workplace conditions influence NIHL risk in electronics manufacturing. The table below gives additional information about the participants.

4.3 Thematic Findings

This section summarizes the key thematic findings from the interviews conducted with workers in electronics manufacturing. Thematic analysis approach identified key themes. From the analysis, five fundamental themes concerning NIHL in the workplace emerged. These themes are arranged according to the relevance to the research objectives, in particular prevalence and risk factors. An overview of the identified themes, sub-themes, and their relationships to the research objectives is illustrated in Figure 4.1.These themes were created by integrating the multiple perspectives of the participants from the different jobs and various functions. Selected participant quotes have been integrated below each sub-theme to demonstrate findings and support

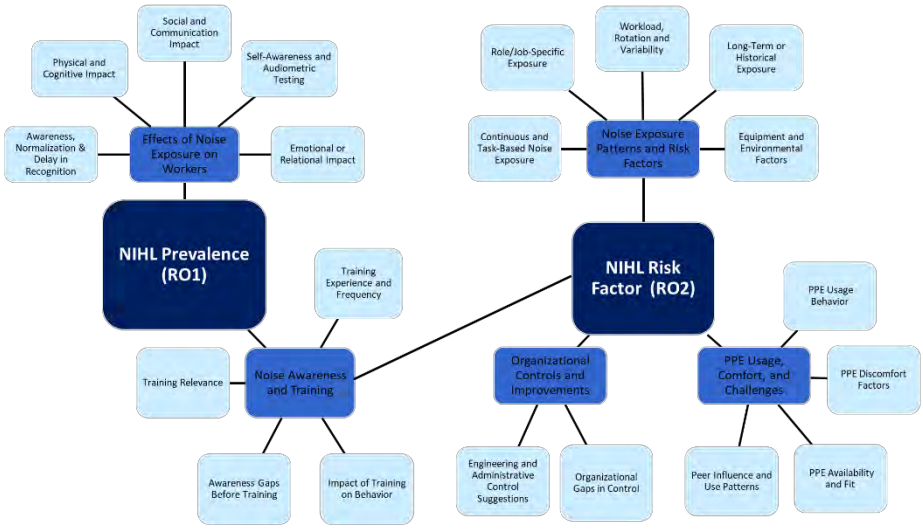

Figure 4.1
Thematic Visualization Network

4.3.1 Major Theme 1: Noise Exposure Patterns and Risk Factors

The first key theme prepared was Noise Exposure Patterns, and Risk Factors, which corresponds with RO2. This theme examines how different job functions and varied work and environmental conditions create different levels of exposure and, in turn, increase the legal risk of hearing loss due to the exposure (Kiryanova et al., 2020; Huang et al., 2023). This theme was decomposed into five sub-themes. These are:

1. Continuous and Task-Based Noise Exposure,
2. Role/Job-Specific Exposure,
3. Workload, Rotation and Variability,
4. Long-Term or Historical Exposure and
5. Equipment and Environmental Factors.

These sub-themes give an overall picture of how the type of work, work program, and machinery used shape the noise exposure level and emphasize the primary key occupational risk factors that are likely to cause noise-induced hearing loss in electronics manufacturing workers.

4.3.1.1 Sub Theme 1: Continuous and Task-Based Noise Exposure

Continuous and task-based noise exposure describes how workers experience uninterrupted noise or noise associated with specific jobs during machinery operation. The intensity and duration of noise depends on machine activity and workload. Respondent A remarked, "*The sound is continuous, unless the machine stops.*" Respondent B observed, "*There are gaps in the noise,* especially during the air release from the welding machine." Respondent C also stated, "The thicker the material, the louder the sound," and "*When cutting many pieces at once, it's extremely loud.*" Respondent D remarked, "*The next loudest is from the milling machine…the noise is constant.*"

These responses also imply that workers are exposed to steady background noise, and task-specific task excesses, especially during material cutting or welding operations. The presence of uninterrupted machinery noise, combined with sharp bursts of sound from pneumatic guns and metal on metal contact, heightens the risk of auditory strain, especially during extended periods of operation. Schutt et al. (2024) focus on the

occupational hearing loss in manufacturing and states, “Continuous and high-intensity intermittent noise” is significant.

4.3.1.2 Sub Theme 1: Role or Job-Specific Exposure

Role or job-specific exposure describes how noise exposure varies depending on one's job responsibilities, such as machine operation and jig development. Respondent A commented, “*In fuse clip, one person does everything, from checking to packing*,” whereas Respondent B illustrated, “*I do screwing… attach the white sheet… perform LCD checking, and finally, wire welding.*” Respondent C said, “*I make jigs. When production requests jigs, I’m the one who makes them,*” and Respondent D stated, “*My core task is in the Electrical & Electronic section—designing and building machines*.”

These responses point to how task allocation changes according to one’s job role. Operators typically control the entire processing tasks, while engineers deal with more focused, isolated, and complex technical responsibilities. Exposure range is not only attributed to machine operation but also defined by task type, job autonomy, and the predictability of task scheduling. Brueck et al. (2023) found that job role primarily determines the intensity and frequency of noise exposure, with the more specialized roles often experiencing continuous or unpredictable high noise levels.

4.3.1.3 Sub Theme 1: Workload, Rotation, and Variability

Workload, Rotation, and Variability have an impact on intervals of silence and changes in tasks, which in turn affect how changes in machine operation schedules and job stability transform a worker's pattern of noise exposure. Respondents A and B indicated that there was little operation of the machines, that shifts were assigned on the basis of the production requirements, and that employees were in the quiet and noisy areas like ECO-Q on a regular basis and in alternating shifts. Respondents C and D had even more rigid job assignments, and in their case, scarce task rotation was the rule and their exposure was the same on a persistent basis, generally staying in the same department, or remaining at a fixed workstation.

These insights point to the conclusion that operators experience varying levels of noise exposure which depends on the rotation and operational schedules, while engineers may be subjected to long-term consistent exposure. Exposure pivoting on frequency and intensity suggests varying layers of risk. This is particularly true when operators shift often between noisy and quiet zones. Fan et al. (2022) noted that variability in work assignments and workload intensity is a factor in inconsistent noise exposure risks, particularly in more complex acoustic environments.

4.3.1.4 Sub Theme 1: Long-Term or Historical Exposure

Long-Term or Historical exposure refers to the duration workers are exposed to noise over the years or decades while in the manufacturing sector. Respondents A and B reported long tenures of 5 to 25 years. Some described early assignments in noisy departments and continuous exposure over the years. Respondents C and D mentioned 30 years of company service, which might suggest long-term, cumulative exposure to noise in different roles over those years.

Participants' length of service suggests the unprotected accumulation possible over those years, especially where there was no job rotation, or in the absence of noise controls. Given the patterns of historical exposure, there is a need to assess more than just prevailing noise levels; the noise exposure of the past must also be considered to reveal the risk to hearing. Chronic noise exposure over many years is a major contributor to hearing loss and other health issues (Salamah et al., 2023).

4.3.1.5 Sub Theme 1: Equipment and Environmental Factors

Equipment Conditions and Environmental Factors correlate with what employees encounter regarding noise. Ideally and procedurally, noise exposure levels can be reduced or amplified depending on how the machines are setup, the quality of the tools, or the condition of the machines. Respondent B recalled, "*There is a blower, but it's not as noisy as the wire welding area,*" while Respondent C shared that "*Noise got worse 10 years ago...past 5 years extremely noisy due to bearing issue,*" drawing attention to how the type of equipment and its mechanical degradation affect noise levels. Respondent D stated, "*We workers in the machine room bought [tools] ourselves because the existing tools were hard to use*," and further stated "*Table cutter can't cut*

many at once—it's dangerous." He also remarked, "*Milling machines are safer because the material is clamped,*" and "*Using blunt tools may cause more noise, while sharp tools may reduce it.*"

The findings also suggest that old and withering machine components like old and stiff bearings are more than likely the scapegoat to increased noise levels and to noise handouts that machinery offer when running. Moreover, the manufactured or standard task-related equipment also determines the type of noise and safety standards in operation, where blunt tools are in-noise tools. This is consistent with the findings of Žiaran et al. (2020), who proposed an argument around the idea that the appropriateness of the equipment and the acoustics of the environment are vital factors that influence the noise level and the risks that are related to noise in the workplace.

4.3.2 Major Theme 2: Effects of Noise Exposure on Workers

The second major theme, Effects of Noise Exposure on Workers, most directly refers to RO1, which investigates the impact of noise on the health, behaviour, and relationships of employees. Occupational noise exposure is the most relevant to the health domain of the public and also the emotional and cognitive dimension of public health as it substantially reduces the performance of the affected individuals (Sheppard et al., 2020). This theme is justified by five sub-themes which capture the multifaceted impact of noise. They are:

1. Awareness, Normalization & Delay in Recognition,
2. Physical and Cognitive Impact,
3. Social and Communication Impact,
4. Self-Awareness and Audiometric Testing, and
5. Emotional or Relational Impact.

These sub-themes describe the range of workplace noise exposure, from dismissal of early warning signs of exposure to noise and the emotional and bodily impacts to the prolonged recognition of the exposure to noise, thus exemplifying the impacts of noise in everyday life. Most importantly, the sub-themes directly address the real-life implications of noise on the functioning, health, and interpersonal relationships of the people, as articulated in RO1.

4.3.2.1 Sub Theme 2: Awareness, Normalization & Delay in Recognition

The sub-theme Awareness, Normalization, & Delay in Recognition encapsulates the phenomenon where workers become desensitized to the noise hazards, considering them an inherent aspect of their working environment. Respondent A remembered, "*Didn't care because I thought it's normal when working in a factory*," whereas Respondent B, when asked about noise complaints, confessed, "*No, I haven't. It just feels normal*." Respondent C demonstrated adaptation to the conditions stating, "*For me, noise is normal*," and, "*I enjoy working—as long as there's work to do*," while Respondent D provided a reflective account, "In the past, I didn't care about noise."

The available testimonies indicate an unawareness of the risks posed by noise and later recognition, only when symptoms develop. Largely, early symptoms were present along with a silence of concern, as described by multiple respondents, where complaints about noise were absent until the equipment changed, escalating the noise. The findings resonate with those of Noushabadi (2024) in that the delay in recognition coupled with the normalization of hazardous noise is primarily due to the low perception of risk in an industrial context.

4.3.2.2 Sub Theme 2: Physical and Cognitive Impact

The sub-theme Physical and Cognitive Impact highlights the varied effects of noise on the workers physical wellbeing, focus, and fatigue. Respondent B said, "*Even when hearing the noise… it feels normal. I don't feel extra tired*". Respondent C explained "*Loud noise can cause mistakes—like overcutting by 1mm*", whereas Respondent D stated "*Wearing them too long gives me headaches*", "*At work I cant detect certain frequencies*".

Despite the overwhelming noise and fatigue, some workers experience symptoms on the other end of the spectrum, such as the fine precision under the reduced noise, and the discomfort of the PPE. While some have physical symptoms and work errors, others have minimal fatigue or disruption, as an example from Respondent B. This supports Mucci et al. (2021) on the phenomenon of continuous exposure to noise and the working conditions on the hearing, focus, and bodily stress.

4.3.2.3 Sub Theme 2: Social and Communication Impact

Social and Communication Impact analyses the influence of incessant workplace noise on interpersonal interactions, collaboration, and the overall social networks within and outside the organizational environment. Respondent A observed, "*But when talking to others, we have to speak loudly*." Respondent C mentioned, "*Communication really suffers.*" Respondent D stated, "*I can hardly hear them unless they shout. My family had to shout to get my attention and I was the one talking,*" suggesting an abnormal change in hearing.

The frustration, mistakes, and disengagement in collaboration that stem from communicative discord and the inability to work collectively in co-operative work settings may be amplified. Family members of noisy-often workers bear the brunt of communicative dysfunction too. Gyllensten et al. (2023) argued the social and psychological ramifications of broken communication and noise as a migraine in occupational settings.

4.3.2.4 Sub Theme 2: Self-Awareness and Audiometric Testing

The sub-theme Self-Awareness and Audiometric Testing discusses how formal hearing assessments trigger workers' realizations about hearing problems related to noise, which go unnoticed because of the gradual hearing loss. Respondent A explains, "*It was only after going for a hearing check (audiometric test) that I learned about noise hazards*," and Respondent B, who "*felt fine*" and seemed "*to [have] pressed the wrong button*" during the test. Respondent C specifies, "*In 2022, your results were borderline. A year later, it started showing abnormal results,*" and Respondent D describes, "*During the first test in 2021… But in 2022, I started feeling the impact*."

Until routine audiometric testing, many workers did not formally recognize hearing problems. This delayed recognition insinuates that reliance on self-detection alone for an intervention is insufficient. This finding supports Narasimhan et al. (2022) on audiometric testing that argues the importance of testing in raising awareness and advocating timely preventive measures for workers.

4.3.2.5 Sub Theme 2: Emotional or Relational Impact

The sub-theme Emotional or Relational Impact highlights the effect NIHL places on workers' personal relationships and emotional well-being. Respondent C noted the following, "*My spouse often gets upset because I can't hear when she talks... There are certain frequencies I just can't hear anymore... Sometimes when people call me, I don't respond because I can't hear them... That's why Respondent D sometimes shouts at me*." Respondent D continued, "*My family did notice...*".

Hearing loss can trigger frustration within the family because of the breakdown of communication and the possibility of misunderstandings. After a diagnosis, the emotional burden becomes heavier, because workers start attributing their interpersonal issues to the hearing loss that has been undiagnosed. These findings are consistent with the work of Holman et al. (2022), who noted that emotional responses and relational conflict arise with the diagnosis of hearing loss, as self-awareness increases.

4.3.3 Major Theme 3: PPE Usage, Comfort, and Challenges

The third major theme, PPE Usage, Comfort, and Challenges, ties in closely with RO2. With this objective, the research sought to unpack the risk factors and patterns of workplace exposure that result in noise-related problems. The wearing of hearing protection devices hinges on a lack of comfort, risk perception, and organizational backing. These variables determine the extent of compliance and effectiveness with which workers don protective gear (Fauzan et al., 2023). This theme presents four sub-themes which capture workers' diverse experiences with hearing protection. These are:

1. PPE Usage Behavior
2. PPE Discomfort Factors
3. PPE Availability and Fit, and
4. Peer Influence and Use Patterns

4.3.3.1 Sub Theme 3: PPE Usage Behavior

The sub-theme PPE Usage Behavior investigates how workers implement PHP according to the loudness of the task, its duration, their own habits, and their previous experiences with hearing loss. One of the respondents, who is labelled A, said, "*Since*

we got earplugs, we wear them. Sometimes we take them off because they're uncomfortable," and "*I wear them after tidying up the workstation, just before the machine starts running.*" Another, B, said, "*Yes, I wear earplugs when working at the wire welding station.*" C noted the greatest compliance, "*Almost everytime, especially now that I have hearing problems*," while D explained, "*Only during noisy tasks like cutting*," and "*Less than an hour. Only during cutting*."

Workers often adapt PPE usage depending on the perceived risk and the type of task, leading to inconsistent protection, especially when noise is constant, intermittent, or limited to particular operations. Previous hearing difficulties exacerbate compliance, but the patterns of PPE usage still differ according to comfort and demands of the task, indicating that the routine is not fully ingrained. This is in line with the work of Fauzan et al. (2023), who noted that PPE use behavior patterns are influenced by task exposure, risk perception, and workplace norms.

4.3.3.2 Sub Theme 3: PPE Discomfort Factors

The sub-theme discomfort with use of PPE explains how physical and sensory discomfort impacts users' unwillingness to wear hearing protection devices. This impacts overall compliance. The discomfort of wearing additional layers and prolonged use was described by Respondent A: "*If I wear it continuously for half a day... it becomes uncomfortable. I wear a headscarf and inner scarf, so it gets a bit uncomfortable*." Respondent B noted: "*When I wear the earplugs halfway into my ears, it feels painful. Just a slight pain around the outer ear area… a little itchy sometimes*." Respondent C described the headset discomfort and its impact on focus and task performance: "*It becomes painful after a while because I wear glasses. The ear muff presses on the frame. Sometimes I lose focus because the ear muff presses on the frame of my glasses near the ear.*" To illustrate the discomfort, Respond D mentioned, "*It feels tight on the head*," and "*Wearing them too long gives me headaches*."

Workers often relate the wearing of ear protection to unease, dismissing potential discomfort from external attributes, length of use, or poor fit. This deeply undermines concentration and task performance. Discomfort inattention may stem from the PPE's pressure of sensitive zones like the head and ears, which can be very distracting and

even irritating to the worker during prolonged shifts. This resonates with the findings of Poissenot-Arrigoni et al. (2023) wherein uncomfortability and functional impediment were the two most reported explanations for the lack of compliance to wearing hearing protection.

4.3.3.3 Sub Theme 3: PPE Availability and Fit

The sub-theme PPE Availability and Fit investigates the way the condition, reach, and the fit of hearing PPE affects the workers' utilisation and adherence and compliance within the hearing protection zone. Respondent A said, "*The ear muffs we have now are old*," and remarked that "e*ar plugs and ear muffs are always placed near the machine*." Respondent B stated, "*Yes, it's easy... I can just ask the leader*." Respondent C stated, "*No, I've only ever been given ear muffs*," and "*I've heard people say ear plugs are uncomfortable, so I just stick with the ear muffs*." Respondent D stated, "*Not really—unless you provide them*."

The comments from the workers indicate that limited choice and outdated tools foster motivation for hearing protection, while better availability and fitting, and more tools and PPE options increase the likelihood of firm adherence and compliance. When the choice of PPE is inadequate and based on old PPE tools, workers may keep familiar protective tools, even if uncomfortable, and this is supported by Brisbine et al. (2022) and Aloufi et al. (2024), who argue that fit and availability are critical determinants of comfort in PPE.

4.3.3.4 Sub Theme 3: Peer Influence and Use Patterns

The sub-theme Peer Influence and Use Patterns focuses on interpersonal relations, team communication, and the collective work culture, and how these factors mold workers' behaviors and attitudes toward the usage of PPE in noisy settings. Respondent A noted, "*Another operator… uses the earplug type and has no problem with it*." In contrast, Respondent B noted the importance of PPE, "*PPE is more important*." Respondent D noted, "…*when someone is cutting, they'll inform everyone to wear ear muffs*." They expressed a preference, "*I'd like to try using earplugs instead*." They also commented, "*For me, ear muffs aren't effective enough… I can still hear the noise*," and proposed, "*It might be better to use double protection with earplugs*."

By describing these scenarios, the effect of the behaviors of peers, task-related communication, shared attitudes, and norms on PPE usage decisions is illustrated. The trusted feedback of peers, along with the collective use and adaptation of PPE, streamlines adherence to mask-wearing. This is consistent with the work of Pooladvand and Hasanzadeh (2024) and Alzamzami et al. (2025), where peer influence and collective behavior were noted as fundamental factors in strengthening or weakening PPE compliance in work environments.

4.3.4 Major Theme 4: Noise Awareness and Training

The fourth major theme, Noise Awareness and Training, relates to both RO1 and RO2 by assessing the role knowledge and training play regarding the effect on workers' health, behavior, and exposure to movements within a noisy work environment. Training interventions contribute positively to the improvement of workers' understanding, attitudes, and behavior towards the hazardous noise situations. Its participatory and targeted approaches, in particular, play an important role in the adoption of protective behaviors and noise-induced hearing loss prevention (Oliveira, 2022; Cavallari et al., 2021). This theme is underpinned by four aligned sub-themes which embody the fundamental aspects related to awareness and training. These sub-themes include:

1. Training Experience and Frequency
2. Impact of Training on Behavior
3. Awareness Gaps Before Training; and
4. Training Relevance

These sub-themes delineate the contribution training makes in the worker's noise risk awareness and advocacy for protective action. The interrelation of knowledge gaps, training gaps, and motivational gaps positioned relative to the training's usefulness serves to explain the adopted apathy. The sub-themes speak to both RO1 and RO2 constructively by illustrating the manner in which training promotes health awareness and facilitates noise exposure mitigation at the behavioral and organizational levels.

4.3.4.1 Sub Theme 4: Training Experience and Frequency

The sub-theme Training Experience and Frequency examines the role that different training opportunities and their quality translate into workers' understanding and awareness of noise hazards. One respondent recalled, "*I only became aware after attending the hearing course last year. That's when I truly understood*," and mentioned, "*Yes, in February 2024 and February 2025*." Another respondent, identified in the study as B, remarked, "*Yes, I've attended two training sessions—once in 2024 and again in 2025.*" Respondent C remarked, "*I've attended three trainings arranged by you, and even before that I've joined other sessions*," and explained, "*The training included both theory and practical sessions*." One of the interviewees, Respondent D, told us, "*It should be done regularly. At least twice a year*."

In cases where workers have received continuous comprehensive training, especially when practical instructions and the theory of noise control were integrated and reinforced, there was a high retention of noise risk awareness and a positive attitude towards behavior adjustments. Maintenance of awareness and behavior change over prolonged periods is most effective when training is relevant and integrated into the workers' routine. This finding appears consistent with Morata et al. (2024), where the authors report that training programs that were tailored, repeated, and hands-on significantly improved workers' adoption of protective behaviors and noise hazard awareness.

4.3.4.2 Sub Theme 4: Impact of Training on Behavior

The sub-theme Impact of Training on Behavior studies how noise exposure training affects workers' daily habits, attitudes towards risk, and the adoption of protective gear for noise exposure. Respondent A said, "*I now frequently use earplugs or earmuffs*," and explained, "*After the training, I understood better and became more diligent in using PPE*." They also said, "*I never thought about the future—like 10 years ahead*." Respondent C said, "*Now, I'm more cautious when working in noisy areas,*" and quoted a trainer who said, "*Once your hearing is gone, nothing can fix it.*" Respondent D also said, "*Yes, it did. Noise damage takes time to show… I became more careful*.".

Training provides knowledge and changes attitudes by promoting habitual use of hearing protection and carefulness in noisy situations. Emotional connections, such as disturbing quotes and the training scope, focusing on long-term implications, assist in behavioral changes. These findings resonate with Wisniewski et al. (2023), who reported that noise hazard training changes behavior by increasing awareness, risk perception, and protective response to hazards at cognitive and neural levels.

4.3.4.3 Sub Theme 4: Awareness Gaps Before Training

The sub-theme Awareness Gaps Before Training outlines the understanding and concern workers lacked prior to training about noise exposure and hearing protection. For example, Respondent A said, "*No, never. We're just operators*," and "*Didn't care because I thought it's normal when working in a factory*." Respondent B admitted, "*Before that, I didn't feel anything even when exposed to loud sounds*," and "*No, only now I've had my hearing tested.*" Respondent C stated, "*Before the training, I didn't care about my hearing health*." Respondent D reflected, "*In the past, I didn't care about noise," and "As I've getting old, I now feel the effects.*"

Until mid-training, it seems, workers didn't feel the impacts of noise exposure. For some, the 'normal job noise' perception only changed when symptoms of noise exposure personally affected their work. In trying to rationalize their noise perception, older workers often used the age near the end of the symptoms' rationalization as a significant reason to explain the circumstance. This is consistent with the work of Srivastava & N (2022), which illustrates how, even in high-risk environments, workers lack knowledge and awareness about hearing protection or risk exposure before pre-focus interventions are put in place.

4.3.4.4 Sub Theme 4: Training Relevance

The sub-theme on Training Relevance underscores that training is most effective when it is integrated with employees' specific responsibilities and accompanied by contextualization. Respondent C stated, "*I like training that relates directly to my job*," and explained further, "*Training is better. Awareness is crucial. If people aren't aware, it's hard to control the risk*." Respondent D noted, "*Without explanation and training, the purpose is not achieved.*"

Job role-specific training enhances levels of engagement and understanding and enables employees to better relate to the material within the context of their everyday tasks. Training accompanied by PPE distribution facilitates understanding and strengthens the rationale for the protective equipment's intended use. These insights align with findings by Anireddy (2024), who documented that job-specific training greatly enhances employees' awareness of noise hazards and improves safety practices during risky tasks in the mining industry.

4.3.5 Major Theme 5: Organizational Controls and Improvements

The fifth major theme, Organizational Controls and Improvements, addresses RO2 by analyzing how work strategies and systems influence the management of noise hazards. Organizations can effectively manage noise workplace by prioritizing engineering controls with the support of administrative measures and implementation of hearing protection programs, as per the hierarchy of controls (Slagley et al., 2023). This theme is supported by two sub-themes that represent core areas of organizational responsibility in noise risk control. These will be referred to as:

1. Organizational Gaps in Control
2. Engineering and Administrative Control Suggestions

These sub-themes mutually create pathways for organizational systems that can effectively control noise. As the organizational systems are currently designed, they have gaps that create real-world issues of feedback, disinvestment, and lack of practical suggestions from workers. Collectively, these sub-themes show how organizational systems can control noise weak methods. This aligns with RO2, which deals primarily with exposure control and program effectiveness.

4.3.5.1 Sub Theme 5: Organizational Gaps in Control

The sub-theme Organizational Gaps in Control deals with the organizational implications systemic within each managerial level in workplace noise control enforcement mechanisms, with respect to workplace control communication barriers at each respective managerial level in the enforcement of organizational noise control, encapsulated by lack of enforcement, resource constraints, and diffuse communication across control. When asked if noise hazards had been problematising the respondent's

tasks and to provide control skip suggestions, Respondent A seemed to have "*No, nothing, as a response and 'I'm not sure how to answer that either.*" Respondent B noted, "*The machine at wire welding is noisy, but without it, the work can't be done*." Respondent C reported, *"I did complain… but he didn't seem to care*," and "*I've complained many times*." Respond D made provocations by saying, "*Outsiders shouldn't be allowed in the machine room… Some technicians just enter without PPE*," and *"Only the Safety and Health Officer understands the situation…*".

Even with recognition of potential high-noise hazards, it seems that organizations do not respond with preventative approaches; instead, they seem to respond in more reactive ways, with little follow-up on complaints and little to no risk communication. These omissions highlight possible divisions or disconnects among frontline workers, technical teams, and management, leading to inadequate and poorly enforced controls and PPE. This aligns with Basu et al. (2022) findings, as again, organizational pitfalls such as late response and absence of anticipatory planning continue to be major impediments to the effective control of industrial noise.

4.3.5.2 Sub Theme 5: Engineering and Administrative Control Suggestions

Under the sub-theme Engineering and Administrative Control Suggestions, the focus is on solutions proposed by respondents to mitigate the risk of noise exposure, particularly noise risk to workers. Respondent C suggested, "*If the company can invest in new machines like CNC, that would help… we just program the cut and can work from outside….*" Respondent D emphasized, "*Machines should come with soundproof covers*," and "*… by adding covers or placing the machines in enclosed rooms.*"

From the engineering control perspective, respondents suggested replacing machines, soundproofing, and isolating noise to decrease exposure. Respondents proposed administrative controls such as strategic budgeting, prioritization of resources to the most at-risk workers, and collection of feedback from workers on the effectiveness of noise PPE and noise exposure to streamline efforts. This aligns with the conclusions of Simion et al. (2020) regarding the administrative and engineering controls needed to effectively and holistically manage noise exposure to prevent occupational hearing loss.

4.4 Summary of Chapter

This chapter discusses findings from interviews conducted with four workers in the electronics-manufacturing sector regarding their experiences with noise exposure and the resultant hearing loss. The analysis revealed five core themes: patterns of noise exposure, the consequences of the noise, PPE use, training and knowledge, and organizational control. Interviewees described hearing constant noise and task-specific noise, while the risks varied with the job, machinery condition, and tenure. The effects of noise exposure on the workers' attention, interpersonal communication, emotions, and relationships revealed the consequences of noise exposure extended well beyond hearing loss. Although training resulted in higher awareness and increases in PPE use, discomfort, noise exposure being socially accepted, and poor reinforcement of PPE use reduced the effectiveness of training. Collectively, the findings indicate the need for more comprehensive management support, practical training, and effective control measures to minimize the risk of NIHL.

CHAPTER FIVE
DISCUSSION

5.1 Introduction

This chapter interprets the major findings of Chapter 4 in light of the study objectives and the associated literature. While Chapter 4 presented the findings using thematic analysis, this chapter intends to describe the findings in a broader context of meaning and significance. The discussion is organized according to the two research objectives: (RO1) to explore the effects of occupational noise exposure on electronics manufacturing workers, and (RO2) to identify noise exposure patterns and contributing risk factors that influence the prevalence of NIHL. This chapter draws on the thematic analysis of Braun and Clarke to weave together the study participants' narratives and the empirical literature to provide participants' accounts of expected and, in some instances, surprising experiences of risks related to noise in the work environment. This chapter also provides a cross-theme synthesis, describes the practical and theoretical contributions, outlines the limitations, and provides a concluding summary that facilitates the transition to Chapter 6.

5.2 RO1 Discussion

5.2.1 Awareness Normalization, Delay in Recognition, and Awareness Gaps Before Training

There is a considerable delay in recognizing the impact of noise in an industrial setup when workers begin to integrate noise into the daily 'normal' activities of an industrial setup. Most respondents stated that risks associated with noise exposure did not come to their attention until there had been an adverse effect, or until official noise assessments were accomplished. Most of the workers have not received training on the noise management frameworks and the legal provisions associated with the noise control mechanisms in the industry. The fact that there was limited understanding of the noise control mechanisms likely contributed to the presumption that the early symptoms of potential noise exposure hearing loss were 'normal' in the industrial setup and were attributed to fatigue.

Furthermore, the present situation with noise exposure in the industry is consistent with the situation found in other industries with similar patterns of noise exposure, as highlighted by Noushabadi (2024) and Srivastava & N (2022). The patterns of noise exposure are elevated to the level of constitutive 'normal' and are, therefore, extremely disruptive and detrimental, as stated in RO1. The OSM extends this finding through reasoning that when employees are constantly exposed to uncontrolled noise, they are likely to develop stress tolerance thresholds which make them unable to consider noise as a risk until problems arise due to long periods of exposure.

5.2.2 Physical and Cognitive Impact

The physical and cognitive effects of occupational exposure to noise on workers differ on an individual level. Some respondents described headaches and discomfort associated with prolonged use of hearing protection. Other respondents described an inability to maintain focus and a decline in attention to detail during concentration-intensive tasks like component cutting and assembly. Interestingly, an absence of fatigue and strain was noted by some workers, suggesting a possible role of individual thresholds and job descriptions in determining the level of noise impact. These findings support the observations of Mucci et al. (2021), who pointed out that chronically sustained concentration-disruptive noise affects accuracy and general physical health. The OSM also supports this outcome, as it explains how continuous noise acts as a physical stressor that triggers cognitive fatigue, headaches, and reduced attentional performance over time. With respect to evidence supporting RO1, the findings of this study illustrate and confirm that sustained noise in the electronics manufacturing industry affects workers' health and performance in tasks in subtle and gross disruptive ways.

5.2.3 Social, Communication Impact, Emotional or Relational Impact

Noise exposure also affects communication and the emotional state of workers adversely. Some respondents focused on the problem of communication when performing tasks in a noisy environment, mentioning that they often had to shout or repeat instructions, thus impeding cooperative work. Some respondents also mentioned frustrations stemming from family members and poor communication when they returned from work. They described being more embarrassed or guilty when they came

to realize the communication problem was chronic and concerned the family. These experiences reflect elements of the OSM, which explains how persistent noise acts as a psychosocial stressor that disrupts communication, increases interpersonal strain, and leads to emotional exhaustion. These findings conform to the observations of Gyllensten et al. (2023) and Holman et al. (2022) in that the social and emotional outfalls from occupational hearing loss include withdrawal and friction in relationships. These results support RO1 and illustrate that the consequences of noise-induced hearing loss impact the psychological state and personal relationships of the individual outside the professional environment.

5.2.4 Self-Awareness and Audiometric Testing

Audiometric testing contributed to the improvement of participants' awareness concerning their hearing health, often identifying problems that employees had failed to recognize. Hearing problems that accompany years of exposure often go undocumented, and many employees become aware of the severity of their hearing health problems only after formal testing. Some even expressed doubts regarding the results, which suggests the lack of accurate self-assessment and the need for regular hearing tests in noisy environments. This pattern is consistent with the NIHL Risk Model, which explains that NIHL progresses gradually and is often unnoticed by workers until objective audiometric assessments reveal significant threshold shifts. Narasimhan et al. (2022) similarly articulated the importance of audiometric testing for early detection in cases when employees unconsciously become accustomed to a gradual deterioration of their hearing health. These findings strengthen RO1 because they demonstrate that routine hearing tests are necessary for the implementation of early intervention, which is essential to prevent serious health issues later in life.

5.2.5 Training Experience, Frequency, Impact of Training on Behavior, and Training Relevance

Training is crucial in developing workers' awareness, attitudes, and behaviors to mitigate noise and develop protective practices. Participants with monthly and hands-on training showed a greater understanding of risk and a greater tendency to use hearing protection. A number of workers said they only became careful or altered their PPE habits after training sessions that described the consequences of noise exposure.

Workers perceived such training to be most useful when it was task-specific and complemented by step-by-step demonstrations or hands-on activities. These behavioural changes reflect the NIHL Risk Model, which highlights training and risk awareness as key modifiable components that can reduce individual susceptibility and strengthen protective behaviours. This is consistent with the findings by Morata et al. (2024) and Wisniewski et al. (2023), which noted that relevant, context-specific, and repeated training is the most effective method of increasing hazard recognition and safe practices. These findings support RO1, accurately affirming the impact of relevant, task-oriented training as a critical element to increasing awareness and ultimately proactive behaviors to occupational noise.

5.3 RO2 Disucssion

5.3.1 Continuous, Task-Based Noise Exposure and Role/Job-Specific Exposure

The difference in job functions and assignments influenced the levels of noise exposure differently. The duration and intensity of noise exposure during machine operations were higher for some positions. During machine operation days, operators were exposed to the noise for the entire shift. During high-intensity cutting tasks, engineers' noise exposure was shorter in duration but more intense. They both performed some tasks, for instance, cutting thicker materials and using air guns, which led to noise exposure spikes. The pattern of noise exposure identified suggests risk is not evenly distributed and depends primarily on task type, duration, and the material being processed. This aligns with the NIHL Risk Model, which explains that variations in exposure intensity, duration, and task conditions directly influence the probability and severity of hearing loss. The model supports the finding that exposure spikes during certain tasks can accelerate threshold shifts even when overall exposure time is shorter. Task-specific and job-specific factors have also been identified by Kiryanova et al. (2020) and Brueck et al. (2023) as determinants of the variation in duration and intensity of noise exposure, thereby determining the risk of NIHL. These support RO2 as they show the need to incorporate specific exposure patterns for the role when assessing noise risk and planning for control measures.

5.3.2 Workload, Rotation, Variability and Long-Term or Historical Exposure

Variations in long-term risks from noise exposure were influenced by workload schedules, rotation frequency, and the total years of service. Operators described having more frequent rotation shifts from noisy environments to quieter ones, while engineers typically had consistent exposure, stationed in one place. The varying cumulative exposure that many participants had acquired from working in identical environments for 5 to 30 years raises concerns about what may be missed in short-term assessments.

In contrast to the noise exposure variability described by the engineers, operators had more pronounced exposure inconsistency, which, along with expected noise exposure in the engineering role, leads to chronic and sustained noise exposure. These models greatly concord with the NIHL Risk Model, which states that exposure for a duration of months or years greatly increases the risk for NIHL, irrespective of exposure to continuous or intermittent noise. The model also states that the long-term accumulation of the dose is understated and that assessments of exposure over a shorter time period raises the concern put forth by the participants.The work of Fan et al. (2022) and Salamah et al. (2023) reinforces the described situations by arguing the significance of exposure variability and long-term exposure as prominent risk factors for NIHL. This aligns with and adds to the insights for specific RO2 by emphasizing the vital nature of exposure variability and tenure in predicting risks and tailoring hearing loss prevention efforts.

5.3.3 Equipment and Environmental Factors

Participants noted that degradation of equipment and the attributes of the physical surroundings were essential factors in the differences in the levels of noise exposure among workers. Some had stated that older equipment, such as machines with worn bearings were particularly loud and uncomfortable and that tools became blunt overly rapidly. Some workers avoided equipment and tools that were deemed unsafe and overly noisy, suggesting a lack of adequately organized maintenance. This indicated that personal maintenance of tools was common.

Noise exposure levels were impacted by the physical design of workstations as well as the existence of enclosures, the type of blowers used, and the general arrangement of workstations. The data aligns with the NIHL Risk Model which assesses how the characteristics of the source, the condition of the equipment, and the design of the surrounding environment all directly determine the degree of noise and the noise dose that the employees receive. Noise created by tools and machines that are not maintained decreases the effectiveness of the environmental design of the workplace. This increases the risk of exposure.This however, aligned with the work of Žiaran and others in 2020 stated that increased acoustic and noise environment risks are attributed to poorly kept machines and machines without appropriate acoustic. This relates to RO2 and this particular theme, as the design of the environment and the condition of the equipment influence the exposure levels, highlighting the need for maintenance and control shifts at the design stage.

5.3.4 PPE Usage Behavior, PPE Availability, and Fit

Task demands, perceived risk, and PHP availability and suitability affect employee PHP usage. Participants said they used PPE during specific tasks, which they considered noisy, even though compliance was inconsistent. Workers observed that earplugs and earmuffs were provided, but different types and modern alternatives varied in supply. Some workers used certain PPE reluctantly and preferred and used familiar, even less protective, alternatives. This quaint, conformist behavior has been observed by Fauzan et al. (2023), Brisbine et al. (2022), and Aloufi et al. (2024). PPE compliance has been noted to depend on the task fit, Equipment range, and user comfort. The NIHL Risk Model states that there is an added risk of increased noise exposure when there is inconsistent use or improper fitting of hearing protection. This aligns with RO2, indicating that PPE use is a behavioral concern, but is also reliant on the fit, type, and variety of PPE and task risk perceptions.

5.3.5 PPE Discomfort Factors, Peer Influence, and Use Patterns

The use of hearing protection was shaped by the presence of discomfort and the social behavior of those around them. Participants mentioned pain, headache, and pressure caused by earmuffs and earplugs, especially when combined with the wearing of glasses and hijabs. Such discomfort was reportedly enough to cause a lack of focus and

unwillingness to wear the PPE, especially during continuous work tasks. The social use of PPE was influenced by team communication and norm behavior, with PPE 'adopters' only getting into the protective gear after social prompts. Such findings align with the works of Poissenot-Arrigoni et al. (2023), Pooladvand and Hasanzadeh (2024), and Alzamzami et al. (2025), and highlight discomfort, along with social modeling, as pivotal to the use of PPE. The NIHL Risk Module complements this finding by stating that lack of comfort and poor fitting of PHPs increases workers' tasks' effective noise dose due to PHP neglect. This evidence strengthens RO2, as it demonstrates that effective PPE compliance is influenced by the culture of the workplace and the design of PPE, as well as training and policies surrounding it.

5.3.6 Training Experience and Frequency, Impact of Training on Behavior, Awareness Gaps Before Training, and Training Relevance

The use of hearing protection was shaped by the presence of discomfort and the social behavior of those around them. Participants mentioned pain, headache, and pressure caused by earmuffs and earplugs, especially when combined with the wearing of glasses and hijabs. Such discomfort was reportedly enough to cause a lack of focus and unwillingness to wear the PPE, especially during continuous work tasks. The social use of PPE was influenced by team communication and norm behavior, with PPE 'adopters' only getting into the protective gear after social prompts. Such findings align with the works of Poissenot-Arrigoni et al. (2023), Pooladvand and Hasanzadeh (2024), and Alzamzami et al. (2025), and highlight discomfort, along with social modeling, as pivotal to the use of PPE. The NIHL Risk Model supports such findings exhibiting that training improves on the aspects of hazard awareness and the use of PPE, which, in turn, lessens workers' effective noise exposure. This evidence strengthens RO2, as it demonstrates that effective PPE compliance is influenced by the culture of the workplace and the design of PPE, as well as training and policies surrounding it.

5.3.7 Organizational Gaps in Control

Even when workers try to resolve issues, people described certain organizational inadequacies that made effective noise control implementation impossible. Respondents described scenarios when noise hazard complaints appeared to be cascading, and there were inadequate opportunities to flex control inputs. In other

comments, workers described scenarios when the PPE policy seemed to be ignored, particularly regarding visitors and technicians, reflecting disorder in operational standardization. Comments described deficits in the scope of work of frontline employees, safety officers, and technical staff concerning noise issues, which pointed to organizational inaction loopholes as described by Basu et al. (2022), i.e., the communication breakdown as a dominant barrier to workplace noise hazard management. The NIHL Risk Model provides additional support to this finding by showing that weak organizational controls and variability in enforcement increase the risk of workers' cumulative exposure to noise. These insights recognize the relevance of RO2, illustrating that the lack of organizational responsibility leaves knowledgeable, risk-averse, and proactive workers with long periods of exposure to noise.

5.3.8 Engineering and Administrative Control Suggestions

Proposed workplace strategies encompass various engineering and administrative approaches to ensure the reduction of occupational noise and the protection of employees' hearing health. Recommendations made refer to the use of CNC machines and their soundproof casings, as well as enclosing the malfunctioning, noisy machines to physically isolate the key sound-producing sources. Participants pointed out the importance of proper allocation, budgeting, and the prioritization of the most critical risk areas. Furthermore, the collection of employees' feedback regarding the efficiency of noise control and the usability of personal protective equipment (PPE) should be systematic. The suggestions made demonstrate that employees have unique viewpoints that could be the basis for improving control strategies should their voices be considered in the process. Simion et al. (2020) highlighted the importance of complementing administrative approaches with engineering solutions, as this synergy tends to deliver the most effective outcomes regarding the control of occupational noise. This is consistent with the NIHL Risk Model's premise that the efficient prevention of NIHL requires integrating engineering controls with administrative modifications that decrease actual noise exposure.These outcomes respond to RO2 since they show that feedback from employees in frontline positions, coupled with organized control strategies, will enhance exposure reduction and the overall efficiency of the program.

5.4 Integration

5.4.1 Awareness, Behavior, PPE Use, and Training (Individual-Level Integration)

Findings indicate that individual-level variables such as awareness, perceived risk, and attitude towards protective noise behavior are interlinked and not independent (Kim & Jung, 2023). Worker normalization of noise led to delayed symptomatic recognition, and therefore, the constant use of hearing protection was delayed. Training was vital in changing behavior as it was the link that prompted increased awareness and the adoption of safe practices such as the regular use of PPE (Bördlein, 2022). Workers who experienced hearing changes or received audiometric feedback developed caution, indicating that personal experience plays a role in deepening awareness. Hearing protection was largely encouraged through group norms and peer reminders, illustrating how informal culture reinforces the outcomes of formal training (Atagbuzia & Natarajan, 2024). The combination of early awareness, relatable training, and team behavior provides a foundation for preventing noise-induced hearing loss effectively.

5.4.2 Organizational Gaps, Equipment Condition, Exposure Patterns (Organizational/Environmental Integration)

These relationships also demonstrate the impact of the condition of organizational practices and equipment on patterns of workplace exposure. Increased noise levels were associated with unmaintained machines and outdated, deteriorating tools; if an organization is slow to replace tools, this is of concern. Stagnant schedules for rotation and fixed job assignments created conditions where exposure durations were inconsistent, placing some workers at risk of prolonged noise exposure throughout the workday (Nikpour & Fesharaki, 2022). Organizational noise risks were exacerbated by unaddressed complaint issues, inconsistent enforcement of PPE policies, and apathetic attitudes toward worker participation. While workers have made reasonable suggestions for engineered noise control measures (e.g., replacing machines and installing soundproofing), organizational attitudes and budgets ultimately dictate the measures that can be taken. These relationships illustrate the need for a systemic approach incorporating environmental engineering, administrative methods, and human factors to mitigate NIHL risks (Alberti et al., 2023).

5.5 Implication

In relation to Malaysia's NIHL electronics manufacturing sector, this is another small piece of research to help better understand this under-researched sector. From the perspective of understanding the noise risks, the piece helps contextualize the tasks, the roles, and the influence of socio-cultural arrangements. Along the lines of understanding the motivations behind practices of noise avoidance, the study helps understand the importance of behavioral constructs on the practice of self-awareness, the absence of which is considered to drive the normalization of risk, and on the influence of peers (McLeod, 2021). Along the lines of the theories of learning and behavioral change, the research helps understand the shifts in safety behavioral practices that occur when emotionally relevant and task-specific training is provided (Bader et al., 2023). Peer influence on unsafe practices of a critical nature and the absence of active safety control is an important constructs in the informal theory of safety compliance (Atagbuzia & Natarajan, 2024). The study serves as a starting point for covering other industrial sectors in NIHL. Interventions with training, design, and the social construct of influence within the broader context of this research are equally important.

5.6 Limitations

This research involved a small sample size, 4 participants, from a single site, an electronics manufacturer, which carries consequences for generalizability. While the qualitative method does provide the opportunity for the researcher to deeply understand the phenomenon, the method used will not provide an understanding of the broader statistical magnitude of NIHL across the sector. The fact that all participants were from the same organization means that practices documented for this study may be unique to the site rather than the whole industry. Since the interviews were conducted in Bahasa Malaysia, later translation may have slightly captured some nuances or omissions. The study also did not include department or education level, which may be relevant variables as they relate to an individual’s noise perception and noise-related behavior. Even with the limitations, there is no doubt that the findings will serve as a solid basis for subsequent work focusing on larger sample sizes or other research designs that incorporate qualitative and quantitative approaches to provide greater depth and breadth in the analysis.

5.7 Summary of Chapter

This chapter presents the analytical outcomes regarding exposure to noise and the associated risk factors among workers within the electronics manufacturing sector. The findings of the first specific RO1 pointed to the fact that the different dimensions of health, attitudes, and the social relations of individuals owing to occupational noise exposure are bottom-of-the-pile effects that might go undetected and unattended until the actual effects surface. With respect to the second specific RO2, this research pinpointed varying exposure patterns and workplace factors that include the use of protective equipment, the state of the machines, functions within the job hierarchy, and organizational factors that amplify the risk of NIHL. The integration of the themes indicates that the behavioral, environmental, and administrative factors are all considerably interconnected. The practical and theoretical implications demonstrate the need for protective engineering, supportive administrative research and policy, informal and early-stage research, and engineering research. The conclusions provide the basis for the last chapter of this research, which outlines the general conclusions and practical implications for the sector and directions for future research.

CHAPTER SIX
CONCLUSION AND RECOMMENDATION

6.1 Introduction

This study examines the impact of occupational noise exposure and identifies risk factors related to NIHL among electronics manufacturing workers. This study utilized a qualitative approach employing thematic analysis to capture the experiences and perceptions of workers regarding noise exposure. For this purpose, data were gathered from 4 participants in diverse roles in an electronics manufacturing organization. RO1 aimed to analyze the impact of noise exposure on the health, behavior, and social functioning of workers. RO2 analyzed the exposure patterns and the risk factors contributing to the prevalence of NIHL in the workplace. This concluding chapter outlines the findings from the previous chapters, presents the conclusions drawn in terms of the study objectives, and offers a blend of practical and research-oriented suggestions.

6.2 Summary of Key Findings Related to RO1

Many employees acquainted themselves with the noise as part of the factory routine, which, in turn, delayed the acknowledgment of its health risks. With the introduction of structured training or audiometric testing, the awareness of health risks became recognized, signifying the role of formal interventions. Exposure to noise during operations affected concentration, caused task errors, and resulted in physical discomfort, with the most negative effects occurring during high-noise operations. Persistent noise during operations disrupted communication and impaired relationships in the workplace as well as the home. Emotional frustration, relationship conflicts, and frustration in the workplace became apparent for those workers who most, far more than others, realized the long-term effects of the noise-induced hearing loss. These observations illustrate that, in addition to the physical hearing loss caused by occupational noise, the loss extends to social behavior and the psychological sphere

6.3 Summary of Key Findings Related to RO2

Different job titles resulted in different patterns of noise exposure. For example, operators on the rotating shifts were exposed to more variable noise. Conversely, engineers had more consistent, task-based exposure to noise. Longer service durations, coupled with frequent exposure to the same noisy tools, meant that the risks to the employees' hearing became cumulative over time. Employee use of PPE was variable, depending on each task's requirements, the tightness of the equipment, and the comfort level the employee experienced while using the equipment. Some employees avoided using the PPE altogether due to discomfort. Employee use of PPE and noise exposure were primarily driven by peer behavior and purposeful teaching. Counterproductive organizational responses, such as the under-provision of maintenance, a lack of enforcement, and ignoring employee concerns, restricted noise control initiatives. Such findings suggest that the risk of NIHL is driven by individual behavior and organizational noise levels.

6.4 Conclusion of the Study

This study demonstrated that working with persistent noise in the electronics manufacturing industry can negatively affect the health and well-being of employees in both direct and indirect ways. The impact of noise and hearing loss was not solely physical. Workers' behaviors, communication, and psychosocial Relationships were also affected. Normalization of noise, lack of awareness, and absence of early remediation contributed to the worsening of these effects over time. Organizational factors such as inadequate and outdated equipment, inconsistent PPE practices, and weak enforcement of PPE compliance significantly contributed to the risk of NIHL. This study pointed out that frontline workers possess unique insights with regard to the proposed control measures that include suggestions for engineering and administrative control adjustments. The prevention and control of NIHL must incorporate training, expected personnel behavior modifications, upgraded equipment, and attention to organizational factors. The study concluded that NIHL in the electronics manufacturing industry requires more than simple organizational changes.

6.5 Recommendation

Employers need to provide training sessions geared toward noise awareness training that is job-specific, scenario-based, and demonstrative. Conducting hearing tests and assessments periodically helps identify signs of NIHL and assist at-risk patients with hearing problems. A wider variety of hearing protectors may be offered to suit various comfort levels and job specifications. Organizations may purchase noise-reducing technologies such as machine enclosures, soundproof covers, and CNC upgrades to lessen noise at its origin. Scheduled inspections and repairs of old or loud equipment must be prioritized to control excessive noise due to faulty mechanics. Proposed management noise controls must be negotiated with workers. Masters of work should control noise hazards, assess determining methods, and execute control measures. Risk control measures and work management must be practical and feasible. Engagement with workers reinforces the likelihood of control measures working and being sustainable.

Future research could harness the advantages of a bigger and more varied cohort to enhance the applicability of findings to the remainder of the industry. Investigations for other sectors as the automotive industry and those for heavy machinery, could highlight unique noise exposure characteristics relevant to specific sectors. This research could also gain from the integration of more qualitative approaches alongside their quantitative counterparts, as with the noise level, which is also a part of the exposure and behavior scorer of the survey. Research around the impact of peers on other safety behaviors is similarly important to identify informal pathways that might facilitate or obstruct adherence to safety behaviors. Research that examines the intersection of gender, age, or experience on noise exposure and the use of PPE can also support more refined and focused efforts. Longitudinal studies are suggested for the examination of the impact of NIHL on workers' lives and the coping mechanisms they employ.

6.6 Summary of Chapter

The present study emphasized the importance of NIHL and the need for further research, and the importance of NIHL within the context of the electronics sector adds value to the existing literature and research. Focusing on the first-hand experiences of employees sheds light on some obstacles and some of the practical solutions suggested

by the employees and management themselves. The proposed NIHL prevention measures contribute greatly to the understanding of the role of individual practices, organizational behaviors, and the state of the equipment in determining exposure risk. The aims of employers, the state, and safety professionals need to align in the direction of the safe, long-term preservation of employees' hearing. The integration of different organizational frameworks to address NIHL prevention must be coupled with further attention to the NIHL problem to address the prevention and control measures currently in use, which are most likely to become obsolete. Beyond the organizational framework. the integration of respect for employees. NIHL prevention will demand the maintenance of safe hearing levels and the organizational control of sound levels.

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Appendix A

Consent Form

PARTICIPANT CONSENT FORM / BORANG PERSETUJUAN PESERTA

Tile of Research / *Tajuk Kajian*	EXPLORING THE PREVALENCE AND RISK FACTORS OF NOISE-INDUCED HEARING LOSS AMONG ELECTRONICS MANUFACTURING WORKERS *MENEROKA KELAZIMAN DAN FAKTOR RISIKO KEHILANGAN PENDENGARAN AKIBAT BUNYI BISING DALAM KALANGAN PEKERJA INDUSTRI ELEKTRONIK*
Researcher Name / *Nama Penyelidik*	Muhammad Alif Najmi Bin Paiman Master of Science (Occupational Safety and Health Management) Universiti Utara Malaysia (UUM), Kampus Kuala Lumpur
Contact Information / *Maklumat Perhubungan*	017 8257 732 alifnajmi1996@yahoo.com
Supervisor / *Penyelia*	Ts. Dr. Khairul Hafezad Abdullah

1. **Purpose of the Study / *Tujuan Kajian***

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Anda dijemput untuk mengambil bahagian dalam kajian ini yang bertujuan meneroka bagaimana pekerja industri elektronik mengalami kehilangan pendengaran akibat bunyi bising (NIHL), dan bagaimana faktor seperti peranan kerja, tempoh perkhidmatan, serta tahap pendedahan kepada bunyi memberi kesan. Pandangan anda akan membantu memperbaiki langkah perlindungan pendengaran di tempat kerja.

2. **Participant Details / *Butiran Penyertaan***

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  Penyertaan anda adalah secara sukarela.
- The interview will take approximately 30 to 45 minutes.
  Temu bual ini akan mengambil masa kira-kira 30 hingga 45 minit.
- The session will be audio recorded with your permission.
  Sesi akan dirakam audio dengan kebenaran anda.
- You may decline to answer any question.
  Anda boleh memilih untuk tidak menjawab sebarang soalan.
- You may withdraw at any time without penalty.
  Anda boleh berhenti daripada kajian ini pada bila-bila masa tanpa sebarang tindakan.

1 | Page

3. **Confidentiality / *Kerahsiaan***

- Your information will be kept confidential.
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Participant / *Peserta*		**Researcher / *Penyelidik***	
Name *Nama*		Name *Nama*	Muhammad Alif Najmi Bin Paiman
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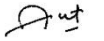
Signature *Tandatangan*		Signature *Tandatangan*	
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Date *Tarikh*	4/7/2025	Date *Tarikh*	4/7/2025

Appendix B

Interview Script Participant A

INTERVIEW	
Interviewer	*Okay kak, soalan saya ini bukan soalan tertutup (ya atau tidak), tapi soalan terbuka. Maksudnya, akak boleh jawab mengikut pandangan sendiri. Soalan pertama saya: Boleh akak terangkan jenis bunyi bising yang akak dengar semasa bekerja?*
	Okay, this is an open-ended question, not a yes-or-no type. You can answer however you like. First question: Can you describe the type of noise you usually hear while working?
Respondent A	*Macam mana nak terangkan ya… Mesin tu dah lama tak digunakan, tapi bunyinya lebih kurang macam ni: jig jig jig jig jig, macam tu.*
	Hmm, how do I explain it… The machine hasn't been running for quite some time, but the sound is something like jig jig jig jig jig, like that.
Interviewer	*Maksudnya bunyi tu berterusan, atau ada berhenti sekejap-sekejap?*
	Is the sound continuous, or does it stop and start?
Respondent A	*Bunyi tu berterusan, kecuali bila mesin berhenti. Contohnya, bila mesin ada masalah atau bila kami tukar bahagian-bahagian tertentu, baru bunyi tu akan berhenti.*
	The sound is continuous, unless the machine stops. For example, when there's a problem or when we change some parts, then the noise stops.
Interviewer	*Itu mesin fuse clip, kan? Kalau mesin 10P pula macam mana?*
	That's the fuse clip machine, right? What about the 10P machine?
Respondent A	*Mesin 10P pun lebih kurang sama. Bunyinya juga berterusan, kecuali bila kami berehat, baru ia berhenti.*
	The 10P machine sounds more or less the same. The noise is continuous too, and it only stops when we take a break.
Interviewer	Jadi, bunyi bising utama adalah daripada mesin, bukan daripada peralatan lain? Adakah anda menggunakan pistol angin (air gun)?
	So it's mainly machine noise, not from tools? Do you use an air gun?
Respondent A	*Air gun jarang digunakan. Biasanya kami guna sekali je, masa nak bersihkan mesin.*
	We rarely use the air gun. Usually, we use it only once — when cleaning the machine.
Interviewer	*Biasanya kerja tu dibuat oleh juruteknik atau operator?*
	Usually, is the task done by the technician or by the operator?
Respondent A	*Operator yang buat.*
	The operator does it.
Interviewer	*Sepanjang waktu bekerja tu, bila bunyi paling ketara? Contohnya, dalam tempoh 8 jam bekerja, waktu bila yang paling bising akak rasa?*
	During your working hours, when is the noise the most noticeable? For example, throughout an 8-hour shift, when does it get the loudest?
Respondent A	*Tak ada la. Bunyinya sama je sepanjang masa.*
	Not really. The sound is the same throughout.
Interviewer	*Kalau masa mesin tiba-tiba rosak (breakdown), bunyinya jadi lebih kuat tak?*
	When the machine breaks down, does the noise become louder?
Respondent A	*Tak ada. Kalau mesin rosak, tak ada bunyi lain pun. Memang itu je bunyi dia. Tapi kalau langsung tak berbunyi, itu maksudnya ada masalah.*
	No. If the machine has a problem, there's no different noise. That's just how it sounds. But if there's no sound at all, then it means something's wrong.
Interviewer	*Maksudnya, bunyinya konsisten la ya?*
	So the noise is consistent?
Respondent A	*Ha ah sama sahaja. tapi kalau bunyi tu kurang sikit itu kiteorang pelik. mesti ade benda tak kena. mesti ada problem.*
	Yes, it's the same. But if the sound becomes slightly quieter, we find it strange. There must be a problem.

Interviewer	*Bila kata perlahan, macam mana perlahan tu?*
	When you say quieter, what do you mean?
Respondent A	*Maksudnya bunyi tu luar biasa. Kalau biasa jig jig jig jig, bila ada masalah dia jadi perlahan sikit. Tapi jarang berlaku. Kalau ada masalah, kami akan terus berhentikan mesin. Tak tunggu lama sebab takut jadi NG.*
	It sounds unusual. Normally it's jig jig jig jig, but when there's an issue, it slows down a bit. But it rarely happens. If there's a problem, we immediately stop the machine — we don't wait, in case we get NG (non-good) products.
Interviewer	*Masa tengah kerja, bunyi bising tu ganggu tak fokus akak bekerja dan nak berkomunikasi dengan orang sekeliling?*
	While working, does the noise affect your focus or make it difficult to communicate with others around you?
Respondent A	*Fokus tu okay je. Tapi bila nak bercakap dengan orang, kena cakap kuat. Kalau tak, memang takkan dengar sebab mesin pun kuat.*
	I can still focus. But when talking to others, we have to speak loudly. Otherwise, they won't hear us because the machine is loud.
Interviewer	*Maksudnya, kalau sembang macam kita sekarang ni, takkan dengar la ya?*
	So, if you talk like we're talking now, people won't be able to hear?
Respondent A	*Dengar, tapi perlahan. Macam saya bercakap dengan technician, kena cakap dekat-dekat dan kuat. Sebab tu kami yang kerja di bahagian fuse clip, bercakap memang kuat. Sampai orang luar pun boleh dengar sebab kami lawan dengan bunyi mesin.*
	You can hear it, but it's faint. When I talk to the technician, I have to speak close and loud. That's why we, in the fuse clip area, talk loudly. Even people outside can hear us because we're speaking over the machine noise.
Interviewer	*Jadi saya boleh simpulkan, fokus akak tak terganggu, cuma komunikasi tu agak sukar, ya?*
	So I can conclude that your focus isn't affected, but communication is a bit difficult?
Respondent A	*Betul. Technician pun tahu, bila mesin sedang berjalan, dia memang selalu dekat dengan kita.*
	Yes. The technician also knows that when the machine is running, he usually stays close to us.
Interviewer	*Okay, akak boleh bezakan tak bunyi yang berlaku secara tiba-tiba dengan yang berterusan?*
	Okay, can you distinguish between sudden noise and continuous noise?
Respondent A	*Bunyi mesin tu ke?*
	You mean the machine noise?
Interviewer	*Ha'ah. Contohnya macam jig jig jig, tiba-tiba bunyi jadi makin kuat atau makin perlahan. Tadi akak ada sebut bunyi perlahan. Kalau bunyi tiba-tiba jadi kuat, akak perasan tak?*
	Yes. For example, like jig jig jig, and suddenly the sound becomes louder or softer. You mentioned a softer noise earlier — how about a sudden loud noise?
Respondent A	*Ya, akak boleh bezakan.*
	Yes, I can tell the difference.
Interviewer	*Apa tugas akak dekat mesin fuse clip dan 10P?*
	What are your tasks at the fuse clip and 10P machines?
Respondent A	*Untuk fuse clip, ada dua mesin. Seorang jaga satu mesin. Proses kami dari awal sampai akhir — tak macam final line yang ada ramai orang. Fuse clip, semua operasi dibuat oleh seorang saja. Dari pemeriksaan sampai ke pembungkusan, semua kami buat sendiri.*
	For the fuse clip, there are two machines, and each person handles one machine. Our process goes from start to finish — unlike the final line, which involves many people. In fuse clip, one person does everything, from checking to packing.
Interviewer	*Fuse clip tu proses yang potong kaki komponen tu ke?*
	Is the fuse clip process the one that cuts the component legs?
Respondent A	*Ha'ah, yang besi bising tu.*

	Yes, that's the one with the noisy metal parts.
Interviewer	*Kalau mesin 10P pula?*
	What about the 10P machine?
Respondent A	*Biasanya akak buat bahagian appearance (penampilan) dekat situ.*
	I usually handle the appearance checking there.
Interviewer	*Dalam tugas akak tu, ada tak kerja-kerja tertentu yang buatkan akak lebih terdedah pada bunyi bising berbanding yang akak cerita tadi?*
	In your tasks, are there any specific jobs that expose you to louder noise than what you've described?
Respondent A	*Tak ada.*
	No, there isn't.
Interviewer	*Berapa kerap akak tukar tugasan atau tempat kerja dalam sebulan, lebih kurang?*
	Roughly how often do you change tasks or workstations in a month?
Respondent A	*Kalau mesin tu tengah operasi, memang akak kerja kat situ saja. Kalau mesin tak jalan, baru buat kerja lain.*
	If the machine is operating, I'll be working there only. If it's not running, then I'll do other work.
Interviewer	*Mesin tu last sekali beroperasi bila ya, kak?*
	When was the last time the machine was operating?
Respondent A	*Bulan Februari 2025.*
	February 2025.
Interviewer	*Sebelum Februari 2025 tu, mesin tu beroperasi secara berterusan juga ke?*
	Before February 2025, was the machine operating continuously?
Respondent A	*Sebelum tu pun tak berterusan. Jarang-jarang saja operasi. Dalam sebulan, mungkin seminggu saja.*
	Even before that, it didn't run continuously. It operated only occasionally — maybe one week in a month.
Interviewer	*Maksudnya, operasi terakhir pada Februari 2025. Sebelum tu pun jalan seminggu je. Sekarang memang dah lama tak operasi ya?*
	So the last operation was in February 2025, and before that it ran just one week a month. Now it hasn't been operating for a while?
Respondent A	*Ha'ah.*
	Yes.
Interviewer	*Mesin 10P pun lagi lama tak beroperasi kan?*
	The 10P machine hasn't been operating even longer, right?
Respondent A	*Ha'ah. Kalau beroperasi pun sehari je.*
	Yes. Even if it runs, it's only for a day.
Interviewer	*Kalau fuse clip dan 10P tak beroperasi, akak kerja dekat mana?*
	If both fuse clip and 10P aren't operating, where do you work?
Respondent A	*Saya bantu di bahagian SMT. Kalau tak ada operator di line, saya tolong back up. Kalau ada syif malam, saya ganti operator syif malam. Tapi kerja-kerja tu tak ada apa-apa sangat. Sunyi, tak ada bunyi bising.*
	I help out in SMT. If there's no operator on the line, I back them up. If there's a night shift, I help cover that. But those jobs are very quiet — no noise at all.
Interviewer	*Kira akak dengar bunyi bising hanya apabila mesin fuse clip atau mesin 10P beroperasi sahaja, ya?*
	So you only hear loud noise when the fuse clip or 10P machine is operating, right?
Respondent A	*Ha'ah. Tapi sejak kami dapat ear plug, kami pakai la. Cuma kadang-kadang buka juga sebab tak selesa, telinga jadi sakit. Yelah, pakai 8 jam memang sakit. Jadi kadang buka sekejap, lepas tu pakai semula.*
	Yes. But since we got earplugs, we wear them. Sometimes we take them off because they're uncomfortable and cause ear pain. Wearing them for 8 hours is painful, so sometimes I remove them briefly and then put them back on.
Interviewer	*Berapa kerap akak bertukar tugasan?*

	How often do you switch tasks?
Respondent A	*Sebelum-sebelum ini tak pernah bertukar pun. Kalau mesin tak beroperasi, baru saya buat kerja lain. Operasi mesin pun bergantung pada pesanan pelanggan. Kalau ada pesanan, mesin akan jalan. Kalau tak ada, mesin tak operasi.*
	Previously, I never switched tasks. I only do other work if the machine isn't operating. The machine runs depending on customer orders. If there's an order, the machine operates. If not, it doesn't.
Interviewer	*Ada tak kerja-kerja yang akak buat terasa lebih penat disebabkan bunyi bising?*
	Are there any tasks that feel more exhausting because of the noise?
Respondent A	*Tak ada. Dah biasa, sebab dah bertahun-tahun kerja.*
	No. I'm used to it after many years of working.
Interviewer	*Sudah berapa tahun akak bekerja di syarikat ini*
	How many years have you been working at this company?
Respondent A	*Akak pernah berhenti sekejap dulu. Kalau tak berhenti, dah 25 tahun. Tapi akak berhenti 8 bulan sebab anak tak ada orang jaga. Lepas tu masuk balik kerja di syarikat ini.*
	I once stopped for a short while. If not, it would be 25 years. I took an 8-month break because there was no one to care for my child. After that, I came back to work at this company.
Interviewer	*Dari mula kerja, memang akak di SMT ke atau proses lain?*
	Since the beginning, were you in the SMT department or elsewhere?
Respondent A	*Sebelum ni akak di department machine. Tapi bila department tu tutup, akak dipindahkan ke SMT.*
	I was in the machine department. But after that department shut down, I was transferred to SMT.
Interviewer	*Akak dah berapa tahun dekat department SMT?*
	How long have you been in the SMT department?
Respondent A	*14 tahun.*
	14 years.
Interviewer	*Berapa lama akak dah kerja di syarikat ini dalam keadaan terdedah kepada bunyi bising?*
	How long have you been exposed to noise while working in this company?
Respondent A	*Masa mula kerja dulu saya di department machine, yang tu memang sangat bising. Mesinnya besar dan bunyi lebih kuat berbanding mesin fuse clip dan 10P sekarang. Dari mula kerja sampai sekarang, saya memang uruskan mesin je. 25 tahun kerja, memang uruskan mesin. Sekarang ni bila mesin fuse clip dan 10P jarang beroperasi, jadi kuranglah terdedah. Dulu satu mesin ada 6 ke 7 orang.*
	When I first started, I was in the machine department, and it was very noisy. The machines were large and louder than the current fuse clip and 10P machines. Since the beginning, I've been handling machines. I've worked with machines for 25 years. Now, since the fuse clip and 10P machines rarely operate, I'm less exposed to noise. Back then, one machine had 6 to 7 people.
Interviewer	*Kira keadaan kerja akak sekarang lebih baik daripada masa awal-awal dulu, ya?*
	So your current working condition is better compared to when you first started, right?
Respondent A	*Ya, betul. Sekarang ni kurang sikit bunyi bising sebab hanya satu mesin saja yang berbunyi. Kalau dulu, ada beberapa mesin, semua bising — tung tang tung tang, jig jig jig jig.*
	Yes, that's right. Now the noise is less because only one machine makes noise. Back then, there were several machines, and all of them were noisy — tung tang tung tang, jig jig jig jig.
Interviewer	*Dulu bunyi bising memang kuat kan? Lepas tu bila dah tukar department, bunyi tu makin kurang. Sekarang pula, mesin pun jarang operasi. Jadi*

	makin kurang akak terdedah kepada bunyi bising. Maknanya kerja akak selama 25 tahun ni memang berubah-ubah la ya?
	So the noise used to be loud, and after switching departments, it reduced. Now, with fewer machine operations, you're less exposed to noise. That means your job has changed over these 25 years?
Respondent A	*Ha'ah, berubah-ubah juga. Sejak tiada pesanan (order), saya banyak tolong operator lain di bahagian SMT. Tak ada bunyi bising pun di situ.*
	Yes, it varies. Since there haven't been any orders, I've been helping other operators at the SMT section. There's no noise there.
Interviewer	*Sebelum ini, akak pernah buat aduan mengenai bunyi bising di tempat kerja?*
	Have you ever filed a complaint about noise in your workplace? Penemuduga:
Respondent A	*Tak pernah pun. Sebab kami ni cuma operator je. Cuma lepas dihantar untuk pemeriksaan telinga (audiometrik), barulah tahu tentang bahaya bunyi bising. Kalau tak, memang tak pernah ambil tahu pun.*
	No, never. We're just operators. It was only after going for a hearing check (audiometric test) that I learned about noise hazards. Otherwise, I wouldn't have known or cared.
Interviewer	*Okay, sejak bila akak mula sedar tentang bunyi bising ini?*
	Okay, since when did you become aware of the noise issue?
Respondent A	*Bunyi bising tu memang dah lama. Tapi kesedaran tu timbul masa saya dihantar ke kursus berkaitan pendengaran tahun lepas. Dari situlah baru saya betul-betul faham.*
	The noise has been there for a long time. But I only became aware after attending the hearing course last year. That's when I truly understood.
Interviewer	*Maksudnya, sebelum pergi kursus tu, akak tahu memang ada bunyi bising tapi tak ambil kisah ya?*
	So before the training, you knew there was noise but didn't really care?
Respondent A	*Ha'ah, tak kisah pun sebab kita fikir itu perkara biasa bila dah kerja di kilang. Lagipun saya cuma operator, jadi memang fokus kerja je.*
	Yes, didn't care because I thought it's normal when working in a factory. It's just part of the job. And since I'm just an operator, I just focused on work.
Interviewer	*Sebelum kursus tahun lepas tu, akak ada hadiri mana-mana latihan berkaitan bunyi bising?*
	Before the training last year, did you attend any other training related to noise?
Respondent A	*Tak ada. Kursus pada Februari 2024 tu yang pertama kali saya hadiri berkaitan bunyi bising. Syarikat yang hantar, jadi saya pergilah. Kalau tak dihantar pun, sebelum ni memang kami tak kisah.*
	No. The one in February 2024 was my first time attending a training about noise. Company arranged it, so I just went. Otherwise, we wouldn't have bothered.
Interviewer	*Berapa kerap akak pakai ear plug?*
	How often do you wear the earplugs?
Respondent A	*Saya akan pakai bila dah siap kemas tempat kerja dan sebelum mesin mula beroperasi. Bila mesin mula jalan, terus pakai. Tapi kalau dah mula rasa sakit, saya buka sekejap.*
	I wear them after tidying up the workstation, just before the machine starts running. Once the machine is on, I put them on. But if I start to feel discomfort, I take them off for a while.
Interviewer	*Akak ada hadapi cabaran untuk pakai ear plug secara konsisten?*
	Do you face any challenges in wearing earplugs consistently?
Respondent A	*Tak ada masalah sangat, cuma kalau pakai lama memang rasa tak selesa. Saya bertudung dan pakai anak tudung juga, jadi bila pakai ear plug lama-lama, memang rasa terganggu dan kurang selesa.*

	Not really, but wearing them for too long can feel uncomfortable. I wear a headscarf and inner scarf, so it gets a bit uncomfortable and bothersome after a while.
Interviewer	*Ada rasa tak selesa atau terganggu masa pakai ear plug?*
	Do you feel any discomfort or disturbance when wearing earplugs?
Respondent A	*Tak selesa bila pakai lama sahaja.*
	It only feels uncomfortable when worn for a long time.
Interviewer	*Biasanya akak rasa tak selesa lepas pakai berapa jam?*
	Usually, after how many hours do you start to feel discomfort?
Respondent A	*Kalau dah setengah hari pakai tak buka-buka memang terasa tak selesa. Kalau pakai ear muff pun lama-lama rasa tak selesa sebab dia melengkung kan. Ear muff yang ada tu pun dah lama.*
	If I wear it continuously for half a day without removing it, it becomes uncomfortable. Even ear muffs feel uncomfortable after a while because they press tightly. The ear muffs we have now are old.
Interviewer	*Akak senang tak nak dapatkan PPE macam ear plug atau ear muff tu?*
	Is it easy for you to get PPE like earplugs or ear muffs?
Respondent A	*Ear plug/ear muff tu memang ada je letak dekat mesin tu. Jadi nak pakai, ambil sahaja.*
	The earplugs and ear muffs are always placed near the machine, so I just take them whenever needed.
Interviewer	*Masa akak kerja dekat department machine yang handle mesin besar-besar tu, ada dapat ear plug/ear muff tak?*
	When you worked in the machine department that handled large machines, were you provided with earplugs or ear muffs?
Respondent A	*Ada dulu. Memang ada diberi jenis ear muff. Yang akak pakai ear muff sekarang ni pun dapat dari dulu masa department machine tu. Memang tak pernah berganti sejak 25 tahun. Dulu banyak, sekarang tak ada lah. Ada satu je ear muff. Yang seorang lagi operator tu India, dia tak pakai tudung, jadi dia pakai jenis ear plug tu yang tak ada masalah.*
	Yes, we were given ear muffs back then. The one I'm using now is from that time when I was in the machine department. It's never been replaced in 25 years. There used to be many, but now there's only one ear muff left. Another operator, an Indian lady who doesn't wear a headscarf, uses the earplug type and has no problem with it.
Interviewer	*Akak pernah tak dapat latihan berkaitan bunyi bising?*
	Have you ever received training related to noise?
Respondent A	*Ada. Pada Februari 2024 dan Februari 2025.*
	Yes, in February 2024 and February 2025.
Interviewer	*Sebelum dari Februari 2024, ada dapat latihan berkaitan bunyi bising?*
	Sebelum dari Februari 2024, ada dapat latihan berkaitan bunyi bising?
Respondent A	*Yang tu tak ada.*
	No, there was none.
Interviewer	*Jenis latihan apa yang diberikan ketika itu?*
	What type of training was provided at that time?
Respondent A	*Latihan macam ujian ukuran bunyi guna alat. Pergi ke tempat-tempat yang bising. Cara nak kurangkan bunyi — tutup itu, tutup ini. Kesan kepada bunyi bising.*
	The training included sound level measurement using a device, visiting noisy areas, learning how to reduce noise, like covering or closing certain things, and understanding the effects of noise exposure.
Interviewer	*Lepas dari latihan tu, ada bagi kesan tak dari segi akak bekerja?*
	After attending the training, did it affect how you work?
Respondent A	*Mestilah ada. Akak jadi kerap pakai earplug/earmuff bila buat kerja dekat tempat bising. Sebelum latihan, akak mana tahu pasal risiko bunyi bising. Kita tak ada fikir masa akan datang — 10 tahun akan datang. Semenjak datang training tu, terus sedar.*

	Of course. I now frequently use earplugs or earmuffs when working in noisy areas. Before the training, I didn't know about the risks of noise exposure. I never thought about the future—like 10 years ahead. After the training, I became fully aware.
Interviewer	*Bagaimana masalah pendengaran yang akak hadapi ini memberi kesan terhadap kerja dan kehidupan peribadi akak?*
	How has your hearing problem affected your work and personal life?
Respondent A	*Saya rasa biasa sahaja. Di rumah pun tiada perbezaan yang ketara.*
	I feel normal. Even at home, it feels the same.
Interviewer	*Sebelum menjalani ujian audiometri, akak pernah perasan tak sebarang simptom masalah pendengaran?*
	Before doing the audiometric test, did you notice any symptoms of hearing problems?
Respondent A	*Tak ada pun. Semuanya rasa normal. Selepas menjalani ujian audiometri barulah saya tahu ada sedikit masalah.*
	No, I didn't. Everything felt normal. Only after the audiometric test I found out there was a slight issue.
Interviewer	*Pernah tak rakan sekerja atau ahli keluarga akak menyedari ada perubahan dari segi pendengaran akak?*
	Have any of your colleagues or family members ever mentioned that you seemed to have changes in your hearing?
Respondent A	*Tak ada. Tiada siapa pun pernah cakap apa-apa.*
	No, no one mentioned anything.
Interviewer	*Pada pandangan akak, perubahan apa yang boleh dilakukan bagi membantu mengurangkan risiko kehilangan pendengaran di tempat kerja?*
	In your opinion, what changes can be made to help reduce the risk of hearing loss in the workplace?
Respondent A	*Saya rasa penggunaan earplug atau ear muff sudah memadai. Mungkin boleh dibekalkan jenis yang lebih tebal supaya lebih selesa pada telinga.*
	I think just using earplugs or ear muffs. Maybe provide thicker types so it's more comfortable for the ears.
Interviewer	*Bagi akak, jenis kesedaran atau insentif bagaimana yang boleh membantu meningkatkan kesedaran mengenai bunyi bising?*
	What kind of awareness methods or incentives do you think are effective in increasing awareness about noise?
Respondent A	*Bagi saya, latihan adalah kaedah paling berkesan. Tanpa latihan, saya sendiri pun tak sedar tentang risiko bunyi bising. Latihan tu memang sangat membantu.*
	I think training is the most effective. Without the training, I wouldn't have known about the risks of noise. The training really helped.
Interviewer	*Antara hanya memberi PPE atau memberi latihan, yang mana lebih berkesan untuk galakkan penggunaan PPE secara konsisten?*
	Between just giving PPE or giving training, which one encourages more consistent PPE use?
Respondent A	*Latihan memang penting. Jika hanya diberi PPE tanpa latihan, ia tidak mencukupi untuk menggalakkan penggunaan secara konsisten. Saya sendiri pernah mengalaminya — dahulu, walaupun persekitaran bising, saya tidak ambil peduli. Tetapi selepas menghadiri latihan, saya lebih faham dan lebih berdisiplin menggunakan PPE.*
	Training is truly important. If PPE is provided without proper training, it's not enough to encourage consistent use. I experienced it myself — previously, even though it was noisy, I didn't really care. But after attending the training, I understood better and became more diligent in using PPE.
Interviewer	*Pada pendapat akak, berapa kerap seseorang itu perlu menghadiri latihan berkaitan risiko bunyi bising untuk mengekalkan tahap kesedaran?*
	In your opinion, how often should a person attend training on noise risk to maintain awareness?
Respondent A	*Sekurang kurangnya setahun sekali la. sebab benda ni bukan janga masa pendek. dah lama baru ada kesan. jadi penting kena diingatkan selalu. lagi*

	lagi macam akak dah berusia ni, lagi kena kerap diingatkan. Dari awal kena jaga.
	At least once a year. Because this thing is not something that happens for a short time. It takes a long time to have an effect. So it's important to be reminded often. Especially since I'm older, I have to be reminded often. From the beginning, I have to take care of it.
Interviewer	*Akak ada apa-apa lagi yang ingin dikongsikan?*
	Do you have anything else you would like to share?
Respondent A	*Setakat ini tiada apa-apa lagi. Cuma kalau boleh, pihak syarikat sediakan ear muff yang baru.*
	So far, nothing else. Just that, if possible, it would be good to provide new ear muffs.

Appendix C

Interview Script Participant B

INTERVIEW	
Interviewer	*Soalan ini adalah soalan terbuka, bukan jenis jawapan Ya atau Tidak. You boleh jawab ikut perspektif dan fahaman sendiri. Soalan pertama, boleh tak you jelaskan jenis bunyi bising yang you dengar di ECO-Q?*
	So I'm going to ask an open-ended question. It's not a Yes or No type of question. You can answer based on your perspective and understanding. First question, can you describe the types of noise you hear in ECO-Q?
Respondent B	*Bunyi bising di ECO-Q secara khusus datang dari kawasan Wire Welding. Bunyi dia macam "tupppp... pssssssssss... tupppp." Bunyi ini berlaku apabila bahagian mesin mula-mula jatuh untuk stamp remote bagi menyatukan permukaan atas dan bawah. Kemudian, angin dilepaskan daripada produk, dan akhirnya bahagian mesin naik semula ke atas.*
	The noise in ECO-Q specifically comes from the Wire Welding area. The sound is like "tuppppp... pssssssssss... tupppp." It starts when the machine part drops to stamp the remote, joining the top and bottom parts. Then there's a release of air from the product, and finally, the machine part moves back up.
Interviewer	*Bunyi bising tu berlaku secara berterusan atau ada sela masa?*
	Is the noise continuous or does it have gaps?
Respondent B	*Bunyi bising itu ada sela masa.*
	There are gaps in the noise.
Interviewer	*Selain kawasan itu, ada lagi tak sumber bunyi bising lain?*
	Besides that area, are there any other noise sources there?
Respondent B	*Tak ada. Blower pun ada digunakan, tapi bunyinya tak sekuat di kawasan wire welding.*
	No, not really. There is a blower, but it's not as noisy as the wire welding area.
Interviewer	*Bila masa bunyi bising paling ketara yang you dengar?*
	When is the noise at its loudest?
Respondent B	*Di kawasan wire welding, bunyi paling kuat ialah semasa angin dilepaskan.*
	In the wire welding area, the loudest part is when the air is released.
Interviewer	*Maaf, tapi bila kali terakhir proses ECO-Q beroperasi?*
	Sorry, but when was the last time the ECO-Q process was in operation?
Respondent B	*Operasi terakhir adalah pada bulan Mei 2025, itu pun hanya satu hari sahaja.*
	The last operation was in May 2025, and it was only for one day.
Interviewer	*Biasanya siapa yang kendalikan proses wire welding?*
	Usually, who handles the wire welding process?
Respondent B	*Biasanya operator yang jalankan. Selalunya saya yang uruskan wire welding. Di kawasan itu ada tiga orang operator.*
	Usually, the operator handles it. Most of the time, I'm the one doing it. There are three operators at that area.
Interviewer	*Ketiga-tiga operator tu buat kerja wire welding serentak ke, atau macam mana pembahagiannya?*
	Do all three operators work on wire welding at the same time, or how is it divided?
Respondent B	*Ia bergantung pada keadaan. Kalau cukup pekerja, setiap operator akan uruskan workstation masing-masing. Tapi kalau tak cukup orang, seorang operator akan kendalikan lebih daripada satu workstation.*
	It depends. If there are enough workers, each operator handles their own workstation. But if manpower is short, one person will operate more than one workstation.
Interviewer	*Boleh tak you bezakan antara bunyi secara tiba-tiba dan bunyi berterusan masa kerja?*
	Can you differentiate between sudden noises and continuous noises while working?

Respondent B	*Ya, boleh. Contohnya, kalau produk tak masuk dengan betul, mesin akan keluarkan bunyi "dut dut dut." Saya kena tutup mesin tu, padam, dan hidupkan semula.*
	Yes, I can. For example, if a product doesn't go in properly, the machine makes a "dut dut dut" sound. I have to shut it down and restart the machine.
Interviewer	*Apakah tugasan you semasa bekerja di workstation wire welding?*
	What are your tasks when working at the wire welding workstation?
Respondent B	*Di bahagian kitchen, iaitu pada permulaan proses, saya akan lakukan kerja-kerja skru menggunakan alat tangan, pasang helaian putih dan tutup casing. Seterusnya di bahagian bathroom yang ada proses wire welding, saya perlu skru juga, masukkan wayar dan besi, pasang helaian putih dan casing, periksa LCD, dan akhir sekali barulah jalankan wire welding.*
	At the kitchen area, which is the beginning of the process, I do screwing using hand screw tools, attach the white sheet, and close the casing. Then at the bathroom section where wire welding is done, I also do screwing, insert wires and metal parts, attach the white sheet and casing, perform LCD checking, and finally, wire welding.
Interviewer	*Boleh jelaskan secara ringkas bagaimana proses wire welding itu dilakukan?*
	How exactly does the wire welding process work?
Respondent B	*Ia sebenarnya proses penyambungan. Mesin akan memanaskan dan kemudian melekatkan bahagian atas dan bawah casing.*
	It's actually a fitting process. The machine heats up and then fuses the top and bottom parts of the casing together.
Interviewer	You kerap terlibat tak dalam proses wire welding di bahagian bathroom?
	Do you often handle the wire welding process at the bathroom section?
Respondent B	*Ya, bergantung kepada perancangan pengeluaran. Kadang-kadang saya akan bekerja di bahagian kitchen dahulu selama setengah hari atau satu hari penuh. Kemudian pada sebelah petang atau hari berikutnya saya akan buat kerja di bahagian bathroom yang ada wire welding.*
	Yes, depending on the production planning. Sometimes I work in the kitchen area for half a day or a full day, then switch to the bathroom section either in the afternoon or the next day.
Interviewer	*Sejauh mana kekerapan you bertukar tugasan atau tempat kerja?*
	How often do you change tasks or work locations?
Respondent B	*Agak kerap juga. Kalau ada operasi di ECO-Q, saya akan kerja di situ. Tapi bergantung juga pada sasaran pengeluaran. Kalau target output hanya 20 atau 30 unit, saya tidak akan terlibat. Memandangkan proses ECO-Q jarang beroperasi, kebanyakan masa saya bekerja di bahagian produk MARCO.*
	Quite often. If there's an operation at ECO-Q, I will work there. But it also depends on the output target. If the target is just 20 or 30 pieces, I won't be involved in ECO-Q. Since the ECO-Q process rarely runs, I mostly work in the MARCO product section.
Interviewer	*Tempat kerja di bahagian produk MARCO bising tak?*
	Is the workplace in the MARCO product section noisy?
Respondent B	*Tak bising pun. Kalau ada pun, cuma bunyi blower yang sedikit sahaja.*
	Not really. If it's noisy, it's only a little from the blower.
Interviewer	*Dalam sebulan, lebih kurang berapa hari you bekerja di ECO-Q?*
	Roughly in a month, how many days do you work at ECO-Q?
Respondent B	*Lebih kurang satu atau dua hari sahaja.*
	Only about one or two days.
Interviewer	*Ada tak mana-mana tugasan yang buat you rasa lebih penat disebabkan bunyi bising?*
	Are there any tasks that make you feel extra tired due to noise?
Respondent B	*Tak ada. Bila dengar bunyi bising di kawasan wire welding pun saya rasa biasa sahaja. Tak rasa penat pun.*
	No. Even when hearing the noise at the wire welding section, it feels normal. I don't feel extra tired.
Interviewer	*Sudah berapa lama you bekerja di syarikat ini?*
	How long have you been working at this company?

Respondent B	*Lebih kurang 5 tahun. Saya mula kerja pada tahun 2020.*
	Around 5 years. I joined in 2020.
Interviewer	*Sejak mula kerja tahun 2020, tahun bila you mula bekerja di kawasan yang bising?*
	Since you started in 2020, when did you begin working in noisy areas?
Respondent B	*Pada mulanya saya bekerja di bahagian produk MARCO. Saya mula bekerja di kawasan yang bising di ECO-Q sekitar tahun 2022 — kira-kira sudah 3 tahun.*
	At first, I worked in the MARCO section. I started working in the noisy ECO-Q section around 2022 — about 3 years ago.
Interviewer	*Adakah tugasan you kekal sama atau sering berubah?*
	Have your tasks remained the same or changed over time?
Respondent B	*Tugasan saya memang sering berubah. Kalau ada staf yang tidak hadir, saya perlu bantu di workstation yang tiada orang.*
	They change. If someone is absent, I have to cover the unmanned workstation.
Interviewer	*You pernah tak buat aduan berkaitan bunyi bising di tempat kerja?*
	Have you ever made a complaint about noise at the workplace?
Respondent B	*Tak pernah. Saya rasa bunyi itu perkara biasa sahaja.*
	No, I haven't. It just feels normal.
Interviewer	*You kerap tak pakai PPE untuk bunyi bising seperti ear plug?*
	Do you often wear hearing protection PPE such as earplugs?
Respondent B	*Ya, saya memang pakai ear plug semasa bekerja di workstation wire welding.*
	Yes, I wear earplugs when working at the wire welding station.
Interviewer	*You ada rasa cabaran tak untuk pakai ear plug secara konsisten?*
	Do you face any challenges in consistently wearing earplugs?
Respondent B	*Ada. Kalau saya pakai ear plug separuh masuk ke telinga, memang terasa sakit. Tapi kalau saya pakai dengan betul, iaitu tarik sedikit telinga ke atas sebelum masukkan ear plug, barulah tidak sakit. Cuma bila pakai dengan cara yang betul, saya memang langsung tak dengar apa-apa—orang bercakap pun saya tak dengar. Saya hanya fokus kerja sahaja.*
	Yes. When I wear the earplugs halfway into my ears, it feels painful. But if I wear them correctly—by pulling the ear slightly upward before inserting—then it doesn't hurt. However, when I wear them properly, I can't hear anything, not even people talking. I just focus entirely on my work.
Interviewer	*Bila pakai ear plug you ada rasa tidak selesa atau terganggu tak?*
	Do you feel any discomfort or disturbance when wearing earplugs?
Respondent B	*Cuma rasa sakit sikit di bahagian luar telinga. Kadang-kadang terasa gatal sedikit sahaja.*
	Just a slight pain around the outer ear area. It also feels a little itchy sometimes.
Interviewer	*Senang tak nak dapat ear plug dekat tempat kerja?*
	Is it easy to get earplugs at your workplace?
Respondent B	*Senang sahaja. Kalau tak ada ear plug, saya minta saja dengan leader. Nanti leader akan ambil daripada pegawai keselamatan & kesihatan (SHO).*
	Yes, it's easy. If there are no earplugs, I can just ask the leader. The leader will get them from the Safety and Health Officer.
Interviewer	*You pernah tak terima latihan berkaitan bunyi bising di tempat kerja?*
	Have you ever received training related to workplace noise?
Respondent B	*Ya, saya dah hadir dua kali—sekali pada tahun 2024 dan sekali lagi tahun 2025.*
	Yes, I've attended two training sessions—once in 2024 and again in 2025.
Interviewer	*Apakah jenis latihan yang diberikan kepada you?*
	What kind of training was provided to you?
Respondent B	*Trainer ajar dalam kelas dulu, kemudian bawa kami ke kawasan mesin dan periksa tahap bunyi bising guna telefon bimbit.*
	The trainer taught us in the classroom first, then took us to the machine area to measure noise levels using a mobile phone.
Interviewer	*Lepas training tu, ada kesan tak pada cara kerja you?*
	After the training, did it change the way you work?
Respondent B	*Ada. Selepas training, barulah saya tahu tentang risiko bunyi bising. Sebelum itu, walaupun dengar bunyi kuat, saya tak rasa apa-apa pun.*

	Yes. After the training, I became aware of the risks of noise. Before that, I didn't feel anything even when exposed to loud sounds.
Interviewer	*Pada pendapat you, latihan berkaitan bunyi bising perlu dibuat sekali sahaja atau secara berkala?*
	In your opinion, should noise-related training be conducted once or on a regular basis?
Respondent B	*Sekurang-kurangnya setahun sekali. Kalau terlalu kerap pun bosan juga sebab isi kandungannya sama sahaja.*
	At least once a year. If it's done too frequently, it can get boring because it's the same content.
Interviewer	*Apa kesan masalah pendengaran you terhadap kerja atau kehidupan peribadi?*
	How has your hearing issue affected your work or personal life?
Respondent B	*Tak ada. Semua orang kata saya masih boleh dengar macam biasa.*
	None. Everyone says I can still hear normally.
Interviewer	*Before the audiometric test, did you notice any symptoms of hearing loss?*
	Sebelum buat ujian audiometri, you perasan tak ada simptom kurang pendengaran?
Respondent B	*Tak ada. Saya rasa saya okay sahaja. Mungkin saya tersalah tekan masa ujian audiometri.*
	No, I felt fine. I think maybe I pressed the wrong button during the audiometric test.
Interviewer	*But based on the results, both last month's and last year's audiometric tests show abnormal hearing.*
	Tapi berdasarkan keputusan, ujian audiometri bulan lepas dan tahun lepas dua-dua tunjuk bacaan tidak normal.
Respondent B	*Saya tak tahu pun keputusan yang tahun lepas.*
	I didn't know the result from last year.
Interviewer	*Rutin harian atau produktiviti kerja you terjejas tak disebabkan masalah pendengaran ini?*
	Has your routine or work productivity been affected by your hearing problem?
Respondent B	*Tak ada terjejas langsung.*
	No, not at all.
Interviewer	*Kawan sekerja atau ahli keluarga you ada perasan tak perubahan dari segi pendengaran?*
	Have your colleagues or family members ever noticed any changes in your hearing?
Respondent B	*Setakat ini, tiada siapa pun berikan sebarang maklum balas. Semua nampak okay sahaja.*
	So far, no one has given any feedback. Everything seems fine.
Interviewer	*Pada pandangan you, apakah perubahan yang boleh dibuat untuk mengurangkan risiko kehilangan pendengaran di tempat kerja?*
	In your opinion, what changes could be made to reduce the risk of hearing loss at the workplace?
Respondent B	*Saya tak pasti nak jawab apa. Contohnya, mesin di wire welding memang bising, tapi kalau tak ada mesin tu, kerja tak boleh dijalankan.*
	I'm not sure what to answer. For example, the machine at wire welding is noisy, but without it, the work can't be done.
Interviewer	*What improvements can the company make in terms of noise control?*
	Apa yang pihak syarikat boleh perbaiki dalam kawalan kebisingan?
Respondent B	*Saya pun tak pasti nak jawab soalan tu.*
	I'm not sure how to answer that either.
Interviewer	*Antara PPE dan latihan, yang mana lebih penting pada pandangan you?*
	In between PPE and training, which do you think is more important?
Respondent B	*PPE lebih penting.*
	PPE is more important.
Interviewer	*Sebelum latihan berkaitan bunyi bising yang dijalankan pada tahun 2024, you ada tahu apa-apa tentang risiko bunyi bising?*

	Before the noise-related training in 2024, did you know anything about noise risks?
Respondent B	*Tak ada. Saya tahu tentang bunyi bising, tapi masa mula kerja dulu rasa macam biasa sahaja.*
	No. I knew about the noise, but when I first started working, it just felt normal.
Interviewer	Akhir sekali, ada apa-apa yang you ingin kongsikan berkaitan bahaya bunyi bising?
	Lastly, is there anything you'd like to share regarding noise hazards?
Respondent B	*Tak ada.*
	No, nothing.
Interviewer	*Sebelum mula bekerja di syarikat ini pada tahun 2020, you bekerja di mana?*
	Before working at this company in 2020, where were you employed?
Respondent B	*Saya mula bekerja di syarikat ini pada tahun 1999 dan bekerja selama 10 tahun. Selepas itu saya berhenti selama 10 tahun. Kemudian pada tahun 2020, saya masuk semula ke syarikat ini. Semasa tempoh 10 tahun berhenti tu, saya bekerja di kilang elektronik di Bangi secara kontrak.*
	I first joined this company in 1999 and worked there for 10 years. Then I stopped for another 10 years. In 2020, I rejoined this company. During that 10-year gap, I worked at an electronics factory in Bangi on a contract basis.
Interviewer	*Masa kerja di kilang elektronik di Bangi, ada terdedah kepada bunyi bising tak?*
	When you were working at the electronics factory in Bangi, were you exposed to noise?
Respondent B	*Tak ada pun. Tempat kerja di sana okay sahaja. Tapi kerja di sini lebih baik.*
	No, there wasn't. The work environment there was okay. But working here is better.
Interviewer	*Semasa kerja di tempat lama, ada buat pemeriksaan telinga (ujian audiometri)?*
	Did they conduct any hearing checks (audiometric tests) at your previous workplace?
Respondent B	*Tak ada. Baru sekarang saya buat pemeriksaan telinga.*
	No, only now I've had my hearing tested.

Appendix D

Interview Script Participant C

INTERVIEW	
Interviewer	*Boleh tak abang terangkan jenis bunyi bising yang abang terdedah semasa waktu bekerja?*
	Can you explain the types of noise you are exposed to during work?
Respondent C	*Bunyi bising datang daripada kerja potong material guna mesin milling dan bunyi angin (air gun). Bila potong, terutamanya guna material setebal 2mm, memang menghasilkan bunyi yang kuat. Kalau pakai 0.5mm, tak kuat sangat. Semakin tebal bahan yang dipotong, semakin kuat bunyinya.*
	The noise comes from cutting materials using the milling machine and from the air gun. When cutting, especially with 2mm thick materials, it produces loud noise. If using 0.5mm, it's not that loud. The thicker the material, the louder the sound.
Interviewer	*Maksud "tebal" tu bagaimana ya?*
	What do you mean by "thicker" material?
Respondent C	*Maksud banyak tu lagi tebal kita potong, lagi kuat bunyi dia. Satu lagi bungi angin (air gun). Mata milling tu kena dibersihkan guna angin. Kalau tak dibersihkan boleh patah mata milling tu. Kalau tempat lain dia bersihkan guna coolant. Coolant tu biasa untuk bosong besi. Tapi macam situasi kita, banyak potong acrylic guna coolant pun tak ada masalah. Kalau coolant tu nanti lantai cepat kotor dan berlecak.*
	I mean the thicker the material we cut, the louder the noise. Another source is the air gun used to clean the milling tip. If not cleaned, the milling bit might break. Other places use coolant, mainly for cutting metal. In our case, we cut acrylic, so using coolant is fine. But coolant makes the floor dirty and slippery.
Interviewer	*Selain dari dua tu, ada bunyi dari mesin pemotongan macam jig saw. Potong guna jig saw tu pun, lagi tebal nak potong lagi bising.*
	Besides those two, are there any other noise sources?
Respondent C	*Ada, dari mesin pemotong seperti jigsaw. Kalau bahan yang dipotong lebih tebal, bunyi pun jadi lebih kuat.*
	Yes, from the jigsaw cutting machine. The thicker the item being cut, the noisier it gets.
Interviewer	*Biasanya bila bunyi bising paling ketara?*
	When is the noise the loudest?
Respondent C	*Masa beban kerja tinggi—contohnya bila perlu siapkan jig dengan segera. Kalau nak potong 20 cm, kita akan potong 25 cm, kemudian square-kan lebihan 5 cm guna mesin milling. Bila nak cepat, kami potong banyak keping sekali gus, bukan satu-satu.*
	When the workload is high—like when we need to make urgent jigs. For example, to cut a 20cm part, we cut 25cm and use the milling machine to square off the excess. When in a rush, we cut multiple pieces at once, not one by one.
Interviewer	*Jadi saya simpulkan, bila permintaan tinggi, masa tu bunyi bising memang sangat kuat ya?*
	So, to summarise, the noise is the loudest when demand is high?
Respondent C	*Ya, betul.*
	Yes, that's right.
Interviewer	*Bunyi bising tu ada jejaskan fokus atau komunikasi abang?*
	Does the noise affect your focus or communication?
Respondent C	*Ya, bunyi bising ganggu fokus. Contohnya masa potong jig ikut ukuran dalam lukisan, bila terlalu bising, saya boleh tersilap potong. Contoh nak potong 1mm, kadang terlebih. Kalau dah terlebih, kena buat semula.*
	Yes, it disrupts focus. For example, when cutting jigs according to drawing dimensions, loud noise can cause mistakes—like overcutting by 1mm. When that happens, we need to redo the whole thing.
Interviewer	*Kalau dalam masa yang sama, mesin lain pun beroperasi juga, masa tu bunyi bising macam mana?*

	What if, at the same time, other machines are also operating? How's the noise level then?
Respondent C	*Bising jadi teramat. Kalau kiri kanan mesin beroperasi serentak, memang kena menjerit kalau nak bercakap. Komunikasi memang sangat terganggu.*
	It becomes extremely noisy. If machines on the left and right run together, people have to shout just to talk. Communication really suffers.
Interviewer	*Abang boleh bezakan tak antara bunyi secara tiba-tiba dan bunyi berterusan?*
	Can you differentiate between sudden noises and continuous noise?
Respondent C	*Boleh. Bunyi biasa tu kita boleh kenal. Tapi kalau bunyi yang terlalu kuat atau tak normal, boleh buat sakit kepala. Contohnya masa order urgent, kita potong 10 keping sekali gus—memang sangat bising.*
	Yes. Normal noise is manageable, but unusually loud or abnormal noises can cause headaches. For example, when cutting 10 pieces at once during urgent orders—it's extremely noisy.
Interviewer	*Apa peranan kerja abang dan tugasan yang biasa abang buat dalam sehari bekerja?*
	What is your role and what tasks do you usually perform in a typical workday?
Respondent C	*Saya buat jig. Bila production minta jig, saya yang akan buatkan.*
	I make jigs. When production requests jigs, I'm the one who makes them.
Interviewer	*Ada tak tugasan tertentu yang mendedahkan abang kepada bunyi bising yang lebih kuat?*
	Are there any specific tasks that expose you to louder noise?
Respondent C	*Ada. Seperti yang saya cakap tadi, bila potong banyak sekaligus, bunyi memang sangat kuat. Semakin banyak dipotong serentak, semakin bising. Biasanya production akan minta lebih dari satu jig.*
	Yes. Like I mentioned, when cutting many pieces at once, it's extremely loud. The more you cut at once, the louder it is. Usually, production requests more than one jig.
Interviewer	*Biasanya staff production minta jig awal atau bagaimana?*
	Do production staff usually request jigs in advance?
Respondent C	*Mereka minta ikut suka. Tak ikut masa. Dalam prosedur, hanya soldering jig sahaja yang perlu diminta dua minggu sebelum operasi.*
	They request jigs as they please—there's no fixed timing. Only for soldering jigs, they're required to request two weeks in advance as stated in the procedure.
Interviewer	*Berapa lama biasanya diambil untuk siapkan satu jig?*
	How long does it usually take to complete one jig?
Respondent C	*Lebih kurang tiga hari.*
	Around three days.
Interviewer	*Berapa kerap abang bertukar tugasan atau tempat kerja?*
	How often do you change tasks or work locations?
Respondent C	*Ada juga, tapi tak kerap. Anggaran dalam sebulan sekali sahaja saya buat kerja selain daripada buat jig. Contohnya, kalau tak ada jig yang nak dibuat, saya akan bantu buat kerja-kerja penyelenggaraan.*
	Occasionally, but not often. On average, maybe once a month I do work other than making jigs. For example, if there are no jigs to be made, I'll help with maintenance tasks.
Interviewer	*Ada tak tugasan tertentu yang terasa lebih memenatkan disebabkan bunyi bising?*
	Are there any tasks that feel more tiring because of the noise?
Respondent C	*Penat sebab bunyi bising tu tak ada. Bagi saya, bunyi bising tu perkara biasa. Saya jenis yang suka buat kerja, yang penting ada kerja. Saya tak boleh duduk diam tanpa buat apa-apa.*
	No, I don't feel tired because of noise. For me, noise is normal. I'm the type who enjoys working—as long as there's work to do. I can't just sit around doing nothing.
Interviewer	*Berapa lama abang dah bekerja di syarikat ini?*
	How long have you been working at this company?
Respondent C	*Saya mula bekerja pada tahun 1994. Jadi lebih kurang 31 tahun saya kerja di syarikat ini.*
	I started in 1994, so it's been around 31 years.

Interviewer	*Adakah tahap kebisingan berubah dari semasa ke semasa?*
	Has the noise level changed over time?
Respondent C	*Ya, berubah. Masa mula-mula masuk pada tahun 1994, saya bekerja di jabatan R&D. Lepas R&D tutup, saya masuk QC. Lepas itu baru tukar ke jabatan PE yang saya kerja sekarang. Dalam anggaran 16 tahun saya berada di jabatan PE ini.*
	Yes, it has. When I first joined in 1994, I was in the R&D department. After R&D closed, I moved to QC. Then I transferred to the current PE department. I've been in PE for about 16 years.
Interviewer	*Sepanjang abang bekerja di syarikat ini, workstation mana yang paling bising?*
	In your time at this company, which workstation is the noisiest?
Respondent C	*Workstation di jabatan PE yang paling bising. Tapi tahap bising yang tinggi tu bermula kira-kira 10 tahun lepas. Dahulu hanya 50% jig dibuat secara in-house. Sekarang lebih kurang 98% jig dibuat sendiri untuk jimatkan kos. Hanya jig yang sangat susah sahaja dihantar keluar (outsource).*
	The PE department is the noisiest. But the high noise level only started around 10 years ago. Back then, only 50% of jigs were made in-house. Now it's about 98%. The company makes most jigs in-house to cut costs. Only the very complex jigs are outsourced.
Interviewer	*Masa abang mula-mula masuk department PE, memang tugas abang hanya buat jig sahaja?*
	So when you first joined the PE department, your task was just making jigs?
Respondent C	*Ya, memang pada awalnya saya hanya buat jig. Tapi sekarang beban kerja dah meningkat banyak. Dulu buat jig yang ringkas sahaja, sekarang jig yang kritikal pun saya buat juga.*
	Yes, in the beginning I only did jigs. But now the workload has increased significantly. Before, I only handled simple jigs. Now I also make critical ones.
Interviewer	*Sejak mula kerja hingga sekarang, macam mana perubahan pendedahan abang kepada bunyi bising?*
	From when you first started until now, how has your noise exposure pattern changed?
Respondent C	*Sepanjang 31 tahun ni, masa kerja di R&D dan QC langsung tak bising. Masa mula-mula masuk PE, ada bising sikit. Tapi dalam 5 tahun kebelakangan ini, bunyi bising memang kuat—terutama sebab masalah bearing mesin milling.*
	In the early years—R&D and QC departments—there was no noise at all. When I started in PE, it was a bit noisy. But the past 5 years have been extremely noisy, mainly due to the bearing issue in the milling machine.
Interviewer	*Tapi masalah bearing tu bukan dah dibaiki setahun dua lepas?*
	But wasn't that bearing issue repaired one or two years ago?
Respondent C	*Ya, bearing tu memang dah tukar dan sekarang dah okay. Tapi masa bearing rosak dulu, bunyi memang tak tahan. Sekarang ni, bunyi bising teruk cuma bila potong banyak keping serentak.*
	Yes, the bearing was replaced and it's fine now. Back when it was damaged, the noise was unbearable. Now it only gets very loud when cutting multiple pieces at once.
Interviewer	*Abang pernah buat aduan tak berkaitan bunyi bising ni?*
	Have you ever complained about the noise issue?
Respondent C	*Pernah. Saya pernah buat aduan pada penyelia saya tentang bearing rosak tu. Tapi dia buat tak kisah saja.*
	Yes, I did complain to my supervisor about the damaged bearing. But he didn't seem to care.
Interviewer	*Berapa kerap abang pakai ear muff (PPE)?*
	How often do you wear your ear muffs (PPE)?
Respondent C	*Hampir setiap masa, terutamanya sekarang sebab saya dah ada masalah pendengaran. Kalau dua tiga mesin beroperasi serentak, saya memang akan pakai terus tanpa buka.*
	Almost everytime, especially now that I have hearing problems. When two or three machines run at the same time, I make sure to wear it non-stop.
Interviewer	*Bila mula timbul kesedaran untuk pakai ear muff?*

	When did your awareness to wear ear muffs start?
Respondent C	*Sejak saya buat ujian audiometri. Lagi satu, sebab sekarang saya dah berumur.*
	Since I did the audiometric test. Also, because I'm older now.
Interviewer	*Abang ada cabaran tak untuk menggunakan ear muff tu secara konsisten?*
	Do you face any challenges in using the ear muff consistently?
Respondent C	*Ada. Kalau pakai lama, terasa sakit sebab saya pakai cermin mata. Bila pakai ear muff, bingkai cermin mata menekan bahagian telinga, jadi sakit. Kalau pakai ear plug pula, saya langsung tak dengar apa-apa. Itu yang saya lebih selesa pakai ear muff. Tapi biasanya lepas 30 minit, saya akan buka sebab rasa sakit.*
	Yes, it becomes painful after a while because I wear glasses. The ear muff presses on the frame near my ears and causes discomfort. If I wear earplugs, I can't hear anything at all, that's why I stick with the ear muff. But after about 30 minutes, I usually take it off due to the pain.
Interviewer	*Abang pernah pakai ear plug?*
	Have you ever tried using earplugs?
Respondent C	*Tak pernah. Saya cuma pernah dapat ear muff sahaja.*
	No, I've only ever been given ear muffs.
Interviewer	*Tidak mengapa. Lepas ini saya bagi abang cuba pakai ear plug pula.*
	No problem. I'll give you earplugs to try after this.
Respondent C	*Saya pernah dengar orang cakap pakai ear plug tak selesa. Jadi saya layan je pakai ear muff.*
	I've heard people say earplugs are uncomfortable, so I just stick with the ear muff.
Interviewer	*Abang ada rasa tak selesa atau terganggu semasa pakai ear muff?*
	Do you feel any discomfort or disturbance when wearing the ear muff?
Respondent C	*Memang tak selesa. Kadang-kadang sampai hilang fokus sebab ear muff menekan bingkai cermin mata di bahagian telinga saya.*
	Yes, it's uncomfortable. Sometimes I lose focus because the ear muff presses on the frame of my glasses near the ear.
Interviewer	*Adakah ear muff mudah diperoleh di tempat kerja abang?*
	Is the ear muff easily available at your workplace?
Respondent C	*Saya tak pasti, sebab saya tak pernah minta. Yang saya pakai sekarang ni pun yang awak bagi dulu.*
	I'm not sure. I've never requested a new one. The one I'm using is the one you gave me before.
Interviewer	*Abang pernah dapat maklumat atau latihan berkaitan bunyi bising?*
	Have you ever received any information or training related to noise?
Respondent C	*Ada.*
	Yes.
Interviewer	*Dah berapa kali abang masuk latihan berkaitan bunyi bising?*
	How many times have you attended noise-related training?
Respondent C	*Dah banyak kali. Yang awak uruskan, saya dah masuk tiga kali. Sebelum awak masuk kerja pun saya dah pernah hadiri latihan berkaitan bunyi bising.*
	Quite a few. I've attended three trainings arranged by you, and even before that I've joined other sessions.
Interviewer	*Jenis latihan apa yang diberikan?*
	What type of training was given?
Respondent C	*Latihan tu ada sesi teori dan praktikal. Latihan tu memang bantu beri kesedaran tentang risiko pendedahan kepada bunyi bising.*
	The training included both theory and practical sessions. It helped raise awareness about the risks of noise exposure.
Interviewer	*Latihan tu ada ubah cara abang bekerja?*
	Did the training change the way you work?
Respondent C	*Sangat membantu. Sebelum latihan, saya tak kisah langsung pasal kesihatan telinga. Bila rosak pun tak fikir. Tapi sekarang saya lebih berjaga-jaga bila kerja di tempat bising. Saya masih ingat ayat trainer masa latihan tu — "telinga kalau dah rosak memang tak boleh buat apa-apa." Ayat tu yang buat saya sedar.*

	It helped a lot. Before the training, I didn't care about my hearing health. Now, I'm more cautious when working in noisy areas. I still remember what the trainer said: "Once your hearing is gone, nothing can fix it." That stuck with me.
Interviewer	*Jadi, abang rasa latihan tu memang membantu abang lah?*
	So would you say the training was helpful to you?
Respondent C	*Memang sangat membantu. Saya suka latihan yang berkaitan dengan kerja saya sendiri.*
	Very helpful. I like training that relates directly to my job.
Interviewer	*Pada pandangan abang, latihan berkaitan bunyi bising ni sesuai dibuat sekali sahaja atau secara berkala?*
	In your opinion, should noise-related training be given once or periodically?
Respondent C	*Berkala. Sekurang-kurangnya setahun sekali pun dah cukup. Dari situ barulah kesedaran boleh dikekalkan. Bagi saya, orang muda ni tak ada kesedaran sebab dia belum rasa lagi macam mana bila pendengaran rosak. Tapi saya yang dah tua ni, bila dah rasa sendiri, kesedaran tu makin tinggi.*
	Periodically. At least once a year is enough. That way, the awareness stays. Younger workers don't usually realise the risks because they haven't experienced hearing problems. For someone like me, who already has hearing loss, the awareness is much higher.
Interviewer	*Macam mana kehilangan pendengaran ni memberi kesan kepada kerja atau kehidupan peribadi abang?*
	How has hearing loss affected your work or personal life?
Respondent C	*Memang terkesan. Isteri saya selalu marah sebab bila dia cakap saya tak dengar. Kadang-kadang saya dengar, kadang tak dengar. Ada frekuensi tertentu yang saya memang tak boleh dengar lagi.*
	It really affects me. My spouse often gets upset because I can't hear when she talks. Sometimes I hear her, sometimes I don't. There are certain frequencies I just can't hear anymore.
Interviewer	*Dari segi kesan kepada kerja?*
	And how about at work?
Respondent C	*Di tempat kerja, memang orang kena menjerit bila bercakap dengan saya dalam bilik mesin tu.*
	At work, people have to shout when talking to me in the machine room.
Interviewer	*Sebelum buat ujian audiometri tu, abang perasan tak ada simptom masalah pendengaran?*
	Did you notice any symptoms before the audiometric test?
Respondent C	*Tak perasan pun. Saya rasa masalah ni mula selepas bearing mesin milling tu rosak. Lagipun saya bukan jenis dengar lagu kuat-kuat atau pakai earphone.*
	No, I didn't. I think it started after the bearing problem in the milling machine. I'm not the type to listen to loud music or wear earphones either.
Interviewer	*Saya tengok rekod audiometri abang. Tahun 2022 bacaan masih borderline. Tapi setahun selepas itu, keputusan sudah mula menunjukkan masalah sehingga sekarang.*
	I reviewed your audiometric record. In 2022, your results were borderline. A year later, it started showing abnormal results until now.
Respondent C	*Bunyi bising tu mula lepas masalah bearing dekat mesin milling tu. Abang dah banyak kali buat aduan.*
	It started getting noisy because of the bearing issue in the milling machine. I've complained many times.
Interviewer	*Bila kali pertama abang buat ujian audiometri?*
	When did you do your first audiometric test?
Respondent C	*Tahun 2022.*
	In 2022.
Interviewer	*Rutin harian atau produktiviti abang terjejas tak selepas ada masalah pendengaran?*
	Has your daily routine or productivity been affected since experiencing hearing loss?
Respondent C	*Memang terjejas.*
	Yes, definitely affected.

Interviewer	*Rakan sekerja atau keluarga abang perasan tak perubahan bila abang ada masalah pendengaran?*
	Did your co-workers or family members notice any changes after you developed hearing problems?
Respondent C	*Ya, memang perasan. Kadang-kadang orang panggil abang, abang buat tak tahu saja sebab tak dengar. Itu yang kadang-kadang Responden D terpaksa jerit.*
	Yes, they did. Sometimes when people call me, I don't respond because I can't hear them. That's why Respondent D sometimes shouts at me.
Interviewer	*Pada pandangan abang, apa perubahan yang boleh bantu kurangkan risiko kehilangan pendengaran di tempat kerja?*
	In your opinion, what changes can help reduce the risk of hearing loss at work?
Respondent C	*Pakai PPE tu memang standard. Bagi kesedaran pun bagus. Kawalan kejuruteraan (engineering control) pun baik juga. Tapi untuk mesin, susah nak buat engineering control. Kalau syarikat boleh beli mesin baru macam CNC, lebih baik. Mesin tu kita hanya program, dan kerja pemotongan berlaku secara automatik. Kita boleh duduk di luar.*
	Wearing PPE is standard. Giving awareness is also good. Engineering control helps too. But for machines, it's hard to implement engineering controls. If the company can invest in new machines like CNC, that would help. With CNC, we just program the cut and can work from outside the machine.
Interviewer	*Jadi boleh saya simpulkan bahawa syarikat perlu pertimbangkan kaedah engineering control dan substitution seperti tukar mesin baru untuk kawal bunyi bising?*
	So I can summarise that the company should consider engineering control or substitution, such as replacing old machines with new ones, to reduce noise exposure?
Respondent C	*Ya betul. Satu lagi pandangan abang. Tempat kerja abang tu dekat machine room jangan bagi orang luar masuk. Orang luar kadang main masuk je tempat abang tak pakai ear plug/ear muff semua tu. Biasa technician masuk tempat kerja abang dia repair jig dalam machine room tu. Sepatutnya mereka tak boleh masuk sebab machine room kan dikira sebagai high noise zone. Kalau mesin cutter guna saw tu pun lagi bising.*
	Yes, that's correct. Also, at my workplace, outsiders shouldn't be allowed in the machine room. Some technicians just enter without PPE. The machine room is a high noise zone, so outsiders shouldn't be there. The saw cutter, for example, is even noisier.
Interviewer	*Bagi abang, jenis kesedaran atau insentif macam mana yang boleh bantu kurangkan risiko bunyi bising?*
	In your opinion, what kind of awareness or incentives can help reduce noise risks?
Respondent C	*Bagi abang, kesedaran lebih penting—contohnya beri latihan secara berkala.*
	For me, awareness is more important—like providing regular training.
Interviewer	*Antara beri PPE sahaja atau beri latihan, yang mana lebih berkesan untuk galakkan penggunaan PPE secara konsisten?*
	Between just providing PPE or providing training, which is more effective in encouraging consistent PPE usage?
Respondent C	*Lebih baik beri latihan. Sebab kesedaran tu penting. Kalau orang tak sedar, susah nak kawal risiko. Ramai orang ambil mudah pasal bunyi bising.*
	Training is better. Awareness is crucial. If people aren't aware, it's hard to control the risk. Many people tend to ignore noise hazards.
Interviewer	*Mungkin sebab mereka belum tengok data atau belum buat ujian pendengaran. Tapi macam abang, abang dah tengok sendiri keputusan ujian.*
	Maybe it's because they haven't seen the data, or had a hearing check. Like you—you've seen your results.
Respondent C	*Betul. Abang dah tengok sendiri data tu. Mula-mula borderline, lama-lama makin turun. Satu lagi, bila telinga dah rosak, memang tak boleh ubah dah.*
	Exactly. I saw my own records—started as borderline, then it kept dropping. And once your hearing is gone, there's no cure.
Interviewer	*Yang abang kata potong sekali banyak tu, kerap ke?*

	How often do you do bulk cutting, like you mentioned before?
Respondent C	*Contohnya hari ni, kalau nak siapkan dua set jig, saya kena potong sekali empat keping. Tambahan pula material lebar. Mesin milling boleh potong setinggi 300mm, tapi material saya lebar lebih 300mm. Bahagian bawah boleh kepit, atas tak boleh. Jadi selain bunyi mesin, ada bunyi getaran juga—getaran tu yang lagi sakit telinga.*
	Like today, if I need two jig sets, I have to cut four pieces at once. Also, the material is wide. The milling machine cuts up to 300mm height, but my material is wider than 300mm. The bottom can be clamped, but the top can't. So apart from machine noise, there's also vibration noise—that vibration really hurts the ears.
Interviewer	*Ada apa-apa lagi abang nak kongsikan tentang isu bunyi bising?*
	Do you have anything else to share about noise hazards?
Respondent C	*Tak ada. Setakat ini, itu sahaja.*
	No, that's all for now.

Appendix E

Interview Script Participant D

INTERVIEW	
Interviewer	*Assalamualaikum dan selamat pagi. Saya nak tanya abang beberapa soalan. Abang boleh jawab ikut pandangan sendiri—tak ada betul atau salah. Kalau tak nak jawab pun tak mengapa. Soalan pertama, boleh tak abang terangkan jenis bunyi bising yang abang terdedah semasa bekerja?*
	Assalamualaikum and good morning. I'd like to ask you a few questions. You can answer however you like—there's no right or wrong. It's also okay if you prefer not to answer. First question: can you describe the types of noise you're exposed to at work?
Respondent D	*Bunyi datang dari mesin di machine room. Bunyi berdengung, termasuk bunyi ketukan, bunyi blower angin, dan bunyi grinding. Sebab kami buat kerja pemotongan dan pembentukan, memang terdedah dengan bunyi bising.*
	The noise comes from machines in the machine room. It's a constant humming, including sounds like banging, air blower noise, and grinding. Since we do cutting and shaping tasks, we're naturally exposed to a lot of noise.
Interviewer	*When is the noise most noticeable during your work?*
	Masa abang bekerja, bila bunyi bising paling ketara?
Respondent D	*Paling bising masa potong material untuk pembentukan, terutamanya bila guna mesin table cutter. Mesin ni digunakan untuk potong bahan seperti aluminium, acrylic, plywood, kayu dan plastik. Kita letak je material atas meja dan tolak ke arah bilah pemotong. Bunyi akan keluar dengan kuat. Tapi mesin ni bukan disediakan oleh syarikat—kami pekerja di machine room beli sendiri sebab peralatan sedia ada susah nak guna.*
	When cutting material for shaping—especially when using the table cutter. We use it for cutting materials like aluminium, acrylic, plywood, wood, and plastic. You just place the material on the table and push it through the blade. The noise is loud. But this machine wasn't provided by the company; we workers in the machine room bought it ourselves because the existing tools were hard to use.
Interviewer	*Selain daripada itu, ada lagi tak sumber bunyi bising lain yang ketara?*
	Besides that, are there any other sources of loud noise?
Respondent D	*Yang kedua ialah bunyi dari mesin milling. Selain itu, bunyi blower angin pun kuat. Kami tak guna coolant untuk bersihkan habuk di mata milling, jadi kena guna blower. Kalau tak bersihkan, mata milling boleh patah.*
	The next loudest is from the milling machine. There's also the sound of air blower. We don't use coolant to clean the dust on the milling tool, so we have to blow it with air, or the tip could break.
Interviewer	*Jadi saya simpulkan, bunyi paling bising datang dari mesin table cutter?*
	So to summarise, the loudest noise comes from the table cutter?
Respondent D	*Betul, tapi jarang guna.*
	Yes, but we don't use it often.
Interviewer	*Jarang tu kira macam mana ya?*
	How often is "jarang"?
Respondent D	*Ia bergantung pada kerja. Kalau banyak material nak dipotong, kami guna table cutter sebab lebih cepat dan mudah berbanding jigsaw. Jigsaw pun bising, tapi tak sekuat table cutter.*
	It depends on the workload. If there's a lot of material to cut, we use the table cutter because it's faster than the jigsaw. The jigsaw is also noisy, but slightly less so than the table cutter.
Interviewer	*Bunyi bising tu jejaskan tak keupayaan abang untuk fokus atau berkomunikasi?*
	Does the noise affect your focus or ability to communicate?
Respondent D	*Ya, bila orang bercakap dengan saya, memang susah nak dengar kecuali mereka jerit. Masa tengah potong material, saya memang fokus pada kerja sahaja, tak dengar apa-apa yang lain.*

	Yes, when someone speaks to me, I can hardly hear them unless they shout. During cutting, I focus only on the task—not on conversation.
Interviewer	*Kira masa buat kerja tu, fokus abang tak terganggu walaupun bunyi bising?*
	So, you don't lose focus while working despite the noise?
Respondent D	*Ya, fokus saya tak terganggu. Tapi mungkin ganggu orang lain yang nak buat kerja. Mereka mungkin perlu pakai ear muff. Tapi bagi saya, ear muff tak berapa sesuai sebab masih dengar bunyi. Mungkin lebih baik pakai sekali dengan ear plug. Kalau boleh, tolong bagi juga ear plug untuk semua pekerja di machine room.*
	Yes, my focus is okay. But it might disturb others who are trying to work nearby. They might need ear muffs. For me, ear muffs aren't effective enough—I can still hear the noise. It might be better to use double protection with earplugs. You can give earplugs to everyone in the machine room.
Interviewer	*Baik, nanti saya akan bagi.*
	Okay, I'll provide them later.
Respondent D	*Yang jenis masuk dalam telinga tu kan? Mungkin lebih sesuai untuk tempat kerja kami sebab bunyi berdengung berterusan. Ear muff tu masih dengar bunyi. Ada material yang kami potong memang sangat bising.*
	That's the type that goes inside the ear, right? It might be more suitable for our machine room since the noise is constant. Ear muffs still let sound through. Some materials we cut are extremely noisy.
Interviewer	*Contoh material apa ya?*
	What types of materials are you referring to?
Respondent D	*Acrylic dan aluminium.*
	Acrylic dan aluminium.
Interviewer	*Biasanya abang potong satu-satu atau sekali banyak?*
	Do you usually cut them one at a time or in bulk?
Respondent D	*Kalau nak potong 10 keping, saya biasanya potong serentak.*
	If I need to cut 10 pieces, I usually cut them all at once.
Interviewer	*Ada beza tak bunyi bising kalau potong satu lapis dengan potong banyak sekali?*
	Is there any difference in noise between cutting one layer versus multiple layers?
Respondent D	*Bagi saya bunyi dua-dua sama je. Tapi table cutter tak boleh potong banyak sekaligus sebab bahaya. Kita tolak manual. Kalau guna milling, material dikepit jadi lebih selamat.*
	For me, both sound the same. But the table cutter can't cut many at once—it's dangerous. We push the material manually. Milling machines are safer because the material is clamped.
Interviewer	*Abang boleh bezakan tak antara bunyi tiba-tiba dan bunyi berterusan?*
	Can you differentiate between sudden noise and continuous noise?
Respondent D	*Memang boleh beza. Bila potong material, kita tahu bunyi macam mana yang biasa. Kalau bunyi tiba-tiba lain, mesti ada masalah—mungkin tool longgar, makan material terlalu banyak, atau kepit tak kuat. Contohnya material 1mm biasanya tak bising, kalau tiba-tiba bising semacam, mesti ada yang tak kena.*
	Yes, definitely. When cutting, we know how it should sound. If it sounds different, something is wrong—like a loose tool or improper clamping. For example, 1mm thick material usually makes soft noise. If it suddenly gets loud, there may be an issue.
Interviewer	*Itu petanda yang baik sebenarnya. Ada kes pekerja yang ada masalah pendengaran tak boleh beza bunyi tiba-tiba.*
	That's actually a good sign—some workers with severe hearing loss can't distinguish sudden noise changes.
Respondent D	*Ya, operator mesin memang kena pandai beza bunyi. Kalau tidak, boleh rosakkan mesin dan sebabkan kemalangan. Contoh mesin grinding, biasa bunyi dia "ciit ciit." Tapi kalau tiba-tiba bunyi "ciiiitttttt," itu tanda ada masalah. Grinding sangat penting sebab melibatkan keselamatan. Kalau boleh kerja grinding ni kena asingkan. Orang yang ada masalah pendengaran tak boleh jalan mesin ni. Sama macam mesin lathe—paling bahaya. Kalau pakaian tak sesuai, lengan panjang atau pakai sarung tangan pun boleh tarik masuk ke dalam.*

	Yes, machine operators must be able to distinguish sounds. Otherwise, it can damage machines or cause accidents. For example, grinding should sound like "ciit ciit," but if it becomes "ciiiitttttt," there's a problem. Grinding is safety-critical and should be isolated. Deaf workers shouldn't operate grinders. Same with the lathe machine—it's very dangerous if clothing gets caught.
Interviewer	*Apa peranan kerja abang dan tugasan harian yang abang lakukan?*
	What's your job role and your daily tasks?
Respondent D	*Tugas hakiki saya di bahagian Electrical & Electronic—mereka bentuk dan membina mesin.*
	My core task is in the Electrical & Electronic section—designing and building machines.
Interviewer	*Kiranya untuk buat mesin atau jig dari lukisan sampai jadi produk, abang yang uruskan?*
	So when it comes to building machines or jigs—from drawing to finished product—you're the one handling it?
Respondent D	*Ya, bergantung juga pada keadaan. Kalau dah ada drawing, saya ikut sahaja. Kalau tak ada, dan orang cuma maklumkan nak buat macam itu, saya sendiri akan buat drawing—tapi yang simple-simple sahajalah. Kalau perlukan teknologi tinggi, memang kena hantar luar (outsource).*
	Yes, depending on the situation. If a drawing is provided, I'll follow it. But if there's no drawing and someone just explains what they want, I'll do the drawing myself—only for simple designs. If it involves advanced technology, it has to be outsourced.
Interviewer	*Ada tak tugasan tertentu yang mendedahkan abang kepada bunyi lebih kuat?*
	Are there specific tasks that expose you to louder noise?
Respondent D	*Seperti yang saya sebut awal tadi—semasa kerja pemotongan dan pembentukan material.*
	As I mentioned earlier, during material cutting and shaping.
Interviewer	*Berapa kerap abang bertukar tugasan atau tempat kerja?*
	How often do you switch tasks or work locations?
Respondent D	*Saya tak pernah bertukar. Dari dulu sampai sekarang, kerja saya tetap sama—dari elektronik, elektrikal, sampai ke mekanikal.*
	I don't switch at all. From the beginning until now, I've been doing the same work—from electronics, electrical, to mechanical.
Interviewer	*Ada tak kerja yang terasa lebih penat disebabkan bunyi bising?*
	Are there any tasks that feel more tiring due to noise?
Respondent D	*Tak ada pula.*
	No, not really.
Interviewer	*Dah berapa lama abang bekerja di syarikat ini?*
	How long have you been working in this company?
Respondent D	*Hampir 30 tahun.*
	Almost 30 years.
Interviewer	*Sejak mula masuk kerja, abang memang kerja di machine room ke atau tempat lain?*
	From the beginning, have you always worked in the machine room or elsewhere?
Respondent D	*Dari awal sampai sekarang, saya memang bawah Jabatan PE.*
	I've always been under the PE department, from day one until now.
Interviewer	*Masa awal-awal kerja dulu, abang terus kerja di machine room ke?*
	So at the start, did you already work in the machine room?
Respondent D	*Mula-mula dulu saya buat kerja elektronik dan elektrikal, tapi kerja mekanikal pun sekali jalan.*
	Initially, my work involved electronics and electrical—but mechanical work was included too.
Interviewer	*Maknanya dari dulu kerja abang memang kekal—buat elektronik, elektrikal, jig dan sebagainya*
	So your role has always been the same: electronics, electrical, jig making, etc.?
Respondent D	*Ya.*
	Yes.

Interviewer	*Sepanjang 30 tahun kerja, bunyi bising dari dulu sampai sekarang masih sama atau ada perubahan?*
	Has the noise level changed since you first started until now?
Respondent D	*Lebih kurang sama. Cuma sekarang ada penambahan peralatan macam table cutter, jadi ada tambahan bunyi bising.*
	More or less the same, but now there's additional equipment like the table cutter, which adds to the noise.
Interviewer	*Tugasan abang ada berubah-ubah ke sepanjang masa?*
	Have your tasks remained the same over time?
Respondent D	*Tak, kerja saya dari dulu sampai sekarang sama sahaja.*
	No, they've always been the same.
Interviewer	*Abang pernah buat aduan berkaitan bunyi bising?*
	Have you ever filed a complaint about noise?
Respondent D	*Pernah. Dulu kami buat aduan masa mesin milling rosak—mesin yang respondent C kendalikan. Bearing dia rosak dan lama sangat nak repair sebab kos tinggi. Bila bearing rosak, bunyi bising jadi bercampur dengan getaran—itu yang rasa bingit sangat.*
	Yes, we complained when the milling machine (handled by Respondent C) had a bearing issue. The repair was delayed due to cost. The noise became more irritating because of the humming vibration from the damaged bearing.
Interviewer	*Abang kerap pakai PPE seperti ear plug atau ear muff?*
	How often do you wear PPE like ear plugs or ear muffs?
Respondent D	*Saya cuma pakai masa buat kerja yang bising, contohnya masa potong material. Dalam machine room, kalau ada orang nak potong, dia akan maklumkan semua orang supaya pakai ear muff. Kalau tak nak pakai, kena keluar ke bilik sebelah.*
	Only during noisy tasks like cutting. In the machine room, when someone is cutting, they'll inform everyone to wear ear muffs. If you don't want to wear them, you should leave the room.
Interviewer	*Anggaran dalam 8 jam kerja, berapa lama abang pakai ear muff?*
	Roughly, out of 8 working hours, how long do you wear the ear muff?
Respondent D	*Kurang daripada sejam. Cuma pakai masa potong sahaja. Tak lama pun.*
	Less than an hour. Only during cutting.
Interviewer	*Ada cabaran tak nak pakai ear muff secara konsisten?*
	Any challenges in using ear muffs consistently?
Respondent D	*Cabaran dia rasa rimas. Sebab ada benda atas kepala. Saya nak cuba pakai ear plug pula. Ear muff pun masih tembus bunyi, cuma kurang sikit. Pakai lama-lama pun boleh sakit kepala.*
	Just discomfort. It feels tight on the head. I'd like to try using ear plugs instead. Ear muffs still let noise through. Wearing them too long gives me headaches.
Interviewer	*Pakai ear muff tu ada rasa tak selesa atau terganggu?*
	Do you feel uncomfortable or disturbed when wearing ear muffs?
Respondent D	*Ya, memang terganggu.*
	Yes, it's disturbing.
Interviewer	*Ear muff senang tak nak dapat di tempat kerja abang?*
	Are ear muffs easily available at your workplace?
Respondent D	*Susah nak dapat. Melainkan kalau awak yang bagi. SHO je yang faham kerja di tempat bising ni.*
	Not really—unless you provide them. Only the Safety and Health Officer understands the situation in noisy work areas.
Interviewer	*Abang pernah diberikan maklumat atau latihan berkaitan bunyi bising di tempat kerja?*
	Have you ever received information or training about workplace noise?
Respondent D	*Ada.*
	Yes.
Interviewer	*Jenis latihan yang diberikan tu macam mana?*
	What kind of training was it?

Respondent D	*Kursus tu berikan penerangan tentang bunyi bising dan cara nak lindungi diri daripada pendedahan bunyi bising.*
	It was a course explaining what noise is and how to protect ourselves from it.
Interviewer	*Latihan tu ada ubah cara abang bekerja?*
	Did the training change how you work?
Respondent D	*Ya, memang ubah cara saya bekerja. Kesan bunyi bising ni ambil masa lama. Bila dah berumur baru terasa. Dulu saya tak kisah. Tapi lepas pergi latihan, dan faham bagaimana telinga boleh rosak, baru saya lebih berhati-hati.*
	Yes, it did. Noise damage takes time to show. As I've getting old, I now feel the effects. In the past, I didn't care about noise. But after training, I understood how hearing damage develops and became more careful.
Interviewer	*Dah berapa kali abang hadiri kursus tersebut?*
	How many times have you attended the training?
Respondent D	*Dua kali, iaitu pada Februari 2024 dan 2025.*
	Twice—once in February 2024 and again in 2025.
Interviewer	*Pada pandangan abang, kursus berkaitan bunyi bising ni elok dibuat sekali sahaja atau secara berkala?*
	In your opinion, should noise-related training be conducted once or regularly?
Respondent D	*Kena buat secara berkala. Kadang-kadang kita cepat lupa. Sekurang-kurangnya dua kali setahun. Mungkin ada kajian baru berkaitan bunyi bising yang kita boleh tahu lebih awal kalau latihan dibuat secara kerap.*
	It should be done regularly. Sometimes we forget easily. At least twice a year. There might also be new research on noise that we can learn about early through regular training.
Interviewer	*Bagaimana masalah pendengaran abang memberi kesan kepada kerja dan kehidupan peribadi?*
	How has your hearing issue affected your work and personal life?
Respondent D	*Memang ada kesan. Dari segi kerja, ada beberapa frekuensi yang saya tak peka. Dari segi peribadi, contohnya bila memandu dan pasang signal, saya tak dengar bunyi tu. Kadang-kadang anak atau isteri tegur minta tutup sebab saya tak perasan. Mereka boleh dengar, tapi saya yang pandu tak dengar.*
	There are effects. At work, I can't detect certain frequencies. In my personal life, for example, when I drive and turn on the signal, I can't hear it. Sometimes my wife or kids tell me to turn it off because I don't notice it. They can hear it, but I can't.
Interviewer	*Sebelum buat ujian audiometri, abang perasan tak sebarang simptom masalah pendengaran?*
	Sebelum buat ujian audiometri, abang perasan tak sebarang simptom masalah pendengaran?
Respondent D	*Masa buat ujian pertama pada 2021, tak ada kesan sangat. Tapi pada 2022 dah mula rasa ada kesan. Dan tahun-tahun selepas tu makin berkurang pendengaran.*
	During the first test in 2021, there were no noticeable effects. But in 2022, I started feeling the impact. And the years after, it worsened.
Interviewer	*Masalah pendengaran ini ada menjejaskan rutin harian atau produktiviti abang?*
	Has your hearing issue affected your daily routine or productivity?
Respondent D	*Setakat ini kerja yang melibatkan bunyi tak terjejas. Cuma rutin harian ada terganggu sedikit, seperti yang saya sebutkan tadi.*
	So far, it hasn't affected my work involving noise. But it has slightly disrupted my daily routine, as I mentioned earlier.
Interviewer	*Ada tak rakan sekerja atau ahli keluarga abang perasan perubahan sejak abang alami masalah pendengaran?*
	Have your colleagues or family noticed changes since you developed hearing issues?
Respondent D	*Keluarga ada perasan. Kadang-kadang bila mereka bercakap, saya tak dengar.*
	My family did notice—sometimes when they speak, I can't hear them.
Interviewer	*Pada pandangan abang, apa perubahan yang boleh bantu kurangkan risiko kehilangan pendengaran di tempat kerja?*
	What changes do you think could help reduce the risk of hearing loss at work?

Respondent D	*Yang penting adalah pendedahan, contohnya melalui kursus atau latihan tentang kesan bunyi bising terhadap pendengaran.*
	The most important is awareness—through training or courses about noise impact on hearing.
Interviewer	*Dari segi peranan syarikat, apa yang boleh diperbaiki dalam kawalan kebisingan?*
	From the company's perspective, what can be improved in noise control?
Respondent D	*Pihak syarikat perlu tanya pekerja sama ada mesin atau peralatan yang diberi sesuai atau tidak. Contohnya, tools tumpul akan hasilkan lebih bunyi, tools tajam mungkin kurang. Kalau mesin tu siap dengan penutup keselamatan, bunyi pun kurang. Syarikat kena peka hal-hal macam ni.*
	The company must ask employees whether the equipment or machines provided are suitable. For example, using blunt tools may cause more noise, while sharp tools may reduce it. Machines should come with soundproof covers. The company must be sensitive to these matters.
Interviewer	*Maksudnya abang tekankan pentingnya pihak syarikat dapatkan maklum balas daripada pekerja?*
	So you're emphasizing the importance of getting feedback from workers?
Respondent D	*Ya betul. Bunyi bising memang tetap ada, tapi penting untuk kawal dan kurangkan. Contohnya letak penutup atau asingkan mesin dalam bilik khas.*
	Yes, definitely. Noise will still be there, but the question is how to reduce it—maybe by adding covers or placing the machines in enclosed rooms.
Interviewer	*Antara kesedaran dan pemberian insentif, yang mana lebih berkesan untuk kawal risiko bunyi bising?*
	Between awareness and giving incentives, which is more effective in controlling noise risk?
Respondent D	*Kesedaran lebih penting. Kalau kita kejar insentif, itu sementara. Tapi pendengaran kalau rosak, seumur hidup. Insentif buat pekerja fikir duit lebih daripada kesihatan.*
	Awareness is more important. If we only chase incentives, it's temporary. Hearing loss is permanent. Incentives can make workers focus on money over health.
Interviewer	*Antara beri PPE sahaja, dan beri PPE bersama latihan, mana lebih baik?*
	Between just giving PPE and giving both PPE and training, which is better?
Respondent D	*Kalau bagi PPE tanpa penerangan dan latihan, objektif nak kawal risiko tak tercapai. Sepatutnya bila bagi PPE, kena ajar cara guna, simpan, dan jaga.*
	Giving PPE alone is not enough. Without explanation and training, the purpose is not achieved. Workers must be taught how to use, store, and maintain it.
Interviewer	*Abang ada apa-apa lagi nak kongsi berkaitan isu bunyi bising?*
	Do you have anything else to share about noise issues?
Respondent D	*Majikan patut sediakan peruntukan untuk keselamatan pendengaran. Contohnya beli mesin yang kurang bising atau kawal bunyi sebelum beli mesin tu. Jangan asal ada, murah terus beli. Sebab majikan tak guna mesin tu, pekerja yang guna.*
	Employers should allocate proper budgets for hearing safety. For example, buy low-noise machines or control noise before purchasing. Don't just provide cheap or "as long as there's something" equipment. After all, it's the workers using it, not the employer.
Interviewer	*Selain itu, ada apa-apa lagi?*
	Anything else to add?
Respondent D	*Saya harap majikan beri lebih perhatian kepada pekerja yang bekerja di kawasan berisiko tinggi.*
	I hope the employer pays more attention to workers in high-risk areas.

Appendix F

List of Coding

RESPONDENT	CODING	QUOTE	RO	EXPLAINATION
A	Continuous noise exposure from machines	The sound is continuous, unless the machine stops	RO2	Identifies noise characteristic: persistent/continuous noise exposure during operation.
A	Same noise across machines	The 10P machine sounds more or less the same. The noise is continuous too	RO2	Both machines produce similar levels/types of noise, indicating cross-role exposure.
A	Noise only pauses during non-operational times	It only stops when we take a break	RO2	Indicates duration of exposure (i.e., only pauses during scheduled or technical stops).
A	Low air gun usage	We rarely use the air gun. Usually, we use it only once — when cleaning the machine	RO2	Air gun is not a frequent contributor to noise exposure in this role.
A	Operator responsible for cleaning	The operator does it.	RO2	Shows job task involving machine cleaning (linked to exposure pattern).
A	Constant noise level throughout shift	The sound is the same throughout	RO2	Reinforces constant noise exposure throughout working hours.
A	Noise signals machine issues	If the sound becomes slightly quieter, we find it strange	RO2	Worker uses sound as an indicator of machine performance, implying sound is well-known and monitored.
A	Noise does not affect concentration	I can still focus	RO1	Indicates that although noise is loud, it does not yet affect cognitive performance.
A	Machine noise impacts communicatio n	But when talking to others, we have to speak loudly	RO2	Communication is impaired due to machine noise – a non-auditory consequence of exposure.
A	Sudden vs. continuous noise awareness	Yes, I can tell the difference	RO2	Demonstrates noise perception ability and responsiveness to noise pattern changes.
A	Full-process task handling	In fuse clip, one person does everything, from checking to packin	RO2	Shows the operator handles all processes alone — likely increases continuous exposure to machine noise.
A	No task with higher noise	No, there isn't [any job noisier than current task	RO2	Confirms that fuse clip and 10P are the main high-noise sources.
A	Infrequent machine operation	It operated only occasionally — maybe one week in a month.	RO2	Indicates intermittent noise exposure, not full-time, which affects risk assessment.
A	Machine has not been used recently	The last operation was in February 2025.	RO2	Important context for current noise exposure status — possibly reduced risk recently.

A	Alternative task in quiet area (SMT)	But those jobs are very quiet — no noise at all.	RO2	Shows job rotation can involve very low noise exposure, a protective factor.
A	Noise only from specific machines	You only hear loud noise when the fuse clip or 10P machine is operating	RO2	Reinforces that noise risk is task-specific, not general workplace-wide.
A	PPE used but causes discomfort	Since we got earplugs, we wear them. Sometimes we take them off because they're uncomfortable	RO2	Highlights PPE usage with compliance issues — discomfort leads to occasional removal.
A	PPE removed due to discomfort	Wearing them for 8 hours is painful, so sometimes I remove them briefly	RO2	Important barrier to full hearing protection — shows practical challenge in prevention.
A	Task assignment based on production demand	The machine runs depending on customer orders	RO2	Indicates that noise exposure is linked to production schedule — variable exposure pattern.
A	Noise is not exhausting	No. I'm used to it after many years of working	RO1	Suggests habituation to noise, and no subjective report of fatigue — may affect NIHL awareness.
A	Long tenure with noise exposure	If not, it would be 25 years... I've worked with machines for 25 years	RO2	Long-term exposure to noise — relevant for NIHL risk.
A	Transferred due to department shutdown	I was in the machine department. But after that department shut down, I was transferred to SMT.	RO2	Reflects changes in job role and potentially different exposure levels.
A	14 years in SMT department	14 years	RO2	Clarifies current department duration — helps track changes in exposure over time.
A	Early exposure to high noise levels	When I first started, I was in the machine department, and it was very noisy.	RO2	Indicates that past noise levels were significantly higher than present.
A	Current job has lower noise exposure	Now, since the fuse clip and 10P machines rarely operate, I'm less exposed to noise	RO2	Confirms a reduction in risk over time.
A	Multiple noisy machines in the past	Back then, there were several machines, and all of them were noisy	RO2	Reinforces that earlier exposure was more intense and
A	Current role involves quiet tasks	I've been helping other operators at the SMT section. There's no noise there.	RO2	Now handling low-risk tasks, showing exposure variability over time.

A	No complaints made before training/testing	No, never. We're just operators.	RO1	Indicates lack of reporting culture among workers — possibly underreporting of NIHL symptoms.
A	Audiometric test triggered awareness	It was only after going for a hearing check (audiometric test) that I learned about noise hazards.	RO1	Shows that testing helped reveal hidden risks — unawareness prior to testing.
A	Training increased noise awareness	I only became aware after attending the hearing course last year. That's when I truly understood	RO1	Training helped shift mindset — awareness is a recent development.
A	Normalizing noise exposure	Didn't care because I thought it's normal when working in a factory	RO1	Reflects common perception: noise is seen as part of the job, which can mask risk awareness.
A	No noise training prior to 2024	No. The one in February 2024 was my first time attending a training about noise.	RO2	Training is not regularly provided — a gap in prevention efforts.
A	Earplugs worn only during operation	I wear them after tidying up the workstation, just before the machine starts running.	RO2	Shows that PPE use is task-based, not full-shift.
A	PPE removed due to discomfort	If I start to feel discomfort, I take them off for a while	RO2	Reflects inconsistent protection — increasing risk.
A	PPE discomfort due to head covering	I wear a headscarf and inner scarf, so it gets a bit uncomfortable	RO2	Highlights cultural/practical barriers to PPE usage.
A	Discomfort after long use	If I wear it continuously for half a day... it becomes uncomfortable	RO2	Indicates physical discomfort as a barrier to PPE compliance.
A	PPE condition is poor or outdated	The ear muffs we have now are old	RO2	Suggests poor PPE maintenance — potential safety concern.
A	PPE is easily accessible	Earplugs and ear muffs are always placed near the machine	RO2	Shows PPE is available, though condition and comfort affect actual usage.
A	Individual differences in PPE comfort	Another operator... uses the earplug type and has no problem with it.	RO2	Demonstrates that comfort and fit vary across individuals, influencing use.
A	Attended recent training sessions	Yes, in February 2024 and February 2025	RO2	Documents training timeline — shows recent implementation of noise awareness programs.
A	No prior training before 2024	No, there was none.	RO2	Indicates long-term gap in training, increasing historical exposure risk.

A	Training included noise measurement and control methods	Sound level measurement... how to reduce noise... effects of noise exposure	RO2	Content shows a comprehensive approach — measuring, controlling, understanding impacts.
A	Training changed PPE behavior	I now frequently use earplugs or earmuffs	RO2	Demonstrates behavioral improvement as a result of awareness.
A	Training increased noise awareness	Before the training, I didn't know about the risks of noise exposure	RO1	Reinforces low baseline awareness despite years of exposure.
A	Increased awareness of long-term hearing risks	I never thought about the future—like 10 years ahead	RO1	Highlights that training instilled awareness of cumulative risk and hearing damage over time.
A	No perceived hearing problems	I feel normal. Even at home, it feels the same	RO1	Indicates the worker is unaware of any hearing loss symptoms, despite prolonged exposure.
A	No symptoms noticed before testing	No, I didn't. Everything felt normal. Only after the audiometric test I found out there was a slight issue	RO1	Suggests early NIHL can be unnoticed, and testing is essential for detection.
A	Others did not notice hearing loss	No, no one mentioned anything	RO1	Supports the idea that mild hearing loss is often socially invisible — not Others noticed hearing difficulty either.
A	Improve PPE comfort	Maybe provide thicker types so it's more comfortable for the ears	RO2	Suggests that discomfort is a key barrier, and improved PPE design could increase usage.
A	Training is key to increasing awareness	The training really helped	RO2	Reinforces the impact of training in changing behavior and increasing awareness.
A	Training improved PPE compliance	After attending the training, I understood better and became more diligent in using PPE	RO2	Shows that knowledge drives compliance — stronger than just providing PPE.
A	PPE effectiveness depends on training	If PPE is provided without proper training, it's not enough…	RO2	Highlights that behavioral change needs both tools and understanding.
A	Regular training is necessary for retention	At least once a year... It takes a long time to have an effect	RO2	Suggests regular refreshers are necessary for sustained awareness and prevention.
A	Regular training is necessary for retention	Especially since I'm older, I have to be reminded often	RO2	Recognizes that age may influence awareness retention — tailored training may be needed.
A	PPE condition is poor or outdated	If possible, it would be good to provide new ear muffs	RO2	Indicates equipment condition as a factor affecting protection and comfort.

B	Noise from wire welding machine	The noise in ECO-Q specifically comes from the Wire Welding area. The sound is like 'tupppp... psssssssss... Tupppp	RO2	Identifies the source and type of noise — mechanical + air release.
B	Noise occurs in bursts/gaps	There are gaps in the noise	RO2	Indicates intermittent noise, not continuous exposure — important for assessing risk level.
B	Blower noise less significant	There is a blower, but it's not as noisy as the wire welding area	RO2	Compares relative intensity of different sources — wire welding is main contributor.
B	Loudest noise during air release	The loudest part is when the air is released	RO2	Identifies peak noise moments, which may exceed threshold and be hazardous.
B	Wire welding operated rarely (May 2025	The last operation was in May 2025, and it was only for one day.	RO2	Identifies peak noise moments, which may exceed threshold and be hazardous.
B	Operator handles noisy process	Usually, the operator handles it. Most of the time, I'm the one doing it	RO2	Connects job role directly to noise exposure — supports risk factor analysis.
B	Workload depends on manpower	If manpower is short, one person will operate more than one workstation	RO2	Shows exposure can increase due to multitasking, affecting noise duration/intensity.
B	Awareness of abnormal noise	If a product doesn't go in properly, the machine makes a 'dut dut dut' sound	RO2	Indicates worker's ability to recognize sudden vs normal machine noise — shows engagement with machine sound patterns.
B	Multiple tasks within workstation	I do screwing... attach the white sheet... perform LCD checking, and finally, wire welding	RO2	Shows that the operator is exposed to noise as part of multiple tasks, not just a single one — relates to task complexity and potential noise duration.
B	Wire welding is a fusion process	The machine heats up and then fuses the top and bottom parts of the casing together	RO2	Provides technical context — likely source of sharp or thermal/mechanical noise.
B	Task rotation between areas	Sometimes I work in the kitchen area... then switch to the bathroom section	RO2	Indicates variable exposure, depending on production needs.
B	Frequent job change based on planning	Quite often. If there's an operation at ECO-Q, I will work there…	RO2	Confirms exposure is irregular and planning-dependent, which affects risk duration.
B	MARCO section is not noisy	Not really. If it's noisy, it's only a little from the blower	RO2	Confirms routine work environment is quiet, except when shifted to ECO-Q.

B	Low exposure frequency to ECO-Q noise	Only about one or two days [per month]	RO2	Suggests minimal monthly exposure to noisy tasks — lowers NIHL risk likelihood.
B	No physical or cognitive fatigue from noise	Even when hearing the noise... it feels normal. I don't feel extra tired."	RO1	Respondent reports no physical or cognitive effect from noise — no fatigue, no complaints.
B	Five years of employment	Around 5 years. I joined in 2020	RO2	Establishes the tenure, an important risk factor — not long-term, but not new either.
B	Time-based exposure indicator	I started working in the noisy ECO-Q section around 2022	RO2	Indicates 3 years of noise exposure, helping assess cumulative risk.
B	Task assignment changes when needed	If someone is absent, I have to cover the unmanned workstation	RO2	Reflects flexibility in task assignment — noise exposure may increase unexpectedly.
B	No noise complaint made	No, I haven't. It just feels normal.	RO1	Indicates low awareness or normalization of noise — even after 3 years of exposure.
B	Wears earplugs at noisy workstation	Yes, I wear earplugs when working at the wire welding station	RO2	Confirms that hearing protection is used during high-noise tasks.
B	Improper PPE use causes pain	When I wear the earplugs halfway into my ears, it feels painful.	RO2	Improper use can cause discomfort, leading to poor PPE compliance.
B	Proper insertion blocks all sound	When I wear them properly… I can't hear anything, not even people talking	RO2	Highlights communication barrier, which may discourage full compliance.
B	Mild discomfort (pain/itchy)	Just a slight pain around the outer ear area… a little itchy sometimes	RO2	Describes physical discomfort as a limiting factor for continuous usage.
B	Easy access to earplugs	Yes, it's easy… I can just ask the leader	RO2	PPE is readily available, showing supply is not the barrier — usage is affected more by comfort and communication issues.
B	Attended noise training in 2024 and 2025	Yes, I've attended two training sessions—once in 2024 and again in 2025	RO2	Confirms exposure to noise-related education, useful for tracking awareness development.
B	Training was practical and contextual	The trainer taught us in the classroom first, then took us to the machine area to measure noise levels using a mobile phone	RO2	Shows training was interactive and contextual, covering both theory and practical elements.
B	Training increased noise awareness	After the training, I became aware of the risks of noise	RO1	Demonstrates change in perception, showing training as a key influence on awareness of NIHL.
B	Previously unaware	Before that, I didn't feel anything even	RO1	Indicates a lack of initial awareness, even after years of

	despite noise exposure	when exposed to loud sounds		exposure — NIHL risk may go unnoticed without intervention.
B	Annual training recommended	At least once a yea	RO2	Suggests optimal frequency for maintaining awareness without overloading — aligns with best practices.
B	No perceived impact on work/life	None. Everyone says I can still hear normally.	RO1	Reflects lack of perceived hearing issues, despite test results indicating otherwise.
B	No symptoms noticed before audiometric test	No, I felt fine	RO1	Suggests undiagnosed or unrecognized hearing loss, supporting the silent nature of NIHL.
B	Doubt about test accuracy	I think maybe I pressed the wrong button during the audiometric test	RO1	Shows denial or uncertainty, common when symptoms are subtle or results are unexpected.
B	Unaware of past test results	I didn't know the result from last year	RO1	Indicates lack of communication or follow-up, which may prevent early intervention.
B	No feedback from others	So far, no one has given any feedback	RO1	Suggests that mild hearing loss may go unOthers noticed hearing difficulty, consistent with early-stage NIHL.
B	Unsure how to reduce noise	The machine at wire welding is noisy, but without it, the work can't be done	RO2	Reflects a sense of helplessness or acceptance, common when workers feel noise is unavoidable.
B	No suggestions on noise control	I'm not sure how to answer that either.	RO2	Indicates low awareness or lack of empowerment to suggest engineering solutions.
B	PPE seen as more important than training	PPE is more important	RO2	Suggests personal protective behavior is prioritized over awareness/knowledge-building.
B	Noise exposure perceived as normal as part of job	I knew about the noise, but when I first started working, it just felt normal.	RO1	Demonstrates noise normalization, a key theme that delays risk recognition.
B	No additional input on noise hazards	No, nothing.	RO2	May reflect lack of concern or ideas — another indicator of low engagement with hazard mitigation.
B	Worked at same company since 1999 (with gap)	I first joined this company in 1999... rejoined in 2020	RO2	Provides a full noise exposure history — significant when considering cumulative risk.
B	No noise exposure at previous factory	No, there wasn't. The work environment there was okay	RO2	Confirms past job had no noise risk — current risk is specific to present job.
B	No audiometric testing at past job	No, only now I've had my hearing tested.	RO1	Highlights a gap in early detection — only tested after rejoining current company.

C	Noise from milling machine and air gun	*The noise comes from cutting materials using the milling machine and from the air gun.*	RO2	Identifies multiple mechanical sources of noise in the job role.
C	Thicker material increases noise level	*The thicker the material, the louder the sound.*	RO2	Shows how work variables (material thickness) influence noise intensity.
C	Air gun used for tool maintenance	*Used to clean the milling tip. If not cleaned, the milling bit might break.*	RO2	Indicates routine noise exposure from maintenance tasks, not just production.
C	Additional noise from jigsaw cutting	*Yes, from the jigsaw cutting machine.*	RO2	Adds another high-noise equipment used in job tasks.
C	Loudest during high workload or urgent jobs	*The noise is the loudest when demand is high…*	RO2	Noise exposure fluctuates with workload, which may increase risk during peak periods.
C	Noise affects concentration and accuracy	*Loud noise can cause mistakes—like overcutting by 1mm.*	RO1	Reports cognitive impact — error during task due to noise distraction.
C	Noise increases with multiple machines running	*If machines on the left and right run together, people have to shout…*	RO2	Shows cumulative exposure when multiple machines operate — worsening impact.
C	Noise disrupts communication at work	*Communication really suffers.*	RO2	High noise leads to interpersonal disruption, affecting teamwork and safety.
C	Abnormal noise causes physical symptoms	*Unusually loud or abnormal noises can cause headaches.*	RO1	Reports a physical symptom, potentially linked to NIHL or stress.
C	Differentiates sudden vs continuous noise	*Yes. Normal noise is manageable, but unusually loud… causes headaches.*	RO2	Shows perceptual awareness of noise pattern — important in hazard identification.
C	Main task involves jig making	*I make jigs. When production requests jigs, I'm the one who makes them.*	RO2	Identifies job role tied to frequent use of noisy machines, relevant for exposure analysis.
C	When cutting many pieces at once, it's extremely loud.	*When cutting many pieces at once, it's extremely loud.*	RO2	Shows that noise intensity is task-dependent, especially with batch cutting.
C	Production requests are unscheduled	*They request jigs as they please—there's no fixed timing.*	RO2	Unpredictable workload may lead to sudden spikes in noise exposure.
C	Long duration for jig production	*Around three days [to complete one jig].*	RO2	Indicates sustained exposure periods, not short bursts.
C	Rare task rotation	*Maybe once a month I do work*	RO2	Confirms limited job variation, meaning repeated exposure to same noise environment.

		other than making jigs.		
C	No physical or cognitive fatigue from noise	*No, I don't feel tired because of noise.*	RO1	Indicates no self-reported fatigue, despite acknowledging loud noise.
C	Noise exposure perceived as normal	*For me, noise is normal.*	RO1	Shows acclimatization or desensitization to noise — may delay perception of risk.
C	Job satisfaction despite noise	*I enjoy working—as long as there's work to do.*	RO1	While not directly NIHL-related, this reflects personality trait that may affect perception/reporting of discomfort or symptoms.
C	Long tenure at the company	*I started in 1994, so it's been around 31 years.*	RO2	Indicates prolonged occupational noise exposure, relevant to NIHL prevalence.
C	Shifted departments over time	*R&D → QC → PE (16 years)*	RO2	Shows changes in job role and exposure level across career stages.
C	PE department is the noisiest	*The PE department is the noisiest.*	RO2	Identifies job role and department as a key occupational risk factor.
C	Noise level increased due to operational or equipment changes	*Noise got worse 10 years ago... past 5 years extremely noisy due to bearing issue.*	RO2	Demonstrates how equipment condition and workload policy impact exposure trend.
C	Company changed jig policy	*Now it's about 98% [of jigs made in-house].*	RO2	Highlights organizational changes leading to increased in-house production and higher noise exposure.
C	Work complexity increased	*Before, I only handled simple jigs. Now I also make critical ones.*	RO2	Suggests task complexity may be tied to louder or more prolonged tool use.
C	Old bearing worsened noise	*The noise was unbearable.*	RO2	Equipment malfunction (bearing issue) increased risk — relates to environmental noise hazard.
C	Worker complaints were not addressed	*I did complain... but he didn't seem to care.*	RO2	Highlights lack of effective control measures or management response, a critical organizational risk factor.
C	Increased PPE compliance after hearing issue	*Almost everytime, especially now that I have hearing problems. When two or three machines run at the same time, I make sure to wear it non-stop.*	RO1	Reflects behavioral change following hearing loss, indicating awareness of NIHL and self-protection.
C	Audiometric test triggered awareness	*Since I did the audiometric test. Also, because I'm older now.*	RO1	Indicates test results and age contributed to increased awareness of hearing risk.

C	PPE discomfort due to glasses	*It becomes painful after a while because I wear glasses. The ear muff presses on the frame…*	RO2	Highlights a practical barrier to PPE compliance — affects sustained use.
C	Limited PPE options provided	*No, I've only ever been given ear muffs.*	RO2	Reveals a gap in PPE availability or option — important when evaluating effectiveness of control measures.
C	Avoids earplugs based on others' feedback	*I've heard people say earplugs are uncomfortable, so I just stick with the ear muff.*	RO2	Demonstrates peer influence and perception as factors in PPE choice and compliance.
C	PPE discomfort affects focus	*Sometimes I lose focus because the ear muff presses on the frame of my glasses near the ear.*	RO2	Indicates PPE-related discomfort is not just physical, but can affect concentration and work performance.
C	Uncertainty about PPE availability	*I'm not sure. I've never requested a new one. The one I'm using is the one you gave me before.*	RO2	Suggests a possible communication gap or lack of proactive replacement — organizational control limitation.
C	Attended multiple noise trainings	*I've attended three trainings arranged by you, and even before that I've joined other sessions.*	RO2	Shows continuous exposure to awareness programs, suggesting consistent reinforcement of knowledge.
C	Training included theory & practical	*The training included both theory and practical sessions. It helped raise awareness about the risks of noise exposure.*	RO2	Confirms comprehensive training content — useful in improving knowledge and preventive behavior.
C	Low awareness before training	*Before the training, I didn't care about my hearing health.*	RO1	Indicates low initial awareness, highlighting training's role in behavioral transformation.
C	Post-training increased caution	*Now, I'm more cautious when working in noisy areas.*	RO1	Demonstrates improved safety behavior and increased risk perception after training.
C	Memorable quote from training	*Once your hearing is gone, nothing can fix it.*	RO1	Shows emotional impact of training, which can lead to lasting behavioral change.
C	Prefers job-specific training content	*I like training that relates directly to my job.*	RO2	Indicates training relevance enhances engagement, suggesting that contextual content is more effective.
C	Recommends periodic training	*Periodically. At least once a year is enough.*	RO2	Suggests optimal frequency for sustaining awareness — aligns with industry best practices.

C	Older workers more aware	*Younger workers don't usually realise the risks… For someone like me, who already has hearing loss, the awareness is much higher.*	RO1	Highlights awareness differences by age/experience, important for targeted training strategies.
C	Hearing loss affects personal and family life	*My spouse often gets upset because I can't hear when she talks… There are certain frequencies I just can't hear anymore.*	RO1	Shows direct emotional and relational impact of NIHL in personal life.
C	Noise disrupts communicatio n at work	*At work, people have to shout when talking to me in the machine room.*	RO1	Indicates interference with communication, which can affect teamwork and productivity.
C	No early symptoms noticed	*No, I didn't. I think it started after the bearing problem in the milling machine.*	RO1	Highlights lack of early detection and the influence of specific workplace events.
C	Not exposed to non-occupational noise	*I'm not the type to listen to loud music or wear earphones either.*	RO2	Helps rule out non-occupational noise, supporting workplace as the likely primary source of exposure.
C	Audiometric timeline	*In 2022, your results were borderline. A year later, it started showing abnormal results until now.*	RO1	Establishes a clear pattern of deterioration, possibly tied to unmitigated exposure.
C	Multiple complaints with no action	*I've complained many times.*	RO2	Suggests a lack of timely response to hazard reporting, relevant for control and management failures.
C	Hearing loss affects work performance	*Yes, definitely affected.*	RO1	Confirms that hearing loss has a negative impact on job performance or routine tasks.
C	Others noticed hearing difficulty	*Sometimes when people call me, I don't respond because I can't hear them… That's why Respondent D sometimes shouts at me.*	RO1	Reinforces social/communication difficulties, with third-party validation of symptoms.
C	Preference for engineering control	*If the company can invest in new machines like CNC, that would help… we just program the cut and can work from outside the machine.*	RO2	Indicates a control recommendation via substitution/engineering intervention.
C	High noise zone concern	*Outsiders shouldn't be allowed in the machine room…*	RO2	Highlights control weakness: unauthorized, unprotected access to high noise areas.

		Some technicians just enter without PPE.		
C	Emphasis on awareness	*Awareness is more important—like providing regular training.*	RO2	Emphasizes training/administrative control as key for behavioral change.
C	Training is more effective than just providing PPE	*Training is better. Awareness is crucial. If people aren't aware, it's hard to control the risk.*	RO2	Indicates perceived effectiveness of training over PPE availability alone.
C	Audiometric test triggered awareness	*Exactly. I saw my own records—started as borderline, then it kept dropping. And once your hearing is gone, there's no cure.*	RO1	Reflects the impact of feedback and awareness on behavior; also shows irreversibility of NIHL.
C	Bulk cutting increases noise	*Like today, if I need two jig sets, I have to cut four pieces at once… the material is wider than 300mm…*	RO2	Describes work process that leads to higher exposure, linking job demand with hazard intensity.
C	Noise and vibration cause discomfort	*So apart from machine noise, there's also vibration noise—that vibration really hurts the ears*	RO1	Indicates additional physical stressor, possibly intensifying the auditory impact beyond noise.
D	Noise from multiple sources	The noise comes from machines in the machine room. It's a constant humming, including sounds like banging, air blower noise, and grinding.	RO2	Indicates a variety of continuous and impact-based noise sources, relevant for assessing exposure levels.
D	Cutting noise is loudest	When cutting material for shaping—especially when using the table cutter.	RO2	Identifies the loudest task-related noise, which is critical in pinpointing peak exposure sources.
D	Use of non-standard equipment increases risk	...we workers in the machine room bought it ourselves because the existing tools were hard to use.	RO2	Highlights lack of formal equipment provision, possibly bypassing standard controls or assessments.
D	Milling machine noise	The next loudest is from the milling machine.	RO2	Adds another key source of noise exposure.
D	Air blower use	...we have to blow it with air, or the tip could break.	RO2	Shows routine exposure from cleaning tools without coolant — contributes to cumulative noise exposure.

D	Workload affects noise exposure	It depends on the workload. If there's a lot of material to cut, we use the table cutter because it's faster…	RO2	Links workload level with increased noise exposure.
D	Jigsaw also noisy	The jigsaw is also noisy, but slightly less so than the table cutter.	RO2	Identifies secondary source with significant exposure.
D	Communicati on disrupted	...I can hardly hear them unless they shout.	RO2	Shows how noise interferes with verbal communication — a known risk for safety.
D	Noise does not affect concentration	I focus only on the task—not on conversation.	RO1	Indicates task concentration remains intact despite noise.
D	Others affected by noise	But it might disturb others who are trying to work nearby.	RO1	Suggests perceived impact on colleagues — relevant to shared work environment.
D	Ear muff ineffectivenes s	For me, ear muffs aren't effective enough—I can still hear the noise.	RO2	Highlights limitations in PPE performance, which may affect compliance.
D	Suggests dual PPE for better protection	It might be better to use double protection with earplugs.	RO2	Suggests a control recommendation to improve hearing protection.
D	Constant noise	...since the noise is constant.	RO2	Characterizes the exposure pattern — important for risk assessment.
D	High-noise materials	Acrylic and aluminium.	RO2	Identifies material-specific contributors to noise intensity.
D	Cutting in bulk	If I need to cut 10 pieces, I usually cut them all at once.	RO2	Reveals operational behavior that may increase exposure duration.
D	Manual pushing is dangerous	...table cutter can't cut many at once—it's dangerous.	RO2	Implies ergonomic and safety concerns, not just auditory.
D	Clamping improves safety	Milling machines are safer because the material is clamped.	RO2	Suggests safer practices may reduce not only physical injury but noise-related risks.
D	Detects abnormal noise	If it suddenly gets loud, there may be an issue.	RO1	Indicates auditory awareness — relevant in hazard recognition and accident prevention.
D	Noise as diagnostic tool	If it sounds different, something is wrong—like a loose tool or improper clamping.	RO1	Shows reliance on auditory cues for maintenance/safety diagnosis.
D	Grinding sound recognition	Grinding should sound like 'ciit ciit,' but if it becomes 'ciiiitttttt,' there's a problem.	RO1	Demonstrates detailed acoustic awareness — valuable in early fault detection.
D	Hearing loss risk in critical task	Deaf workers shouldn't operate	RO1	Emphasizes safety-critical tasks where hearing ability is essential.

		grinders... it's very dangerous.		
D	Clothing hazard with lathe	...lathe machine—it's very dangerous if clothing gets caught.	RO1	Adds context to hearing-related situational awareness and task safety.
D	Job role: E&E machine builder	My core task is in the Electrical & Electronic section—designing and building machines.	RO1	Provides context about the respondent's primary role, relevant to understanding exposure profile.
D	Handles full jig development	...from drawing to finished product—you're the one handling it?" / "Yes, depending on the situation.	RO1	Indicates direct involvement in processes that may involve noise-generating equipment.
D	Custom drawing for simple designs	...if someone just explains what they want, I'll do the drawing myself—only for simple designs.	RO1	Suggests autonomy in design, may influence task execution and exposure.
D	Outsourcing complex tech	If it involves advanced technology, it has to be outsourced.	RO1	Indicates only certain tasks (possibly quieter or different in nature) are outsourced.
D	Repeated exposure during shaping	As I mentioned earlier, during material cutting and shaping.	RO2	Reinforces specific operations as key sources of noise exposure.
D	Fixed work location	I don't switch at all. From the beginning until now, I've been doing the same work…	RO2	Suggests consistent exposure over time, important for determining cumulative risk.
D	No fatigue from noise	No, not really. (when asked about tiring tasks due to noise)	RO1	Reflects personal perception of noise not leading to physical fatigue — relevant for subjective impact.
D	Long tenure (30 years)	Almost 30 years.	RO1	Indicates prolonged exposure duration, relevant for assessing cumulative NIHL risk.
D	Consistent department	I've always been under the PE department…	RO1	Reflects static job environment—important for exposure consistency.
D	Initial task scope	...my work involved electronics and electrical—but mechanical work was included too.	RO1	Provides insight into the range of tasks linked to noise exposure.
D	Role stability over time	Yes." / "They've always been the same.	RO1	Confirms consistent job duties, suggesting steady exposure patterns.
D	Slight increase in noise	...but now there's additional equipment like the table cutter…	RO2	Indicates introduction of new machinery has increased noise levels.

D	Complaint on noisy machine	...we complained when the milling machine...had a bearing issue.	RO2	Shows employee awareness and action regarding noise hazard.
D	Delay in machine repair	The repair was delayed due to cost.	RO2	Highlights organizational barrier in hazard control (engineering).
D	Noise type: humming vibration	...noise became more irritating because of the humming vibration...	RO2	Describes specific nature of noise exposure affecting auditory comfort.
D	PPE used only during noisy tasks	Only during noisy tasks like cutting.	RO1	Indicates PPE usage is task-based, not continuous—potential gap in protection.
D	PPE use coordination	...when someone is cutting, they'll inform everyone to wear ear muffs.	RO2	Shows informal peer-based control system in noisy environments.
D	PPE used for limited time only	Less than an hour. Only during cutting.	RO1	Reflects limited protection window despite being in a noisy area.
D	PPE causes general discomfort	It feels tight on the head.	RO2	Highlights a common physical barrier to consistent PPE use.
D	Prefers alternative PPE option	I'd like to try using ear plugs instead.	RO2	Suggests alternative PPE options may improve compliance.
D	PPE causes headache	Wearing them too long gives me headaches.	RO1	Links PPE discomfort to physical symptoms, discouraging prolonged use.
D	PPE causes general discomfort	Yes, it's disturbing.	RO1	Emphasizes negative user experience with current PPE.
D	PPE availability is limited	Not really—unless you provide them.	RO2	Indicates possible control failure in providing consistent access to PPE.
D	SHO understands PPE need	Only the Safety and Health Officer understands the situation…	RO2	Suggests lack of management-wide awareness about noise hazard and PPE necessity.
D	Received noise training	Yes.	RO2	Confirms participation in occupational noise awareness training.
D	Training content – noise and protection	...explaining what noise is and how to protect ourselves from it.	RO2	Reflects training focused on hazard understanding and preventive measures.
D	Behavior change after training	Yes, it did. Noise damage takes time to show… I became more careful.	RO1	Indicates training influenced risk perception and improved behavior.
D	Low initial awareness	In the past, I didn't care about noise.	RO1	Shows lack of awareness before training—relevant to behavioral change.
D	Awareness increased due to age/symptoms	As I've getting old, I now feel the effects.	RO1	Demonstrates how symptom onset with age reinforced training messages.

D	Frequency of training	Twice—once in February 2024 and again in 2025.	RO2	Shows consistent exposure to awareness programs.
D	Suggestion for regular training	It should be done regularly. At least twice a year.	RO2	Emphasizes the need for reinforcement and updates, aligning with best practices.
D	Training to include latest research	There might also be new research on noise…	RO2	Suggests ongoing training can improve understanding by integrating latest findings.
D	Hearing loss affects ability to detect certain frequencies	At work, I can't detect certain frequencies.	RO1	Indicates occupational impact of NIHL — difficulty perceiving specific sound ranges.
D	Hearing loss affects personal activities	...when I drive and turn on the signal, I can't hear it.	RO1	Highlights real-world consequences of hearing impairment.
D	Family noticed hearing difficulty	Sometimes my wife or kids tell me to turn it off…	RO1	Third-party validation of hearing loss from close contacts.
D	Symptoms appeared after audiometric test	During the first test in 2021… But in 2022, I started feeling the impact.	RO1	Shows gradual emergence of symptoms after initial "normal" results.
D	Hearing loss progressed over time	And the years after, it worsened.	RO1	Demonstrates progression of hearing damage — typical for NIHL.
D	Minimal productivity impact	So far, it hasn't affected my work involving noise.	RO1	Despite impairment, no major work disruption reported yet.
D	Disruption to routine	...slightly disrupted my daily routine…	RO1	Suggests NIHL begins to affect personal functioning even if work unaffected.
D	Family noticed symptoms	My family did notice…	RO1	Reinforces the personal and social implications of hearing issues.
D	Importance of awareness	The most important is awareness—through training or courses about noise impact…	RO2	Emphasizes education as a key preventive strategy.
D	Suitability of equipment affects noise	...using blunt tools may cause more noise, while sharp tools may reduce it.	RO2	Identifies equipment condition as a modifiable noise risk factor.
D	Engineering control recommendation	Machines should come with soundproof covers.	RO2	Suggests practical engineering control measures.
D	Need for worker feedback	The company must ask employees whether the equipment... is suitable.	RO2	Encourages participatory approach in control measures.
D	Noise reduction	...by adding covers or placing the	RO2	Proposes structural/engineering solutions to reduce noise.

	through isolation	machines in enclosed rooms.		
D	Awareness over incentives	If we only chase incentives, it's temporary. Hearing loss is permanent.	RO2	Highlights lasting value of awareness versus short-term motivation.
D	Combination of PPE and training is more effective	Without explanation and training, the purpose is not achieved.	RO2	Advocates for combined control methods, not just equipment.
D	Budget allocation for noise control	Employers should allocate proper budgets for hearing safety.	RO2	Points out management's role in resource planning for control measures.
D	Poor quality equipment undermines protection	Don't just provide cheap... equipment. After all, it's the workers using it.	RO2	Calls for higher standards and proper investment in safety.
D	Prioritize high-risk workers	...employer pays more attention to workers in high-risk areas.	RO2	Urges targeted protection and prioritization for exposed workers.

Appendix G

List of Theme

Main Theme	Sub Theme	Coding
Noise Exposure Patterns and Risk Factors (RO2)	Continuous and Task-Based Noise Exposure	Continuous noise exposure from machines
		Same noise across machines
		Noise only pauses during non-operational times
		Constant noise level throughout shift
		Noise only from specific machines
		Noise from wire welding machine
		Noise occurs in bursts/gaps
		Loudest noise during air release
		Noise from milling machine and air gun
		Thicker material increases noise level
		Additional noise from jigsaw cutting
		Loudest during high workload or urgent jobs
		Noise increases with multiple machines running
		When cutting many pieces at once, it's extremely loud.
		Noise from multiple sources
		Cutting noise is loudest
		Milling machine noise
		Jigsaw also noisy
		Constant noise
		High-noise materials
		Cutting in bulk
		Slight increase in noise
	Role/Job-Specific Exposure	Operator responsible for cleaning
		Full-process task handling
		No task with higher noise
		Multiple tasks within workstation
		Wire welding is a fusion process
		Main task involves jig making
		Production requests are unscheduled
		Long duration for jig production
		Work complexity increased
		Job role: E&E machine builder
		Handles full jig development
		Custom drawing for simple designs
		Outsourcing complex tech
		Repeated exposure during shaping
	Workload, Rotation, and Variability	Infrequent machine operation
		Machine has not been used recently
		Alternative task in quiet area (SMT)
		Task assignment based on production demand
		Task rotation between areas
		Frequent job change based on planning
		Low exposure frequency to ECO-Q noise
		Time-based exposure indicator
		Task assignment changes when needed
		Rare task rotation
		Shifted departments over time
		Fixed work location
		Role stability over time
	Long-Term or Historical Exposure	Long tenure with noise exposure
		14 years in SMT department
		Early exposure to high noise levels

		Multiple noisy machines in the past
		Five years of employment
		Worked at same company since 1999 (with gap)
		Long tenure at the company
		Long tenure (30 years)
	Equipment and Environmental Factors	Blower noise less significant
		Noise level increased due to operational or equipment changes
		Old bearing worsened noise
		Company changed jig policy
		Use of non-standard equipment increases risk
		Manual pushing is dangerous
		Clamping improves safety
		Noise type: humming vibration
		Suitability of equipment affects noise
Effects of Noise Exposure on Workers (RO1)	Awareness, Normalization & Delay in Recognition	Noise does not affect concentration
		Noise is not exhausting
		Normalizing noise exposure
		No noise complaint made
		Noise exposure perceived as normal as part of job
		Noise exposure perceived as normal
		Job satisfaction despite noise
		No early symptoms noticed
		Low initial awareness
	Physical and Cognitive Impact	Noise affects concentration and accuracy
		Abnormal noise causes physical symptoms
		No physical or cognitive fatigue from noise
		No fatigue from noise
		PPE causes general discomfort
		PPE causes headache
		Hearing loss affects ability to detect certain frequencies
		Hearing loss affects personal activities
		Minimal productivity impact
		Disruption to routine
	Social and Communication Impact	Machine noise impacts communication
		Noise disrupts communication at work
		Noise disrupts communication at work
		Communication disrupted
		Others affected by noise
		Others noticed hearing difficulty
		Family noticed hearing difficulty
		Family noticed symptoms
	Self-Awareness and Audiometric Testing	Audiometric test triggered awareness
		No symptoms noticed before testing
		Others did not notice hearing loss
		No symptoms noticed before audiometric test
		Doubt about test accuracy
		Unaware of past test results
		Audiometric timeline
		Audiometric test triggered awareness
		Symptoms appeared after audiometric test
		Hearing loss progressed over time
	Emotional or Relational Impact	Hearing loss affects personal and family life
		Family noticed symptoms
		Others noticed hearing difficulty
PPE Usage, Comfort, and	PPE Usage Behavior	PPE used but causes discomfort
		PPE removed due to discomfort

Challenges (RO2)		Earplugs worn only during operation
		PPE removed due to discomfort
		Wears earplugs at noisy workstation
		Increased PPE compliance after hearing issue
		PPE used only during noisy tasks
		PPE used for limited time only
	PPE Discomfort Factors	PPE discomfort due to head covering
		Discomfort after long use
		PPE discomfort due to glasses
		PPE discomfort affects focus
		Improper PPE use causes pain
		Mild discomfort (pain/itchy)
		PPE causes general discomfort
		PPE causes headache
		PPE causes general discomfort
	PPE Availability and Fit	PPE condition is poor or outdated
		PPE is easily accessible
		Improve PPE comfort
		PPE condition is poor or outdated
		Easy access to earplugs
		Limited PPE options provided
		Avoids earplugs based on others' feedback
		Uncertainty about PPE availability
		PPE availability is limited
	Peer Influence and Use Patterns	Individual differences in PPE comfort
		PPE use coordination
		Prefers alternative PPE option
		PPE seen as more important than training
		Ear muff ineffectiveness
		Suggests dual PPE for better protection
Noise Awareness and Training (RO1 + RO2)	Training Experience and Frequency	Training increased noise awareness
		Attended recent training sessions
		No prior training before 2024
		Training included noise measurement and control methods
		Attended noise training in 2024 and 2025
		Training was practical and contextual
		Training increased noise awareness
		Attended multiple noise trainings
		Training included theory & practical
		Recommends periodic training
		Frequency of training
		Suggestion for regular training
		Training to include latest research
		Training is key to increasing awareness
		Importance of awareness
	Impact of Training on Behavior	Training changed PPE behavior
		Training increased noise awareness
		Increased awareness of long-term hearing risks
		Training improved PPE compliance
		PPE effectiveness depends on training
		Training increased noise awareness
		Post-training increased caution
		Memorable quote from training
		Behavior change after training
	Awareness Gaps Before Training	No complaints made before training/testing
		Normalizing noise exposure
		Previously unaware despite noise exposure

		Low awareness before training
		Low initial awareness
		Awareness increased due to age/symptoms
		No audiometric testing at past job
	Training Relevance	Prefers job-specific training content
		Training is more effective than just providing PPE
		Combination of PPE and training is more effective
Organizational Controls and Improvements (RO2)	Organizational Gaps in Control	Worker complaints were not addressed
		Multiple complaints with no action
		High noise zone concern
		Delay in machine repair
		No additional input on noise hazards
		Unsure how to reduce noise
		No suggestions on noise control
		PPE availability is limited
		SHO understands PPE need
	Engineering and Administrative Control Suggestions	Preference for engineering control
		Engineering control recommendation
		Noise reduction through isolation
		Need for worker feedback
		Budget allocation for noise control
		Poor quality equipment undermines protection
		Prioritize high-risk workers
		Awareness over incentives
		Suitability of equipment affects noise