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From the Guest Editor . . .

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Johan du Plessis

Research findings are communicated to the scientific community in journals, through original research articles, short communications, and review articles, to name a few. Most journals still have an editorial for each issue, usually written by the editor of the journal. As a researcher, 2022 marks 20 years since I co-authored my first research article. Since then, I have published many research articles, short communications, and review articles in national and international journals, but I have never had the privilege of writing an editorial for an issue of any research journal.

The airborne transmission of the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)¹ raised awareness about the importance of indoor air quality (IAQ) in homes, public spaces, and places of work. Indoor air quality refers to the quality of air in and around buildings and structures, considering the risk that it poses to the health and comfort of those occupying these buildings. Poor IAQ is associated with immediate health effects such as headaches, dizziness, fatigue, and irritation of the eyes, nose, throat, and lungs, and long-term health effects such as respiratory diseases, heart disease and cancer.² It also increases the risk of transmission and infection by airborne micro-organisms, such as SARS-CoV-2.¹

The Pandemic has also increased the use of hand sanitisers, bleach, quaternary ammonium products, and other indoor air cleaning devices. These air cleaners make use of ozonolysis, photolysis and ionisation, to name a few, to 'remove' indoor air contaminants, but they can also generate harmful secondary chemicals.³ This results in even more complex indoor chemistry in addition to chemicals already introduced by cleaning, cooking, indoor combustion sources, moisture, emissions from building materials, carpets, furniture, electronics, and consumer products.^{3,4}

Within occupational health and safety legislation, such as the South African Environmental Regulations for Workplaces (1987),⁵ IAQ is currently addressed through regulations on thermal requirements (extreme cold and heat) and ventilation (natural or mechanical), and carbon dioxide content in the place of work. Carbon dioxide, along with other hazardous chemical agents, is also included in the Regulations for Hazardous Chemical Agents (2021).⁶ The Environmental Regulations for Workplaces (1987) is currently under revision by the Department of Employment and Labour. Considering the ever-increasing complexity and dynamics of indoor air chemistry and IAQ, there is a need for regulations that consider this complexity to ensure adequate IAQ at places of work. This will, in future, facilitate improvement in IAQ health risk assessments, exposure monitoring, and control measures. As with SARS-CoV-2, ventilation (as an engineering control measure that removes or dilutes airborne contaminants) will be the most important control measure to ensure adequate IAQ.

In this issue of *Occupational Health Southern Africa*, we publish an original research paper and an opinion related to noise, and a review paper on hazardous biological agents. Rikhotso et al.

analysed occupational health risk assessment reports, from 21 facilities of four companies in the manufacturing and utilities sector, to identify noise abatement measures and to rate the effectiveness thereof. Of concern is the limited use of engineering control measures to reduce noise exposure, and a reliance on administrative control measures and hearing protection devices, which were found not to be effective in reducing noise exposures. The opinion, written by Drs Thomson and Delva, is also related to noise, specifically medical surveillance of noise-induced hearing loss. They present the current approach to mitigating hearing loss by monitoring for changes in standard threshold shift and percentage loss in hearing. They state a case for an alternative approach, making use of algorithmic pattern recognition of audiograms.

The review article by Gomba et al. discusses microbiological water quality concerns in buildings during periods of no or low occupancy, as experienced during the COVID-19 pandemic. The authors conclude that reduced water usage in buildings, due to closures during the Pandemic, can result in a deterioration of water quality, and that this should form part of risk assessments with appropriate implementation of control measures to reduce contamination risks.

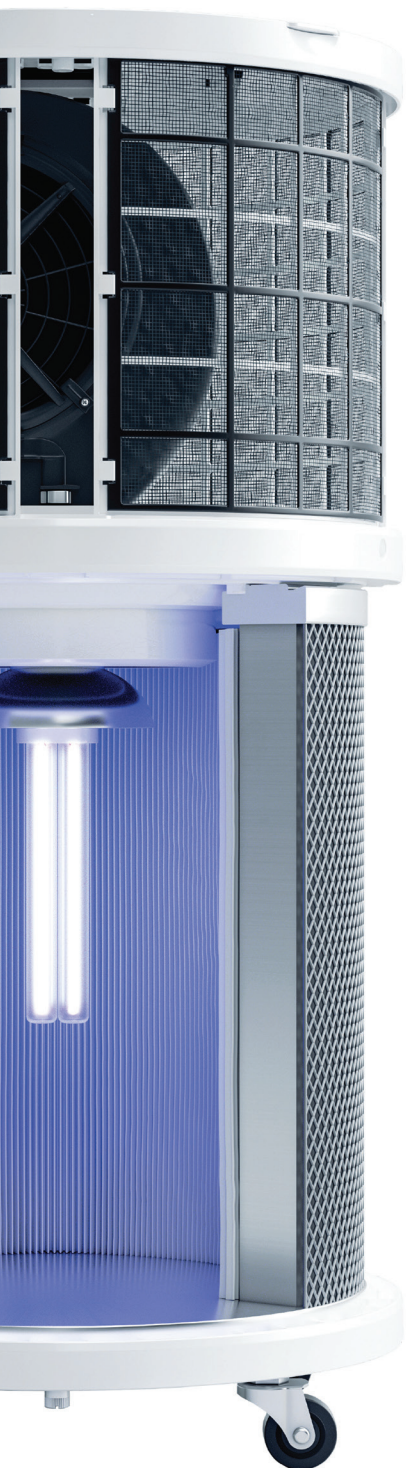
To conclude, August is Women's Month in South Africa. The Minerals Council South Africa celebrates this with an article about women in mining, and the progress (or lack thereof) that has been made with regard to increasing the proportion of women in the workforce, and addressing the challenges that they face, especially underground.

Johan du Plessis
OHSA Editorial Board member: SAIOH

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Women in mining in 2022

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Historically, women were prohibited from underground mine work according to the 1935 International Labour Organization (ILO) Convention. Many countries have since ratified and denounced this Convention, including South Africa, which did so in 1996. There have since been many efforts leveraged off South Africa's comprehensive equality laws and regulations to increase the participation of women in all levels of work across the different sectors of the economy. However, despite a legal system that includes various laws that encourage diversity, and guarantees equal treatment at work, the South African mining sector is still not representative of the population, with a relatively low participation of women across all levels. According to the 21st Commission for Employment Equity Annual Report (2020–2021),¹ only 16% of the employed mining population are women. This is 25 years after South Africa denounced the ILO Convention of 1935, prohibiting women from underground mining work. The transformation of the sector is happening too slowly and more needs to be done.

In recognition of the need for accelerated transformative actions in the sector, the Board of the Minerals Council South Africa commissioned research in 2019, which sought to identify the barriers that women faced in the mining sector, and the challenges that contributed to the high attrition rates of women, especially in core mining roles, over the long term. The results of the research were included in a white paper,² which saw the establishment of the Minerals Council Women in Mining (WiM) initiative and the Women in Mining Leadership Forum (WiMLF) in August 2020. The WiMLF set stretch targets in its WiM strategy to at least double the percentage of women in mining by 2025, reaching 30–40% in the next five years, and ultimately achieving a 50% representation of women over the next decade. These are ambitious targets, which require focused and targeted strategy and action to eliminate the challenges faced daily by women in the mining sector.

Challenges such as a lack of gendered personal protective equipment (PPE), discriminatory practices in the hiring and promotion of women, lack of gender pay parity, physical and psychological harassment, and a built environment that is not conducive to women's safety, are amongst a myriad of challenges faced by women in the South African mining sector. Research and women's lived experiences indicate that these challenges are not exclusive to South Africa, but are endemic to the global mining sector.

Mining is a high-pressure environment that requires an emphasis on physical safety. Health and safety concerns are front of mind for every individual operating in the mining sector. According to the Wits Mining Institute, environment, community, health, and safety concepts have become integral parts of the everyday mindset of companies operating in the sector.³

Over the past two years, the Minerals Council WiM initiative has carried out several crucial workstreams that tackle the challenges women face in the industry, as part of the overall WiM strategy. One

of two key outputs in 2021 was a survey conducted among member company employees about the provision and use of the appropriate gendered PPE at the respective operations. This survey was based on the research findings by the Mine Health and Safety Council (Project SIM 100904), which were utilised by the Department of Mineral Resources in its 2015 Guideline for the compilation of a mandatory code of practice on the provision of personal protective equipment for women in the South African mining industry.⁴ The findings from this project provide detailed guidelines on the selection, provision and use of PPE in the workplace, which is not only based on hazard identification and risk assessment and mitigation, but also considers female anatomical and physiological make up. The findings from the WiM survey indicated that there are still areas that need to be addressed in the provision of gendered PPE, and that there is a need for close collaboration with all stakeholders to ensure that women's needs are fully catered for in the provision of PPE, to ensure a safe working environment.

The results of Research Project SIM 100904 have been discussed at WiM meetings, and members and occupational health personnel have been conscientised about the findings and the upcoming amendments to the Mine Health and Safety Act, relating to the guidelines on the provision of PPE and the required mandatory code of practice.

Further to this, Minerals Council WiM members are part of the multi-stakeholder consultative team, which includes the Mine Health and Safety Council and the Department of Mineral Resources and Energy, and which is drafting formal guidelines and a code that will assist employers in providing suitable PPE for WiM, where required. The drafting of the Guideline is a crucial element in further developing legislation that practically removes barriers to women's full participation in mining and ensures their safety.

Physical and sexual harassment are pervasive risks that women face daily in their operations on the mines. Harmful behaviour is practised between employees at various levels in the sector, and women are the most vulnerable due to the nature of the sector, its history, and traditionally held views, which are rooted in biases, toxic masculinity and a male-dominated culture. The settings in which many employees work contribute to, and exacerbate, their experiences of harmful behaviours.

A study was conducted by the Minerals Council WiM in 2021 to understand the drivers of gender-based violence and femicide (GBVF) in the mining sector. One of the findings indicated that the built physical environment, amongst other drivers, contributed to the risk of physical harassment that women face. This risk is heightened in core mining operations underground. Therefore, not only do women have to contend with fall of ground, chemical hazards, noise, dust inhalation, etc., but they also face the hazards of falling prey to harmful behaviours in constricted and poorly lit environments. This is especially the case where the ablution facilities are unisex, far from

the rest of the team, and along paths that are not well lit. The physical environment is not the only contributing factor to the risks faced by women, but it is a significant contributor.

On 14 July 2022, the Minerals Council Mining Industry Occupational Safety and Health (MOSH) team launched the Underground Workplace Visibility Leading Practice. The event highlighted the adoption of light-emitting diode (LED) lights mounted on the rockface to improve visibility, and the ability to identify hazards timeously and improve production. A further positive linkage to improved visibility is improved physical safety for women working underground. The survey on PPE conducted by Minerals Council WiM found that women working underground sometimes delayed visiting ablution facilities during their long shifts, for fear of harassment. This has health implications as underground work is physically demanding, rendering women prone to health complications due to their physical safety fears. Improved underground workplace visibility is a welcome step in the right direction that will have positive outcomes for women's health and physical wellbeing, creating safer work spaces for all.

Progress is being made, but more needs to be done to get greater participation and inclusion of women in the mining industry.

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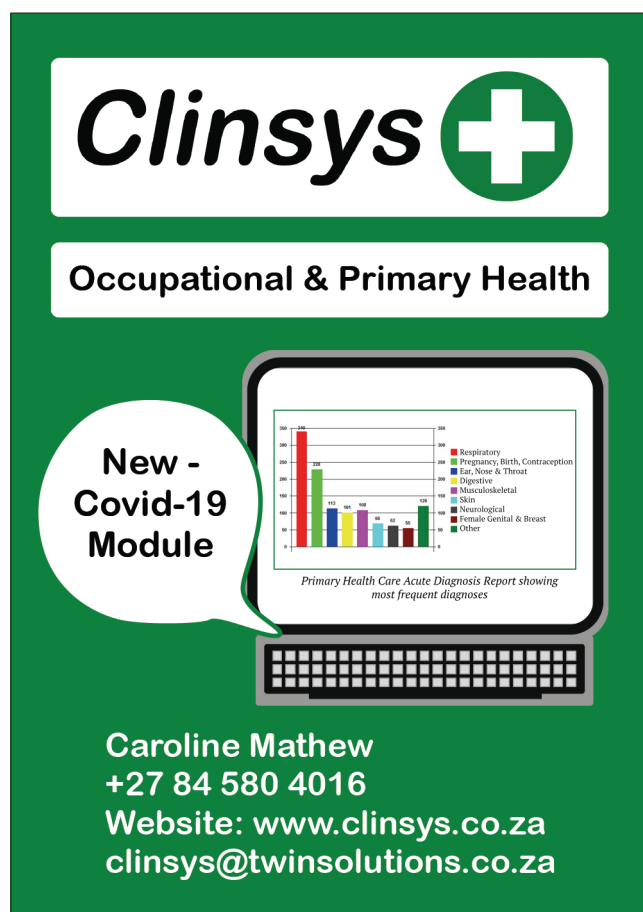



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Noise exposure abatement: a perspective from industry occupational health risk assessment reports

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ABSTRACT

Background: Occupational health risk assessments are building blocks for occupational health programmes, allowing for the rating of identified risks and the continuous re-evaluation of the effectiveness of abatement measures. In South African industry, occupational health risk assessments are formally documented in reports, which can be presented as demonstration of legal compliance with legislation.

Objective: To identify noise abatement measures recorded in noise risk assessment reports of four manufacturing companies and to rate their effectiveness.

Methods: We analysed the occupational health risk assessment reports from 21 operational facilities in four South African companies from the manufacturing and utilities sectors to evaluate, through document analysis, the recorded noise abatement measures. Noise abatement measure effectiveness was rated using a pre-assigned effectiveness percentage scale.

Results: Administrative controls and hearing protection devices were the most commonly used noise exposure abatement measures, but hearing conservation programmes were generally poorly formulated. There were inter- and intra-company differences in the qualitative risk assessment approaches used for rating or ranking the noise risk, which led to different risk conclusions and prioritisation outcomes. The calculated control effectiveness of the abatement measures showed that noise exposure remained largely unacceptable: 16 of the 21 operational units had unacceptable noise exposures, four had tolerable exposures, and one had broadly acceptable exposures.

Conclusion: The four companies' common noise abatement measures, as elements of formalised hearing conservation programmes, which included administrative controls and hearing protection devices, were not effective in reducing noise exposure to the broadly acceptable level, reflective of limited use of engineering controls.

INTRODUCTION

Activities performed in almost all economic sectors expose employees to a myriad of occupational health and safety hazards, the extent of which varies widely from sector to sector. Employees in the manufacturing sector, in particular, with its diverse subsectors, continue to experience adverse health outcomes. With a view to mitigating these adverse health impacts, the labour-intensive manufacturing sector has established occupational health and safety policies and systems.¹ As it has proved impossible to eliminate all hazards,² it is important to reduce risks as much as possible.³ Noise remains the most pervasive health hazard in the manufacturing industry, with recorded exposure levels among the loudest of those in all sectors.⁴ Regulatory authorities, worldwide, have developed regulations and standards governing noise exposure in the workplace.⁵⁻⁷

In addition to prescribing the health and safety standard for noise in industry, the South African Noise-Induced Hearing Loss (NIHL) Regulations,⁶ birthed by section 43 of the Occupational Health and Safety Act No. 85 of 1993,⁸ require employers to conduct risk assessments and record the outcomes.⁶ In so doing, employers fulfil the general duties of maintaining a workplace free of hazards and providing systems to ensure safe working conditions.⁸

A risk assessment is defined as the "overall process of risk identification, risk analysis and risk evaluation",⁹ conducted continuously and proactively.¹⁰ During the identification phase of the risk assessment, the risk assessor uses a mixture of methods, including a workplace walkthrough, employee interactions or interviews, and review of historic and existing documentation relating to standard operating procedures, incident reports, safety data sheets, first aid/injury records, and employee health records to identify hazards associated with activities. The information collected during this interactive process enables the risk assessor, during the risk analysis and risk evaluation phases, to prioritise abatement measures directed towards identified hazards.³

The risk assessment process, hazards and risks, and other outcomes of the assessment are entered into a formal record, which, according to the NIHL Regulations, should be kept by the employer for a minimum of 40 years.⁶ This ensures that focus is maintained in following up on the proposed abatement measures while also assisting in the management of other risks and hazards similar to those recorded in the assessment. Additionally, record keeping provides evidence that the risk assessment was conducted in line with legal requirements.³ One important aspect recorded during the risk assessment is the assessment regarding reasonable deterioration

in, or failure of, any control measures that have been implemented.⁶ The NIHL Regulations require the implementation of the abatement measures to be hierarchical; engineering controls are the foremost option, followed by administrative controls and hearing protection devices (HPDs).⁶ When the risk assessment is conducted, the assessed risks from identified hazards should factor in the effectiveness of these exposure abatement measures.¹⁰

Hearing conservation in terms of the South African National Standard (SANS) 10083 (2013), within the reasonably practicable philosophical context, pits engineering controls against a hearing conservation programme (HCP), with engineering control given legal preference.¹¹ The risk assessment should be completed as accurately as possible, as it is used by management as a decision-making tool in the risk management process.

The noise risk assessment, as envisaged in the NIHL Regulations and the SANS 10083 (2013) requirements, encompasses all exposure aspects of noise, providing a comprehensive view of measures implemented to prevent NIHL. The review of a company's noise risk assessment report(s) provides useful insight into the extent and nature of industry noise abatement measures.

The objective of this study was to identify noise abatement measures recorded in noise risk assessment reports from four manufacturing companies, and to rate their effectiveness.

METHODS

Company enrolment

Four companies in the manufacturing and utilities sectors were selected to participate in the study, using convenience sampling, viz. an electricity manufacturing company (Company A, with 11 operational facilities), a petroleum refinery (Company B, with two operational facilities), a radioisotope manufacturing company (Company C, with six operational facilities), and a cement manufacturer (Company D, with two operational facilities). Workers employed in these companies are exposed to a myriad of chemical, physical, biological, and ergonomic hazards.¹²⁻¹⁶ An operational facility represents a single plant or business unit of a parent company, operating as an independent entity.

Report review for control identification

We evaluated noise abatement measures recorded in risk assessment reports of four companies in the manufacturing and utilities sectors, and assessed their effectiveness. The reviewed reports had a time lag, imposed by the review frequency prescribed in the NIHL Regulations. In total, 21 risk assessment reports covering the period 2018 to 2021, recording occupational health hazards, including noise, were evaluated. Companies were requested to submit the most recently conducted and recorded risk assessment for the respective operational facilities. The evaluation criteria for the participating companies' risk

assessment reports covered the control aspects stated in Regulation 10 of the NIHL Regulations; the controls are divided into engineering controls, administrative controls, and HPDs.

Document analysis

Document analysis, a type of qualitative research method and a data collection method,¹⁷ was used to evaluate the risk assessment reports systematically and to identify noise abatement measures in use by the operational units of the four companies. The READ approach to document analysis was used to 1) read the materials, 2) extract the data, 3) analyse the data, and 4) distil the findings.¹⁸

Effectiveness of existing abatement measures

The recorded exposure abatement measures were weighted in accordance with an effectiveness scale (Table 1), whereby the engineering measures (elimination, substitution and separation) were rated as having higher effectiveness than administrative controls and HPDs.^{3,19} Elimination carries a higher weighting as it excludes the noise source from the work area.

The Health and Safety Executive (HSE) framework on tolerability of risk²⁰ classifies risks into tolerable, broadly tolerable, and unacceptable categories. Following the control measure weighting, it was used to determine the tolerability of risk, using predefined effectiveness percentages that translated into residual risk scores, as shown in Table 1. In terms of this HSE framework, when applying the 'as low as reasonably practicable principle' employers are required to allocate more resources towards efforts to reduce risks rated as unacceptable. Conversely, employers are required to allocate fewer financial resources for the reduction of risks rated as broadly acceptable.^{20,21}

The HSE framework on tolerability of risk also outlines the level of risk acceptance relative to stated objectives, determines the significance of risk in terms of predetermined categories, and supports decision-making processes. The framework should, however, be aligned with companies' risk management frameworks, which are specific to the scope of the activity being considered and regulatory requirements against which legal compliance is measured.²² However, as not all risks can be eliminated or removed, the HSE framework on tolerability of risk provides decision-makers with a tool to decide on the acceptability of remaining and assumed risks.²³

The overall control effectiveness was calculated by summing the pre-assigned effectiveness percentages for engineering and administrative controls, and HPDs (as shown in Table 1) into a single score, expressed as the overall control effectiveness percentage. Thereafter, the residual risk, subtracted from the overall control effectiveness score, was calculated. A single or group of reported control measures falling under each hierarchy of control element

Table 1. Effectiveness of hierarchy of control measures

Control measure	Description	Effectiveness (%)
Elimination*	Removal of noise source from facility	100
Substitution*	Substitution with quieter equipment	75
Separation*	Lagging, acoustic covers, steam silencers, enclosures, automation, silencers; measures reduce noise at the source or modify routes of noise emission	50
Administrative	Regulatory requirements, e.g. noise zoning, audiometry, training, etc.; limit number of exposed employees and duration of exposure	10–30
Hearing protection devices	Earmuffs, earplugs, etc.	5

*engineering controls

Table 2. Controls for noise exposure identified in operational facilities of participating companies

	Hierarchy of control element			
	Engineering controls	Administrative controls	PPE	HCP formalisation
Company A				
Facility 1	None	Hearing conservation training	Non-specific earmuffs or earplugs or customised HPDs	Formalised
Facility 2	None	<ul style="list-style-type: none"> • Hearing conservation awareness • Noise survey • Audio medical surveillance 	Non-specific hearing protection	Formalised
Facility 3	None	<ul style="list-style-type: none"> • Zoned noise areas • Noise survey • Training/awareness • Medical surveillance 	Non-specific hearing protection	Not formalised
Facility 4	None	<ul style="list-style-type: none"> • Noise survey 	None mentioned	Not formalised
Facility 5	None	<ul style="list-style-type: none"> • Periodic (and refresher) training on safe work procedures and PPE • Annual audiometric testing 	Personnel make use of ear plugs and earmuffs	Not formalised
Facility 6	Maintenance and lubrication of plant machinery	<ul style="list-style-type: none"> • Audiometric testing • Site-specific training and education on safe work procedures and control measures • Reduction of exposure time 	HPDs with noise reduction rating ranging from 24 to 30 dB	Not formalised
Facility 7	None	<ul style="list-style-type: none"> • Noise zones identified and conspicuously demarcated by using required pictogram • Periodic (and refresher) training on safe work procedures and PPE • Annual audiometric testing 	Personnel make use of ear plugs and earmuffs	Not formalised
Facility 8	None	<ul style="list-style-type: none"> • Audiometric testing • Noise survey • Awareness sessions 	Use of HPDs	Not formalised
Facility 9	Non-specific engineering controls reported	<ul style="list-style-type: none"> • Noise zone demarcation • Audiometric testing • Noise survey 	Non-specific PPE reported	Formalised
Facility 10	None	<ul style="list-style-type: none"> • None 	HPDs	Not formalised
Facility 11	<ul style="list-style-type: none"> • Cabin and spreader enclosures lined with acoustic absorptive material • Fly ash conveyor automation • Regular maintenance of conveyor belt and motors 	<ul style="list-style-type: none"> • Employees occupancy in noisy areas reduced • Medical examinations • Training and education • Noise zone demarcation 	Disposable coded earplugs with NRR of 34 dB	Not formalised
Company B				
Facility 1	<ul style="list-style-type: none"> • Lagging • Acoustic cover • Steam silencer • Enclosures 	<ul style="list-style-type: none"> • Noise zone demarcation • Noise survey • Audiometric testing 	Non-specific earmuffs	Formalised
Facility 2	<ul style="list-style-type: none"> • Most compressors and boilers have silencers • Compressor acoustic housing 	<ul style="list-style-type: none"> • Noise zone demarcation • Training on NIHL • Signposting noise areas • Audiometric testing 	Non-specific hearing protectors	Formalised
Company C				
Facility 1	None	<ul style="list-style-type: none"> • Registered noise workers • Annual medical surveillance 	Howard Leight earplugs with NRR of 29 dB	Not formalised
Facility 2	None	<ul style="list-style-type: none"> • Annual audiometric testing • Noise worker training • Equipment used for short periods 	Non-specific hearing protectors used in demarcated areas	Not formalised
Facility 3	Regular service and maintenance on electric motors. Noise < 85 dBA	<ul style="list-style-type: none"> • None 	None	Not formalised
Facility 4	None	<ul style="list-style-type: none"> • Noise zone demarcation 	Howard Leight Bilsom 304 L earplugs with NRR of 29 dB	Not formalised
Facility 5*	None required	<ul style="list-style-type: none"> • None required 	None required	None required
Facility 6	None	<ul style="list-style-type: none"> • Noise zone demarcation 	MSA earmuffs and Howard Leight ear plugs provided	Not formalised
Company D				
Facility 1	None	None	None	Not formalised
Facility 2	None	None	None	Not formalised

dB: decibel, dBA: A-weighted decibel, PPE: personal protective equipment, HCP: hearing conservation programme, HPD: hearing protection device, NRR: noise reduction rating, NIHL: noise-induced hearing loss

* Company C Facility 5 required no further abatement measures as the reviewed risk assessment report indicated that noise sources were eliminated

was assigned a single or a combined effectiveness percentage. The maximum allocation of the effectiveness percentage for engineering controls, administrative controls, and HPDs are based on the legal prescripts defined in Regulation 10(2) of the NIHL Regulations.

The assigned effectiveness percentages for each control indicate that elimination is the most effective measure for noise control. Residual risk percentages > 0% indicate the implemented measures' inabilities to eliminate the noise, hence the need for implementation of the continuous HCPs. Continuous HCPs require employers to conduct noise monitoring, audiometric testing, noise zoning, and noise monitoring at prescribed frequencies.

This study formed part of a larger study for which ethical clearance was obtained from the Tshwane University of Technology (TUT) Ethics Committee: FCRE 2020/10/015 (FCPS 02) (SCI).

RESULTS

Identified noise control measures

The noise risk assessment records showed that the risk assessors recorded current controls in use at the different companies to demonstrate measures implemented to minimise noise exposure. Table 2 shows the specific hierarchy of control elements and the extent of formalisation of the HCP. The most common abatement measure across the enrolled companies was

Table 3. Control effectiveness statement and resultant risk classification for each operational facility of the participating companies

	Hierarchy of control element			Effectiveness of current controls statement	Risk classification	Further proposed abatement measures
	Engineering controls	Administrative controls	PPE			
Company A						
Facility 1	-	✓	✓	✓	Medium	Assessment will be done as per the NIHL Regulations
Facility 2	-	✓	✓	✗	High	No additional controls identified in report
Facility 3	-	✓	✓	✓	High	No additional controls identified in report
Facility 4	-	✓	✗	✗	Low	No additional abatement recommendations made
Facility 5	-	✓	✓	✗	Medium	<ul style="list-style-type: none"> • Explore viability of installing engineering control measures as required by Regulation 10 of the NIHL Regulations • Loose, vibrating components on equipment generate rattling noise and should be repaired to reduce exposure to noise
Facility 6	✓	✓	✓	✓	Low	No additional abatement recommendations made
Facility 7	-	✓	✓	✓	Medium	<ul style="list-style-type: none"> • Explore viability of installing engineering control measures as required by Regulation 10 of the NIHL Regulations • Loose, vibrating components on equipment generate rattling noise and should be repaired to reduce exposure to noise
Facility 8	-	✓	✓	✗	Medium	Develop and maintain an occupational hygiene programme
Facility 9	✓	✓	✓	✗	Medium – high	No additional abatement recommendations made
Facility 10	-	-	✓	✓	Acceptable	Audiometric testing
Facility 11	✓	✓	✓	✓	Medium – high	Stop intermittent steam leaks by means of proper cladding or fastening of the cladding
Company B						
Facility 1	✓	✓	✓	✓	Not stated	HCP
Facility 2	✓	✓	✓	✓	Not stated	Noise reduction plan proposed
Company C						
Facility 1	-	✓	✓	✓	Medium	Occupational hygiene monitoring programme
Facility 2	-	✓	✓	✓	Low	Maintain controls in place for compliance
Facility 3	✓	-	-	✓	Negligible	No further action required
Facility 4	-	✓	✓	✓	Low	No additional abatement recommendations made
Facility 5	-	-	-	✓	Negligible	No further action required
Facility 6	-	✓	✓	✓	Low	No additional abatement recommendations made
Company D						
Facility 1	-	-	-	✗	-	None proposed
Facility 2	-	-	-	✗	-	None proposed

PPE: protective personal equipment
 - not implemented, ✓ present, ✗ absent

HPDs, followed by a range of administrative measures. Engineering controls as a first consideration within the hierarchy of control principle was the least utilised measure across all companies. Both the administrative controls and HPDs are basic controls catered for within the NIHL Regulations and the SANS 10083 (2013) requirements. The HCP formalisation in some of the companies' operational facilities' reports had little information about the programme elements. The HCP formalisation in the context of this study means that the risk assessors explicitly mentioned the HCP in the risk assessment report, with corresponding verifiable programme elements listed. The HCP, itself, is a risk management tool for the reduction of NIHL.

Identified noise controls and risk characterisation

The effectiveness of implemented abatement measures should be considered during the risk evaluation and included in the analysis processes of a risk assessment. Table 3 shows the consideration of the effectiveness of abatement measures, as a whole, on the overall outcome of the risk assessment process, and proposed additional abatement measures. Certain operational facilities of Companies A, C and D had no proposed abatement measures in spite of the noise risks being rated as high. The risk assessment report of noise at Company D had no risk conclusion statement, unlike those of Companies A, B and C, adding ambiguity as to what the next risk management steps for eliminating noise at this company might be.

Management decisions about future expenditures are grounded on outcomes that consider the effectiveness of current controls. Thus, if the conclusion of the risk evaluation step is incorrect, it has a detrimental effect on the allocation of financial resources for future exposure abatement.

Effectiveness of controls and tolerability of risk

The recorded existing noise controls were assigned corresponding effectiveness percentage scores, derived from Table 1, and an overall control effectiveness score, from which residual risk percentages were calculated, as shown in Table 4. The residual risk percentages were assigned to the corresponding risk level, derived from the HSE framework on tolerability of risk²⁰ (broadly acceptable, tolerable, and unacceptable).

The tolerability of the residual noise risks for Companies A, C and D were classified as unacceptable, which reflects an over-reliance on administrative controls and HPDs as the controls of choice. The noise risk of Company B was 'tolerable', reflecting the effectiveness of engineering controls compared to that of administrative controls and HPDs. In assigning final risk scores, certain operational facilities of Company B used both qualitative (controls and likelihood) and quantitative (noise levels) variables to allocate risk rating. Companies A, C and D relied on only qualitative variables for assigning final risk ratings.

Table 4. Control effectiveness and residual risk percentages of existing abatement measures

	Risk control hierarchy percentage (%)			Overall risk control effectiveness (%)	Residual risk (%)	Tolerability of residual risk*
	Engineering controls	Administrative controls	PPE			
Company A						
Facility 1	0	10	5	15	85	Unacceptable
Facility 2	0	20	5	25	75	Unacceptable
Facility 3	0	30	5	35	65	Unacceptable
Facility 4	0	10	0	10	90	Unacceptable
Facility 5	0	15	5	20	80	Unacceptable
Facility 6	50	20	5	75	25	Tolerable
Facility 7	0	20	5	25	75	Unacceptable
Facility 8	0	15	5	20	80	Unacceptable
Facility 9	0	15	5	20	80	Unacceptable
Facility 10	0	0	5	5	95	Unacceptable
Facility 11	50	30	5	85	15	Tolerable
Company B						
Facility 1	50	20	5	75	25	Tolerable
Facility 2	50	30	5	85	15	Tolerable
Company C						
Facility 1	0	15	5	20	80	Unacceptable
Facility 2	0	20	5	25	75	Unacceptable
Facility 3	50	0	0	50	50	Unacceptable
Facility 4	0	10	5	15	85	Unacceptable
Facility 5	100	0	0	100	0	Broadly acceptable
Facility 6	0	10	5	15	85	Unacceptable
Company D						
Facility 1	0	0	0	0	100	Unacceptable
Facility 2	0	0	0	0	100	Unacceptable

PPE: protective personal equipment

*using HSE-defined tolerability of risk framework

Assigning the control effectiveness percentages to current control and risk conclusions, based on the HSE framework on tolerability of risk, confirmed that noise was a high risk in all four companies. However, divergences in risk conclusions from the use of the control effectiveness percentages and the companies' own final risk ratings (assigned as acceptable, i.e. low to medium) were noted in nine of the 11 operational facilities of Company A and in five of six operational facilities of Company C.

DISCUSSION

The findings of the study revealed that current exposure abatement measures were recorded in the risk assessments conducted at the four companies – a requirement of the NIHL Regulations. The recording of these abatement measures fulfills a critical objective of the risk assessment process.²⁴ These abatement measures, together with the consequences of exposure and exposure probability,^{10, 22, 25, 26} when interpreted as a whole during the risk evaluation phase of the risk assessment, influence subsequent risk scoring, risk prioritisation, and decision making for additional risk treatment – a process undertaken for risk modification through risk avoidance, risk removal from the source, and changing the likelihood of exposure.⁹

Risk assessors have a professional duty to ensure that abatement measures do not exaggerate the control effectiveness potential of these measures. The risk assessment results should be reproducible.²⁷ In addition to being a legal requirement to record existing abatement measures, such information also informs additional measures that should be considered to further reduce residual risks.²⁸

Similar to not adhering to the requirement that a statement be made about the effectiveness of implemented abatement measures during the risk evaluation phase, the qualified use of HPDs by the respective companies was not clearly stated. Regulation 9(d) of the NIHL Regulations requires the identification of reasons for the noise level being at or above the noise rating limit, but it was not clear if this was done.⁶ On this point, the nonprescriptive nature of the risk assessment process in its current form, as described in Regulation 6 of the NIHL Regulations, complicates the risk assessment process for South African industry.

Another objective of a risk assessment is to recommend further exposure abatement measures for reducing identified hazards to levels that are considered tolerable.²⁴ The effectiveness of implemented abatement measures should be expressed during the risk assessment process. Assigning noise as a low risk prevents it from being prioritised for further risk treatment – a possible reason for the poor or sporadic implementation of engineering controls.²⁹ If a risk assessment outcome ranks noise as a low risk, then the employers would be justified in not taking action to further reduce the risk.³⁰

None of the evaluated risk assessments recorded the reasons for the persistence of noise exposure, although this is required in the NIHL Regulations. In such cases, the risk should be assessed as not adequately controlled. The risk assessment should assist employers to identify and institute immediate control measures to prevent exposure.^{30, 31} Worldwide, noise regulations require that exposure be adequately controlled, a practice not observed in some of the operational units of the participating companies.³⁰

Hearing conservation programme implementation versus engineering control

Risk assessment reports, from the companies' operational facilities that did not mention HCP formalisation, indicated a deviation of the risk management process from the legal criteria used in South Africa. Risk

assessment should comply with legal requirements and national standards.³⁰ The administrative controls and the use of different HPDs that were extensively relied upon by the four companies did not eliminate noise from the source. Hearing protection shifts the responsibility of exposure control to the workers rather than being used to supplement engineering and administrative controls. Risk management must focus primarily on risk elimination, substitution and engineering controls as these measures lead to a substantial reduction in NIHL.¹⁹

The reported control measures that had not entirely eliminated noise from the workplace were being used for risk reduction rather than risk avoidance. The technical nature of noise in these companies has remained unchanged throughout the life cycle of these installations.²⁷ It was noted that the risk evaluations of noise across operational facilities of the same company, where high noise risk ratings were assigned, proposed no further abatement measures. This was noted especially in certain operational facilities of Companies A, C and D. Conversely, in some instances, where noise risk was assigned as low or medium, further abatement measures were proposed. This highlights the need to conduct quality risk assessments that involve trained, highly motivated and experienced teams.³²

The recommendation of abatement measures, following risk evaluation, is undoubtedly arduous in the absence of national risk acceptability guidelines. For example, using the HSE framework on tolerability of risk,²⁰ noise risks assigned as tolerable will not incur prohibitive costs as the risk would have been reduced to as low as reasonably practicable, whereas risks assigned as acceptable will need continuous attention for improvement.³³ Undoubtedly, a suitably and appropriately completed risk assessment is a useful decision-making tool for the risk management team.³²

Uncertainty of risk assessment outcomes and ensuing proposed controls

The noise risk assessment and risk management landscape in South African general industry is fraught with uncertainties, brought about by the non-prescriptive risk assessment procedures and the largely self-regulatory regime.^{6, 8} Companies misinterpret the legal meaning of concepts such as 'reasonably practicable', while adopting HCPs as a default control. The non-prescriptive nature of the risk assessment procedures also leads companies to adopt unproven risk management philosophies that assign noise as an insignificant health risk, thereby not prioritising its control during risk treatment initiatives.

NIHL remains the most frequently compensated occupational disease in South Africa,³⁴⁻³⁶ with poorly conducted risk assessments being a notable contributor. The NIHL scourge indicates the shortcomings of risk assessment in preventing ill health.³²

Problems associated with noise risk assessments include their unreliability due to uncertainties relating to model variations, lack of industry-specific knowledge about hazards by risk assessors, including occupational hygienists, and their incompleteness.³⁷ These factors can lead to unrealistic and inappropriate risk assessment conclusions,³⁸ as observed in this study. Despite these uncertainties, employers must use risk assessment outcomes to make risk management decisions.³⁹ In general, companies should evaluate the overall effectiveness of adopted risk assessment practices.²⁷

Only Company B used a mixture of both quantitative (noise levels) and qualitative (controls and likelihood) assessments. Using only qualitative variables to characterise risks³³ introduces subjectivity. A semi-quantitative risk evaluation, using both qualitative assessments (controls and likelihood as risk variables) and noise levels, enriches

risk characterisation decisions. The effectiveness control percentage introduces objectivity for actioning envisaged preventive or corrective abatement measures.⁴⁰ Employers are mandated to evaluate the status of existing control effectiveness and to consider new technologies that may be more effective, protective and/or reliable as part of continuous efforts for hazard prevention.³¹

The study had some limitations in that the risk assessment analysis relied on secondary data, and errors and omissions in the records could thus not be followed up with company representatives who wrote the documents. On a regulatory level, the assessed records were ambiguous about whether the recorded engineering controls were implemented as part of a separate risk treatment process. Added to that, the records were ambiguous as to whether the recorded engineering controls were an outcome of a requirement for employers to identify the reasons that the noise levels exceeded the noise rating limit, without the use of the HPDs.

More studies evaluating the effectiveness of existing control measures should be conducted in South African industry. Prospectively, companies reliant on qualitative risk assessments should consider conducting quantitative assessments to quantify noise risks accurately.

CONCLUSION

The recording of risk control measures in risk assessments, which is a legal requirement, and the evaluation of effectiveness, are established company practices, in general. These control measures undoubtedly influence risk evaluation and risk prioritisation in the risk assessment process. Administrative controls and HPDs (elements of HCPs) were the commonly recorded control measures in the four companies, in preference to engineering controls. The noise risk assessment process is fraught with uncertainties with regard to risk conclusion statements and risk prioritisation for further risk treatment, with minimal guidance for employer action to reduce or prevent residual risks. The over-reliance on HCPs is problematic, as some operational facilities had fragmented programmes that did not include all HCP elements. The quantification of the effectiveness of recorded controls yielded unacceptable noise risks, diverging from the actual risk conclusions made in the company representatives' risk assessment reports.

Unacceptable noise risks are indicative of the fact that administrative controls and HPDs do not eliminate or reduce the noise from the source. Studies such as this, which analyse real field data, assist in the search for better approaches in preventing industrial health risks.

KEY MESSAGES

1. The formalisation of hearing conservation programmes is lacking in industry.
2. Administrative controls and HPDs are commonly implemented as noise abatement measures.
3. Occupational health risk assessments conducted in industry need improved recording of information, such as implemented abatement measures, which influence risk ranking during the risk evaluation phase.

DECLARATION

The authors declare that this is their own work; all the sources used in this paper have been duly acknowledged and there are no conflicts of interest.

AUTHOR CONTRIBUTIONS

Conception and design of the study: OR, TJM, DMM
 Data acquisition: OR
 Data analysis: OR
 Interpretation of the data: OR
 Drafting of the paper: OR
 Critical revision of the paper: TJM, DMM, OR

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Water quality challenges in buildings during prolonged low or no occupancy: a cause for concern during COVID-19 lockdowns and related building closures

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ABSTRACT

Introduction: In compliance with the COVID-19 lockdown restrictions, many non-essential workplaces and public spaces were closed or left sub-operational with no or low occupancy for several months. The abrupt and unprecedented long periods of building closures have raised concerns about the proliferation of opportunistic premise plumbing pathogens that may be a biohazard for returning occupants.

Objective: In this review paper, we discuss microbiological water quality concerns during periods of no or low occupancy, as experienced during the COVID-19 lockdowns.

Methods: PubMed and Google Scholar databases were searched for peer-reviewed articles using specific keywords. The literature search was extended to grey literature. The paper focuses on *Legionella*, as a pathogen of concern, in building water systems that are not well managed and the potential risks to workers and other occupants.

Results: Most articles suggest a positive relationship between stagnation or reduced water usage and compromised microbiological quality of building water systems, but the effects are site-specific and are associated with biofilm formation and disinfectant decline. Considerations for building water risk assessment are discussed as a decision-making framework for selecting appropriate responses to anticipated changes in water quality.

Conclusion: The unprecedented building closures due to COVID-19 lockdowns present a hazardous event likely to impact building water quality. Building owners and facility managers, especially in high-risk settings, should consider conducting risk assessments of water systems during low-occupancy periods to identify potential risks and apply appropriate corrective measures, where necessary.

INTRODUCTION

Building water systems play an important role in the distribution of water through complex pipe networks. If not well maintained, microbial growth, persistence, and transmission of opportunistic pathogens, particularly *Legionella*, can cause acute and sometimes fatal illnesses in susceptible individuals. The unprecedented coronavirus disease (COVID-19) pandemic impacted economies worldwide.¹ Disaster management strategies, including lockdown measures and remote work to minimise transmission in various workplace settings, resulted in reduced water usage in many non-essential buildings. There is a growing concern that reduced building water usage created favourable conditions for microbial proliferation, with potential exposure to opportunistic premise plumbing pathogens (OPPPs) such as *Legionella*, and adverse health effects for returning occupants.²⁻⁴ At the beginning of the Pandemic, health ministries were forced to convert facilities, including sports stadiums, hotels, conference centres, and even cruise ships into field hospitals and quarantine centres to cope with the extraordinary demand for hospital beds.⁵ Poor oversight of potential risks after periods of low or no occupancy in these facilities could lead to unintended health consequences for patients and healthcare workers.⁶

The projected intermittent COVID-19 waves due to microbial resurgence, the emergence of new variants of SARS-CoV-2,^{7,8} and the

digitisation of many workplaces compelled some organisations to adopt telecommuting strategies, perpetuating water quality issues if the building water systems were not maintained. There is a paucity of information about water contamination risks, particularly during prolonged building closures. The two most recently published reviews on the topic provide critical accounts of the assumptions surrounding the definition and impact of stagnation in premise plumbing systems (PPSs) and *Legionella* growth,⁹ and discuss issues to consider when developing and implementing guidelines for restoring building water systems to baseline conditions, after extended periods of no or limited water use.³

This paper provides an in-depth review of studies on factors affecting building water quality after periods of reduced water usage, to better understand microbial contamination and growth during reduced water demand, also referred to as stagnation, in PPSs. We highlight the importance of performing site-specific building water risk assessments (RAs) as a decision-making framework when selecting appropriate control measures and responses to anticipated changes in water quality. The review also provides guidance on points to consider when verifying the effectiveness of corrective actions, including what to test for, where and what to sample, sampling frequency, test methods, and interpretation of results. Emphasis is placed on *Legionella* as one of the most notoriously

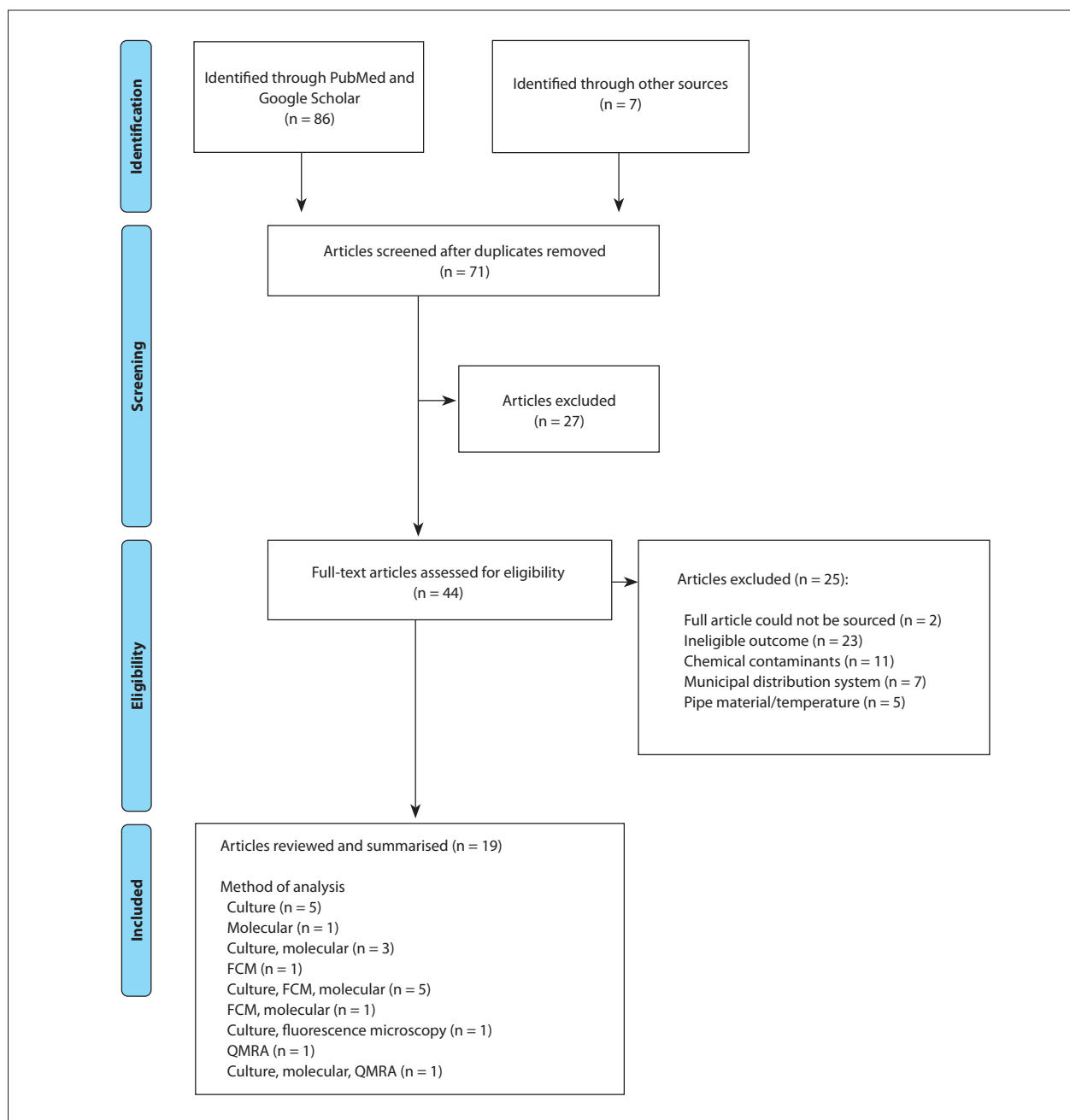
difficult OPPPs to manage, with case numbers reported to be increasing globally.^{10,11}

We anticipate that this information will assist building owners, facility managers, environmental health practitioners, infection control personnel, health and safety officers, occupational hygienists, and other stakeholders to proactively manage the risk of opportunistic pathogen-related illnesses in the built environment.

METHODS

We searched PubMed and Google Scholar for peer-reviewed articles published in English from 2000 to 2021, using keywords related to water quality in large buildings, i.e. stagnation, disinfectant residuals, biofilms, *Legionella* growth, risks and control, and *Legionella* risks during COVID-19 lockdown. Reference lists of selected articles were

manually searched to identify additional papers (Figure 1). We included both field and experimental primary research studies on PPSs. Grey literature was included, specifically guidance documents on managing *Legionella* risks during COVID-19 building closures, from internationally recognised institutions or government agencies such as the Centers for Disease Control and Prevention, United States of America (CDC USA), American Water Works Association (AWWA), and the European Study Group for *Legionella* Infections (ESGLI). Publications focusing on temperature, plumbing materials, chemical contaminants, municipal distribution systems, and cooling towers were excluded as they were considered beyond the scope of this paper. Studies were characterised using the following variables: origin, type of building, water usage pattern, parameters assessed (population) and detection methods, main findings (outcomes), and recommendations.



FCM: flow cytometry, QMRA: quantitative microbial risk assessment

Figure 1. PRISMA-like flowchart summarising the article selection

Table 1. Summary of reviewed articles relating to water quality issues as a result of no or low building occupancy

Study type, country	Type of building	Water use pattern	Method(s) of analysis and microbial parameters assessed	Main findings (outcomes)	Recommendations
Field study, Italy ²	Cold water taps and showers in three wards (62-beds) of a university hospital	Wards had been closed for three months due to the COVID-19 pandemic	Culture Coliforms, <i>E. coli</i> , <i>Enterococci</i> , <i>P. aeruginosa</i> , <i>Legionella</i>	<ul style="list-style-type: none"> • Generally, risk of waterborne diseases increased due to water stagnation in unused buildings during lockdown • <i>Legionella</i> contamination higher after lockdown than pre-lockdown in some wards 	<ul style="list-style-type: none"> • Implement a water safety plan, including staff training and more rigorous environmental microbiological surveillance in all hospitals • Survey building water network previously closed for > 1 week before starting normal services so that waterborne disease risks, including Legionnaires' disease, are minimised
Field study, USA ⁴	Cold and hot water showers in university buildings using chloraminated water	Wholly or largely unused for > 2 months due to the COVID-19 pandemic	Culture, molecular (qPCR) simulation (QMRA) Total bacteria (16S rRNA genes), <i>Legionella</i> spp., <i>L. pneumophila</i> , <i>L. pneumophila</i> serogroup 1, NTM, MAC	<ul style="list-style-type: none"> • Culturable <i>Legionella</i>, <i>L. pneumophila</i>, and <i>L. pneumophila</i> sg1 genes not detected • Most (12/14) pre-flush samples positive for <i>Legionella</i> spp. • Most (9/10) pre-flush samples positive for NTM and MAC • Flushing rapidly restored disinfectant residual and decreased bacterial gene targets to building inlet concentrations within 30 minutes, but opportunistic pathogens regrew • Low health risks from opportunistic pathogen exposure during showering 	<ul style="list-style-type: none"> • For buildings with history of <i>Legionella</i> or NTM contamination: • Routine flushing and cleaning to increase water turnover and maintain disinfectant residual in storage tanks • Flushing periodically during shutdown, or at least flushing within 2–3 days of building re-occupancy
Field study, China ¹⁵	Cold water taps in university buildings and a community residential building	Little or no water usage in buildings for nearly four months, except for the community residential building	Culture, FCM, molecular (qPCR, 16S rRNA Illumina sequencing) HPCs, <i>L. pneumophila</i> , <i>P. aeruginosa</i> , <i>E. coli</i> , <i>Enterococcus faecalis</i> , <i>Shigella</i> sp., <i>Salmonella</i> sp., endotoxin	<ul style="list-style-type: none"> • Long-term water stagnation resulted in deteriorated water quality, which increased microbiological risks • Disinfectant residual decreased significantly while HPCs increased significantly with stagnation • <i>L. pneumophila</i> occurred in 91% of stagnant water samples with high turbidity (> 1 nephelometric turbidity unit) • Took 1–2 months for bacterial levels to return to normal levels 	<ul style="list-style-type: none"> • Health risks from pathogenic bacteria in stagnant water require attention, and countermeasures are needed before buildings are re-opened • Routine flushing coupled with cleaning of water tanks (pathogens regrow with routine flushing alone), taking into account plumbing design, complexity of components, and stored volume of water relative to water use. Flushed water can be used for non-potable purposes, e.g. landscape irrigation and floor washing • Maintain a disinfectant residual, e.g. by installing automatic disinfectant device • Monitor water quality of buildings frequently • Residual chlorine can be used as early warning indicator for microbiological safety of tap water with long stagnation
Field study, China/USA ¹⁶	Cold tap water in multi-story university dormitory buildings	Two-month dormitory shutdown with no water usage	Culture, molecular (16S rRNA Illumina sequencing) HPCs, sequencing for <i>Legionella</i>	<ul style="list-style-type: none"> • Stagnation significantly elevated HPCs and <i>Legionella</i> relative abundance • Elevated <i>Legionella</i> infection risks in buildings with prolonged closure 	<ul style="list-style-type: none"> • Urgent need to mitigate <i>Legionella</i> infection risks during re-opening of buildings previously closed due to COVID-19
Field study, Canada ¹⁷	Cold and hot water systems in a 10-story, 450-bed children's hospital	Induced variable controlled stagnation time periods (1, 24, 48, 72, 120 and 240 hours)	Culture, fluorescence microscopy HPCs, total viable and total bacterial cell counts	<ul style="list-style-type: none"> • Short stagnation periods (1 hour) had lower culturable bacteria than longer periods (≥ 24 hrs), probably due to biofilm detachment; bacterial load not significantly higher with increasing stagnation time • Flushing large volumes of water was required to reduce viable and total cell counts after stagnation in cold water system 	<ul style="list-style-type: none"> • For buildings with extended non-occupancy, daily flush may not be more beneficial than weekly flush • For low-use taps or after longer stagnation (≥ 24 hrs), flush only stagnant water specific to tap and connecting pipes • For HCFs, small sampling volume on first flush is preferred to evaluate distal contamination and increase chances of bacteria recovery • Standardised sampling protocols, taking into account sample volume and prior stagnation, for better RA and interpretation of results against targeted thresholds for infection prevention

Table 1 continued opposite

Table 1 continued

Study type, country	Type of building	Water use pattern	Method(s) of analysis and microbial parameters assessed	Main findings (outcomes)	Recommendations
Field study, USA ¹⁸	Green buildings with water and energy conservation features and a conventional house; cold and hot water taps	Elevated water age depending on building (days to months of water retention)	Molecular Total bacteria (16S rRNA gene) <i>Legionella</i> spp., <i>L. pneumophila</i> , <i>Vermamoeba vermiformis</i> , <i>Mycobacterium avium</i>	<ul style="list-style-type: none"> • Pathogenic gene copies and total bacterial genetic markers detected at higher concentrations in all green buildings compared to conventional building and flushed water samples • Rapid disinfectant loss in all green buildings 	<ul style="list-style-type: none"> • Temporary solution for green buildings connected to drinking water mains is routine flushing to maintain disinfectant residuals and temperature, and control corrosion • Green building designs with water conservation features should minimise water retention in buildings • Avoid conditions conducive to OPPPs in green buildings, e.g. disinfectant decay and poor temperature control • Avoid unnecessary water storage in green buildings
Field study, Germany ¹⁹	Cold water (taps and showers) from residential and nursing home, hotel, and sports facilities with <i>Legionella</i> contamination history	Standard operating conditions	Culture <i>Legionella</i> spp., <i>L. pneumophila</i> , HPCs	<i>Legionella</i> spp. occurrences significantly correlated with stagnation, temperature, and pipe length	<ul style="list-style-type: none"> • Culture methods cannot always reliably reveal contamination and infection risks • Longitudinal rather than cross-sectional sampling approach provides a better risk estimate for outlets within a building water system • Parameters that lead to colonisation are unique to the individual system and should be dealt with as unique problems • Estimation of <i>Legionella</i> risks in building water outlets should consider combinations of temperature, stagnation, pipe length, etc.
Simulation, USA ²⁰	Simulated residential premise plumbing supplied with freshly treated drinking water	Simulated stagnation periods of up to 48 hrs and induced biofilms	QMRA <i>L. pneumophila</i>	<ul style="list-style-type: none"> • Stagnation of up to 48 hrs in the presence of biofilms significantly increased <i>Legionella</i> annual infection risk compared to clean pipes • Decay of residual chlorine due to biofilms during 48-hour stagnation increased <i>Legionella</i> annual infection risk compared to when biofilm was absent 	Reduce stagnation, maintain residual chlorine, and suppress biofilm growth, especially in dead-ends, to better manage <i>L. pneumophila</i> infection risk in building water systems
Field study, Switzerland ²¹	Cold water from taps in households served with treated water from the same network	Standard operating conditions with overnight stagnation	Culture, FCM, molecular (DGGE) HPCs, TCCs, ATP levels, microbial communities	<ul style="list-style-type: none"> • TCCs, ATP levels, and HPCs increased after stagnation • Microbial composition shifts observed after stagnation • Cell concentrations returned to normal after five-minute flushing 	<ul style="list-style-type: none"> • Short flushing of taps prior to use to reduce microbial cell concentrations following stagnation periods • Development of validation methods and guidelines on microbiological quality of in-house water installations are needed
Field study, Finland ²²	Cold and hot water systems in office building with 250 employees working regular office hours	Standard operating conditions with overnight and weekend stagnation	Culture, molecular HPCs, ATP levels, total microbial counts, and 16S rRNA gene copy numbers	<ul style="list-style-type: none"> • Viable microbial biomass increased due to stagnation in cold water • Microbial biomass (HPC, ATP levels and total 16S rRNA gene copy counts) higher in biofilms of cold water system than hot water system. Cold water system was mostly stagnant with irregular consumption during sampling • HPC and total microbial counts were higher in cold than in hot water system 	Water should be flushed before use after stagnation to ensure acceptable microbiological and chemical quality
Field study, USA ²³	Three four-storey university housing buildings with stable free chlorine for the duration of study	Controlled access for 5–6 days to create stagnation periods	FCM, molecular (16S rRNA Illumina sequencing) Cell counts, microbiome	<ul style="list-style-type: none"> • Bacterial community composition changes from city supply following ~6-day stagnation along with increase in TCCs and depleted disinfectant residual • Small-diameter distal end pipes had highest cell counts and deviated most from the city-water supply microbiome 	<ul style="list-style-type: none"> • Hospitals and extended care facilities should upgrade PoUs of disinfection to counteract disinfectant decay and within-pipe cell growth • Precise flushing of smaller-diameter pipes, rather than whole building, is preferred to prevent stagnation while minimising water waste
Field study, UK ²⁴	12 private houses and medium-sized research building receiving chlorinated water	Variable, depending on location in building; all experienced weekend and Christmas holiday stagnation	FCM TCCs, ICCs	<ul style="list-style-type: none"> • Water from infrequently used taps had the highest TCCs and ICCs following weekend and Christmas stagnation periods • Flushing reduced microbial load in less frequently used cold water taps only 	<ul style="list-style-type: none"> • Microbiological water quality depends on building-specific parameters • Tap water profiling is recommended to assess plumbing system hygiene and maintenance

Table 1 continued on the next page

Table 1 continued

Study type, country	Type of building	Water use pattern	Method(s) of analysis and microbial parameters assessed	Main findings (outcomes)	Recommendations
Field study, USA ¹²	Cold and hot water systems in 437-bed hospital complex with three cases of hospital-acquired Legionnaires' disease over 18-month period	Variable water usage pattern with large secondary distribution and water storage tanks	Culture <i>Legionella</i>	Dead-leg removal reduced but did not eradicate <i>Legionella</i> colonisation in system	Disinfection sites, e.g. storage tanks should be situated closer to distal outlets to minimise disinfectant decay during distribution
Field study, USA ¹³	Controlled model plumbing system with clear PVC pipes	95% water recirculation and 5% continuous flow with turbulent, laminar, and stagnant flow regimes	Culture <i>Legionella</i>	<ul style="list-style-type: none"> Turbulent flow had highest <i>Legionella</i> counts and biofilm accumulation, followed by laminar flow and stagnant flow Unable to demonstrate increased <i>Legionella</i> colonisation due to stagnation 	Controlled studies in large buildings needed to validate removal of areas of stagnation, including dead-legs
Field study, China ²⁵	SSDWP connected to a DWDS in a university campus	Controlled stagnation times with operating temperature of 22–26 °C during July–August 2019 summer holidays	Culture, FCM, molecular (Illumina 16S rRNA sequencing) HPC, TCCs, ICCs, microbiomes	<ul style="list-style-type: none"> ICCs and HPCs increased with stagnation time more rapidly in SSDWP than in DWDS Microbial diversity increased with stagnation time in SSDWP Pathogenic bacteria communities increased with water stagnation Disinfection residual not detected in purifier AOC increased with stagnation time 	<ul style="list-style-type: none"> Backwashing, terminal disinfection, and filter replacement should be conducted regularly in water purifiers If measures are impractical, automatic backwashing or disinfection can be integrated with household purifiers to improve anti-bacterial performance Residual disinfectants should be compulsory in terminal water storage tanks
Field study, USA ²⁶	Newly renovated low-energy and low-water use residential green building with PEX pipes	Standard operating conditions with 72 hrs maximum stagnation time	Culture, molecular (qPCR) HPCs, bacteria gene copy numbers	Infrequently used hot water basement fixtures determined as hot spots for degraded water quality (lowest disinfectant residual and high bacteria concentration-HPC and gene copies)	Sampling protocol should consider fixture usage and distance from service line to account for differences in water age, disinfectant residual, and microbiological characteristics
Field study, USA ²⁷	New (5–11 months) university campus buildings with taste and odour complaints; copper plumbing	Water conservation features	Culture <i>L. pneumophila</i> , <i>P. aeruginosa</i> , HPCs, HABs, APB	Rapid chloramine decay and microbial regrowth observed in buildings using advanced water conservation features	<ul style="list-style-type: none"> Design of water systems in buildings should consider impacts of low water usage on microbial regrowth Consider reducing pipe diameter or ensure minimal flushing to maintain palatable water
Field and controlled studies, 11 countries in Europe, USA, and Africa ¹⁴	Office and residential buildings	Standard operating conditions with overnight stagnation	Culture, FCM, molecular (qPCR) TCCs, microbiome composition, <i>L. pneumophila</i> , <i>M. avium</i> , <i>Acanthamoeba</i> spp., <i>V. vermiformis</i>	<ul style="list-style-type: none"> <i>Legionella</i> sequencing data positively correlated with biofilm cell concentration Biofilm TCCs correlated positively with frequency of hose use 	<ul style="list-style-type: none"> Shower hoses should be considered in building drinking water risk management strategies Effective management of building water plumbing should be supported by effective monitoring
Field study, USA ²⁸	Cold and hot water systems in a highly water-efficient, single-family residential building	Reduced water usage due to low-flow water saving fixtures	Culture, FCM, molecular (qPCR) <i>Legionella</i> spp., <i>L. pneumophila</i> , <i>Mycobacterium</i> spp., HPCs, TCCs, gene copy numbers	<ul style="list-style-type: none"> Reduced water usage led to increased stagnation, which was positively correlated with elevated <i>Legionella</i> and <i>Mycobacterium</i> spp. gene copies, TCCs, and low chlorine levels Reduced water usage and increased stagnation can have unintended consequences in water quality 	<ul style="list-style-type: none"> Flushing of taps or onsite disinfection to control microbial growth and opportunistic pathogens, especially in buildings with low-flow plumbing and high occupancy of the elderly and the immunocompromised In event of suspected waterborne disease, water samples should be collected throughout the building, not only at the entry point where water quality is more likely to comply with drinking water standards

AOC: assimilable organic carbon, APB: acid-producing bacteria, ATP: adenosine triphosphate, dead-end: closed pipework through which no water passes, DGGE: denaturation gradient gel electrophoresis, DWDS: drinking water distribution system, FCM: flow cytometry, HAB: heterotrophic aerobic bacteria, HCF: healthcare facility, HPC: heterotrophic plate count, ICC: intact cell count, MAC: *Mycobacterium avium* complex, NTM: nontuberculous mycobacteria, OPPP: opportunistic premise plumbing pathogen, qPCR: quantitative polymerase chain reaction, PEX: cross-linked polyethylene, PoU: point of use, PVC: polyvinyl chloride, QMRA: quantitative microbial risk assessment, RA: risk assessment, rRNA: ribosomal ribonucleic acid, SSDWP: small-scale distributed water purifier, TCC: total cell count

RESULTS

A total of 93 potential articles were identified; 22 duplicates were removed, leaving 71 articles for screening (Figure 1). Subsequently, 27 articles were excluded as the topics were not related to the review, leaving 44 articles that were assessed for eligibility. A further 25 articles were excluded as they were not eligible for various reasons. Nineteen articles met the inclusion criteria and are summarised in Table 1. Most (n = 18) were field-based and one was a simulation study. We collated some of the major drivers of the microbiological quality of building water systems, including stagnation, disinfectant residuals, and biofilms. We provide insights into how these factors impact microbial changes and, ultimately, water quality in buildings with reduced water demand due to low or no occupancy.

Most studies reviewed demonstrated a positive correlation between stagnation (measured qualitatively as low withdrawal or reduced water usage), from hours to several months, and inferior water quality. It was evident that the effects of stagnation are complex and difficult to separate from factors such as biofilm development and disinfectant loss.

Water samples in most of the articles reviewed, including biofilm studies, were collected at the point of entry (PoE) and point of use (PoU) (taps, showers, showerheads, and other fixtures) (Table 2). Many articles on *Legionella* occurrence, such as that by Sidari et al. (2004),¹² which evaluated the effect of removing and repairing dead-legs (length of pipework leading to a fitting through which water passes infrequently when there is a draw-off from a fitting; and intermittently used fixtures and equipment), did not mention where the water samples were collected. The only paper describing a study where water samples were collected at points other than the PoU was that by Liu et al. (2006).¹³ The authors simulated the effect of flow regimes on *Legionella* occurrence in biofilms and samples (bulk water and biofilms) were collected from the pipes after disconnection.

Our literature search identified only one study in Africa (Proctor et al., 2018),¹⁴ highlighting a gap in this crucial research on the continent. This may be attributed to a general lack of awareness and full appreciation of water quality concerns in PPSs, despite deteriorating water quality due to inadequate investment in infrastructure and the effects of climate change. We highlight considerations for site-specific risk assessments for building water systems.

Legionella risks in premise plumbing systems

Legionellae are gram-negative bacteria that are ubiquitous in natural aquatic environments, albeit at concentrations too low to cause infections.³⁷ However, the bacteria can colonise PPSs, proliferating to harmful levels with substantial risk for infection in susceptible individuals.³⁸ Potential reservoirs include showerheads, decorative water features, hospital plumbing (dental water lines and respiratory equipment), heating, ventilation, and air conditioning systems, among others.^{10,39} The most common transmission route is inhalation of contaminated water aerosols,¹⁰ although aspiration has also been documented.¹¹ *Legionella* infections, collectively known as legionellosis, comprise Legionnaires' disease (LD), an acute pneumonia-like infection often requiring hospitalisation, and Pontiac fever, a milder flu-like illness.⁴⁰ High-risk groups include the aged (older than 50 years) and those with underlying health conditions.^{10,36} More than 50 species and 70 serogroups have been described to date, with *Legionella pneumophila* accounting for over 90% of all notified LD cases, globally.⁴¹

Although legionellosis is a notifiable disease in many countries, including South Africa, a lack of awareness, coupled with severe

under-reporting and misdiagnosis, presents challenges to accessing prevalence data. Nevertheless, legionellosis case numbers are reported to be increasing, globally,^{10,39,41} with drug-resistant isolates from healthcare water systems being of particular concern.⁴² In South Africa, 93 laboratory-confirmed legionellosis cases were notified from 1 January 2018 to 30 September 2020, with the majority of cases (n = 72; 77.4%) reported in the Western Cape province;³⁹ the case fatality ratio was 20.8%. The condition was most common in individuals with comorbidities (n = 64; 81.3%), those aged 40 to 69 years (n = 65; 69.9%) and males (n = 61; 65.6%). Whilst difficult to ascertain the source of infection due to poorly completed case investigation forms, ongoing surveillance and improved investigation of LD are important for cluster identification, particularly during the COVID-19 pandemic when lockdown measures resulted in restricted use of buildings, potentially increasing the risk for *Legionella* growth in PPSs.^{39,43}

Reported outbreaks are most often associated with deficiencies in building water quality management, including operating conditions and maintenance.^{41,43} Premise plumbing systems inherently offer ideal conditions for microbial growth due to their complexity and extensive pipe networks.^{18,44,45} In summary, periodical stagnation, inadequate disinfectant residual, and biofilm formation, among other risk factors, individually or in combination, may result in deterioration of water quality in closed buildings, as discussed below.

DISCUSSION

Stagnation concerns in premise plumbing

In PPSs, stagnation occurs when water within pipes remains idle until an outlet is used at any point in a building water system;¹⁹ it can be intermittent or permanent.⁴⁴ Stagnation is associated with a drop in disinfectant residuals to ineffective levels, biofilm development, ambient temperatures, and increased bio-available nutrients.^{46,21} These conditions provide an ideal environment for plumbing microflora, such as *Legionella*, to flourish. As such, stagnation is commonly considered a proxy for inferior microbial water quality.^{19,45}

Many studies have reported a positive association between stagnation and microbial occurrence and growth, including that of *Legionella*. For example, bacterial cell concentrations and activity increased by several orders of magnitude, following overnight stagnation, as reported in 2010.²¹ Similar findings were reported for weekend,²² week-long,²³ two weeks,²⁴ and 1-4 weeks²² stagnation. A six-month study involving nine buildings with histories of *Legionella* contamination also reported a significant correlation between *Legionella* occurrence and stagnation, temperature, and pipe length, suggesting interactions between these factors.¹⁹ Several green building water quality studies support these findings.^{18,26,28} Unsurprisingly, the researchers involved in these studies recommend flushing of taps post stagnation, although this might not be appropriate in water-scarce countries. A limitation of some of the studies is the lack of information on microbial baseline data before sampling, which is critical for meaningful comparisons and decisions about what constitutes unacceptable duration and frequency of stagnation.⁹

Conversely, using culture methods, two studies showed no association between stagnation and *Legionella* growth.^{12,13} However, conventional culture methods can raise important biases given the ability of *Legionella* to enter a viable but non-culturable (VBNC) state in response to stress conditions,^{47,48} and its association with free-living protozoa like amoeba,⁴⁴ which can affect recovery and quantification, thus underestimating *Legionella* concentration levels in water systems. Using molecular techniques, Bédard et al. (2018)¹⁷ reported similar

results for a hot water system in a large hospital in Canada following a controlled 10-day stagnation. It should be noted that only two taps of the system were studied, which is not representative of the extent and nature of the entire system. Moreover, the large volume of samples collected (1 L) may draw water from further within the system as opposed to a small volume of stagnant water in the distal ends.¹⁷ The intrinsic characteristics of systems, including cold versus hot water systems and plumbing material, can also contribute to variations in results. It has been postulated that higher copper levels, present after prolonged stagnation, can impact culturability.¹⁷

Limited studies have evaluated the impact of COVID-19 lockdowns on the microbiological quality of building water. De Giglio et al. (2020) reported significant post-lockdown *L. pneumophila* contamination compared to pre-lockdown levels in three hospital wards in Apulia, southern Italy, that had been temporarily closed for three months following repurposing for COVID-19 patients.² The authors attributed this to lockdown building inactivity. In another study (Hozalski et al., 2020), *Legionella* spp. gene markers were frequently detected in unoccupied (partially or fully, for approximately two months) university buildings in Minnesota, USA.⁴ Contrary to the findings reported by De Giglio et al. (2020),² *L. pneumophila* was not detected in any samples tested by Hozalski et al. (2020).⁴ Nevertheless, more than 20 *Legionella* spp. are

pathogenic, and their presence in PPSs indicates inadequate control to prevent bacterial regrowth, which should be addressed to prevent recurrence and potential proliferation to harmful levels.

Increased microbiological risks, indicated by reduced residual chlorine, elevated HPCs, and turbidity were reported in university buildings with reduced or no water usage for almost four months in Fujian province, south-eastern China.¹⁵ It took 4-54 days to restore building water quality to normal levels. The presence of *L. pneumophila* gene markers in 91% of the water samples, despite the absence of the culturable cells – possibly due to VBNC status – further confirmed increased microbiological risks in these buildings. Reports on *Legionella* detection in buildings, following COVID-19 lockdown, have also appeared on media platforms.⁴⁹ However, these should be treated with caution. Scientific studies are needed to ascertain these claims, using appropriate building water system characterisation and the collection of baseline data.

It is plausible that low building occupancy, resulting from COVID-19 precautionary measures and other similar situations, could lead to stagnation in PPSs. The World Health Organization's (WHO's) 2011 report on water safety in buildings lists poor flow and stagnation due to intermittent use or extended periods of no use (e.g. floors/wings of hotels with seasonal occupancy, hospital wards, schools) as hazardous

Table 2. Overview of building water system components associated with microbial concerns

Component	Definition	Water quality concern	References
PPSs	Piping connecting buildings from PoE to PoU and all associated equipment, treatment devices, fixtures, and appliances related to providing water in the building. Also known as building water systems	<ul style="list-style-type: none"> • High plumbing surface-to-volume ratio is ideal for biofilm formation • Unique pipe materials that react with disinfectants or leach nutrients into water • Variable occupancy patterns affect flow conditions and water age • Difficult to maintain temperature and residual disinfectant targets that discourage microbial growth 	Hozalski et al., 2020 ⁴ Salehi et al., 2018 ²⁶ WHO, 2007 ²⁹
PoU fixture or fitting	Any plumbing receptacle, device or appliance that can be temporarily or permanently fixed in place to provide, store or dispose water, e.g. shower heads, taps (faucets), sinks, bathtubs, eyewash stations, water-using medical equipment, toilets	<ul style="list-style-type: none"> • High surface-to-volume ratio suitable for biofilm formation • Generate aerosols that can contaminate surfaces or be inhaled (0.3–10 µm) • Prone to disinfectant decay with increased distance from service lines 	Johnson et al., 2013 ³⁰ Allegra et al., 2020 ³¹
Dead-leg and dead-end	<p>Dead-leg: length of pipework leading to fitting through which water passes infrequently when there is a draw-off from a fitting. Intermittently used fixtures and equipment can become dead-legs depending on how long they remain unused</p> <p>Dead-end: redundant length of pipework that does not lead to anything, is completely closed at one end, and through which no water passes, e.g. outlet, equipment or valve that is no longer being used, or capped-piping installed for future plumbing expansion</p>	<ul style="list-style-type: none"> • Contribute to stagnation in PPSs due to low or no water circulation • Out of reach of disinfectants due to low or no water circulation • Offer favourable conditions for biofilm formation and bacteria proliferation, including <i>Legionella</i> 	National Academies of Sciences, Engineering, and Medicine, 2020 ³²
Decorative fountains/water features, e.g. spa pool, misting device	<p>A spa pool (also known as heated spa, portable spa, hot tub, whirlpool, whirlpool spa, bubble bath or jacuzzi) is a self-contained body of warm (usually > 32 °C), agitated water designed for sitting in (rather than swimming). May or may not be drained, cleaned or refilled after each use</p> <p>Misting devices include those used for cooling. Typically installed in outdoor areas to produce and release water aerosols that flash evaporate in the surrounding air, resulting in reduction of ambient temperature</p>	<ul style="list-style-type: none"> • Can create favourable conditions for pathogen growth if not adequately maintained and routinely cleaned • Pipework, pumps and filters used for air and water circulation; provide large surface areas for bacterial growth • Generate aerosols during operation • Prone to thermal gain, especially if located in the sun • Submerged heat-generating lighting, UV units, and pumps contribute to warm water temperatures • Prone to stagnation due to closed system and if turned off for extended periods • Wet or damp surfaces promote biofilm formation unless appropriately managed 	Palmore et al., 2009 ³³ Haupt et al., 2012 ³⁴ Smith et al., 2015 ³⁵ Masaka et al., 2021 ³⁶

PoE: point of entry, PoU: point of use, PPS: premise plumbing system, UV: ultraviolet

events.⁴³ Additional research to establish the impact of long-term stagnant water periods with extensive system characterisation and systematic sampling to build statistical confidence, would be valuable for informing risk prediction and mitigation.⁹

Disinfectant residual concerns

Potable water is disinfected to meet prescribed national standards before entering buildings for the intended use. Nevertheless, disinfectant decay to below detectable levels is common with reduced water usage.⁵⁰ Extended stagnation periods, as experienced in some buildings during COVID-19 lockdowns, may exacerbate the degradation of disinfectant residuals in PPSs.³ The lack of pre-COVID-19 data presents challenges when identifying lockdown effects on disinfectant decay and the subsequent impact on the microbiological quality of PPSs.

Chlorine residuals were completely depleted in six-day stagnant water samples and were negatively correlated with microbial cell counts in a study in three four-storey buildings in Champaign, USA

published by Ling et al. (2018).²³ Similarly, infrequently used basement fixtures with longer stagnation periods in a residential green building in West Lafayette, Indiana, USA were considered as hot spots for degraded water quality due to depleted disinfectant residual and increased microbial concentration.²⁶ Reports of rapid disinfectant decay and elevated microbial levels in green building water systems, most likely due to older water inherent in these buildings and high disinfectant demand of the copper piping, corroborate these findings.^{18,27} Baseline residual chlorine concentrations (0.48 mg/L) declined significantly to below the recommended level (0.05 mg/L) in most university buildings with reduced or no water usage due to COVID-19 shutdowns in Fujian province, south-eastern China.¹⁵ This decline was significantly correlated with HPC levels for completely stagnant laboratory water samples. Interestingly, the HPC values dropped below detection levels when residual chlorine concentration reached the national standard (0.05 mg/L) a week after resumption of water usage.

More recently, disinfectant residuals were acknowledged as an

Table 3. Considerations for building water quality risk assessment for potential microbial growth during reduced or low occupancy

Activity	Consideration	Comment
<p>Hazard and hazardous event identification</p> <ul style="list-style-type: none"> Major microbial hazard of concern in PPSs is <i>Legionella</i>, specifically, <i>L. pneumophila</i>, given the global increase in notified cases. Building closures present a hazardous event that can impact building water quality due to prolonged stagnation. 	<ul style="list-style-type: none"> Duration when building or parts thereof were closed. History of the facility with regard to water quality issues, e.g. presence of <i>Legionella</i>. Walkthrough assessment to inspect system for potential sources of contamination (low-use / high-risk outlets), e.g. aerosol-generating devices, storage tanks, dead-legs/dead-ends, water heaters/coolers, etc. Alterations or modifications of the water system that may introduce areas of stagnation or low-flow. Water source, e.g. municipal, roof harvested rain water, or recycled/grey water. 	<ul style="list-style-type: none"> All water supply systems are potential reservoirs of microorganisms, including <i>Legionella</i>, even if water is treated. There are no set standards to define unacceptable levels of building occupancy or period of stagnation. Rule of thumb: reduced occupancy can result in water stagnation, which can compromise water quality. Schematic characterisation of plumbing system will help identify high-risk areas but requires someone who understands the layout. Use of checklists to document observations and inventory of plumbing components is encouraged.
<p>Exposure assessment to decide who might be harmed</p> <p>Depends on the purpose of the building, services provided, and who has access, including workers, visitors (e.g. patients), and contactors.</p>	<p>Presence of the pathogen does not automatically imply a health problem; other factors must be considered, including:</p> <ul style="list-style-type: none"> Vulnerability of people with access (age, illness, or compromised immunity). Potential exposure events or work activities while at the facility. For <i>Legionella</i>, this is use of, or close proximity to, aerosol-generating devices. Frequency and duration of stays/visits, use of aerosol-generating devices or outlets, e.g. showers. 	<p>There are no occupational exposure limits for pathogens such as <i>Legionella</i> and other OPPPs.</p>
<p>Control measures in place</p> <p>Building closures can present challenges to monitoring and routine maintenance of control measures, e.g. temperature monitoring, periodic flushing of less used outlets, and water quality testing.</p>	<ul style="list-style-type: none"> Determine if there was operational monitoring and recording of control measures during building closure. Consider action level specifications of routine controls. Non-routine/operational controls should be addressed at design phase 	<ul style="list-style-type: none"> Monitoring records should be up-to-date and accessible, so that the system can be assessed. To be useful, operational monitoring should provide real-time or near real-time results. A risk management approach integrates several methods, including elimination of stagnation or dead ends, reduction of aerosol formation, maintenance of adequate temperatures, and use of materials unfavourable to biofilm development.
<p>Rate the remaining risk</p> <p>Rate the remaining risk under the existing control measures. If no control measures exist, then the level of risk may be high.</p>	<p>A risk scoring matrix, whereby the likelihood of a hazard occurring is combined with the severity of consequences, can be used to assess and rank the risks.</p>	<p>Aim is to prioritise hazardous events that are likely and may have moderate to catastrophic consequences, requiring immediate corrective action.⁴⁴</p>
<p>Implement corrective action</p> <p>Corrective actions should be informed by the RA and depend on available resources; can include one or a combination of interventions such as flushing, thermal shock, and shock disinfection.</p>	<ul style="list-style-type: none"> If microbial growth in the water system is suspected due to the ineffectiveness of existing control measures, and the risk of exposure is unacceptably high, consider implementing corrective action(s) before returning the water systems to action. Engage competent personnel or professional assistance to prevent mistakes, or injury of or exposure to workers, visitors or contractors to microbial contaminants. 	<p>If high risks are identified, a plan of action should be developed, detailing corrective actions to be undertaken to return water quality to normal conditions. Include timeframes and delegate responsibilities for implementing corrective action timeously to prevent potential exposures.</p>

PPS: premise plumbing system, OPPP: opportunistic premise plumbing pathogen

important parameter for monitoring building water quality by subject matter experts, and were mentioned in several guidance documents, as shown in a survey by Singh et al. (2020).⁵⁰ However, monitoring of disinfectant residuals is generally not a requirement for most drinking water standards.^{50,51} Further research is therefore needed to determine the appropriateness of disinfectant residual as an indicator of water quality, particularly regarding *Legionella* amplification.⁵⁰

Biofilm concerns during stagnation

Water stagnation, especially in the presence of low disinfectant levels, can encourage the proliferation and persistence of premise plumbing biofilms,⁴⁴ contributing to microbial loading in potable water.^{51, 52} Biofilms are problematic because they are difficult to remove once established,⁵³ they provide bacteria with nutrients, provide protection from disinfectants, and induce VBNC and chlorine decay.^{47,48} Biofilms also offer an ecological niche to free-living amoeba where *Legionella* can survive,^{54,55} further reducing the efficacy of disinfectants.

The constructional complexity of PPSs presents a limitation for biofilm studies, allowing sample collection only at PoU, which is not representative of the entire water system and does not adequately reflect systemic issues. Biofilms in the last few metres of the water system before the PoU present a potential health risk, particularly in healthcare facilities (HCFs), where both health workers and patients can be exposed to OPPPs when showering and bathing.⁵⁶ In a study published by Huang et al. (2020), the annual infection risk of *Legionella* was significantly higher when water stagnated for up to 48 hours in

pipes with biofilms compared to those without biofilms.²⁰ Proctor et al. (2018) reported that *L. pneumophila* was detected in biofilms of showerheads, faucets, and humidifiers in high-occupancy buildings such as HCFs and hotels, with *Legionella* sequencing data correlating positively with biofilm TCC.¹⁴ They also reported that frequently used hoses had the highest biofilm concentrations after weekend stagnation, and that biofilm TCC was significantly higher in shower hoses of premises that did not use a disinfectant. Shower hoses are characterised by long stagnation periods, mild-to-warm temperatures (22–43 °C), and high biodegradable carbon leaching – conditions that support bacterial proliferation and biofilm development.⁵³ Hence, interventions targeting biofilm growth suppression may reduce the risk of *Legionella* proliferation.^{14, 57} Currently, control strategies directly targeting biofilms in PPSs are limited, and maintenance practices such as chemical and thermal disinfection are more effective against planktonic microorganisms compared to sessile microorganisms in biofilms.³² This calls for science-based evidence of the efficacy of maintenance procedures on biofilms, to guide mitigation strategies.

Following unprecedented stagnation periods over several months during the COVID-19 pandemic, re-occupation of once-deserted buildings and sudden resumption of water use can result in rapid changes in the water flow rate. This can disrupt portions of biofilms into the bulk water column,⁵⁸ with the potential to reach PoU at doses sufficient to cause infections in susceptible populations.⁵⁹ The first flush upon building re-opening is a possible point of concern for human exposure through the inhalation of contaminated aerosols.^{4,6}

Table 4. Considerations for verification of the effectiveness of control measures or remedial actions

<p>What to test for?</p> <ul style="list-style-type: none"> • Many drinking water quality standards/guidelines have adopted bacterial pathogen indicators (total coliforms, faecal coliforms and <i>Escherichia coli</i>) for microbiological quality monitoring, even though their presence does not always correlate with other pathogenic microorganisms. Hence, tests should include <i>Legionella</i> detection and enumeration. • Other parameters, such as disinfectant residuals (chlorine/chloramine) and temperature (hot and cold water), should be measured onsite during sampling, and benchmarked with the city's main water supply. Disinfectant residual monitoring provides a good indicator that building water turnover is being adequately managed. • Temperature monitoring may provide a good indicator that a flushing programme is moving sufficient water through the system. <p>Where to sample?</p> <ul style="list-style-type: none"> • Critical sampling points, representative of the entire system (different buildings, floors, wings, etc.) can be mapped, depending on the size of the facility. • Sampling points should include high-risk areas such as faucets, emergency showers, eyewash stations, high-pressure jet areas, areas with low disinfectant concentrations (e.g. storage tanks), intensive-care units, surgery suites and problematic outlets with recurring positive results, etc. • Generally, any water source that may generate aerosols should be considered a potential source for <i>Legionella</i> transmission. <p>What type(s) of samples to collect?</p> <ul style="list-style-type: none"> • Different sample types provide different information, e.g. biofilm swabs versus bulk water, stagnating first-draw versus 'after flushing' samples, and hot versus cold water samples. • Sample type information must be reported to ensure that results are interpreted correctly and that appropriate recommendations are made. It is generally recommended to flush at least 2–3 minutes prior to drawing the first sample, for representation of the actual conditions in the plumbing system. • Use personnel with competency in sampling procedures and sample handling as this may affect laboratory results and response action. <p>Sampling frequency</p> <ul style="list-style-type: none"> • Sampling frequency should be informed by a site-specific RA and should reflect a balance of the benefits and the costs of obtaining more information. • To determine effectiveness of corrective action, sampling and testing should be repeated to ensure that the water is safe for use. <p>Choice of test method in testing laboratory if outsourcing</p> <ul style="list-style-type: none"> • Several culture and molecular water quality tests have been developed over the years; some are qualitative, determining only presence/absence, while others are quantitative, providing estimates of concentration levels of the target organism. • The priority may be confirmation or quantification, determining viability, or distinguishing serogroups or sequence type. • Culture methods are more ideal for RA than molecular methods, which cannot differentiate infectious from non-infectious genetic material, making it difficult to assess the risk. • Consider proximity of facility to testing laboratory to ensure sample integrity is maintained during transport. Long-distance shipping will require cold chain maintenance, which may increase costs. <p>Interpretation of results</p> <ul style="list-style-type: none"> • National or international guidelines and standards relevant to the building type (e.g. hospital with high-risk occupants, fitness centre) should be consulted to interpret test results. • Competent personnel should be assigned this role so that results are interpreted correctly and appropriate actions are taken to prevent risk of exposure.
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RA: risk assessment

Although OPPPs, particularly *P. aeruginosa*, share common characteristics regarding disinfectant resistance and growth in biofilms in PPSs,⁵⁶ we did not consider them in our review for various reasons. For example, the source of *P. aeruginosa* in PPSs appears to be more external – as retrograde contamination via patients and workers or from the sink environment – than systemic.⁵⁶ In fact, *P. aeruginosa* is rarely detected in bulk water samples within plumbing systems.⁵⁶ Consequently, most prevalence studies on *P. aeruginosa* in high-risk buildings such as hospitals focus on faucet and drain contamination as possible sources of *P. aeruginosa* infections.⁵⁶ Furthermore, *P. aeruginosa* is not regulated in drinking water in most countries⁶⁰ and infections are not notifiable,⁵⁴ making it difficult to assess the burden of disease. Nevertheless, *P. aeruginosa* and other OPPPs are of growing concern and should not be ignored as they are difficult to eradicate once established. More research is needed to understand how these OPPPs respond in premises that have intermittent water demands and stagnation, as several factors may promote their growth and persistence in plumbing systems.

Premise plumbing risk assessment for decision making

The COVID-19 pandemic underscored the importance of a proactive approach to managing building water quality. Risk assessments (RAs) are an essential component for managing building water quality and infection control, particularly in high-risk buildings.⁴³ According to the South African Department of Employment and Labour,⁶¹ RAs, guided by competent person(s), should be carried out on water systems that have been idle for extended periods and are likely to present risks upon building re-opening. In conducting an RA of a building's water system, several critical issues must be considered, as presented in Table 3. Microbiological water-quality testing to verify the effectiveness of control measures and 'fitness-for-use' of the water is highly recommended.

Table 4 summarises important points to consider when verifying the effectiveness of control measures or remedial actions following periods of reduced water demand in PPSs. This information is generic and should be informed by site-specific RAs. Although this information is critical, some guidance documents on potential *Legionella* risks due to COVID-19 lockdown that were reviewed, did not provide detailed information on the sampling strategy, choice of test methods, and interpretation of results.

CONCLUSION

There is a potential for microbial growth in some PPSs, following COVID-19 lockdowns, and warnings to be mindful of the associated health hazards, such as legionellosis, are understandable. Building owners and facility managers should review the RAs of their PPSs to identify hazards, prioritise risks, and apply appropriate corrective measures. More importantly, site-specific premise plumbing RAs should be considered as an integral component of the 'one-health' approach to managing building water quality and infection prevention and control. More research on the risk factors for *Legionella* colonisation in buildings' water systems, including prolonged building closures, is needed to support these efforts.

KEY MESSAGES

1. Reduced water usage due to building closures, as experienced during COVID-19 lockdowns, can result in water quality deterioration in buildings.
2. Every building is unique and the microbial quality of the water is dependent on several factors, which should be considered when assessing building water contamination risks.
3. Control measures to reduce contamination risks should be guided by site-specific risk assessments.

DECLARATION

The authors declare that this is their own work; all the sources used in this paper have been duly acknowledged and there are no conflicts of interest.

AUTHOR CONTRIBUTIONS

Conception and design of the study: AG, TS

Data acquisition: AG, LS

Data analysis: AG

Interpretation of the data: AG, TS, LS

Drafting of the paper: AG, TS, LS

Critical revision of the paper: AG, TS, LS

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Should algorithmic pattern recognition be included in medical surveillance of noise-induced hearing loss?

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In 2005, worldwide, 16% of the disabling hearing loss in adults was attributed to occupational noise, ranging from 7–21%.¹ The estimated cost of noise to developed countries ranged from 0.2–2% of the gross domestic product (GDP), where it is the cause of more than one-third of hearing impairments. The effects of the exposure to occupational noise are higher in developing regions.² A 2017 report from the World Health Organization (WHO)³ suggested that the annual cost of unaddressed hearing loss was in the range of 750–790 billion USD, globally, for the period 2015–2016. According to the report, a significant proportion of hearing loss is attributable to noise exposure. For example, in Australia, 37% of hearing loss was the result of exposure to excessive noise in 2005.⁴

Scientific evidence suggests that damage to hearing in the workplace may occur where employees are exposed to an 8-hour time-weighted average (TWA) of 85 dB(A) or more.⁵ For this reason, there are various requirements for workplaces with noise levels at or above this level, and these include the performance of audiometric surveillance.^{5–9} The intention of this surveillance is to monitor hearing, to detect noise-induced hearing loss (NIHL) and, where NIHL is severe enough to warrant compensation, to process such claims accordingly.

Any hearing loss implies decrease in hearing against a pre-exposure hearing level, so baseline audiograms are required before exposure to noise occurs. Audiometric data are unique compared to other medical surveillance metrics. Each audiogram contains tests at seven frequencies (0.5, 1, 2, 3, 4, 6 and 8 kHz) in each ear, i.e. 14 discrete measurements. Test-to-test variability is high and the minimum unit of measure is 5 dB.

In terms of progression, some employees may have small year-to-year changes that, over time, may result in a significant overall audiometric deterioration from baseline. Unless a system to detect this is in place, these changes may not be detected until a point where significant irreversible hearing loss has occurred. Because the test-to-test variability is high, test-to-test changes may not reliably distinguish normal variability from an actual decline that demands action.^{10, 11} This is aggravated when testing procedures and testing environments are sub-optimal in clinics and mobile units.

The methodology and technical requirements for workplace audiometry are specified by regulations such as SANS 10083 in

South Africa. Audiogram test administration and collection, along with threshold and percentage loss in hearing (PLH) shift reporting, takes up much of the efforts of occupational health services, yet there is a disappointing impact on the reduction of NIHL. This may well be because attention is on compliance (even when the regulations make little sense, as explained below), rather than on prevention and intervention.

Pure tone air conduction audiometric screening is typically applied as follows:

1. Monitoring for changes in standard thresholds: standard threshold shift (STS)

This methodology is advocated by the Occupational Health and Safety Administration (OSHA) and the Mine Safety and the Health Administration (MSHA) in the United States of America (USA) (many countries follow this lead, including the mining industry in South Africa). Of note is that, since 1998, the National Institute for Occupational Safety and Health (NIOSH) in the USA no longer recommends this method.

An STS is defined by the OSHA and MSHA Noise Standards as “a change in hearing threshold, relative to the baseline audiogram for that employee, of an average of 10 decibels (dB) or more at 2 000, 3 000, and 4 000 hertz (Hz) in one or both ears”.¹² An STS is deemed ‘recordable’ if the current test’s average is ≥ 25 dB above audiometric zero. Either or both ears can have an STS, and more than one STS can occur over a worker’s employment with an employer. Of note is that:

- a. In the OSHA, recording is not required if a “physician or other licensed healthcare professional determines the hearing loss is not work related or aggravated by occupational noise exposure”.¹³
- b. In the SA Mine Health and Safety Inspectorate “Guidance Note for the Implementation of STS in the medical surveillance of NIHL”, the wording is “Determine whether the hearing loss is work-related”.¹⁴

The STS is used for regulatory reporting, and may be useful in this context, but, from an occupational medicine perspective, STS is a lagging indicator that is non-specific, with low sensitivity for early NIHL. By the time that an STS is detected, there is a degree of permanent functional impairment due to the hearing loss.

The characteristic notch pattern of NIHL,¹⁵ with a peak loss in either the 3, 4 and/or 6 kHz range, and recovery at 8 kHz, is often present in early stages of hearing loss before an STS is present. As NIHL advances to the point where an STS does occur, the pattern sometimes cannot be readily differentiated from common diseases such as presbycusis (in older workers), or other rarer diseases associated with high-frequency hearing loss.

2. Monitoring for changes in percentage loss in hearing (PLH)

This methodology is advocated by SANS 10083:2013¹⁶ in South Africa. In section 18.6 of this Standard, it is required to “*Compare periodic screening audiometry results with the baseline audiometry results*”, and to categorise them into one of the three specified categories, with each category requiring specific corrective actions. However:

- a. The PLH formula, as detailed in Circular Instruction No.171,¹⁷ might be useful to indicate the compensation awarded, as lower frequencies – important for hearing speech – have a higher weighting than higher frequencies.
- b. For surveillance purposes, PLH is not an effective indicator of high-frequency hearing loss.¹⁸ It is also a lagging indicator that is non-specific, with low sensitivity for early NIHL and is thus a poor tool for NIHL surveillance. By the time a PLH shift (due to NIHL) is detected, it is often too late to prevent the permanent functional impairment due to the hearing loss. It produces frequent false positive results because it focuses on the low frequencies affected by non-occupational causes of hearing loss.

We need an alternate approach to STS/PLH monitoring – either to run independently or to be integrated and combined with these current methods. We therefore recommend a focus on pattern recognition of audiograms – detecting the ‘classical pattern’ of NIHL as described by the ACOEM Task Force on Occupational Hearing.¹⁵ This entails surveillance for the appearance and progression of ‘notching’ of the audiogram at the high frequencies of 3, 4 or 6 kHz (with recovery at 8 kHz). Comparison with earlier audiograms is important because notches are generally more obvious in early NIHL as, over time, adjacent frequencies are affected and the prominence of the ‘notch’ may be reduced or disappear, as described above.

Various methods have been proposed to standardise the interpretation of serial changes based on diagnostic criteria for a ‘notch progression’ of NIHL, but none has been validated or widely adopted. There is a need for such a standardised approach.^{19, 20}

While there may not be a universally accepted ‘gold standard’ audiogram pattern for NIHL diagnosis, it is probably better to include algorithmic pattern recognition in the screening methodology to detect NIHL at an earlier stage, with higher sensitivity and specificity. It must be noted that notches occur in a significant number of people with no documented noise exposure, so it is not pathognomonic of NIHL^{19, 21, 22} (but highly suggestive in noise-exposed individuals). It is thus important to apply such algorithms only to noise-exposed employees.

Several computerised algorithms and machine-learning models have been produced and tested in order to diagnose NIHL, with varying results.²³⁻²⁵ We are testing our computerised algorithms and machine-learning models that will only be applied to noise-exposed individuals. These consider longitudinal records (to quantify notch progression) and noise exposure levels. We believe these

will greatly assist in addressing the shortcomings of the current surveillance methodologies by providing an objective, reproducible, and explainable pattern recognition, which is time efficient and will increase the sensitivity and specificity of audiometric screening. This will reduce the pressure on audiometrists, of which there is a growing shortage in South Africa, and internationally.¹⁸

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Community of practice on occupational health and safety – 2021 annual tuberculosis and occupational health and safety regional response progress report meeting

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INTRODUCTION

The tuberculosis (TB) burden in the southern African region is attributed to the high HIV prevalence and mining environment, which exposes mine workers to inhalable dust and predisposes them to occupational lung diseases (OLDs), such as silicosis. Against the background of the migratory nature of mine workers from labour-sending areas to mining communities, within and across borders, and weak occupational health and safety (OHS) regulatory systems, the Southern Africa TB and Health Systems Support (SATBHSS) project has adopted a regional multi-sectoral approach to respond to TB and OLDs. To reduce the high incidence of TB among mine workers, primary prevention has been emphasised through strengthening OHS regulatory systems and services in the project countries. The project also focuses on strengthening collaborations between the public and private sectors in the fight against TB and OLDs. The African Union Development Agency (AUDA-NEPAD) will continue supporting the region and the project countries to strengthen their capacity to offer workers occupational health and safety (OHS) services and engage the private sector for an effective and sustainable response to TB and OLDs.

The community of practice on occupational health and safety (CoP-OHS) was established in 2017 to share knowledge and experience towards solving the challenge of OLDs and TB in four project countries (Lesotho, Malawi, Mozambique, and Zambia). In an endeavour to foster and encourage a collective regional response to the scourge of TB and OHS in the region, four more member states were added, viz. Eswatini, Botswana, Tanzania, and Zimbabwe. The meeting was attended by South Africa's Department of Employment and Labour, the International Labour Organization (ILO), the International Organisation for Migration (IOM), the Southern Africa Development Community (SADC), and the World Health Organization (WHO) as key partners; they shared their expertise on issues related to TB and OHS. This CoP-OHS supports countries to i) roll out a standardised package of occupational health services and mining safety standards, and ii) strengthen mine health regulatory capacity. It is attended by TB and OHS experts from ministries of health, mines, and labour; and chambers of mines.

The main objectives of the CoP-OHS meeting were to provide technical input on the draft code of practice on OLDs, to review and advise on developing the OHS information system, to forge the alignment of regional projects such as TB in the Mining Sector (TIMS), and the United States Agency for International Aid (USAID) project on artisanal

small-scale miners (ASMs), and to discuss the proposed COVID-19/OHS workplace response plans.

METHODOLOGY

This was a hybrid meeting, with the majority of the members attending the meeting in person at Radisson Blu hotel, Sandton, Johannesburg, South Africa. The data for the report were collected from the meeting concept note, meeting agenda, presentations, observations, and dialogues.

MEETING CONSTITUTION

The CoP-OHS meeting was attended by 25 participants from Botswana, Eswatini, Lesotho, Malawi, Mozambique, South Africa, Tanzania, Zambia, Zimbabwe, AUDA-NEPAD, the ILO, the WHO, and the IOM.

OPENING REMARKS

The AUDA-NEPAD re-iterated the importance of the community of practice on CoP-OHS as a strategic vehicle to accelerate regional OHS harmonisation, innovation, knowledge sharing, and policy development. Due to the CoP-OHS impact, the membership has been extended to Botswana, Eswatini, Tanzania, and Zimbabwe, including South Africa, which has always been part of the CoP-OHS. The WHO, the IOM, and the ILO remain key strategic partners for the enhancement of OHS in the region.

Since the inception of the CoP-OHS, some of the achievements attained include the revision or development of OHS laws and regulations, implementation of a regional baseline study on mine health regulation and OHS results, development of human resources capacity in OHS, OHS systems strengthening, OHS information management system design, and many more interventions.

Project progress and impact on strengthening OHS system in southern Africa

Regional progress

AUDA-NEPAD has spearheaded training in several areas. Twenty-eight Malawian and Zambian medical doctors and radiologists were trained on the ILO International Classification of Radiographs of Pneumoconioses (ILO-ICRP). These doctors and radiologists have improved occupational health service deliverance, especially in remote areas. Forty-five occupational health nurses from Lesotho, Malawi, and

Mozambique were trained on the fundamentals of OHS. These trained health professionals are providing services in the countries. Seventy-one OHS inspectors from Lesotho, Malawi, and Zambia were trained on risk assessment, and practical sessions were conducted on the use of inspection equipment. The training imparted skills and knowledge that capacitated the inspectors to effectively utilise the equipment procured under the project. Thirty-five occupational hygiene professionals were trained on measurements (W501) and controls (W505) of hazardous substances in Mozambique and South Africa. In addition, AUDA-NEPAD trained more than 450 Government officials from Lesotho and Malawi on sector-specific COVID-19 workplace response and intervention measures.

The CoP-OHS provided guidance on developing a regional code of practice for the management of occupational lung diseases (CoP-OLDs). The CoP aims to guide countries to harmoniously undertake comprehensive and quality medical surveillance and manage OLDs in workplaces. It received overwhelming support from the Southern African Development Community (SADC), where several member states, such as Botswana and Namibia, have shown a keen interest in adapting it. The CoP-OLDs is a critical document to accelerate the compensation of current workers and ex-workers for OLDs. Notably, the document will assist member states to expedite the establishment of their own compensation systems.

In-country progress

The Government of Malawi has recruited an occupational health specialist and trained more than 65 professionals on the ILO-ICRP, occupational hygiene, occupational health nurses' roles, and mine workplace inspections. The Government inaugurated four occupational health centres and purchased various occupational health diagnostic equipment. These efforts resulted in the initiation of inspections of workplaces for compliance to national standards and the training of workers on the proper use of personal protective equipment (PPE).

Table 1. Lesotho mining industry COVID-19 statistics

Mine	COVID-19 tests	Negative test result		Positive test result		Fatalities	
	n	n	%	n	%	n	%
Mine 1	463	451	97.4	12	2.7	2	16.7
Mine 2	3 195	3 121	97.7	74	2.4	7	9.5
Mine 3	2 175	2 128	97.8	47	2.2	1	2.1
Total	5 833	5 700	97.7	133	2.3	10	7.5

Table 2. Regional OHSCs operational status

Country	Current operational status
Eswatini	Two OHSCs are open with the support of internal voluntary deferred pay (VDP) and functioning on low funds after the TIMS project.
Lesotho	Three OHSCs are open and functioning, running on internal Global Fund savings from the National TB Control Program (NTP) Grant.
Mozambique	Three OHSCs are open and supported by the SATBHSS project, but face challenges regarding sustainability after the project.
Zimbabwe	Both OHSCs are closed due to lack of funds. Plans are underway to re-open them before the end of 2022, using a different funding mechanism.
Zambia	The OHSC is open and functional, and is currently being funded, month-by-month, from the fiscal budget. The sustainability of this funding is not assured. There are plans to incorporate the OHSC budget into the fiscal budget permanently.
Namibia	The OHSC is open and functional, but not 'as usual'. It is now being used to provide spill-over primary healthcare services from the nearby health service centre.
Botswana	The OHSC is open and functional as usual. It is currently being funded month-by-month from the fiscal budget. There are plans to incorporate the OHSC budget into the fiscal budget permanently.
Tanzania	The static OHSC is open and functional as usual. The mobile OHSC is closed and non-functional.
Malawi	Four OHSCs are being established in Government hospitals.

In Zambia, the focus was on the development of occupational health and hygiene standard operating procedures. The country trained 83 professionals on the ILO-ICRP, and completed the renovation of the Solwezi occupational clinic, which is now operational. Most (80%) of the total inhalable dust samples in the mines were compliant with the set occupational exposure limit (OEL) of 3 mg/m³. Finally, the Government of Zambia has reviewed several OHS laws and Regulations to harmonise them to international best practices and standards, and to remove the clause restricting former TB patients from working in mines.

In Lesotho, all operational mines have been inspected twice. The programme realised an overwhelming increase in compliance following OHS training, supported by the provision of PPE, occupational hygiene monitoring, and appointment of safety, health and environment (SHE) officers. More than 400 workers were trained from various Ministries and Government entities, including the Ministries of Labour and Mines. The impact of that training has been published elsewhere,¹ but the training ignited public-private sector engagement and resulted in the reporting of COVID-19 statistics. The mining industry had a 2.3% positivity rate, and a 7.5% death rate (Table 1).

In Mozambique, all the established occupational health service centres (OHSCs) are operational and funded through the SATBHSS project. More than 50% of the 116 mines were inspected, 70% of which complied with OHS regulations.

Strengthening occupational health services in Africa

AUDA-NEPAD presented on the status of the OHSCs in southern Africa, which were initially designed to provide TB screening and diagnosis services, HIV testing, silicosis screening and diagnosis, and linking of ex-mine workers to compensation funds. These are meant to unlock significant compensation funds for ex-mine workers in South Africa, Lesotho, Malawi, Botswana, Mozambique, and Eswatini for TB and other lung diseases. Through the Global Fund, the region established 11 OHSCs: two each in Eswatini, Mozambique, and Lesotho, and one each in Namibia, Zambia, Tanzania, Botswana, and Zimbabwe. Table 2 summarises the operational status of OHSCs in each country.

Drawing lessons from the TIMS and SATBHSS projects on OHSCs, AUDA-NEPAD, the Tshiamiso Trust, and the Medical Bureau for Occupational Diseases (MBOD) held a meeting to develop a sustainable ideal OHSC blueprint in Cape Town, South Africa. The ideal OHSC blueprint aims to provide guidance and support for the implementation of fully fledged sustainable, OHSCs in various African Union (AU) member states.

Forging the future for the Centre of Excellence on OHS

The Centre of Excellence on Occupational Health and Safety (CoE-OHS), through technical support from AUDA-NEPAD and partners, developed an ILO-ICRP curriculum. The curriculum aims to provide a stepwise approach and simple, reproducible training in systematically describing and recording radiographic abnormalities, provoked by the inhalation of dust. The approach follows the standardised reading of chest X-rays for silicosis. The first training will be held in Kitwe, Zambia, where the CoE will host trainees from Malawi.

The Centre has upgraded its ICT infrastructure and installed an Extension for Community Healthcare Outcomes (ECHO) platform, which links hospitals to the OHS specialist physicians for X-ray interpretations and clinical meetings. The CoE, with technical support from AUDA-NEPAD, established the Regional Experts Advisory Panel (REAP), the details of which are published elsewhere.²

Alignment with other regional projects on TB and OLDs

The Government of Zimbabwe is implementing an artisanal small-scale mining TB and silicosis project, titled the Kunda-Nqob'iTB project, which is funded by the USAID. The project focuses on eight priority districts with high artisanal mining activities, high TB disease burden, and poor TB treatment outcomes. To date, more than 500 officers have been trained within the project on the ILO-ICRP, including occupational health nurses, environmental health practitioners, and district TB officers. The results of the project show a high prevalence of TB, silicosis, and HIV among ASMs at two occupational health clinics. Sixty-four of 2 473 ASMs screened through outreach campaigns (2.6%) were diagnosed with TB, and 393 (15.9%) with silicosis.³

Progress on OHS policy reforms (policies, laws, regulations and guidelines) and sharing of best practices

The sustainability of all the regional investments in eradicating silicosis, TB and other OLDs hinges on a comprehensive OHS legal framework. It was acknowledged that some laws are outdated, fragmented, unenforceable, and not aligned with international best practices and standards. Member states have successfully reviewed and developed relevant Acts and Regulations. Countries faced challenges due to protracted reform processes and procedures in passing the revised laws. The delay in progress has negatively impacted OHS service delivery. AUDA-NEPAD will engage key stakeholders, including parliamentarians and policy makers, to facilitate the quick review and approval of legislation.

The Government of South Africa has been exceptional with regard to legal reforms as it successfully developed and revised its OHS laws. The Department of Employment and Labour has developed and/or revised the following Regulations under the Occupational Health and Safety Act: Ergonomics; Facilities; Hazardous Biological Agents; Asbestos Abatement; Lift Escalators and Passenger Conveyors; Electrical Installation; Electrical Machinery; Pressure Equipment;

Commercial Diving; General Administrative; General Safety; Health and Safety of Children at Work; Construction; and Driven Machinery. The Department is revising the Environmental Regulations for Workplaces Regulations and the Noise-Induced Hearing Loss Regulations.

AU-Occupational safety and health information system

Problems related to the information management system continue to affect the project and need to be resolved. AUDA-NEPAD is engaging with stakeholders (country, regional and global) to develop an information system that will generate the data needed to inform policy. The Cross Border Referral System (CBRS) is a tool developed, under the TIMS project, for the management of patients across borders. Personnel in the participating countries have been trained on its use. Personnel from Eswatini, Lesotho, Mozambique, and Zimbabwe were trained in November 2020, while those from Botswana, Namibia, South Africa, and Zambia were trained in May 2021. The IOM informed the meeting on data management for occupational health screening, as well as TB/HIV outreach services, for Mozambican miners and migrant workers working in South Africa; screening is now mandatory.

CONCLUSION

The CoP-OHS is a critical technical working group aimed at harmonising and collating all regional occupational TB and OHS activities. It provides a platform for countries to share lessons learned and best practices. The meeting focused on public sector initiatives; however, there is a need to include private sector initiatives such as the Minerals Council South Africa's Masoyise iTB and Women in Mining (WiMSA) projects, and the Mine Health and Safety Council's Centre of Excellence.

ACKNOWLEDGEMENTS

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Occupational health and safety challenges in workplace improvement in Africa

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Africa is documented as the region with the largest youth population; almost 60% of the population is younger than 25 years.¹ This should be of benefit to the continent but many in this population group are not in education, employment or training (NEET).² In the midst of these challenges, a number of youths who are fortunate enough to find employment feel threatened in their workplaces; a high level of workplace risk, without adequate safety procedures, is compounded by the absence of a social safety net.³

While Africa has been at the centre of several global conversations on workplace safety and health improvement, these have not yielded significant results, due to lack of actionable commitment from stakeholders. Poor commitment to occupational health and safety (OHS) by leadership at regional, country, and enterprise levels is one of the challenges facing Africa. Heads of state have participated in several meetings where OHS was discussed, yet there have been no tangible results. These meetings include the World Health Organization-International Labour Organization (WHO-ILO) Joint Efforts on Occupational Health and Safety in Africa held in March 2001 in Harare, Zimbabwe; the Ouagadougou Convention of all African leaders held in Burkina Faso in 2004; and the Review of Occupational Health and Safety in Africa held in Benin Republic in 2005.⁴ This lack of commitment has adversely affected both the growth of the workplace health and safety profession, and the implementation of health and safety interventions in African workplaces.

The African region is characterised by inadequate or non-existent workplace health and safety legislation and regulations. There is a limit to what can be achieved without these. The 2019 OSHAfrica Conference (Johannesburg, South Africa) highlighted lack of legislation as a key limitation to workplace health and safety growth in Africa. OSHAfrica announced its ongoing efforts to review all existing legislation with the aim of working with the African Union for a One-Africa Workplace Health and Safety Protocol. This project was significantly hampered by the COVID-19 pandemic but efforts are back on course, with legislation in more than 40 countries already reviewed. The legislation in several African countries was found to be obsolete and ineffective for the protection of worker health and safety. Such legislation needs to be amended to make it relevant to the current realities within each sovereign state.

Another issue of concern is the launch of the African Confederation Free Trade Agreement (AfCFTA) in May 2019 in a region with inadequate legal frameworks for workplace health and safety governance and regulation.⁵ This Agreement enables, for example, a Nigerian to freely trade in Gabon or Zambia, or a Kenyan to freely trade in Egypt or Cameroon. However, there is no unified regional health and safety legislative framework that covers such workers. We need to rethink this process.

The amount of funding that OHS attracts in Africa is unknown. We can assume that it is grossly underfunded, based on the quality and outcomes of work done by government agencies across the continent. The Abuja Declaration of 2001 mandated all African heads of state to increase their national healthcare budgets to 15%.⁶ Nineteen years later, only South Africa and Rwanda have fulfilled their commitments. The current state of healthcare in many countries suggests that workplace OHS continues to be underfunded in Africa,⁷ which has handicapped regulatory government agencies. Of note is the insufficient number of workplace health and safety inspectors across the continent, leading to inadequate inspection coverage. In most countries, some workplaces have not been inspected in more than five years, making it difficult to know if these workplaces are adhering to OHS regulations. Other challenges include inadequate inspector training and lack of resources to perform inspections.⁸

The implementation of safe OHS processes is also hindered by the inadequate number of institutions providing health and safety training and standardisation of training. Some individuals have managed to access education in the West, which is prohibitively expensive for most families. Consequently, there are very few qualified OHS practitioners in Africa; many learn on the job, which is unsafe.

When a standard is not set, everything you see will look like a standard. The region needs to have defined standard training requirements. For example, what constitutes standard first aid training, what constitutes standard risk assessment training, what is the standard content that should be included in training modules, and how many learning hours are adequate? Currently, we do not have such standards in Africa, and training programmes apply whatever standards they deem fit. Hence, there is lack of coherence in workplace health and safety practice. Some training certificates have been rejected in other countries because the training was deemed to be substandard. What, though, is the standard and what certificates should be issued? Training programmes need to be well defined and standardised across the continent. If we do this, opportunities for institutions of learning to develop health and safety programmes will be created.

In addition to inadequate and, often, obsolete OHS legislation, where law does exist enforcement is poor. Health and safety inspectors, from national ministries responsible for labour, are responsible for enforcement, but they are either too few in number or not properly trained on their roles, making enforcement difficult. Many inspectors have qualifications that are not related to OHS, but get little or no on-the-job training and, consequently, do not have the requisite knowledge and skills to conduct effective inspections. The poor research capabilities of African OHS practitioners is another challenge. We need to scale up research capabilities in this field. While some research is done, improvement is required and more scientific

manuscripts need to be published in accredited, peer-reviewed journals, such as *Occupational Health Southern Africa*. Research helps to identify problems and provides evidence to support the development of interventions to address the challenges. Practitioners should be trained in research methods and writing funding proposals. With this local expertise, Africa will be able to develop the capacity to identify health and safety challenges and provide solutions, instead of waiting for experts from the West to do the research.

The National Institute for Occupational Health (NIOH) in South Africa is an ILO- and WHO-collaborating centre in Africa. This is good, but there is an urgent need to set up smaller research centres across all four subregions of Africa. These subregional centres, being close to health and safety issues, could conduct research locally, leaving the NIOH to assume the role of a flagship African occupational health research centre. All the research conducted in the smaller centres could be sent to the NIOH, which would maintain a regional repository of OHS resources for the continent.

While there are many OHS challenges in Africa, including the implementation of improvements in workplaces, these problems can be addressed if approached in a structured manner, with honesty and commitment from all stakeholders, and with mindful use of the available resources and expertise. If we achieve this, at the very least, employees' families will be assured that their loved ones work under safe conditions and will return home, healthy and uninjured, at the end of the day.

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The logo for the British Occupational Hygiene Society (BOHS) features the letters 'BOHS' in a bold, blue, sans-serif font. The letter 'O' is stylized with a white circle inside it.

British Occupational
Hygiene Society



IOHA



OCCUPATIONAL
HYGIENE SOCIETY
OF IRELAND

13th IOHA International Scientific Conference

Dublin, Ireland
June 2024

The Occupational Hygiene Society of Ireland (OHSI) and the British Occupational Hygiene Society (BOHS) are privileged to jointly host this conference and to contribute to its successful outcome.

The conference theme has been confirmed as - 'Protecting workers from health hazards: Advancing in this changing world'.

The conference aims to promote occupational hygiene and worker health protection by the minimisation of worker exposure to hazardous agents globally through plenary sessions, keynote lectures, parallel talks, workshops, poster presentations and

professional development as well as networking opportunities and social functions.

A strong Global media campaign will publicise the main causes of occupational disease throughout the conference.

More information including venue, dates and abstract submission arrangements will be announced very soon. Please mark your diaries for June 2024 in Dublin, Ireland!

Edited by **Dr Thomas P Fuller**: IOHA Immediate Past President
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Updates of IOHA associations and activities with the International Labour Organization

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Over the past few years, the International Occupational Hygiene Association (IOHA) Stakeholders Relations Committee and members of the Executive Committee have worked hard to build bridges with the International Labour Organization (ILO). In 2016, Nancy Leppink (Chief of Labour Administration, Labour Inspection and Occupational Safety and Health Branch (LABADminOSH)) attended the IOHA Board meeting; in 2018 she was the keynote speaker at the IOHA Triennial Conference in Washington, D.C., United States. IOHA members have recently worked on think pieces to support the ILO 100/World Health Day (Manal Azzi, Norhazlina Mydin, Chris Laszcs-Davis), written and reviewed guidance documents on biological and chemical agents (Frank Muchiri, Christian Schumacher, Remko Houba, Andrea Hiddinga, Thomas Fuller), and assisted the ILO on specific regional research projects, such as the cotton/textile industry hazard assessment in Madagascar (Andres Winkes, Andrea Hiddinga).

Since 2020, Thomas Fuller has represented IOHA on the ILO Global Coalition for Safety and Health at Work Task Group on Vision Zero at the Enterprise Level, and the Task Group for Promoting Decent Work and Productive Employment through Higher Education. This project brings together educators from around the world to work on a variety of research projects, looking at the role that education can play in improving worker health and safety, globally.

In May of this year, Rene Leblanc and Thomas Fuller each co-chaired different sessions of the ILO Vision Zero Summit held virtually and hosted by Japan. Rene co-chaired a session and spoke at a session on Health/Hygiene/COVID-19, and Thomas co-chaired and presented a paper at a session on Education/E-learning/Credentialing. As a result of our participation at the event, IOHA was one of only five international organisations invited to sign the Tokyo Declaration on Vision Zero for All, Japan 2022.

More recently, on 8 June 2022, IOHA President, Norhazlina Mydin, addressed the plenary session of the 110th International Labour Conference, (ILC) of the ILO. This is a fantastic honour and represents the culmination of many years of hard work by our members in putting the good face and name of IOHA forward on so many ILO collaborations and projects. The following is the statement made by Lina, virtually, to the Conference:

Dear President, distinguished delegates, guests, observers, ladies and gentlemen. Firstly, thank you for giving the International Occupational Hygiene Association (IOHA) the opportunity to speak at this Plenary of the 110th ILC. IOHA, representing 18 000 members and 8 200 professional occupational hygienists from 35 countries, is truly excited to be part of the journey for the amendment of the 1998 Declaration: Fundamental Principles and Rights at Work. Recognition of health and safety as a fundamental human right is



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only the beginning of an exciting journey ahead of us. IOHA believes this will drive three focused areas, namely:

1. Strengthened regulatory framework
2. Enhanced capability building
3. Greater partnership nurtured

Strengthened regulatory framework

Director General Guy Rhyder, in his speech (https://www.ilo.org/global/about-the-ilo/newsroom/news/WCMS_846791/lang--en/index.htm), mentioned that three million lives are lost each year because of work-related accidents and diseases. He stressed the 'stark and clear' responsibility of the ILO to protect workers against sickness, disease and injury arising from employment. This demonstrates the urgent need to review and strengthen the legal instrument to provide minimum requirements to protect workers in their working environment. At the time that businesses are recovering from the impact of COVID-19, economic viability will be a bigger priority for some, over the investments that protect workers' safety, health and wellbeing. Stronger regulations and enforcement, as a result of the adaptation of health and safety as a fundamental right, will drive the compliance culture.

Enhanced capability building

IOHA recognise the concerted effort to enhance capability building, especially in the areas of occupational hygiene, for various stakeholders. It is not only for the regulatory bodies, but also for professional safety and health organisations, researchers, social security institutions, workers, and students, who are desperately needed to support the larger companies and SMEs for implementation of measures to assure safe and healthy working conditions.

Access to trainings is now easier than before with e-learning modules, and some are even offered pro bono. Aligned with technological enhancement, research to further improve workers' health and safety should also focus on developing economies, where a lot more industrialisation is taking place. The aspect of local culture should be taken into consideration to ensure an effective strategy and holistic mindset for prevention, which is built on the common desire to promote and establish a global prevention culture.

Greater partnership nurtured

In IOHA, our mission is to enhance the international network of occupational hygiene organisations that promote, develop, and improve occupational hygiene worldwide, providing a safe and healthy working environment for all. With the recognition of health and safety as a fundamental human right, we are even clearer about our contribution to the United Nations Sustainable Development Goals (SDGs), in particular SDG 8 (Decent Work and Economic Growth), SDG 3 (Good Health and Wellbeing), SDG 4 (Quality Education), and SDG 17 (Partnerships for the Goals). The

Tokyo Declaration on Vision Zero for All 2022 is another testament for greater partnership across the globe.

In conclusion, access to safe and healthy working environments is not optional, it is the fundamental right of the 3.3 billion workforces, globally. It is the right thing to do.

Thank you very much.

Norhazlina Mydin, CIH, CPIH, CSFC

President, IOHA

Workplace Health Without Borders and Wolaita Sodo University flexibility and international capacity building project

Tuan Nguyen

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A chance meeting, at the 2017 National Institute for Occupational Safety and Health (NIOSH) USE Conference in Denver, USA, between Workplace Health Without Borders-US (WHWB-US) former President, Dr Albert Tien, and the former Vice-President of Wolaita Sodo University (WSU) in Ethiopia, Dr Yesuneh Chernet, DVM, has led to a memorandum of understanding (MoU) between WHWB-US and the University. The goal of the MoU is to establish capacity-building joint research programmes and professional exchanges in occupational health and safety (OHS). WHWB-US has embarked on a five-year project to assist WSU. The University was established in 2007 and is a non-profit public higher education institution. WSU has branch campuses in Bodity, Areka, Humbo, Otona, and Tercha. It is officially accredited by the Ethiopian Ministry of Education and has an enrollment of approximately 35 000 students.

Several meetings have been held with WSU leadership to formulate short- and long-term goals and areas of co-operation. The project leader, Dr Albert Tien, developed a strategic five-year plan for the University, which includes capacity-building programmes in the areas of work-related health and safety issues; organising symposia, conferences and meetings on research issues related to work-related health and safety issues, promoting interest in reducing occupationally related injuries and diseases among underserved workers, their families, and their communities at large; and seeking possibilities for joint research projects. The project has been awarded a grant by the American Industrial Hygiene Association (AIHA) International Affairs Committee, Emerging Economy Microgrant Program. Project participants are grateful for this support and are looking for additional funding.

The Pandemic's travel and visa restrictions threw a wrench into plans to bring the WSU leadership delegation for in-person meetings and training at Ann Arbor, Michigan. To maintain the momentum, a



series of online virtual presentations and trainings were developed by the WHWB-US team and partner organisations such as AIHA, Michigan Occupational Safety and Health Administration (MiOSHA), the Occupational Hygiene Training Association (OHTA), and the University of Michigan. Virtual symposia began on 25 March 2022 and continued through to 17 June 2022. WHWB is planning to host the WSU leadership delegation in Ann Arbor next year, and therefore WHWB-US is seeking further funding to cover the costs of hosting the delegation.

WHWB-US is a 501(c)(3) public charity whose mission is to ensure that workers and employers have the knowledge and means to prevent work-related illness and injury. The organisation is composed of occupational health professionals, and other concerned individuals, whose mandate is to share technical skills and training. This mandate includes providing the financial means to help underserved worker populations, throughout the world, to identify and manage OHS risks. The goal is to develop the knowledge and creative capacity in these worker populations to assess and mitigate the risks of occupational hazards in their workplaces, as well as where those hazards may impact their communities at large. To contact WHWB, please mail WHWB-US at 1100 N Main Street Suite 001, Ann Arbor, MI 48104, USA, or e-mail whwb-us@whwb-us.org.

History and status of the Argentinian Occupational Health and Safety Administration

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Argentina was a pioneer among United Nations (UN) member countries when they sanctioned their first Occupational Health and Safety (OHS) Standards law 19587 in 1972. Fifty years of existence of the law was marked on 21 April 2022. During this time, the field of OHS in Argentina has grown significantly, aided by a variety of educational programmes offered by colleges and universities. Graduates of these programmes work to support the health and safety of workers in a variety of organisations and industries.

In 1995, Occupational Risks Law 24557 was created to provide additional worker protection. It was called 'Insurers of Risk at Work' (ART, *Aseguradora de Riesgo del Trabajo*), known in other countries as '*Mutuas*'. The principal aims of the Insurers are to work together with companies in matters of safety prevention, providing them with technical assistance, and to assist with damages related to work activity (covering accidents at work sites, *in itinere*, and occupational diseases).

Simultaneously, the OHS Public Administration is managed by the Superintendence of Occupational Risks (SRT), who issues and updates the regulations on this field. The SRT also audits the insurance companies (ARTs) and employers through the Local Labour Administrations, covering OHS issues throughout the country. All the above-mentioned programmes and organisations make up the Argentine Occupational Risks System. Prior to this, the only compensation for injured workers in Argentina was for funeral expenses.

After the publication of the Occupational Risk Law, various regulations were issued in pursuit of risk prevention. Argentina has three highlighted regulatory items:

- Decree 351/79: industrial workplaces
- Decree 911/96: construction workplaces
- Decree 617/97: agriculture and cattle-raising workplaces

In order to comply with the International Labour Organization (ILO) Convention 139/77, in 2000 Argentina created its Record of Companies that use Carcinogenic Substances. Although it has been updated over the years, an important modification was sanctioned in 2019, which lead to an improvement in the data quality, forcing employers to keep medical records for a period of 40 years. Consequently, this has enabled better control and follow up of occupational disease cases.

Another milestone in Argentinian OHS Law was Resolution 295/2003, which conducted a technical update for exposure limits, following the main international guides and best practices for OHS hazards. Above all, it added ergonomic risk to the system, whose pathologies occupy, in Argentina's OHS Administration, a place in the top three most-commonly occurring occupational diseases. This amendment was updated by Resolution 886/2015, which forces all companies to have an ergonomic assessment of workplaces, validated by an interdisciplinary team.

Currently, the Argentine Occupational Risks System, after more than 25 years of experience, provides coverage to more than 9 930 000 workers and 1 020 000 employers. In conclusion, it has managed to reduce fatalities at work by 80%, which can be translated into 14 000 lives that have been saved.¹

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The role of industrial hygiene in 4.0 industries

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The American Industrial Hygiene Association (AIHA) defines industrial hygiene as the science and art of anticipating, recognising, evaluating, controlling and confirming existing health hazards in work environments. Although the prevention of occupational disease continues to be the main driver in this field, the disruptive changes that today's society is experiencing present new challenges and opportunities that must be taken into consideration. In this sense, both the digital transformation and the evolution of the concept of corporate sustainability play a fundamental role. In the first instance, it should be kept in mind that exposure assessment is a core part of industrial hygiene.

This exposure assessment is carried out through the articulation of different elements that are combined in a Plan-Do-Check-Act cycle of continuous improvement (from diagnosis to control). In turn, digital transformation has taken a predominant role in terms of how companies apply digital capabilities to their processes and services to improve efficiency, manage risk, and leverage new revenue-generating opportunities. In this sense, the assessment of exposure can take advantage of the interconnection of measurement equipment under real-time web platforms to enhance hygiene risk management. Monitoring networks are installed at different points in the company, generating 24/7 coverage of different physical agents. In addition, these systems can be used to identify the need for additional studies in the most critical areas or in those areas with the greatest variations in exposure.

Nevertheless, the volume, interdependence and analysis of this information demands an adequate technological infrastructure and presents additional challenges that must be resolved under a global company scheme. As a second aspect, the concept of business sustainability has evolved in recent decades towards a holistic vision that

articulates three elements, viz. environmental, social, and economic sustainability. Based on that, areas of a company must be aligned to the strategic planning and generate real value in favour of a holistic sustainability. Industrial hygiene, as a transversal science that interacts with different dependencies of the company (production, maintenance, supply, medicine, legal department, and environmental, among others), has the challenge, and responsibility, of improving its integration to enhance the generation of corporate value.

It is important to emphasise that the required interaction between areas of a company presents a highly complex challenge for managers. The analysis of results by those who make decisions in a company requires knowledge of these interactions to identify strengths and opportunities for improvement. Therefore, hygiene management should be oriented not only towards the prevention of occupational illnesses, but also towards the construction of traceable information that can be used strategically by other company departments. Based on a corporate business intelligence model, industrial hygiene activities can provide another useful dataset in support of the entire information structure. Data quality concepts related to integrity, homogeneity, and granularity are relevant in this regard and must be considered throughout the hygiene process. Finally, the implementation of artificial intelligence algorithms, applied to data analytics, is a field of wide development and adoption. In hygiene, the use and analysis of information to profile similarities (e.g. similar exposure groups (SEGs)) or predict future scenarios (exposure variation over time) are being adopted as management support.

Workplace vaccination policies: employers' individual circumstances and proper procedures are still paramount

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Recent apparently contradictory rulings from the Commission for Conciliation, Mediation and Arbitration (CCMA) on whether employers can fairly dismiss employees who refuse to be vaccinated against the COVID-19 virus have caused some confusion in the labour market. Yet in our view, one thing is clear: the decision to introduce a vaccination policy remains one that must be based on each individual employer's circumstances, as set out in its risk assessment and as informed by the prevailing medical science. This principle, coupled with the imperative to follow proper consultation procedures, still holds.

This should offer some comfort to employers wondering where they stand after a recent CCMA ruling in favour of an employee who had been retrenched after refusing to comply with her employer's vaccination policy. In this case between *Kgomotso Tshatshu and Baroque Medical (Pty) Ltd*, the employer had framed vaccination as an operational requirement to reduce the time employees spent away from work due to illness and ensure a safe working environment. The policy required all employees to be vaccinated, failing which their services "may then be terminated for operational reasons". There were no alternative positions or roles that did not require vaccination and four employees were ultimately retrenched.

The employee in this case, a senior inventory controller, had refused to be vaccinated because of her fear of the vaccination, having experienced a previous negative response to a flu vaccine 10 years earlier. She also objected on Constitutional grounds, namely her right to bodily integrity, stating that the vaccine was experimental. The employer required her to substantiate her refusal on medical grounds, but ultimately rejected the doctors' notes she presented as being insufficient. Having rejected her grounds for refusing to vaccinate, the employer dismissed the employee without severance pay.

Risk assessment was lacking and consultation cursory

The matter went to the CCMA, where the Commissioner ruled that the company's actions amounted to unfair dismissal as its vaccine mandate was an unreasonable rule and unconstitutional. Further, it had not followed the necessary consultation process for retrenchments. Since it had already decided, in advance, that any employee who refused to vaccinate would be dismissed, the consultations were largely lip service. In addition, the Commissioner found the employer had not produced a risk assessment, as required at the time under the Consolidated Occupational Health and Safety Direction. While this Direction contemplated that a risk assessment would be performed to identify certain employees to be vaccinated, it did not provide for or permit a blanket vaccination policy. Going further, the Commissioner

held that mandatory vaccination policies were not only unreasonable but also had "no place in our labour market". He awarded the employee the maximum compensation, equivalent to 12 months' remuneration.

No cause for alarm

Many who have voiced their opposition to workplace vaccination policies may welcome the decision, but employers who have such policies in place need not necessarily be alarmed.

The decision is only one of many to have come out of the CCMA recently and does not create binding precedent.

Where the employer in this case appears to have fallen short is in failing to produce a risk assessment to substantiate its vaccination policy. It is clear from the applicable regulations that any employer's vaccination rule must be informed by its risk assessment and the particular hazards and working conditions that arise in its specific workplace. Further, when it comes to the dismissal of an employee for failing or refusing to comply with an employer's vaccination policy, employers will need to be able to show that the proper procedures were followed – both in introducing the policy and in exploring alternatives and reasonable accommodation measures. As is always the case, dismissal remains an act of last resort.

Taking issue with some of the findings

While the ultimate outcome reached on the fairness of the employee's dismissal may be reasonable in the circumstances of the case, a number of issues can be raised over the Commissioner's findings. For example, in relying directly on the Constitution, the Commissioner's reasoning failed to appreciate the principle of subsidiarity and the fact that there is existing legislation which creates the legal framework for vaccination policies in the workplace. In particular, the Commissioner failed to consider the employer's duty, in terms of the Occupational Health and Safety Act, to create and maintain, as far as reasonably practicable, a safe and healthy working environment. The Commissioner also failed to consider the Hazardous Biological Agents Regulations and the Code of Practice on Managing Exposure to SARS-Cov-2 in the Workplace, which further inform this general duty.

In conclusion, while the Commissioner in this case has undoubtedly made his views clear on workplace vaccination policies, the sweeping statements made about such policies in general should not be taken as the final pronouncement on the issue. Any decision to introduce a vaccination policy remains one that must be based on each individual employer's circumstances and adherence to proper procedure.

Asbestos Abatement Regulations, 2020 promulgated under the Occupational Health and Safety Act No. 85 of 1993 (as amended)

Elize Lourens: Department of Employment and Labour

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Exposure to asbestos dust has long since been known as an occupational risk; however, it is often overlooked because of the difficulty in identifying asbestos 'in place' and the long latency period before symptoms or diseases present in exposed persons.¹ Asbestos in place is defined in the Regulations as any asbestos, asbestos cement products, asbestos coatings, asbestos-containing material, asbestos dust, asbestos insulation, asbestos insulation board and asbestos waste at the workplace.

South Africa began mining asbestos around 1883, after a crocidolite mine was established in the Northern Cape region, in Koegas.² The country developed into a major producer of crocidolite, supplying Australia and the United Kingdom,² for many years, with the (then) sought-after heat-resistant mineral. South Africa's mining of asbestos peaked in 1977, when it was the third-largest supplier in the world.³ Within a decade, however, the Northern Cape mines were closed due to the related health risks and a growing concern over litigation against mining companies.

In 2001, the (then) Department of Labour promulgated the Asbestos Regulations under the Occupational Health and Safety Act No. 85 of 1993.⁴ These Regulations directed how asbestos needed to be controlled in a work environment to limit and control exposure to employees. At this time, South Africa was still manufacturing materials containing asbestos, such as water pipes, roof sheets and insulation rope. In 2008, the (then) Department of Environmental Affairs promulgated the Regulations for Prohibition of the Use, Manufacture, Import and Export of Asbestos and Asbestos Containing Material.⁵ This resulted in the cessation of the manufacturing of asbestos-containing materials in the country. However, many buildings built between the 1940s and 1980s still contain materials that contain asbestos.

The Department of Employment and Labour established a Technical Committee to review the Asbestos Regulations (2001) in 2014. The Committee comprised representatives from organised business, organised labour and Government, and technical specialists in the field. The work of the Technical Committee culminated in the promulgation of the Asbestos Abatement Regulations in November 2020⁶ after approval from the Advisory Council of the Minister for Occupational Health and Safety (ACOHS) and the Minister of Employment and Labour.

The Asbestos Abatement Regulations focus on asbestos in place as no new asbestos products may be produced or imported, as well as the elimination of health risks associated with asbestos exposure. The Regulations require an employer to identify all asbestos-containing building materials. A written inventory of all asbestos building materials should be drawn up and regularly reviewed by the employer. Where the employer is not the owner of the building or facilities used by him/her, an agreement should be reached with

the building owner, as the employer is accountable for assessing the risk to his/her employees at that place of work. Once an inventory of asbestos building materials is available, a management plan should be developed for maintaining and/or removing asbestos-containing building materials. A transition period provided for in the Regulations allowed time for employers to develop these management plans after the Regulations were gazetted in November 2020. The transition period of 18 months came to an end in the middle of May 2022.

The Regulations also changed the approach to registered asbestos contractors, dividing asbestos work into three types:

Type 1 asbestos work is the painting of asbestos cement products in a manner that does not require surface preparation and does not cause the release of asbestos fibres; or the removal of < 10 m² of asbestos cement products, or equivalent gutters and piping, or asbestos insulating board, where removal work may not be repeated on the same site within a period of six months; and does not require registration as an asbestos contractor with the Chief Inspector of the Department of Employment and Labour.

Type 2 asbestos work is the repair or encapsulation of asbestos cement products in a manner that does not require surface preparation, or the removal of asbestos cement products or asbestos insulating boards.

Type 3 asbestos work is the removal, repair or encapsulation of any asbestos and asbestos-containing material. Both asbestos and asbestos-containing material are defined in the Regulations.

Companies performing type 2 and/or type 3 asbestos work require registration as asbestos contractors with the Chief Inspector of the Department of Employment and Labour. Registration is valid for a three-year period and companies are provided with a registration certificate with a unique reference number.

The risks associated with performing type 1 asbestos work are considered to be negligible ONLY if there is adherence to the restrictions for volume, frequency and type of material. The intent of type 1 asbestos work is to allow for once-off small asbestos removals to be conducted by building owners themselves, without incurring exorbitant costs; a plan of work does not need to be submitted to the Department of Employment and Labour. However, a written safe operating procedure that includes the disposal of waste needs to be developed and adhered to at all times, and the Department should be notified of such work before commencement.

The criteria that provide guidance for the preparation of an application to register for type 2 and type 3 asbestos work are available on the Department's webpage under (<https://www.labour.gov.za/DocumentCenter/Pages/Forms.aspx>). An up-to-date list of registered asbestos contractors is available from the Department. This is useful for verifying that a company has a valid registration certificate.

While asbestos demolition was a main focus of the old Regulations and allowed for registered asbestos contractors to perform this work, asbestos demolition is prohibited under the new 2020 Regulations. Demolition work is defined as a method to dismantle, wreck, break, pull down or knock down a structure, or part thereof, by way of manual labour, machinery, or the use of explosives in line with the Construction Regulations of 2014.⁷ All asbestos-containing materials must be safely removed for disposal before any demolition may start on a building.

The Regulations gazetted in November 2020 allowed for an 18-month transition period for the identification of asbestos in place in all buildings and the development of asbestos inventories and asbestos management plans. The management plan should contain, for example, a description of the asbestos or asbestos-containing material; the location, quantity, and state of deterioration; labelling that is in place; and the planned maintenance activities for the following years until final removal and disposal. The timeframe for final disposal is not prescribed and should be based on the risk and unique circumstances of each building.

There is no cut-off date by which all asbestos building materials will have to be removed (banned). There is, however, a National Asbestos Management Strategy that aims for an asbestos risk-free South Africa by 2030.⁸

The reason for there being no 'cut-off' date for the removal of all asbestos-containing building materials is that many buildings in South Africa still contain asbestos. If these asbestos materials are kept in a good state of repair (not broken or damaged) they can safely remain in place for many years, with no risk to health. The cost of safely removing and disposing of asbestos and asbestos-containing materials is high and may be disproportioned to the risk, should a 'cut-off' or ban be instituted. In addition, the cost of disposal of asbestos waste at hazardous waste landfill sites can be expensive, and disposal reduces the lifetimes of the sites when large quantities of contaminated building materials are added to them. Every maintenance plan for asbestos in place must include the phase-out of all asbestos and asbestos-containing material, within a self-selected timeframe.

The 2020 Asbestos Abatement Regulations stipulate specific requirements for the major role players in the removal of asbestos or asbestos-containing material. Responsibilities are assigned to the client, the registered asbestos contractor, and the approved inspection authority (AIA). The asbestos client, being an employer, cannot simply hand over an asbestos removal project to the registered asbestos contractor; the employer remains accountable.

Although established as 'good practice' in the past and provided by many AIAs, a 'dispensing of asbestos clearance certificate' is now required for the final closure of an asbestos project. Requirements for certifying that an area or building is 'clear', after an asbestos project, include visual inspections and environmental air sampling compared to the clearance indicator of 0.01 fibres per millilitre of air.

A change has been introduced regarding the time period for safe keeping of records, from 40 to 50 years, mainly due to research, which has shown that the latency period of asbestos-related disease can be up to 50 years after exposure.

On 20 May 2022, the Minister of Employment and Labour gazetted an amendment to the Asbestos Abatement Regulations of 2020.⁶ Three changes were made to the Regulations that impact their implementation. First, clarity is provided that the occupational exposure

limit (OEL) for asbestos is related to a four-hour sampling time. To this purpose, a short section was added to the definition: 'OEL for asbestos' means an occupational exposure limit of 0.1 regulated asbestos fibres per millilitre of air over a continuous period of four hours, measured in accordance with the Health and Safety Executive's analysts' guide for sampling, analysis and clearance procedures for asbestos.⁹ Second, some text was deleted from Regulation 7(4)(a) in order to clarify who can deem a person competent.⁶ The intention is not for the Chief Inspector, Occupational Health and Safety to 'declare' persons competent, but for everyone following the definition of a competent person to come to the same conclusion regarding a person's competency to perform a task, as required in the Regulations. Last, Regulation 13(e) has been deleted; it is no longer the responsibility of an AIA to obtain acknowledgement from the Chief Director, Provincial Operations for notification of type 2 and type 3 asbestos work. This is an important change to keep in mind during SANAS audits of AIAs.

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ICOH2024 Congress – Save the date!

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Claudia Frost: SASOM National Office Coordinator

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The work has officially begun for the next congress of the International Commission on Occupational Health (ICOH) – the 34th International Congress on Occupational Health (ICOH2024 Congress). The first face-to-face planning meeting for the ICOH2024 Congress was held between ICOH officers and members of the Secretariat (onsite and online) and members of the Moroccan local Congress organisers, including the ICOH2024 Congress President, Prof. Abdeljalil El Kholti, in Marrakesh, on 27 and 28 June 2022. Discussion points included Congress logistics, scientific programme, content for the announcements, the constitution of the various Congress committees, key deadlines, and the official Congress website. The meeting included an audience and question-and-answer session with the conference centre management and a virtual tour of the venue. The ICOH officers took this opportunity to hold their officers' meeting prior to the meeting with the local Congress organisers.

The ICOH2024 Congress will be held in Marrakesh, Morocco, from 28 April to 3 May 2024, at the Movenpick Palais des Congrès, with the theme, *Enhancing Occupational Health Research and Practices: Closing the Gaps!* The Congress will be hosted by the Moroccan Occupational Health Association (MOHA) and the Occupational Health Unit of the Faculty of Medicine and Pharmacy of University Hassan II of Casablanca, in collaboration with ICOH.

Marrakesh is one of the most visited and popular cities in Morocco.

Although Marrakesh is not the capital (Rabat), largest (Casablanca), or oldest (Fes) city in Morocco, it is certainly the country's most intriguing one and the cultural capital. Its famous sights, which include historic medinas (old parts of the city) and ornate palaces, bustling traditional marketplaces ('souks'), and labyrinthine alleyways, have given the city this designation. Known as 'The Pearl of the South' and 'The Red City', Marrakesh offers visitors the perfect blend of a rich culture, delicious cuisine, historic wonders, unique scenery, famous traditional Arabic architecture, and a myriad of places of interest.

Please access the official Congress website to register your interest for the ICOH2024 Congress (click on the 'Interest' button in the menu at the top of the website) and subscribe to the Congress newsletter to receive updated information as it becomes available (<https://www.icoh2024.ma/>).

SASOM National Office

The Department of Employment and Labour (DoEL) has circulated, for review, the 'Requirements for Registration as an Occupational Health Service Provider (OHSP)' with the main aim of developing a databank and standardising the recognition of OHSPs. The document was developed before the COVID-19 lockdown by the sister organisations in occupational health that are part of the DoEL Forum – the South African Society of Occupational Medicine (SASOM), the South

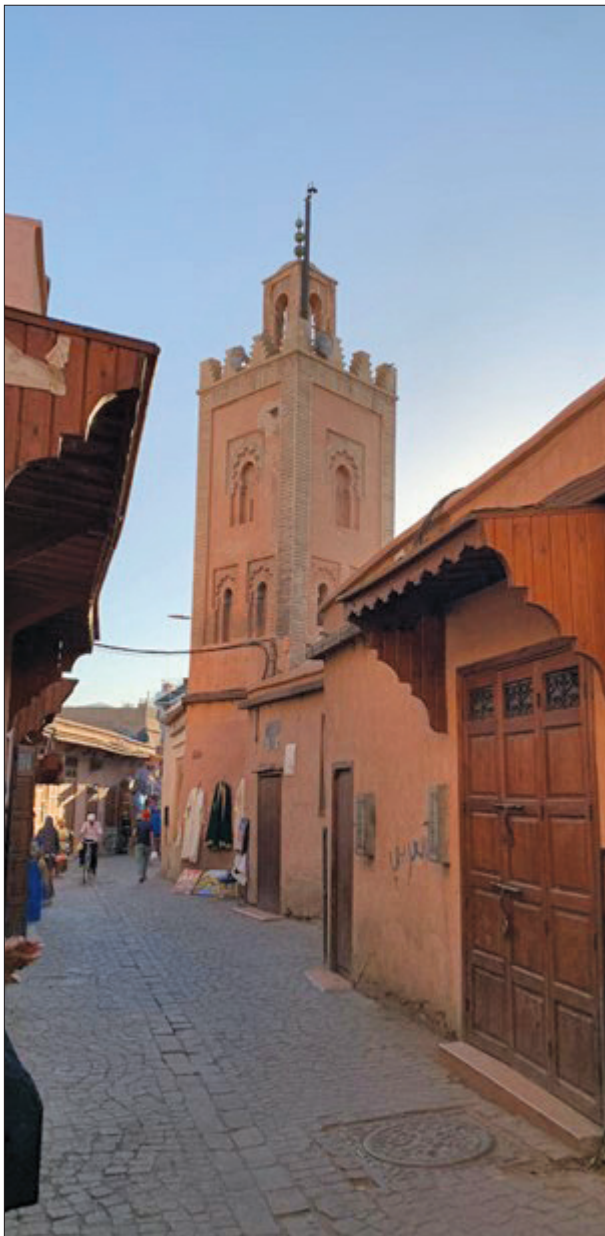


A tale of two Presidents – At the planning meeting in Marrakesh, the ICOH flag was handed by ICOH President Prof. Seong-Kyu Kang (left) to the ICOH2024 Congress President Prof. Abdeljalil El Kholti (centre), while Loubna Tahri, member of the Local Organising Committee, looked on Photograph: Dr Diana Gagliardi, ICOH Secretary General, Rome, Italy



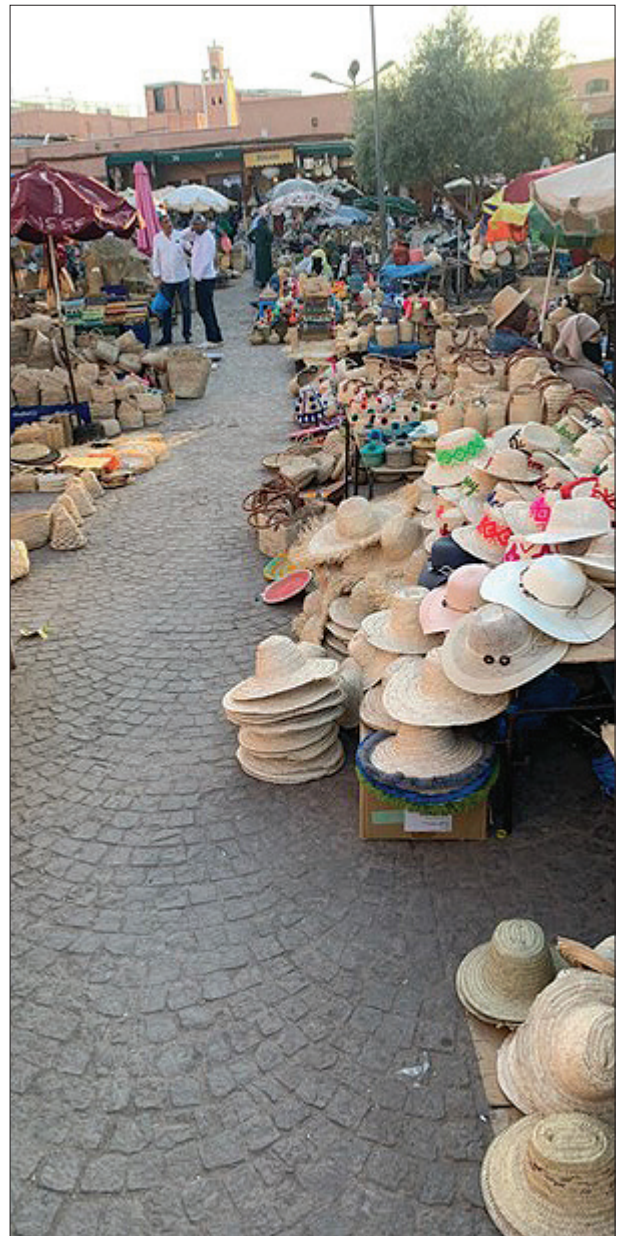
Use of the official ICOH2024 Congress logo and promotional material:
courtesy of the ICOH2024 Congress Local Organising Committee,
Marrakesh, Morocco

Use of the ICOH logo: courtesy of the ICOH Secretary General,
Rome, Italy



Prepare to be a-maze-d – The Marrakesh medina (old part of the city) is famous for its souks (marketplaces), winding alleyways, mosques, traditional houses, peaceful inner courtyards, a tangle of tunnels, and hidden treasures down dead-end streets. It is enclosed by 19 kilometres of pink walls built circa 1122

Photograph: Dr Diana Gagliardi, ICOH Secretary General, Rome, Italy



Hats off to traditional crafts – The sights and sounds of Marrakesh were evident at a street market selling hats, baskets, and other woven goods

Photograph: Dr Diana Gagliardi, ICOH Secretary General, Rome, Italy

African Society of Occupational Health Nursing Practitioners (SASOHN), and the Southern African Institute for Occupational Hygiene (SAIOH). The National Institute for Occupational Health (NIOH), as the 'service facilitator', edited the final draft for review and comments from the three societies; this process is underway.

Prof. Daan Kocks, Chair of SASOM, attended the most recent meeting of the Editorial Board of *Occupational Health Southern Africa* (OHSa). One of the points of discussion was the declining income for the journal over a number of years. The yearly membership fees for occupational health and safety professionals to belong to SASOM, SASOHN, SAIOH, or the Mine Medical Professionals Association (MMPA) include a subscription to OHSa (six issues per year). Even though the costs associated with the journal have increased over the past few years, SASOM remains of the opinion that the journal is an occupational health asset for members of the four aforementioned societies and for southern Africa, more broadly. SASOM continues to support the publication of the journal and will endeavour to contribute in any feasible way that will facilitate the sustainability of OHSa.

SASOM Annual Congress 2022 – A virtual event in four sessions

After not holding an annual congress in 2020 and 2021, due to the impact of the global COVID-19 pandemic, SASOM will hold its continuing professional development (CPD)-accredited virtual Annual Congress over four months in 2022 – on the last Fridays of the months of July, August and October, and on 16 September 2022 (13:00–17:00 South Africa Standard Time) – to offer its members four Congress sessions with individual themes, and four presentations in each session.

The programme for 'Session 1 – Updates on chemical exposures and medical surveillance', to be held on 29 July 2022, is as follows:

- Dr Haidee Williams (occupational medicine specialist and consultant, University of Cape Town (UCT), South Africa) – 'Manufacture of vaccines: Process and toxicology'
- Anna Fourie (Immunology Section, NIOH, South Africa) – 'Occupational skin exposures and the immune response in the COVID-19 era and beyond: Skin reactions to personal protective equipment (PPE) and hand hygiene measures'
- Dr Taneshka Kruger (senior researcher and project manager, Institute

for Sustainable Malaria Control (ISMC), University of Pretoria (UP), South Africa) – 'Understanding the malaria challenge: The UP ISMC's perspective on attaining malaria elimination through transdisciplinary research, innovation, education, and capacity building'

- Dr Sashikala Chandrasekar (medical and occupational health consultant, Bangalore, India, and current Chair of the ICOH Scientific Committee on Rural Health) – 'Pesticide issues and the need for action: A perspective from India'

The programme for 'Session 2 – Lessons learned from the COVID-19 pandemic', scheduled for 26 August 2022, is under development; three of the four invited speakers have agreed to present papers:

- Prof. Veronica Ueckermann (Department of Internal Medicine, UP, South Africa) – 'Clinical aspects of 'long COVID': What can we expect and for how long?'
- Dr Herina Grobler (Life Health Solutions at Ford Motor Company, South Africa) – 'Occupational health management programmes and corporate pandemic preparedness in the post-COVID era'
- Dr Gwen Brachman (retired medical and occupational health consultant, New Jersey, USA, and current Chair of the ICOH Scientific Committee on Occupational Health for Health Workers) – 'The global shortage of health workers: The peril for our health systems'

SASOM representation at the SAMA Annual Conference

The South African Medical Association (SAMA) invited SASOM to participate in its Annual Conference and allocated a SASOM-dedicated two-hour session in its programme, for Saturday, 13 August 2022. The following SASOM members will present at the virtual SAMA Annual Conference, and represent the society:

- Dr Jan Lapere (medico-legal practitioner and advisor to SASOM) – 'Occupational health for medical practitioners: Sick certification – rights and duties of the doctor'
- Dr Haidee Williams (occupational medicine specialist and consultant, University of Cape Town (UCT) – 'Updates on medical surveillance in the workplace in the COVID-19 era'
- Dr Itumeleng Ntatamala (Chair of the SASOM Western Cape branch and occupational medicine specialist, UCT) – 'Evaluating work ability and managing disability: A pragmatic approach'



34th ICOH CONGRESS
28 April - 3 May 2024
Marrakesh - Morocco

Enhancing Occupational Health Research and Practices
Closing the Gaps!

Hosted by: MOHA, FMPC, USAT FMPC, ICOH

Save the date to visit Marrakesh! – For only the second time in ICOH's 118-year history, the ICOH Triennial Congress will be held in Africa. The ICOH2009 Congress was held in Cape Town, South Africa, in March 2009

SASOHN academic workshop

Hosted by: SASOHN KZN Inland Region

Gillian Lotze

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INTRODUCTION

On 3 June 2022, the South African Society of Occupational Health Nursing Practitioners (SASOHN) KwaZulu-Natal (KZN) Inland Region presented a successful workshop to 43 delegates at the Maritzburg Golf Club, Pietermaritzburg. The event was well supported by sponsors and exhibitors, and included a line-up of highly experienced speakers who addressed a variety of relevant topics.

WELCOMING ADDRESS

The event was opened by Regional Chairperson, Gillian Lotze, who delivered a warm welcoming address:

Nurse – Just another word to describe a person strong enough to tolerate everything and soft enough to understand everyone

This workshop presents a unique opportunity for a variety of registered nurses to network, socialise and share their knowledge and experience, after two harrowing years of isolation.

The COVID-19 pandemic has shone a light on nurses on the frontlines of care in all sectors and highlighted our vital role as leaders in healthcare delivery. We have been asked to show up, step up and man up with courage, time and again – many of us operating alone – and it has been a lonely and sometimes scary journey. But, with every challenge comes an opportunity to grow, both personally and professionally, and I salute you for your resilience.

In a country of so much diversity and disparity, nurses are the universal gift to everyone; the dedicated work we do and the kindness we deliver, on a daily basis, serves as a reminder of the fundamental humanity inside us all.

SASOHN KZN Inland Region Executive Committee

Gillian Lotze: Chairperson

Tony Mthiyeni: Vice-Chairperson (and master of ceremonies)

Kathryn Olive: Educational Representative

Kim Arnold: Secretary

Penny Wheeler: Treasurer

Sandra Koekemoer: Public Relations Officer

I hope you leave here today with a bit more knowledge and that you feel connected, enriched, and inspired to continue your invaluable work of changing the lives of others, and making the world a better place.

PRESENTATIONS

The Regional Chairperson then introduced the first speaker, Dr Daniel Fiandero, an emergency medicine specialist who presented on 'Emergency treatment in the workplace'. He spoke on a wide variety of emergency treatments, including anaphylaxis, multiple injuries, cardiac arrest, and effective continuous cardiopulmonary resuscitation (CPR).

The second speaker was the inimitable Dr Alistair Bull – a family medicine specialist who presented 'The neurological assessment' in a practical and straightforward way. Using Vice-chair Tony Mthiyeni as his prop, he demonstrated, using a YouTube clip, how nurses can comprehensively cover all the neurological screening tests in a medical examination.



Speakers addressing the workshop

Photograph: courtesy of SASOHN



Exhibitors at the event

Photograph: courtesy of SASOHN



Winners of the lucky draw prizes

Photograph: courtesy of SASOHN

The third speaker was Sr Robyn de Wet, an occupational health nurse, who spoke about the South African Nursing Council's (SANC's) soon-to-be-implemented continuous professional development (CPD) point system. Her main message was to encourage nurses to become familiar with how to document their points, so that they are compliant, and avoid being struck off the register of practitioners once CPD is implemented.

After breaking for lunch and allowing the delegates an opportunity to visit the exhibitors' stands, the afternoon session was commenced with a presentation from clinical psychologist, Alistair Mork-Chadwick, on 'Recognising burnout'. He highlighted the differences between burnout and depression, and discussed prevention and management. To drive his point home, he used the analogy of a glass of water to demonstrate that if we hold our patients too close, we risk burnout; but if we are too detached, we are not serving them as we should.

Occupational medicine practitioner, Dr John Do Vale, was the final speaker of the day, who presented a talk about the 'Legalities of drug testing and consent'.

We closed the event with a lucky draw of prizes.

ACKNOWLEDGEMENTS

Exhibitors

A big thank you to the following exhibitors:

- The Ear Institute – a comprehensive range of hearing healthcare services for adults and children, ranging from a quick HearingCheck™ to a full diagnostic hearing evaluation

- SSEM Mthembu Medical – the leading distributor of electro-medical devices and medical consumables throughout southern Africa
- Ampath Laboratories – one of South Africa's foremost laboratories, offering innovative professional and quality pathology and laboratory medicine services to healthcare practitioners and patients
- Kwazulu Private Ambulance – leaders in ambulance and emergency care, education and training, as well as event medical services
- Software 1066 – the home of ClinicSister and SHREQManager software solutions
- Electroserve – providing personal, yet professional, service in the ever-changing world of hi-tech medical equipment
- Royal Rehabilitation Hospital – a private sub-acute rehabilitation facility offering a wide variety of medical services that bridge the gap between acute, sub-acute and homecare
- Apex Environmental – SANAS 17020-accredited and Department of Employment and Labour-approved inspection authority (AIA), offering a range of specialist environmental and occupational hygiene monitoring services
- Kendon Laboratories – medical and remedial equipment and supplies, medical equipment and medical supplies
- Pearly Blue – a waste management company offering an environmental-centred business approach founded on safety, responsibility and service
- Omy Naidoo Dietician – an award-winning dietician based in Pietermaritzburg, who does regular podcasts
- Global Learning Services – providers of legislated skills training, who live by the ethos of individual performance enhancement in every sphere of training, maximising the potential of every employee and reducing the risk of injury and damage to property
- Midlands Medical Hospital – a private hospital comprising 274 beds across all major healthcare disciplines, situated in the central business district of Pietermaritzburg

Sponsors

The event was sponsored by Ampath Laboratories, Ambergldes Retirement Village, Belgotex, Ear Institute, Illovo Sugar, Killarney Brick and Block, Occusure, Royal Hospital, Safari Nuts, and SSEM Mthembu Medical.

The KZN Inland Region Executive Committee members extend their sincere thanks to all members, exhibitors and sponsors for their generous support in making the day a success.

SAIOH newsletter

PRESIDENT'S ADDRESS

Hennie van der Westhuizen: SAIOH President
e-mail: president@saioh.co.za

As part of the Southern African Institute for Occupational Hygiene's (SAIOH's) service to our members, we provide feedback below on the latest developments within the society. SAIOH exists due to, and for, its members and is reliant on them to continue to serve this noble profession, ethically. Therefore, we invite your inputs and feedback on any matters communicated in this newsletter.

Occupational hygiene and academia

In the spirit of growing its own timber, SAIOH recognises the sterling contributions by academic and training institutions that nurture the saplings that are in the process of becoming solid oaks in occupational hygiene – and in the community. Their input is instrumental in developing and honing the knowledge, skills, competence, and attitudes of future occupational hygienists. When comparing these attributes to the eight characteristics of professionalism described in Mind Tools,¹ one cannot but acknowledge the invaluable contributions of these tertiary institutions. The characteristics or attributes listed in Mind Tools are competence, knowledge, conscientiousness, integrity, respect, emotional intelligence, appropriateness, and confidence. It is not surprising how the Council on Higher Education's (CHE's) philosophy of knowledge and skills,² and the execution thereof by tertiary institutions, resonate in the attributes of a professional.

Several academic institutions offer formal tertiary courses in occupational hygiene. These courses are aimed at meeting the varying needs of contenders seeking a future in occupational hygiene. Prospective students may find more information about trainers and approved training providers on the SAIOH website.³ SAIOH has a designated forum – the Occupational Hygiene Skills Forum (OHSF) – to which training institutions may apply for recognition of their courses. This is not a complicated process; the basic criterion is that the curriculum comprises at least 50% occupational hygiene content.

Although details of the academic institutions are available on the website, SAIOH wishes to strengthen the alliance between itself and these institutions by offering them an opportunity to share relevant information about their curricula in this newsletter. This will be done in a structured manner. Each newsletter will allow the opportunity for one SAIOH-approved institution to showcase its courses. This opportunity will be extended to institutions as and when their curricula are approved.

Reminder

From January 2023, all SAIOH-certified members will be required to provide proof that they have completed an acceptable occupational hygiene ethics training course. There will be a one-year phase-in period during 2022. During 2022, there will be further ethics training sessions organised in conjunction with the SAIOH branches, and again at the 2022 annual conference in Gauteng.

NATIONAL COUNCIL FEEDBACK

Hennie van der Westhuizen: SAIOH President
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Deon Jansen van Vuuren: SAIOH General Manager
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Strategic plan

The current SAIOH strategy (five-year plan) is steered by Jaco Pieterse. The strategy is discussed, and progress thereof is evaluated, at each monthly SAIOH Management Board meeting, and at the quarterly Council meetings. Several objectives/targets have already been met. The next five-year strategy plan will be finalised at a special Management Board meeting in July 2022.

Ethics

As previously mentioned, SAIOH entered into an agreement with a well-known legal advisor to represent the Institute when required. The first task was to develop a memorandum of incorporation (Mol) to replace our current Constitution. SAIOH has already received the second draft of this important document. Our legal advisor's next task will be to review the SAIOH Ethics Policy and Procedure(s), thus enabling the Ethics Committee to start its work in earnest. The Ethics Plan forms an important part of the SAIOH strategy.

SAIOH branch activities

Virtual meetings and workshops present numerous opportunities to SAIOH members. All SAIOH members are automatically invited to attend any SAIOH branch meeting (or event), regardless of their branch affiliations. We encourage all our members to support their branches, and to participate in branch activities and earn continuing professional development (CPD) points. Members can submit topics for discussion to the various branch Chairs, for consideration for future webinars/meetings and/or workshops.

The Western Cape branch hosted its second face-to-face meeting on 10 June 2022, where Rinus Kriel gave an interesting presentation on autotoxins; 42 persons attended. The Gauteng branch(es) held a virtual meeting (their second meeting) on 24 June 2022. Sean Chester gave an excellent presentation on toxicology ('Human biology and target organs'); 53 persons attended. The KwaZulu-Natal (KZN) branch held their second meeting via Zoom, on 23 June 2022. Four KZN branch members presented on the new Hazardous Chemical Agent Regulations; 51 persons attended. The Botswana branch held a virtual meeting on 14 July 2022. There were two presentations, i.e. 'Mine ventilation during COVID-19'; and 'The effects on women working in open cast mines'.

With regard to online events by our stakeholders, the University of Pretoria (UP) held a public health webinar on *Total Worker Health – an integrated, holistic approach to worker safety, health, and well-being* (24 June 2022), and the International Commission

on Occupational Health: Scientific Committee on Mining Occupational Safety and Health (ICOH SC-MinOSH) hosted an international webinar on an *Update on Silicosis Detection and Relief – sharing experiences* (29 June 2022).

SAIOH would like to revive stagnant branches, starting with the Mpumalanga and Namibian branches. Members who would like to assist with, or contribute ideas towards, this initiative are requested to contact Moses Mokone (SAIOH Branch Co-ordinator) at Mokonemoses2@gmail.com.

IOHA and OHTA feedback

The Occupational Hygiene Training Association (OHTA) recently published its May 2022 *Global Link* newsletter. SAIOH e-mailed the link to all its members and posted it on the SAIOH website: www.saioh.co.za. It was also published in *Occupational Health Southern Africa*. Note that OHTA has a new website: www.ohtatraining.org.

SAIOH has a representative (Garth Hunter) on the International Occupational Hygiene Association (IOHA) Board and its National Accreditation Recognition Committee (NARC), providing the Professional Certification Committee (PCC) with valuable feedback from the IOHA and IOHA NARC meetings. The issue of ISO 17024 accreditation, as a requirement for any national occupational hygiene association to become a member of IOHA, was also discussed in detail at the IOHA and NARC meetings. The overwhelming majority of the IOHA and NARC national associations voted to align their quality management systems (QMS) to the ISO 17024 quality management system.

SAIOH Technical Committee feedback

The SAIOH Technical Committee is still busy with its research on welding fumes, i.e. the measurement and analysis thereof. We anticipate completing this procedure and finalising a SAIOH technical and position paper in the near future. The next position paper will be on heat stress equations.

SAIOH 2022 Annual Scientific Conference

The 2022 SAIOH Annual Scientific Conference is scheduled for 25–28 October 2022, in Gauteng. The Conference will be a hybrid event, i.e. face-to-face and via livestreaming, and will be hosted by the Gauteng branch(es). The Conference Organising Committee has met several times and, after careful evaluation of the shortlisted venues, entered into a contract with the Birchwood Hotel and Conference Centre. A subcommittee also met to develop the draft Conference programme. The theme will be centred around control (i.e. *Occupational hygiene: controlling the future*); a Conference banner has been designed and is in use.



New SAIOH website

SAIOH engaged website developers to overhaul the current website – specifically to allow integration with our current member management system (MySAIOH). The administration teams are progressing well with the implementation and population of the new website.

SAIOH has started the process to implement an online credit card payment system on an accredited international platform, like PayU, to make electronic payments easier for members. As soon as this is finalised, SAIOH will notify all members with a guideline on how to use it. Special thanks go to Kate Smart for driving this initiative.

Communications

SAIOH publishes its newsletter and President's address in two electronic media, namely *Occupational Health Southern Africa* (OHSA), and the *African Occupational Safety and Health* magazine (A-OS&H). These publications are issued every two months; the links are sent to all members via a Mailchimp and posted on our website. Three issues of these two publications have been sent to all SAIOH members this year.

SAIOH communicates daily with its stakeholders (e.g. the Department of Employment and Labour, Mine Health and Safety Council (MHSC), Mine Ventilation Society of South Africa (MVS SA), Ergonomics Society of South Africa (ESSA), South African Society of Occupational Medicine (SASOM), South African Society of Occupational Health Nursing Practitioners (SASOHN), Workplace Health Without Borders (WHWB), OH AIA Association, South African Institute of Occupational Safety and Health (Saiosh), South African National Accreditation System (SANAS), National Institute for Occupational Health (NIOH), National Institute for Occupational Safety and Health (NIOOSH), International Occupational Hygiene Association (IOHA) and the IOHA NARC, OHTA, Australian Institute of Occupational Hygienists (AIOH), British Occupational Hygiene Society (BOHS), American Industrial Hygiene Association (AIHA), International Commission on Occupational Health (ICOH), University of Cape Town (UCT), etc.) i.e. via webinars, communicating important news, technical information, legislation changes, new standards, etc.

FROM THE PROFESSIONAL CERTIFICATION COMMITTEE (PCC)

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Certification assessments

A summary of results from the first quarter's assessments for 2022 is provided in Table 1.

The second round of PCC written assessments took place on 24 June 2022, again mostly online. A total of 63 candidates wrote the assessment. Results are pending:

- OH assistants: 29
- OH technologists: 15
- Occupational hygienists: 19

Table 1. Results for oral/final assessment (17 May 2022)

	Assessed	Passed	Failed	Pass rate
Certification category	n	n	n	%
OH assistant	59	53	6	89.8
OH technologist	20	14	6	70.0
Occupational hygienist	12	8	4	66.7
Total	91	75	25	82.4

A special PCC technical team is hard at work revising the PCC oral assessment format and questions, in line with the occupational hygiene self-assessment tool, ensuring not only that the growing field of occupational hygiene is covered, but also that the assessment format and tools continue to improve over time and are not subjective.

Occupational Hygiene Skills Forum (OHSF)

The SAIOH OHSF was initiated to co-ordinate all aspects related to the recognition of occupational hygiene training materials (e.g. the AIHA Basic Industrial Hygiene Course at the registered occupational hygiene assistant (ROHA) level, OH training providers and institutions, and the development and management of assessment and examination systems, where required. Another function of the OHSF is to evaluate applications from tertiary institutions for recognition of their occupational hygiene-related qualifications. The OHSF is progressing well with this.

North-West University's and the Tshwane University of Technology's four-year bachelor's degrees were recognised by the OHSF as

meeting the criteria at the registered occupational hygienist (ROH) level. The OHSF is currently evaluating the University of the Witwatersrand's and the Cape Peninsula University of Technology's programmes.

All tertiary institutions that offer OH qualifications are encouraged to contact the PCC administrator for information regarding application for recognition (lee@saioh.co.za).

Details of recognised training providers and recognised qualifications will be posted on the SAIOH website (www.saioh.co.za). This will make it easier for potential students and certification candidates to select suitable occupational hygiene training programmes that meet SAIOH and international requirements.

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Guideline for the compilation of a mandatory code of practice for an occupational health programme (occupational hygiene and medical surveillance) for noise: an update

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INTRODUCTION

The Guideline for the compilation of a mandatory code of practice (MCOP) for an occupational health programme (occupational hygiene and medical surveillance) for noise was first promulgated on 1 February 2002. The Mining Occupational Health Advisory Committee (MOHAC) embarked on a process of reviewing the Guideline in June 2021. The reviewed Guideline was promulgated by the Department of Mineral Resources and Energy (DMRE) in Government Gazette No. 45903, 11 February.¹ The review was long overdue, and it was necessary to update the Guideline with the latest developments as per SANS 10083 (the measurement and assessment of occupational noise for hearing conservation purposes) and the Guidance Note on standard threshold shift (STS). It is thus important that the Guideline is read in conjunction with the Guideline for the compilation of a mandatory code of practice on minimum standards of fitness to perform work at a mine (reference number DMR 16/3/2/3-A3)² and the Guidance Note for the implementation of STS in medical surveillance of NIHL (reference number DMR 16/3/2/3-B8).³

This DMRE Guideline will assist employers with the establishment of an occupational hearing conservation programme, but does not stipulate requirements for specific circumstances. It considers that there are different mines in South Africa and their risks are not the same, thus their programmes will have to be tailored according to their risk assessment results.

OBJECTIVES OF THE GUIDELINE

The objective of the Guideline is to enable the employer at every mine to compile a MCOP which, if properly implemented and complied with, would assist in monitoring and reducing employees' exposure to noise. The Guideline provides general guidance on the required format and content for the MCOP and provides sufficient technical background to enable the drafting committee at the mine to prepare a comprehensive and practical MCOP for their mine. The Guideline considers two components of an occupational health programme:

1. Occupational hygiene, where the employer is required, in terms of regulation 9.2(2) or section 12 of the Mine Health and Safety Act (MHSA),⁴ to establish and maintain a system of occupational hygiene measurements in respect of occupational exposure to noise.
2. Medical surveillance, where the employer is required, in terms of section 13 or regulation 11.4 of the MHSA, to establish and maintain a system of medical surveillance.

SCOPE OF THE GUIDELINE

The Guideline covers a basic occupational health programme to assist in protecting employees from occupational noise-induced hearing loss (NIHL). It further provides for the measurement of occupational exposures to noise and the linking of these exposures to employee medical records. Regulations 9.2(1) and 9.2(2) of the MHSA prescribe that the employer must ensure that occupational exposure to noise is maintained below the occupational exposure level (OEL) of 85 dB. This Guideline will assist the employer to comply with the legal requirements. For purposes of this article, focus is on medical surveillance pertaining to NIHL.

Medical surveillance

Section 13(2)(c) of the MHSA requires a system of medical surveillance to consist of an initial medical examination, periodic medical examinations at appropriate intervals, and an exit medical examination in line with section 17. Regulation 11.4(2), read with sections 11(3) and 11(4) of the MHSA, provides that the system of medical surveillance relating to noise must consist of:

- A baseline audiogram
- Periodic audiograms
- An exit audiogram
- Any additional audiogram required in terms of the employer's risk assessment

Audiometry

Employees need to undergo audiometric testing where a hearing conservation programme is required. The programme is required when noise engineering controls have not been possible or have failed to eliminate the noise hazard. Audiometric testing should be regarded as a means of identifying and prioritising problem areas to enable implementation of appropriate interventions. Testing cannot be viewed as a solution to decrease the risk of NIHL in the absence of appropriate control measures. Mandatory audiometric testing must be conducted by the employer at no cost to the employee, using a registered audiometrist or an occupational health practitioner with a certificate in audiometry.

Initial and baseline audiometry

A baseline audiogram is an initial audiogram conducted to establish a reference against which subsequent audiograms can be compared. Employees need to have a valid baseline audiogram before

commencing employment within a noise zone and enrolling in a hearing conservation programme. This audiometry should be done within 30 days of commencement of employment. A valid baseline result determined at a previous working place remains relevant at the next working place if it meets the audiometric test requirement mentioned in the Guideline. Baseline audiograms should be used to determine future compensable hearing loss and the hearing status of an employee.

Screening audiometry should be conducted to establish a baseline audiogram and, if the results are abnormal, the employee should be referred to the audiologist to establish a baseline. A valid baseline involves two comparable screening tests conducted in one day. If this is not possible, then the test should be repeated within 30 days of employment, or before transfer to a noise zone. Two baselines are mentioned in the Guideline:

1. **Instruction 171 baseline** – an audiometry test is conducted on an employee entering the mining industry for the first time and will be the baseline of that employee for the rest of his/her working career unless there is a need to revise it. The Instruction 171 baseline was intended to be complete for existing mine employees by December 2003.
2. **STS baseline** – this baseline was introduced to the mining industry after Instruction 171, and was expected to have been completed by December 2017, according to the DMRE Guidance Note for the implementation of STS in medical surveillance of NIHL. This baseline is repeated every time an employee changes employment because it is used for assisting the employer in preventing NIHL.

For someone entering the mining industry for the first time after December 2017, the Instruction 171 baseline audiogram may be used as the STS baseline audiogram, at the first employer only.

Revised baseline audiometry

The above-mentioned baselines may need to be revised as follows:

- a) The Instruction 171 baseline is revised when an employee has been compensated for NIHL, in which case the audiogram test results used for compensation become the new baseline.
- b) The STS baseline is revised when there is an average change in hearing of 25 dB or more, at the frequencies of 2 000, 3 000 and 4 000 Hz in one or both ears, when compared to the employee's STS baseline audiogram.

Both revised baselines must be diagnostic audiograms, thus the tests should be conducted by an audiologist.

Periodic audiometry

The employer must conduct periodic audiometric evaluations on an annual basis for all employees having noise exposure levels that equal or exceed 85 dBA. Where employees are exposed to an 8-hour rating level equal to or higher than 105 dBA, audiogram tests should be conducted at intervals not exceeding six months. Periodic audiometry shall be used to determine:

- The occurrence and extent of any STS, i.e. to determine the need for further investigation, and to monitor the efficiency of the hearing conservation programme
- Whether a percentage loss of hearing (PLH) shift of 5% has occurred for what is considered early NIHL
- Whether a PLH shift of 10% has occurred for compensable hearing loss

In any of the above scenarios, the employee will need to be referred to an audiologist for a confirmatory diagnostic audiogram, and for investigations to assist with further interventions, whereby:

- a) An analysis of the contribution of noise exposure to the hearing loss of the employee is conducted
- b) After a diagnostic audiogram is performed to ascertain if the above scenarios are work related, a section 11(5) investigation of the MHSA needs to be initiated and may include, amongst others, the following interventions:
 - o Retraining of employees regarding the hearing conservation programme and how to use hearing protective devices
 - o Careful inspection of hearing protection devices used by the employee for possible shortcomings
 - o Identifying necessary steps to prevent further STS or PLH shift

Exit audiogram

An exit audiogram is conducted when an employee leaves the mine through retrenchment, retirement, or medical incapacity. The employer must conduct an audiometric evaluation for all persons at the conclusion of employment in a noise zone.

The exit audiogram test results are compared to the baseline audiogram test results. If the difference in PLH from baseline to exit is 10% or more, the individual shall be referred for diagnostic audiometry. Any employee diagnosed with a PLH shift of 5% to 10% or an STS of 25 dB for the first time on exit is required to have the relevant investigation.

CONCLUSION

All audiometric evaluations are required to be preceded by a period of at least 16 hours during which there is no exposure to noise levels \geq 85 dBA. The use of hearing protection devices with attenuation of noise during this 16-hour period will not qualify as non-exposure to noise.

Before audiometric testing, an otoscopic examination is needed to examine the external ear canals of an employee to exclude presence of wax or infections such as otitis media with perforation of the ear drum. Any of these conditions could result in hearing loss. Where required, successful treatment is possible and needs to be completed before testing is done.

It is necessary to obtain the medical history of the employee undergoing audiometry testing, focusing on previous traumatic incidents, use of ototoxic medication, or other non-auditory events that could have influenced the employee's hearing. The occupational history of the employee is also very important; a record of hazardous work is necessary in terms of exposure levels in the different working environments.

It is clear that a holistic approach is necessary for all employees undergoing audiometric evaluations during medical surveillance to establish if the hearing loss is work related or not, and to ensure that adequate interventions are made. The employer should report all cases of confirmed compensable NIHL to the relevant authority, as per relevant compensation legislation. Audiogram results for all employees must be stored with other medical surveillance records in line with section 15 of the MHSA, for a period of 40 years.

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LOCAL AND INTERNATIONAL EVENTS

Many events were postponed due to the COVID-19 pandemic



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to access new dates in our live calendar with links to event organisers' websites

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Mine waste leaves toxic legacies

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On 31 May 2022, the Mine Tailings Working Group of South Africa, a partnership of civil society groups, including the Bench Marks Foundation, Federation for Sustainable Environment (FSE) and the International Alliance on Natural Resources in Africa (IANRA), hosted a hybrid seminar at the University of Johannesburg, South Africa.

The first part of the seminar focused on South African tailings facilities – highlighting the legal situation and the impacts on mining-affected communities. The environmental, social and health effects of mine waste facilities, called tailings dams, are extreme, and some speakers from affected communities presented their impacts.

Waste from gold mines constitutes the largest single source of waste and pollution in South Africa and there is wide acceptance that water pollution from mining operations is responsible for the most-costly environmental and socio-economic impacts. On the Witwatersrand gold fields, more than 120 mines have extracted 43 500 tons of gold in one century and 73 000 tons of uranium from 1953 to 1995, leaving a legacy of more than 270 tailings facilities that cover approximately 400 km². Contamination, including air, water and soil pollution, have significant health impacts on surrounding communities, many of which are composed of low-income homes.

The working group finds that current laws and regulations in South Africa are not preventing or mitigating the detrimental impacts of tailings dams. These shortcomings include a lack of adequate regulations for mine closure and dust emissions, insufficient buffer zones between tailings facilities and communities, a lack of control and maintenance for abandoned tailings dams, and misclassification of the reprocessing of residual gold and other metals from historic tailings facilities and residue stockpiles.

Mariette Liefferink from FSE notes that *“it is widely recognised that problems related to mining waste (tailings) may be rated as second only to global warming and stratospheric ozone depletion in terms of ecological risk. The release to the environment of mining waste can result in profound, generally irreversible destruction of ecosystems. Waste from gold mines constitutes the largest single source of waste and pollution in South Africa.*

Gold mining waste was estimated to account for 221 million tonnes, or 47% of all mineral waste produced in South Africa, making it the largest, single source of waste and pollution.”

“The South African government must introduce regulatory reforms that will ensure effective transparency and monitoring of tailings facilities,” says Hassen Lorgat from the Bench Marks Foundation and a convener of the working group.

“We have noticed a number of corporations starting to talk about tailings management but talk is cheap. Real reform begins with the Government making real legislative reforms. But corporations do not have to wait for that and must include mining communities and independent experts as part of the oversight for individual tailings management,” he added.

South Africa is not alone in dealing with unsafe and abandoned tailings facilities; communities from Madagascar, Brazil, and the United States face similar issues. Tailings dams are failing with [increasing frequency and severity](#). Recent tailings dam failures across the world have led to over 300 deaths, hundreds of kilometers of contaminated rivers and ecosystems, and have resulted in [billions](#) in lost profits and remediation costs for mining companies. As climate change brings increasingly severe and extreme weather conditions, tailings dams are becoming more and more of a [risk](#).

The 31 May seminar coincided with the publication of *Safety First: Guidelines for Responsible Mine Tailing Management* (available at www.earthworks.org/safety-first), an updated set of guidelines for improving the management of mine waste disposal facilities, endorsed by an international group of scientists, communities, Indigenous Peoples and civil society groups.

“Dangerous tailings dams threaten thousands of communities across the globe. There must be civil society oversight for tailings dams, as well as rigorous, independent third-party technical review,” said Jamie Kneen of MiningWatch Canada. *“It is clear that much more stringent oversight of the mining industry is urgently needed.”*

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Rand Mutual Assurance launches its Prevention Programme

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For 128 years, Rand Mutual Assurance (RMA) has been administering claims for occupational injuries and diseases according to the Compensation for Occupational Injuries and Diseases Act No. 130 of 1993 (COIDA). RMA is passionate about caring for the lives of its claimants and their families and has the licence to administer claims for both the mining- and metals-related industries.

In April 2022, RMA launched its Prevention Programme as part of one of the company's key strategic focus areas. RMA believes that the prevention of injuries and diseases at work is crucial to contribute to enhanced employee productivity for employers and, more importantly, to improve the health and safety of employees. As a mutual assurance company, RMA understands the impact of working conditions and environments that contribute to workplace fatalities, injuries and diseases. RMA believes that such events can be prevented by being proactive and helping our members put actions in place before an event occurs.

The Prevention Programme will be driven by the Occupational Health and Safety Act No. 85 of 1993. In addition, the COIDA has specific provisions that require RMA to implement an effective prevention programme that reduces occupational injuries and diseases in the workplace.

RMA's Prevention Programme supports employers' existing initiatives for the benefit of their employees and aims to complement their existing occupational health and safety (OHS) systems. A successful and effective prevention programme requires the involvement of all the key stakeholders in the occupational health and safety value chain. RMA's Prevention Programme is premised on partnering with employers, employees and unions to reduce occupational incidents by offering of a blend of OHS and financial wellness solutions that improve employee safety, reduce the severity of injuries, and reduce the debt burden of employees. Working closely with our stakeholders will enable the delivery of strategic actions where, together, the greatest impact on illnesses and injury reduction can transpire. Every stakeholder has a responsibility to reduce the incidence of OHS incidents. Working

together allows for greater collaboration and partnering to increase the reach for the goal of improving employee health and safety.

Understanding the hazards and inherent risks in our client's businesses, our Prevention Programme will ensure that we partner with our clients in their efforts to achieve effective management of OHS, where our assessment, solutions and evaluations will result in sustainable safety benefits for our employers. RMA will adopt a data-driven approach to raise awareness of occupational injuries and diseases in the workplace, and identify those who are the most affected or at the highest risk.

RMA's Prevention Programme is aimed at the metals industry, initially. Claim data suggest that this industry would benefit greatly from such a programme, given the types of injuries that RMA administers and the incidence of injuries in comparison to the mining industry. The programme aims to reduce occupational injuries and diseases in the workplace, creating a safe place of work for employees and having tangible benefits for the employer. Safety is not only an ethical and moral business imperative, but also results in financial benefits for organisations. Failure to consider OHS can result in increased damage to property and equipment, absenteeism and presenteeism, legal costs, reputational damage, and loss in productivity. RMA's Prevention Programme makes business sense. Having this programme in place ensures a beneficial partnership for RMA and its clients, which is not only about compensation but also about assisting its clients in preventing work-related accidents and injuries, and promoting the safety of their employees. There is always room for improvement and, with a focus on current evidence and our approach to prevention, this initiative will have an effect on claim and injury rates. This will lead to an improved health and safety culture that has benefits extending beyond the workplace.

If you have any questions about the RMA Prevention Programme and how we can work closely with you, please contact our team at rmaprevention@randmutual.co.za.

Positive industry turnout for A-OSH Expo, 2022

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The occupational health and safety (OHS) sector proved, once again, that face-to-face interaction cannot be beaten, with excellent industry support seen at the recent A-OSH Expo trade show.

The exhibition took place from 31 May to 2 June 2022 at Gallagher Convention Centre (alongside the Securex, Facilities Management Expo and Fireexpo shows – a ‘four-industries-one-roof’ offering from Specialised Exhibitions, the largest trade show organiser in southern Africa). More than 8 300 visitors attended over the three-day period, and the shows featured more than 200 exhibitors. Mark Anderson, Portfolio Director at Specialised Exhibitions, said:

It has been a long two years since we've been able to hold larger live events and exhibitions in South Africa, so 2022 was a landmark year for these trade shows in many ways. Not only was it the first year since 2019 that we were able to bring Securex, A-OSH Expo and Facilities Management Expo back to the industry after a two-year hiatus, but we were also able to introduce the very first Fireexpo, focusing exclusively on fire-related products and services.

As Africa's biggest security exhibition, we were extremely proud to celebrate 29 years of Securex this year, with its continued focus on all elements of the security sector, from physical and retail security to access control, vehicle and personnel tracking, cybersecurity and more, while A-OSH marked more than a decade as Africa's leading occupational health and safety expo. 2022 also commemorated the second year that Facilities Management Expo, the trade show that brings together all aspects of facilities management, has run alongside these two sector stalwarts.

The show floor was buzzing over the three-day period, and it was clear, for both visitors and exhibitors, that the industry was more than ready to re-engage and reconnect on an in-person basis.

While there was a very small drop in visitor numbers compared with the 2019 figures, reflecting the same trend already seen this year both locally and globally, the quality of visitors across the board is still extremely high.

The four trade shows also brought in a number of visitors from outside South Africa's borders, with an excellent turnout from neighbouring African countries in particular.

Excellent feedback from exhibitors was received across all four shows. *"It's clear that this type of live event is now more important than ever in terms of building face-to-face connections and relationships, as well as allowing for a first-hand experience of new offerings,"* said Anderson. *"The BBF Safety Group is very committed to A-OSH Expo, and we are very pleased that we have had a busy stand,"* disclosed BBF Safety Group's Ruan Breedt. *"We had a brilliant turnout and I'm very happy with the attendance. There has been significant appreciation from the visitors, who have been very interested."*

Securex South Africa, A-OSH Expo, Facilities Management Expo and Fireexpo will return from 6–8 June 2023 at Gallagher Convention Centre. For more information, please visit www.securex.co.za, www.aosh.co.za, www.fmexpo.co.za, and www.fireexpo.co.za.

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HASS Industrial supplies custom-made hearing protection devices and hearing conservation management programmes

Photograph: Wendy Lopes



Haslac offers occupational health and safety legislation training

Photograph: Wendy Lopes

Award-winning occupational health audiometry enabling business to have faster, more efficient and affordable hearing testing procedures, on site

hearX Group

e-mail: info@hearxgroup.com

In a study conducted in South Africa and published in 2011, 73.2% of miners from 14 mines were exposed to excessive noise, above the legislated occupational exposure limit of 85 dB,¹ despite hearing conservation programmes implemented in the mining sector. Hearing conservation programmes in South Africa are characterised as very complex, expensive, time intensive, and dependent on equipment and soundproof booths.

Audiometric testing in occupational health settings helps to determine if occupational hearing loss is being prevented by the noise control measures in place. As occupational hearing loss occurs gradually, workers often fail to notice changes in their hearing ability until significant deterioration occurs. This can be avoided by conducting annual hearing checks, and taking appropriate action as soon as a change is detected – when comparing audiometry results with those from previous years. Annual hearing checks also contribute to increased productivity in the workforce, reduced workplace injuries and communication barriers, and ensure adherence to regulations.

Developed in close co-operation with audiologists and safety professionals, [hearX Group's hearTest Occ Health](#) solution is an IEC-certified tablet-based audiometer for seamless occupational hearing testing, fully compliant to OSHA and SANS requirements. With automated audiogram threshold tracking and assessments at the click of a button, [hearTest Occ Health](#) allows for simplified patient counselling, efficient on-site screening, and seamless reporting, without the need for third-party vendors. This digital solution provides attenuation equivalent to a single-wall sound booth, allowing the freedom of portable, reliable and cost-effective occupational health audiometry for businesses.

[hearTest Occ Health](#) enables workplace hearing screening anywhere, any time, without the need for bulky equipment, and offers a variety of features including:

- Percentage loss of hearing (PLH) and standard threshold shift (STS) calculations, with the option to enable age adjustments when determining if a valid shift occurred
- Pre-test questions that ensure detailed data capturing by recording patient information to ensure compliance to standards and conformance to operational test requirements
- Optimisation of testing times by preloading patient, facility and testing information to the device
- Monitor of changes in hearing health by manually adding a baseline or importing the screening test as a baseline test
- Smart features that ensure on-site quality control and test reliability. Quality control metrics include noise monitoring, false response counts, response times, and 1 kHz retest
- Use of automated testing and smart algorithms – significantly faster than traditional screening services, allowing for accurate, easy and reliable automated tests
- The [hearScope](#) digital video otoscope, which can integrate with the [hearTest Occ Health](#) device to include eardrum images on patient records
- [mHealth Studio](#), which is included free with any [hearTest Occ Health](#) subscription. [mHealth Studio](#) allows for online data management, surveillance, referrals and report generation, safe and reliable storage of clinical data, and a graphical comparison of baseline and screening tests, providing you with full access and control over all employee test data

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