

# National Institute for Occupational Health ANNUAL REVIEW 2022/23

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# LIST OF ABBREVIATIONS

AFRICA	Asbestos Fibre Regular Informal Counting Arrangement	
AOP	Adverse Outcomes Pathway	
ARAOH	African Regional Association for Occupational Health	
ASLM	African Society for Laboratory Medicine	
AUDA	African Union Development Agency	
BRICS	Brazil, Russia, India, China and South Africa	
ССМА	Commission for Conciliation, Mediation and Arbitration	
CDC	Centers for Disease Control and Prevention, US	
CEFT	Committee for Evaluations and Technical Function	
CEO	Chief Executive Officer	
COIDA	Compensation for Occupational Injuries and Diseases Act	
COVID-19	Coronavirus Disease	
CPD	Continuing Professional Development	
CSIR	Council for Scientific and Industrial Research	
СТДС	CTDC Counter-Trafficking Data Collaborative	
DMRE	DMRE Department of Mineral Resources and Energy	
DoEL	Department of Employment and Labour	
DoH	Department of Health	
DOH	Diploma in Occupational Health	
DOMH	Diploma in Occupational Medicine and Health	
DPSA	Department of Public Service and Administration	
DSI	Department of Science and Innovation	
ESBB	European, Middle Eastern and African Society for Biopreservation and Biobanking	
EU	European Union	
FFR	Filtering Facepiece Respirator	
FIOH	Finnish Institute for Occupational Health	
FTIR	Fourier Transmission Infrared Spectroscopy	
GEMP	GEMP Graduate Entry Medical Programme	
GLP	Good Laboratory Practice	
GPG	Gauteng Provincial Government	
HIV	Human Immunodeficiency Virus	
HPCSA	Health Professions Council of South Africa	
HRA	Health Risk Assessment	
HSE	Health, Safety Executive	
HSL	Health and Safety Laboratory, UK	
HSRC	Human Sciences Research Council	
HWSETA	Health and Welfare Sector Education Training Authority	
ІСОН	ICOH International Commission on Occupational Health	
IEC	International Electrotechnical Commission	

# LIST OF ABBREVIATIONS

ILO	International Labour Organization	
ISBER	International Society for Biological and Environmental Repositories	
ISO	International Organization for Standardization	
п	Information Technology	
MBA	Master of Business Administration	
MBOD	Medical Bureau for Occupational Diseases	
MCSA	Minerals Council South Africa	
мні	Moist Heat Incubation	
MHSC	Mine Health and Safety Council	
ММРА	Mine Medical Professionals Association	
MoU	Memorandum of Understanding	
МРН	Master of Public Health	
MRC	Medical Research Council	
MSc	Master of Science	
NBD	NBD National Burden of Disease	
NEDLAC	NEDLAC National Economic Development and Labour Council	
NEPAD	New Partnership for Africa's Development	
NHLS	National Health Laboratory Service	
NICD	National Institute for Communicable Diseases	
NIOH	National Institute for Occupational Health	
NIOSH	National Institute for Occupational Safety and Health, US	
NMBP	Nanotechnologies, Advanced Materials, Biotechnology and Advanced Manufacturing and Processing	
NMISA	National Metrology Institute of South Africa	
NOMS-SA	National Occupational Mortality Surveillance South Africa	
NRF	F National Research Foundation	
NRGC	Nano Risk Governance Council	
NUM	National Union of Mineworkers	
OECD	Organization for Economic Cooperation and Development	
OEHS	OEHS Occupational and Environmental Health and Safety	
OHASIS	Occupational Health and Safety Information System	
OHORT	Occupational Health Outbreak Response Team	
OHS	HS Occupational Health and Safety	
OHSS	Occupational Health Surveillance System	
ОМР	Occupational Medicine Practitioner	
PACC	Premier's Advisory Committee on COVID-19	
PATHAUT	Pathology Disease Surveillance Database	
PathReD	Pathology Research and Development Congress	
РСМ	Phase Contrast Microscopy	
PCR	Polymerase Chain Reaction	

# LIST OF ABBREVIATIONS

PhD	Doctor of Philosophy	
PMR	Proportional Mortality Ratio	
PPE	Personal Protective Equipment	
QCTO	Quality Council for Trades and Occupations	
QMS	Quality Management System	
qPCR	Quantitative Polymerase Chain Reaction	
RedCap	Research Electronic Data Capture	
SABCOHA	South African Business Coalition on Health and AIDS	
SABS	South African Bureau of Standards	
SACCESS	South African Collaborative COVID-19 Environmental Surveillance System	
SACNASP	South African Council for Natural Scientific Professions	
SADC	Southern African Development Community	
SAFETP	South African Field Epidemiology Training Programme	
SAIMR	South African Institute for Medical Research	
SAIOH	Southern African Institute for Occupational Hygiene	
SANAS	IAS South African National Accreditation System	
SARS	Severe Acute Respiratory Syndrome	
SASOHN	South African Society of Occupational Health Nursing Practitioners	
SASOM	South African Society of Occupational Medicine	
SETA	Sector Education Training Authority	
SHE	Safety, Health and Environment	
SHSPH	School of Health Systems and Public Health	
SOP	Standard Operating Procedures	
SPH	School of Public Health	
тв	Tuberculosis UK United Kingdom	
UNAIDS	AIDS Joint United Nations Programme on HIV/AIDS	
UNISA	University of South Africa	
URL	URL Uniform Resource Locator	
USA	USA United States of America	
UVGI	UVGI Ultraviolet Germicidal Irradiation	
VHP	Vapourised Hydrogen Peroxide	
VOC	Volatile Organic Compound	
WHO	World Health Organization	
WHWB	Workplace Health Without Borders	
Wits	University of the Witwatersrand	
WPMN	Working Party on Manufactured Nanomaterials	
WRC	Water Research Commission	
WWTP	Wastewater Treatment Plant	
XRD	X-ray Diffraction	
XRF	X-ray Fluorescence.	

# EXECUTIVE DIRECTOR'S OVERVIEW



#### **DR SPO KGALAMONO**

I am pleased to share the key activities and accomplishments of the National Institute for Occupational Health (NIOH) for the 2022/2023 financial year. For the period under review, the Institute played a significant role in occupational health and safety (OHS). It reinforced its role as a centre of excellence and a repository of knowledge for the country, the Southern African Development Community (SADC), and the African Region. The NIOH's resolve and commitment to support the South African government's occupational health efforts are steadfast. The Institute provides advice and support, conducts research, and develops capacity through teaching and training as part of efforts to promote healthy conditions in workplaces and improve workers' health.

For the period under review, the NIOH gradually transitioned from COVID-19 and refocused on its primary functions, which were disrupted by the global pandemic. However, the OHS initiatives implemented as part of the response to the pandemic continued, albeit on a smaller scale. These included participating in OHS knowledge generation, providing training sessions, and capacitating workplaces to address the effects of the pandemic. The Institute's COVID-19 response was agile, adaptive, and informed by the need to provide workplaces with timely and relevant information. The Institute collaborated and engaged with key stakeholders locally and abroad, which has strengthened its stature as a centre of excellence.

The NIOH contributes to knowledge and information generation through research and education. The Institute's multidisciplinary team participated in research projects on a national and international scale in support of initiatives to help make workplaces healthy and safe. The NIOH worked together with many key workplace role players and partners on a national and international level. In turn, this assisted the Institute in building a new body of knowledge that allowed research to be turned into practical policy and practice.

#### **HIGHLIGHTS**

Our training programmes are crucial to developing the next generation of scientists and occupational health professionals. The NIOH Occupational Medicine Specialist Training Programme, offered in partnership with the University of the Witwatersrand School of Public Health (Wits SPH), was accredited for another four-year period (2022-2025) by the Health Professions Council of South Africa (HPCSA). This bears testimony to the NIOH's high-quality standards and the calibre of its staff. The NIOH's in-house programme complements the formal academic programmes in occupational medicine and public health offered by the Universities of Pretoria and the Witwatersrand and is aligned with the College of Public Health Medicine guidelines for specialist training. We also strengthened our collaboration with the Nelson Mandela, Fort Hare, Rhodes, and Sefako Makgatho Universities in various programmes and projects.

The NIOH, yet again, played a fundamental role in providing OHS expertise in the country, with various staff members being part of drafting and revising specific occupational health legislation and guidelines for both the formal and informal economies. The NIOH provided strategic leadership and participated in various stakeholder forums convened by the National Department of Health (NDoH), the Council for Scientific and Industrial Research (CSIR), the Department of Employment and Labour (DoEL), the World Health Organization (WHO), the International Labour Organization (ILO), the International Commission on Occupational Health (ICOH), the Africa Centres for Disease Control and Prevention (CDC), and academia in accelerating and strengthening occupational health resilience with respect to OHS issues of concern.

Our staff served on numerous high-level decision-making technical committees including the National Economic Development and Labour Council (NEDLAC), the Regional Biosafety and Biosecurity Technical Working Group – Southern Africa, the South African Society of Occupational Medicine (SASOM), the South African Society of Occupational Health Nursing Practitioners (SASOHN), and the Southern African Institute for Occupational Hygiene (SAIOH).

I am proud to share that the specialised laboratories of the NIOH have once again maintained their accreditation for their respective quality management systems. The Institute is the only organisation in South Africa to have obtained four separate quality management systems: ISO 17020 (Conformity Assessment for Inspection Bodies), ISO 17025 (Testing and Calibration Laboratories), ISO 15189 (Medical Laboratories), and ISO 9001. The support provided to NHLS laboratories towards SANAS accreditation is ongoing.

The Institute continues to regularly use media to strengthen its brand identity and raise its profile, especially social media, which has proven effective in directly engaging some of our stakeholders. Through the use of social media sites such as X (formerly Twitter) and YouTube, the Institute has seen consistent growth and has reached a wider audience. These communication channels have made it possible to network worldwide, helping with stakeholder targeting through personalised communication. The NIOH's periodical (OccuZone) was also used to disseminate information about the Institute's activities. This quarterly journal details the NIOH's latest research findings, the provision of specialised services, and its teaching and training initiatives.

#### **COVID-19 ACTIVITIES**

With the easing of restrictions and lifting of the National State of Disaster at the start of the year under review, some initiatives put in place to respond to the pandemic were brought to an end. The NIOH's dedicated workplace advisory hotline, set up specifically to assist occupational health professionals, employees, and employers in responding to the COVID-19 pandemic, was repurposed to respond to general occupational health queries relating to appropriate occupational health practice in workplaces. At the start of the year under review, the NIOH hosted a centenary webinar celebrating 100 COVID-19 webinars since the beginning of the pandemic in March 2020. The webinar series attracted audiences from the public and business sectors, mostly in South Africa, the SADC Region, and the African continent. For the period under review, webinars redirected the focus on sector-specific occupational health topics and the production of information materials for use on an ongoing basis in workplaces.

In October last year, the NIOH, in partnership with NEDLAC and funded by the Compensation Fund, launched the COVID-19"Related Occupational Health and Safety Education and Awareness Programme for Workplaces." This initiative builds on the achievements and momentum of COVID-19 training webinars held in the past years. This programme produces COVID-19-related occupational health and safety information materials that workplaces can use to educate and inform at all organisational levels. These materials are delivered in various formats: short videos, infographic sheets, and webinars. For the latest information, please visit our website at www.nioh.ac.za and our X page at @nioh\_sa.

#### RESEARCH

The NIOH's mandate is to advance knowledge and innovation to prevent illness, injury, and poor health and to promote good health. Research continued to be a top priority, with a particular emphasis on preventing workplace exposure to potentially harmful agents. Sections have completed extensive and varied interdisciplinary research programmes that address various problems crucial to improving workers' health and the health of surrounding communities. The wide range of research needs in occupational health and safety in the nation is evident from the topics of the scholarly articles published throughout the year under review. The limited researchers at the NIOH were able to produce 37 articles in peer-reviewed journals and contribute to four book chapters. We commend and congratulate the NIOH staff for their dedication and diligence in producing new knowledge.

#### SURVEILLANCE

Occupational health, morbidity, injury, and mortality surveillance is insufficient in South Africa. Contributing to better surveillance is a long-standing but increasingly significant aspect of the NIOH's activities. Without a national occupational injury and disease surveillance system, the NIOH used the annual mortality data for South Africa, released by Statistics South Africa, to investigate the role of occupation in common diseases as well as in the development of occupational diseases and to produce surveillance reports. Six reports were produced for the year under review on occupation and road injuries, interpersonal violence, haematological disorders, malignancies, liver disease, and cardiovascular disease. These are available on the NIOH website for public access. The Institute is also still engaged in several additional surveillance activities. The Pathology Division's Disease Surveillance (PATHAUT) report was also produced and is available on the NIOH website. The Immunology and Microbiology Section continued its occupational allergy disease surveillance activities, including its efforts to monitor the trends of common allergens and the most common industry referral patients. The HIV and TB in the Workplace Unit conducted and reported on tuberculosis (TB) among healthcare workers.

#### **SERVICE DELIVERY**

The Pathology Division filled the existing service gap by providing a diagnostic surgical pathology service within the NHLS for the Limpopo province while supporting the province in building further capacity. This resulted in an improved pathology service for the province. Ergonomic assessments are conducted to ensure that ergonomic hazards in the workplace are identified and addressed accordingly in line with the Occupational Health and Safety Act (Act No. 85 of 1993) and its new Ergonomics Regulations (2019). Risk factors identified in both public and private workplaces were similar and ranged from workplace stress to awkward postures, prolonged sitting, and poor workstation accommodation. A preventive programme to address the risk factors has been initiated in a phased approach.

NIOH Laboratories played a critical role in supporting preventative efforts towards reducing occupational allergies and infectious diseases, which continue to be challenging in both formal and informal economies. Workplaces particularly affected include healthcare facilities, agriculture, wastewater treatment plants, and waste recycling. The Occupational Hygiene Section maintained registration with the DoEL as an Approved Inspection Authority (AIA), in its capacity as a Type C Inspection Body, to provide occupational hygiene services to the private sector and its parent organisation, the NHLS. In support of the NDoH, several strategic programmes were initiated including participation in the National Regulations relating to Lead in Paint as well as the provision of testing services for the same.

The NHLS Biobank helps to secure and manage collections of biomaterials and their associated data for research, human health, and biotechnology development for the benefit of society. The Biobank has increased storage capacity in response to the increase in demand and has maintained its ISO 9001:2015 accreditation for the period under review. This makes it the only biobank in Africa that is accredited with this standard.

#### **INTERNATIONAL LIAISON**

The NIOH maintained solid international links through concerted efforts to collaborate and network with influential international organisations. The NIOH has successfully been awarded re-designation as a WHO Collaborating Centre for Occupational Health for the next four years. The Global Network of WHO Collaborating Centres aims to stimulate networking between participating institutions and international partners to substantially contribute to the WHO's overall goal. New projects have been initiated after the successful completion of previous ones.

The collaboration has facilitated the inclusion of some staff members to serve on a committee that contributed towards the development of global guidelines entitled "Caring for those who care: a guide for the development and implementation of occupational health and safety programmes for health workers". The NIOH also worked on a new project with the WHO regarding using a new Joint Estimation Group Indicator to enhance reporting on specific occupational health indicators.

In conclusion, the NIOH has once again managed to fulfil its mandate and exceed targets in some areas in spite of limited resources.

#### **APPRECIATION**

I want to express my gratitude to the NHLS and the NIOH management teams for their strategic leadership, which allowed the NIOH to produce excellent achievements despite limited resources. Staff members at the NIOH continue to strive for excellence in their work, and I appreciate and thank them for their efforts towards ensuring healthy, safe, and ultimately sustainable workplaces. I further appreciate our partners, funders, collaborators, and stakeholders, who have contributed immensely to the NIOH's success.

# PATHOLOGY DIVISION



#### HEAD DR DEEPNA LAKHOO

## PATHOLOGY DIVISION

The origins of the Pathology Division lie in the Pneumoconiosis Research Unit, which was founded in 1953 to conduct research into dust-induced lung disease in mineworkers. While working at this unit, Dr JC Wagner discovered the causal link between crocidolite asbestos and malignant mesothelioma of the pleura.

The work of the Pathology Division has traditionally focused on occupational lung disease and continues to provide an autopsy service to assist with the compensation of the families of deceased mineworkers. The Division has become a referral centre for lung biopsies through the expertise gained in lung pathology. Due to a general shortage of histopathologists nationally, the division has also been assisting with diagnostic surgical pathology services for the Limpopo province. In addition to pathology services, the division offers analytical electron microscopy services. The diagnostic service work of the Pathology Division provides data and material for teaching, research, and surveillance purposes.

#### **DIAGNOSTIC SERVICES**

The Pathology Division continues to carry out the statutory requirement of examining the cardio respiratory organs of deceased miners as stipulated in the Occupational Diseases in Mines and Works Act, Act No. 78 of 1973. A pathology report of this examination is sent to the Mines Medical Bureau for Occupational Diseases to assist with the compensation process for families of deceased mine workers.

#### **AUTOPSIES**

There has been a steady decline in the total number of cases received over the past three decades. Factors contributing to this attrition include a decline in the number of operational mines in South Africa, which has led to a lower number of miners working in the industry, a lack of awareness of the compensation process, and cultural and religious reasons. There is nonetheless a recognised need to facilitate access to the compensation system. The Division undertakes outreach activities in the mines and with stakeholders in order to increase awareness about the autopsy service it provides. For the year under review, the pathology team made presentations at the Gijima Occupational Hygiene company, conducted a health awareness campaign at the ArcerlorMittal base in Vanderbijlpark, and attended the National Union of Mineworkers Free State region event, highlighting occupational hazards, occupational lung disease, the examination of cardiorespiratory organs, and the autopsy compensation.



IMAGE 1: Pathology staff on an outreach campaign in Welkom, Free State Province.

The autopsy service plays a crucial role in assisting in workers' compensation and generates a great deal of information about the lungs that are examined at the centre. Pathologists carefully record approximately 200 items of information. This information is entered into the Pathology Division's Pathology Disease Surveillance Database (PATHAUT). The PATHAUT is a national resource and contains unique information about diseases in the mining industry. The database has been maintained since 1975 and continues to be extensively used for policy decisions, to indicate disease trends in the mining industry, and for research in collaboration with local and international collaborators. It is also an important tool for disease surveillance that informs policy and other interventions that contribute to the improvement of work exposures in various workplaces. Detailed disease surveillance reports compiled from PATHAUT data, giving demographic data and disease rates, are produced annually. The reports are available on the NIOH's website: https:// www.nioh.ac.za/pathology-division-surveillance-reports/.

#### **SURGICAL PATHOLOGY**

The Division has vast experience in pulmonary pathology. A diagnostic service is offered to satisfy the demand for opinions on lung biopsies, fine needle aspirates, and bronchial washings. Since 2017, the NIOH's Pathology Division has been providing specialised pathology services to the Centre of Pulmonary Excellence in Johannesburg for the newly created centre. The Division also fills in the gap by providing general surgical pathology within the NHLS, in particular to the Limpopo province, while supporting Limpopo in building further capacity. This has resulted in an improved pathology specimens received from the Limpopo province provide an opportunity for pathologists at the NIOH to examine a broad range of general pathology and offer a broader training platform for registrars.

#### **ELECTRON MICROSCOPY**

The Electron Microscopy Unit is an essential component in the Pathology Division, and its function is to assist in service delivery, research, and training. The Unit is equipped with a scanning electron microscope (SEM). The microscope is linked to an analyser for energy dispersive spectroscopy (EDS), which analyses the chemical composition of asbestos and other various molecules. Its function is to determine the type of asbestos fibre and asbestos fibre concentration in the lung tissue of deceased miners, to assist with the diagnoses of asbestos-related diseases, and to determine environmental and occupational asbestos exposure. Samples are analysed to identify asbestos in building materials and enumerate asbestos fibres in the air. These analyses are performed for internal and external clients, including national, provincial, and local government, non-governmental organisations, universities, and private businesses. The Unit participates in an external quality assurance scheme and has maintained its satisfactory rating in the Asbestos in Materials International Quality Assurance Scheme that is coordinated by the Health and Safety Laboratory, UK. Its database is unique in South Africa and provides information about the legacy of asbestos in the country. The information from the database has been

used to produce the annual asbestos surveillance report. The reports are available on the NIOH's website: https://www. nioh.ac.za/asbestos-surveillance-reports/.

#### RESEARCH

Staff members of the Pathology Division conduct research relevant to the health of South African workers. Material and data from the service work of the Division provides information for research projects. Current areas of interest centre on lung diseases in mineworkers, which are caused by exposure to silica dust or asbestos fibres, as well as some aspects of the surgical pathology cases received from the Limpopo province. A summary of the current projects is presented below:

#### MINIMALLY INVASIVE POST-MORTEM TISSUE SAMPLING FOR DIAGNOSIS OF OCCUPATIONAL LUNG DISEASES

**Study Team:** R Manenzhe<sup>1</sup>, J de Bruin<sup>1,2</sup>, D Govind Lakhoo<sup>1,2</sup>. National Institute for Occupational Health, a division of the National Health Laboratory Service<sup>1</sup>, School of Pathology, Faculty of Health Sciences, University of the Witwatersrand<sup>2</sup>.

**Summary:** The aim of the study is to assess Minimally Invasive Tissue Sampling (MITS) of lungs and determine the level of correlation between MITS and conventional lung autopsy in occupational lung disease. Awaiting final ethics clearance.

#### IMMUNOPHENOTYPIC AND MOLECULAR FEATURES OF TP53 IN DIFFUSE LARGE B-CELL LYMPHOMA (DLBCL)

**Study Team:** T Mashele<sup>1</sup>, P Magangane<sup>1,2</sup>, S Pather<sup>1,2</sup>. National Institute for Occupational Health, a division of the National Health Laboratory Service<sup>1</sup>, School of Pathology, Faculty of Health Sciences, University of the Witwatersrand<sup>2</sup>.

#### Funding: NHLS PR2232879

**Summary:** The study aims to document histopathologic features and determine the p53 immuno-expression profile associated with TP53 gene mutations within DLBCL at CHBAH. This is a retrospective, descriptive cross-sectional review of confirmed cases of DLBCL and will be conducted from 01 January 2019 to 31 December 2021. Immunohistochemistry for the p53 protein and sequencing of TP53 will be conducted on a sample size of not less than 66 samples. Awaiting approval of funds.

#### HISTOLOGICALLY CONFIRMED INVASIVE FUNGAL INFECTIONS BEFORE AND DURING THE COVID-19 PANDEMIC IN SOUTH AFRICA (1 SEPTEMBER 2018-31 AUGUST 2021)

**Study Team:** C Sriruttan<sup>1</sup>, N Govender<sup>1</sup>, D Govind Lakhoo<sup>1,2</sup>, D van der Byl<sup>1,2</sup>.

National Institute for Communicable Diseases (NICD), a division of the National Health Laboratory Service<sup>1</sup>, National Institute for Occupational Health, a division of the National Health Laboratory Service<sup>2</sup>, School of Pathology, Faculty of Health Sciences, University of the Witwatersrand<sup>3</sup>.

## **Funding:** NHLS research trust, development grant (PR2229196)

**Summary:** In this retrospective, cross-sectional, observational study, the investigators aim to describe the epidemiology of histologically diagnosed invasive fungal infections (IFI) before (1 September 2018 – 28 February 2020) and during (1 March 2020 – 31 August 2021) the COVID-19 pandemic in South Africa. A search of the NHLS CDW, NIOH PATHAUT, and NICD MRL databases will be conducted for histologically-confirmed IFI. Fungal PCR and sequencing will be performed on FFPE tissues with a histologically-confirmed diagnosis of IFI where no/discordant fungal serology or culture or molecular result is present. Stage of research: Data collection and analysis.

#### EVALUATION OF THE POSSIBILITY OF ASBESTOS ENVIRONMENTAL CONTAMINATION AND EXPOSURE RESULTING FROM LABORATORY PROCESSING OF PROBABLE ASBESTOS CONTAMINATED SAMPLES

**Study Team:** L Mhlongo<sup>1</sup>, Z Ngcobo<sup>1</sup>, G Mizan<sup>1,2</sup>, M Keyter<sup>1,3</sup>, D Govind Lakhoo<sup>1,3</sup>.

National Institute for Occupational Health, a division of the National Health Laboratory Service<sup>1</sup>, School of Public Health, Faculty of Health Sciences, University of the Witwatersrand<sup>2</sup>, School of Pathology, Faculty of Health Sciences, University of the Witwatersrand<sup>3</sup>.

Funding: Application via NHLS K-fund in progress

Summary: Exposure to all kinds of asbestos leads to lung cancer and various non-malignant respiratory diseases, as well as some non-respiratory cancers. It is therefore very critical to ensure that both the quality and safety management systems are always in place in the laboratory during the processing of all laboratory specimens, to ensure the safety of the employees working with samples suspected to contain asbestos. With this understanding, this study aims to evaluate the possibility of asbestos contamination during the processing of probable asbestos-containing lung tissue or bulk samples in the pathology department. Specimens of the lung tissue and air monitoring filters will be analysed to determine asbestos contamination in the pathology laboratory during lung tissue processing of samples from autopsies of individuals with a history of occupational exposure to asbestos and probable asbestos-containing bulk samples. The NIOH method for lung, bulk, and air filter asbestos fibre processing will be used for analysis. Scanning Electron Microscopy will be used for this study. Stage of research: Awaiting funding approval.

#### COST EFFECTIVE AND TARGETED MOLECULAR TESTING FOR NON-SMALL CELL LUNG CARCINOMA (NSCLC) IN THE PUBLIC SECTOR OF SOUTH AFRICA

**Study Team:** D Govind Lakhoo<sup>1,2</sup>, J de bruin<sup>1,2</sup>, M Keyter<sup>1,2</sup>. National Institute for Occupational Health, a division of the National Health Laboratory Service<sup>1</sup>, School of Pathology, Faculty of Health Sciences, University of the Witwatersrand<sup>2</sup>.

#### Funding: Not yet applied

**Summary:** The study aims to determine the presence of driver mutations in non-small cell lung carcinoma in the public sector of South Africa; to determine the presence of PDL-1 expression in non-small cell lung carcinoma in the public sector of South Africa; and to develop a cost-effective molecular testing algorithm for targeted therapy in non-small cell lung carcinoma in the public sector of South Africa. Stage of research: protocol development.

#### VALIDATION OF PDL-1 22C3 CLONE USING BOND III TO EFFECTIVELY IDENTIFY PATIENTS IN THE PUBLIC SECTOR FOR ANTI PDL-1 IMMUNOTHERAPY

**Study Team:** T Mayeza<sup>1</sup>, S Naidoo<sup>1</sup>, J de Bruin<sup>1,2</sup>, M Keyter<sup>1,2</sup>, D Govind Lakhoo<sup>1,2</sup>.

National Institute for Occupational Health, a division of the National Health Laboratory Service<sup>1</sup>, School of Pathology, Faculty of Health Sciences, University of the Witwatersrand<sup>2</sup>.

**Summary:** The study aims to validate PDL-1 22C3 clone expression using the Leica Bond III IHC platform to effectively identify NSCLC patients in the public sector that may be eligible for anti-PD-L1 immunotherapy. To validate PD-L1 22C3 clone expression on NSCLC cases using formalin fixed-paraffin embedded blocks retrieved from the NIOH Pathology Division archived material by comparing them to results obtained from the gold standard method of PDL 1 testing. Stage of research: Ethics application in progress.

#### OCCUPATIONAL LUNG DISEASES IN SOUTH AFRICAN MINERS AT AUTOPSY: 2020 SURVEILLANCE REPORT

**Study team:** L Mhlongo<sup>1</sup>, KS Wilson<sup>1,2</sup>, Z Ngcobo<sup>1</sup>, D Fassom<sup>1</sup>, G Lakhoo<sup>1,3</sup>.

National Institute for Occupational Health, a division of the National Health Laboratory Service<sup>1</sup>, School of Public Health, Faculty of Health Sciences, University of the Witwatersrand<sup>2</sup>, School of Pathology, Faculty of Health Sciences, University of the Witwatersrand<sup>3</sup>.

This report describes the ages, commodities, employment durations, and occupational cardio-respiratory diseases in miners whose organs were submitted for autopsies in 2019 and 2020. There were 759 and 557 records of deceased miners and ex-miners in 2019 and 2020, respectively. Pulmonary tuberculosis decreased from 192/1 000 in 2019 to 153/1 000 autopsies in 2020, and silicosis decreased from 246/1 000 to 223/1 000. However, neither decrease was significant. There was a significant increase in the rate of asbestosis from 50/1 000 in 2019 to 79/1 000 in 2020. Pulmonary tuberculosis (TB), emphysema, and silicosis were the most frequent diseases, with high rates. There was a non-significant decrease in occupational respiratory disease rates in 2020 from 2019, but these remain higher than the rates seen in the early 1990s.

#### **TEACHING AND TRAINING**

The Division provides teaching and training through workshops, presentations and formal lecturing to professional bodies, universities, and teaching hospitals. Staff members

participate in the mentoring, teaching, and supervision of various students. The pathologists are actively involved in the undergraduate teaching of medical, dental, and allied health care students at the University of the Witwatersrand, as well as postgraduate anatomical pathology registrar training. The pathologists actively participate in and present cases at regular clinical pathology meetings with pulmonologists from the Johannesburg teaching hospitals.

Staff members from the Division are actively involved in the teaching and training of intern medical scientists. There are currently two medical scientist interns training in the Division. The Division is also accredited by the HPCSA for the training of student medical technologists and technicians. Currently, two medical technologists and three medical technicians are training within the Division.

#### **PROFESSIONAL DEVELOPMENT**

One staff member completed a postgraduate diploma in Occupational Medicine and Health at the end of 2022.

#### HONOURS

Dr M Keyter was awarded the Dhiren Govender medal in April 2022, for obtaining excellent results in the part II Anatomical Pathology Fellowship examination at the Colleges of Medicine of South Africa graduation.

# OCCUPATIONAL MEDICINE SECTION



ACTING HEAD DR NOMPUMELELO NDABA

## OCCUPATIONAL MEDICINE SECTION

The year under review provided the Occupational Medicine Section with an opportunity to restore service offerings to the scope of what was offered before the COVID-19 pandemic. The Section continued to offer support services to individual practitioners in different industries through a query service, the provision of continued professional development activities, and the contribution to webinars and academic programmes in various institutions.

#### DIAGNOSTICS SERVICES AND SURVEILLANCE

## Occupational Medicine Specialist Referral Clinic Service

The Clinic, which is managed by occupational medicine specialists, continues to provide services to current and former workers that have been referred for different clinical assessments from various clinics. Clinic staff also engage with the Ergonomics Unit staff in assessing patients with musculoskeletal conditions. The Clinic's processes – referral system, data entry and management, report writing, and increased frequency of clinical discussion meetings – have been reviewed, and its consultation fees were aligned with the newly updated NHLS tariffs.

A total of 51 patients were assessed during the financial year under review, from different industries. The majority of the patients assessed were from the mining sector (61%) and the remainder (39%), were from different industries, as shown in Figure 1.



**FIGURE 1:** Classification of industries from which patients were referred or last exposed while at work.

The majority of the referred patients had respiratory problems, while the rest had musculoskeletal disorders and other conditions affecting other organs, as shown in Figure 2 below. Some of the patients were referred with confirmed diagnoses requiring either attribution to workplace exposure or assistance with documentation requirements for compensation criteria. It is worth noting that compared to the previous years, there has been an increase in the number of workers referred for problems affecting other systems, particularly the musculoskeletal system.



Figure 3 below depicts the outcome of the assessments of patients during this period. Patients under investigation include those awaiting further assessments and a final diagnosis based on details of exposure information from the workplace and other pertinent information to assist in the final diagnosis and attribution to workplace exposures.



FIGURE 3: Assessment outcome of clinic patients.

The Occupational Medicine Section dedicated resources to planning internal systems to make it easy to access clinical data that will inform various surveillance objectives. This included a review of the existing database and collaboration with the Information Technology Section to develop clinic data management software.

The Clinic now has lung function testing capacity to assist in finalising respiratory assessments, considering that these constitute at least 74% of cases during this financial year. It was also notable that the number of work-related musculoskeletal disorders is on the rise again, as it had been before COVID-19.

#### **OTHER SERVICES**

#### Ergonomics Services and Specialised Assessments

The Ergonomics Unit provides ergonomic services to varying workplaces in the Southern Africa region. The services of the Ergonomics Unit are not only aimed at reducing musculoskeletal disorders, typically caused by awkward postures, repetition, or forceful exertions of the body, but also at considering the impact of psychosocial and cognitive factors on the productivity and well-being of employees. Such services are designed to assist employees in working efficiently, safely, and in a healthy manner. The information below provides insight into the work activities undertaken by the Unit in the year under review.

Ergonomics assessments are conducted to ensure that ergonomic hazards in the workplace are identified and addressed accordingly. In line with the Occupational Health and Safety Act (Act No. 85 of 1993) and the Ergonomics Regulations of 2019 employers must provide a safe and healthy workplace that is free from hazards. This further necessitates the elimination of such hazards and, where not reasonably practicable, ensures effective control measures are taken accordingly. To assist employers in the pursuit of such a requirement, the Ergonomics Unit conducted a number of ergonomic risk assessments in various workplaces during the 2022/23 financial year. Of these assessments, 75% were conducted at the NHLS laboratories and offices, and the rest were conducted for external clients. One of the requests from a laboratory setting was in response to an employee experiencing adverse health effects from prolonged sitting and ill-fitting accommodations at their workstation.

TABLE 1: Common risk factors and the associated workplaces observed by the Ergonomics Unit in the 2022/23 Financial Year.

WORKPLACE TYPE	COMMON RISK FACTORS
Office	Prolonged sitting / sedentary behaviour
	Awkward postures
	Poor workstation accommodation
	Work stress
Laboratory	Incorrect manual handling techniques*
	Awkward postures
	Repetitive movements
	Work stress

\*Includes lifting, carrying, lowering, pushing, and pulling.

An observed trend from the requested assessments was the requirement for ergonomic chairs. The focus on solely attending to one aspect of the work system (e.g., a chair) gives a false sense of security that employees are safeguarded from adverse health effects. It is thus important to consider the work system holistically. All parties in the workplace need to understand that a good fit for an employee in the work system should be key. This work system included amongst others, organisational factors such as performance targets and, employee behaviour. These factors work together to affect the employee's exposure level to hazards and eventual events and adverse health effects. Prolonged sitting, coupled with sedentary behaviour and insufficient rest breaks, for instance, may lead to development of adverse effects.

As part of its service offerings, the Ergonomics Unit, through its laboratory, also conducts standardised testing for one of the musculoskeletal disorders typically experienced by employees who use vibrating hand-held tools. Overexposure to hand-held vibrating tools often leads to the development of a condition called Hand-Arm Vibration Syndrome (HAVS), which affects the muscles, the nerves and the blood vessels of the upper limb. The Unit, in conjunction with the Occupational Medicine Specialist referral clinic, continued to conduct tests on patients suspected to have HAVS. As this specialised testing is a critical service to the South African workforce and the only one in Africa, the Unit is currently in the process of upgrading its laboratory. This will ensure that the Unit continues to provide quality services to its clientele.

# SUPPORT SERVICES TO NATIONAL GOVERNMENT DEPARTMENTS

The Occupational Medicine Section provided support to at least two government departments through active participation in structures and committees. The Section participates and provides support as the project team and committee members in the following departments: Medical Reviewing Authority of the National Department of Health's Medical Bureau for Occupational Diseases (MBOD) and the Department of Employment and Labour's (DoEL) Technical Committees and Project Teams.

#### RESEARCH

Members of staff are involved in collaborative research projects with other sections within the NIOH, as described below.

#### THE HARMONY/NUM/NIOH PROJECT: MUSCULOSKELETAL DISORDERS AND ASSOCIATED RISK FACTORS AMONG MINEWORKERS ON A MAN-RIDING CONVEYOR BELT GOLD MINE IN SOUTH AFRICA

**Project team:** V Ntlebi, K Wilson, N Ndaba, B Nyantumbu, H Maso, E Sepirwa, B Nkosi, Z Hoyi.

Funding: Harmony Gold Mining Company Limited

**Summary:** This project is a continuation from 2021. The study aims to assess if the musculoskeletal conditions reported by workers can be attributed to the unique transportation system used in the mine and, if so, also determine if those conditions fulfil the work-related criteria for compensation. The project was converted to a research project, thus requiring the following of all formal research process steps in the documentation and relevant approvals. Data collection will be finalised in the 2023/24 financial year.

#### PROFILING HIGH PERFORMING TEAMS IN MINING

**Project team:** Z Hoyi, N Tlotleng, C Kufe, H Maso, A Mkulisi, O Volmink, M Zungu.

Funding: Harmony Gold

**Summary:** The Occupational Medicine, Epidemiology and Surveillance and HIVTB Sections of the NIOH are supporting a mining house in conducting research, for operational reasons, in their workplace. The aim of the study is to investigate the physical, psychological, and psychosocial determinants of high-performing and low-performing production teams in two operations of the same organisation. Furthermore, the study aims to profile the production teams in terms of physiological parameters, environmental factors, and organisational factors hypothesised to impact performance. The study is currently awaiting ethical clearance for the commencement of data collection and analysis.

#### **TEACHING AND TRAINING**

The Section, including the Ergonomics Unit, contributed to a number of training programmes in occupational health and ergonomics, ranging from participation in occupational medicine specialist exams to post-graduate teaching and continuing professional development (CPD)/Continuing medical education (CME) workshops for occupational health and safety professionals, workers, and other stakeholders in different settings. Figure 4 below provides a summary of training interventions offered by the staff in the Section, as a quantified output.



#### Training interventions for the South African College of Public Health Medicine in the field of Occupational Medicine

The two occupational medicine specialists in the Section participated as examiners in the 2022 second semester of the College of Public Health Medicine [FCPHM (SA) Occ Med] as core and additional examiners, respectively.

#### POSTGRADUATE MASTER OF MEDICINE REGISTRAR TRAINING

#### HPCSA Accreditation of the Wits University's Master or Medicine training programs

The Occupational Medicine specialist training program,

offered through the NIOH Occupational Medicine Section and the Wits School of Public Health (SPH), was accredited by the HPCSA for another four-year period from 2022 to 2025. The assessment focused on the availability of appropriate resources for registrars to learn at a training platform, including the number of specialists available onsite to provide training and supervision, physical and virtual facilities accessible to registrars in the field, and practical exposure and projects assigned relevant to the field of training.

The occupational medicine specialists within the Section provided an ongoing post-graduate registrar (occupational medicine and public health medicine) training programme from within the NIOH throughout the year. The in-house programme complements the formal academic lectures in the field of occupational and public health offered by the SPH, aligned with the College of Public Health Medicine guidelines for specialist training.

#### Training interventions for Post graduate academic qualification programs - Diploma in Occupational Health

The Occupational Medicine staff contributed to the postgraduate teaching activities, namely lectures, clinical case presentations for postgraduate Diploma programmes in Occupational Health, Master of Science and Master of Public Health in the field of Exposure Science offered by Wits University.

At the end of the 2022/23 financial year, 22 postgraduate Diploma (PGD) lecture presentations were provided by the Section, as well as program coordination for the assigned block, and end-of-block student assessments. The lectures were offered to both the University of Pretoria's School of Public Health and Health Systems and the Wits School of Public Health programmes.

#### Training offered to Occupational Health (OH) Professionals and Stakeholders

The Occupational Medicine Section also contributed to the NIOH training mandate by providing presentations to professional bodies, not for academic qualification purposes. Through the Ergonomics Unit, the Section additionally offers training for employees and health and safety practitioners. These provided knowledge and skills to aid in preventing adverse health effects and events due to poor ergonomic considerations in the workplace.

# IMMUNOLOGY AND MICROBIOLOGY SECTION

#### HEAD DR TANUSHA SINGH

## IMMUNOLOGY AND MICROBIOLOGY SECTION

The Immunology and Microbiology Section's annual report provides an overview of the activities and accomplishments during the financial reporting year. The Section focused on its mission of promoting and protecting workers' health through research, education, and laboratory services. It played a critical role in supporting preventative efforts towards reducing occupational allergies and infectious diseases, which continues to be a challenge in both formal and informal economies. Workplaces particularly affected include healthcare facilities, agriculture, wastewater treatment plants, and waste recycling. The Section also contributed to implementing effective and sustainable mitigation strategies, particularly in airborne infection control and water quality. We provided tailored occupational allergy diagnostics to clinically manage workers' allergies. The maintenance of our accreditation status and expansion of scope attest to our undertaking to provide accurate and reliable results. The Section's deliverables included consultations, allergy testing, water testing, and efficacy testing of devices purported to reduce microbial transmission and allergen exposure in various settings. Our training programmes are critical to developing the next generation of scientists and occupational health professionals interested in occupational allergies and infectious diseases. The research activities centred on the impact of biological agents in various workplaces. The Section provided strategic leadership and participated in various stakeholder fora convened by the National Department of Health (NDoH), the Department of Employment and Labour (DoEL), World Health Organization (WHO), the International Labour Organization (ILO), the International Congress for Occupational Health (ICOH), the Africa Centres for Disease Control and Prevention (Africa-CDC), the Council for Scientific and Industrial Research (CSIR), and academia in accelerating and strengthening occupational health resilience concerning occupational allergies and infectious diseases.

#### LABORATORY SERVICES

The Section provided a worker-centric approach to allergy testing for occupationally-related allergic diseases tailored to specific workplace exposures. This specialised service provides a confirmatory diagnosis of specific occupational allergies for improved clinical management of workers or aids in reducing workplace exposure to hazardous biological agents. This is advantageous for identifying highrisk occupations and recommending measures to control exposure. A case to mention is that of a cosmetologist exposed to multiple agents, highlighting the complexities of managing patients with occupational and non-occupational exposures, thereby controlling the exposure while protecting livelihoods. The findings are pertinent to a growing, unregulated informal economy. Further details are provided in the following reference "Fourie A and Singh T. 2022. Contact dermatitis in a cosmetologist and the ramifications of occupational and non-occupational exposures in disease prognosis. Current Allergy & Clinical Immunology; 35(2): 106-111". We are pleased to report that of all the tests performed during the reporting period, all met 100% turnaround times. The largest proportion of tests conducted was the identification of waterborne pathogens (75%), followed by respiratory allergy tests (13%), skin allergy tests (9%), and bioaerosols (3%).

The Section maintained its high-quality standards, with the Occupational Allergy Unit being accredited for 15 consecutive years by the South African National Accreditation System (SANAS) for the International Organisation for Standardisation 15189 (ISO 15189). In addition, two technical signatories maintained their ISO 17025 accreditation status, and three new technical signatories were added. The new tests added to the scope included water pathogen testing and mould testing, which is a phenomenal achievement for the Section.

#### ENGAGEMENT

Senior staff participated in or contributed to several technical committees, including: the Legionella Action Group; the Department of Employment and Labour: Inspection and Enforcement Service Branch Hazardous Biological Agents (HBA) regulations technical committee; the Regional Biosafety and Biosecurity Technical Working Group: Southern Africa Technical committee; the ICOH scientific committee for Biohazards; and the Occupational Health and the South African Bureau of Standards: Clean Air Delivery Rate working group.

#### RESEARCH

The Section's key priority for the reporting year was strengthening our research profile by expanding the research agenda and increasing the research outputs. The Section successfully pivoted its leadership role through collaborative projects by addressing current occupational health priorities with multiple stakeholders across various disciplines. The multidisciplinary approach afforded an opportunity to enhance the quantity and types of data collected and the relevance of the work. A summary of the various projects is presented below:

#### PREVALENCE AND TRENDS OF ALLERGIC SENSITISATION IN PATIENTS TESTED AT THE NHLS LABORATORIES

**Study Team:** T Singh<sup>1,2,3</sup>, E Ratshikhopha<sup>1</sup>, M Muvhali<sup>1</sup>, N Naicker<sup>3</sup>.

National Institute for Occupational Health (NIOH), a division of the National Health Laboratory Service (NHLS)<sup>1</sup>, Department of Clinical Microbiology and Infectious Diseases, University of the Witwatersrand<sup>2</sup>, Department of Environmental Health, University of Johannesburg<sup>3</sup>.

**Summary:** Exposure to allergenic substances in the work environment can cause occupational allergies. Identifying putative allergens to guide avoidance measures and allergen immunotherapy or desensitisation is crucial. Although the NIOH publishes an Annual Surveillance Report on the prevalence of sensitisation of occupational patients, the information is limited. In addition, sensitisation data from private laboratories has been published, but these are for patients with access to private healthcare. It is, therefore, important to determine the prevalence and trends of allergic sensitisation in patients tested at the NHLS laboratories as it serves over 80% of the population who mainly use public health facilities. The study aims to analyse the prevalence of allergic sensitisation to various allergens tested at NHLS across the provinces and to compare these results to those of occupational cases tested at the NIOH. Allergic sensitisation results to different occupational and non-occupational allergens in working-age adults (18 to 65 years old) conducted at the NHLS between 2005 and 2021 were obtained from the NHLS Corporate Data Warehouse (CDW). The data are currently being analysed using Stata 15 SE version 4.2. Preliminary results were presented at a local scientific forum.

#### ADVERSE OCCUPATIONAL SKIN REACTIONS ASSOCIATED WITH PERSONAL PROTECTIVE EQUIPMENT (PPE) USE AMONG SOUTH AFRICAN HEALTH-CARE WORKERS DURING THE COVID-19 PANDEMIC

**Study Team:** A Fourie<sup>1</sup>, T Singh<sup>1,2,3</sup>, N Naicker<sup>1,3</sup>, Z Kirsten<sup>1</sup>, P Moloi<sup>4</sup>.

National Institute for Occupational Health (NIOH), a division of the National Health Laboratory Service<sup>1</sup>, Department of Clinical Microbiology and Infectious Diseases, University of the Witwatersrand<sup>2</sup>, Department of Environmental Health, University of Johannesburg<sup>3</sup>, Department of Health, Mpumalanga Province<sup>4</sup>.

Summary: Occupational skin disease constitutes a significant public health concern in industrial countries as it is among the most common occupational hazards, with occupational hand dermatitis (HD) being the most frequent work-related skin disease in many countries. At the occupational skin clinic at NIOH, of the 402 patients seen, 191 (48%) had HD. A Danish study showed that healthcare workers (HCWs) were almost twice as likely to develop hand dermatitis than the general population (21% vs. 11%). To prevent transmission of the COVID-19 infection, HCWs sanitise and wash their hands even more frequently than usual. In addition, they wore personal protective equipment (PPE) such as gloves, filtering facepiece respirators, and other PPE for extended periods. Although these measures are necessary to prevent the spread of disease, they can cause occupational skin diseases in several forms, including irritant contact dermatitis, allergic contact dermatitis, contact urticaria, acne, and physical skin damage. It is important to identify problems experienced with PPE to ensure health workers are offered safer alternatives to prevent serious illnesses. Therefore, this study aims to determine the extent of skin disorders among users of PPE within public and private health facilities during the COVID-19 pandemic. This cross-sectional study will be conducted by determining the number of cases of adverse skin reactions. Permission for the study was obtained from the Mpumalanga Department of Health, Research Department. Meetings were held with stakeholders to encourage participation, and permission was obtained from 12 hospitals. A pilot study was conducted, and amendments were made where relevant. Permission is currently being sought from a private group of hospitals.

#### CHARACTERISATION OF BIOAEROSOLS, VOLATILE ORGANIC COMPOUNDS, ODOUR EMISSIONS IN WASTEWATER TREATMENT PLANTS AND ASSESSMENT OF THE ASSOCIATED EMERGING EPIDEMIOLOGICAL, OCCUPATIONAL AND PUBLIC HEALTH RISKS

**Study Team:** D Masekameni<sup>1</sup>, D Mmereki<sup>1</sup>, A Gomba<sup>2</sup>, T Singh<sup>1,2,3</sup>, L Singh<sup>2</sup>, T Duba<sup>2</sup>.

University of the Witwatersrand<sup>1</sup>, NIOH, a division of the National Health Laboratory Service<sup>2</sup>, Department of Environmental Health, University of Johannesburg<sup>3</sup>.

Summary: This four-year study (2022-2024) study seeks to characterise bioaerosol, volatile organic compounds (VOC), and odour emissions in wastewater treatment plants (WWTPs) and assess the associated epidemiological, occupational, and public health risks. The results from this study will help elucidate the presence, concentration levels, and variability of bioaerosols, VOCs, and odours in wastewater environments. The results will also help establish human health risks caused by hazardous air pollutants at WWTPs, ultimately informing policy on effective and appropriate control methods to abate air pollutant emissions. Permission to conduct research and access WWTPs was obtained from the relevant Bulk Water and Waste Water Services, and ethics clearance was received from the Wits University Human Research Ethics Committee (Medical). The study team is optimising bioaerosol sampling and planning to commence field sampling and laboratory analysis by the end of May 2023. To date, three deliverables,

namely, a comprehensive literature review and two progress reports have been submitted.

#### GENOTYPIC ANALYSIS AND MICROBIOME INTERACTIONS OF SARS-COV-2 IN WASTEWATER FROM BOTSWANA AND SOUTH AFRICA

## **Collaboration Team:** University of Botswana Group<sup>1</sup>, A Gomba<sup>2</sup>, T Singh<sup>2,3,4</sup>.

The University of Botswana, Faculty of Health Sciences<sup>1</sup>, NIOH, a division of the National Health Laboratory Service<sup>2</sup>, Department of Clinical Microbiology and Infectious Diseases, University of the Witwatersrand<sup>3</sup>, Department of Environmental Health, University of Johannesburg<sup>4</sup>.

**Summary:** This is a collaborative project with researchers from the University of Botswana. The project seeks to 1) assess the prevalence and fate of SARS-CoV-2 in wastewater and its environments in Botswana and South Africa; 2) assess the prevalence of different lineages and genomic variations of SARS-CoV-2 in Botswana and South Africa; and 3) assess the impact of wastewater microbiomes on the molecular evolution and/or adaptation of SARS-CoV-2. The project is funded by the COVID-19 Africa Rapid Grant Fund for a total of USD 90 000.00 for two years, starting in January 2021 and ending in December 2022. Our mandate was to collect and analyse wastewater samples for SARS-CoV-2 in South Africa and participate in genomic analysis. Sample collection and analysis were completed in August 2022. Genomic and microbiome analysis is currently underway.

#### POTENTIAL OCCUPATIONAL EXPOSURE TO ENTERIC AND RESPIRATORY BACTERIAL PATHOGENS AT WASTEWATER TREATMENT PLANTS (WWTPS): A PRELIMINARY STUDY

**Collaboration Team:** E Poopedi<sup>1,2</sup>, T Singh<sup>1,2,3</sup>, A Gomba<sup>1</sup>. NIOH, Division of the National Health Laboratory Service<sup>1</sup>, Clinical Microbiology and Infectious Diseases, University of the Witwatersrand<sup>2</sup>, Department of Environmental Health, University of Johannesburg<sup>3</sup>.

Summary: WWTPs provide an invaluable public service while being at constant risk of exposure to microbiological contaminants. However, there is a paucity of data on the precise cause of symptoms and illnesses reported among workers at WWTPs. The current study aimed to provide a qualitative profile of human pathogenic bacteria present in untreated municipal wastewater (sewage) that could pose an occupational health risk to WWTP workers if ingested or inhaled. Grab influent samples were analysed using Illumina Miseq 16S amplicon sequencing to assess potential worker exposure to bacterial pathogens occurring in five municipal WWTPs. This work was completed, and the results were published in the International Journal of Environmental Research and Public Health under the title: "Poopedi, E.; Singh, T.; Gomba, A. Potential Exposure to Respiratory and Enteric Bacterial Pathogens among Wastewater Treatment Plant Workers, South Africa. Int. J. Environ. Res. Public Health 2023, 20, 4338. https:// doi.org/10.3390/ijerph20054338". These results suggest that WWTP workers may be occupationally exposed to several bacterial genera classified as hazardous biological agents for humans. Therefore, there is a need for comprehensive risk assessments to ascertain the actual risks and health outcomes among WWTP workers and inform effective intervention strategies to reduce worker exposure.

#### EVALUATION OF OCCUPATIONAL HEALTH RISKS FROM BACTERIAL CONTAMINANTS AT WASTEWATER TREATMENT PLANTS IN GAUTENG PROVINCE, SOUTH AFRICA

**Study Team:** E Poopedi<sup>1,2</sup>, T Singh<sup>1,2,3</sup>, A Gomba<sup>1</sup>. NIOH, Division of the National Health Laboratory Service<sup>1</sup>, Clinical Microbiology and Infectious Diseases, University of the Witwatersrand<sup>2</sup>, Department of Environmental Health, University of Johannesburg<sup>3</sup>.

Summary: This study assessed the occurrence and concentration levels of selected microbial hazards and their potential health risks at WWTPs. Following the screening and prioritisation of microbiological contaminants in wastewater, respiratory pathogens (Legionella and Mycobacterium spp.) and enteric pathogens (Aeromonas hydrophila and Arcobacter butzleri) were selected as priority contaminants for further assessment. A total of 176 grab wastewater samples were collected from five municipal WWTPs in Pretoria that primarily treated household sewage and analysed for the selected bacterial contaminants. Samples were collected at different treatment stages: influent (untreated), activated sludge, and secondary settling tank (SST) effluent, and laboratory analysis of the samples is almost complete. Preliminary findings revealed high detection rates of both respiratory (L. pneumophila and Mycobacterium spp.) and enteric (A. hydrophila and A. butzleri) pathogens in wastewater at different treatment points, suggesting a conducive environment for the enrichment of these bacteria in the activated sludge tanks. A total of 193 consenting workers across all WWTPs in the City of Tshwane Metropolitan Municipality and NIOH cleaning service workers (19 workers) who will serve as a control group were recruited for the human health study. The surveys have been completed, and statistical analysis of the results is underway. E Poopedi, a PhD student received a Wits Faculty research award.

#### INVESTIGATING THE PRESENCE OF SARS-COV-2 IN WASTEWATER AND HEALTH IMPLICATIONS FOR WASTEWATER TREATMENT PLANT WORKERS AT THREE WWTPS IN GAUTENG, SOUTH AFRICA

**Collaboration Team:** D Jambo<sup>1</sup>, T Singh<sup>1,2,3</sup>, L Molale-Tom<sup>4</sup>, A Gomba<sup>1</sup>, C Bezuidenhout<sup>4</sup>.

NIOH, Division of the National Health Laboratory Service<sup>1</sup>, Clinical Microbiology and Infectious Diseases, University of the Witwatersrand<sup>2</sup>, Department of Environmental Health, University of Johannesburg<sup>3</sup>, North West University, Potchefstroom<sup>4</sup>.

**Summary:** Studies showing evidence of SARS-CoV-2 genetic material in wastewater raised questions regarding potential transmission risks within water environments. This WRC-funded project aims to establish the extent of SARS-CoV-2 RNA presence, survival, persistence, and disinfection

efficiency in WWTPs in South Africa. In this study, samples (influent, primary sludge, activated sludge, secondary settling tank (SST) effluent, final treated effluent swab, and bioaerosol) were collected from three WWTPs. This project has made significant progress, with laboratory sample analysis completed and the preliminary results presented at several internal and external scientific fora. This initial study will serve as a basis for determining the risk implications for potentially exposed wastewater workers and the reuse of the treated wastewater. Investigations on viral infectivity are currently underway, which will aid in further elucidating the actual health risks posed to WWTP personnel.

#### HEALTH RISK ASSESSMENT IN OCCUPATIONAL SETTINGS DURING NON-POTABLE USE OF ROOF-HARVESTED RAINWATER

**Study Team:** L Singh<sup>1</sup>, C. Nkonzo<sup>1</sup>, T Singh<sup>1,2,3</sup>, A Gomba<sup>1</sup>. NIOH, Division of the National Health Laboratory Service<sup>1</sup>, Clinical Microbiology and Infectious Diseases, University of the Witwatersrand<sup>2</sup>, Department of Environmental Health, University of Johannesburg<sup>3</sup>.

Summary: Despite a wealth of scientific evidence concerning the health risks associated with the potable use of roof-harvested rainwater (RHRW), studies for non-potable uses in occupational settings are limited. Consequently, the likelihood of contamination of RHRW and the potential exposure of workers to human bacterial pathogens in occupational settings are not well defined. The continuous detection of pathogens in RHRW systems is concerning, considering that non-potable routes of exposure, like inhalation and dermal contact, are more relevant in occupational settings. With the increasing demand for freshwater resources, research focusing on the human health risks of RHRW is critical to inform guidelines and ensure the safe use of rainwater for non-potable purposes in occupational settings. Water samples were collected over a month from a commercial property in Pretoria where workers use the rainwater for showering, toilet flushing, handwashing, and as a machine coolant. Samples were analysed for total coliforms, Escherichia coli, Legionella pneumophila, and Enterococci spp. Planned work includes a quantitative microbial risk assessment to determine if a risk to the worker exists while using rainwater in their daily activities.



IMAGE 2: Photograph showing student collecting water from a RHRW tank. (Source: research team)

#### POTENTIAL HEALTH RISKS OF OCCUPATIONAL EXPOSURE TO MICROBIOLOGICAL CONTAMINANTS IN RECYCLED WATER DESTINED FOR NON-POTABLE REUSE

**Study Team:** N Mahlangu<sup>1</sup>, L Singh<sup>1</sup>, T Singh<sup>1,2,3</sup>, T Barnard<sup>4</sup>, A Gomba1.

NIOH, Division of the National Health Laboratory Service<sup>1</sup>, Clinical Microbiology and Infectious Diseases, University of the Witwatersrand2, Department of Environmental Health, University of Johannesburg,<sup>3</sup> Department of Water and Health Research Unit, University of Johannesburg<sup>4</sup>.

Summary: In water-scarce countries and regions, the reuse

of treated municipal wastewater effluents (also known as recycled water) provides one opportunity to augment limited freshwater resources for purposes that do not require drinking water quality, such as landscape and crop irrigation, industrial cooling, street cleaning, and toilet flushing, among others. However, using recycled water (RW) carries significant risks given that the source water is municipal sewage, which naturally contains a wide range of biological contaminants. Yet, studies to evaluate occupational health risks associated with RW are limited globally and almost non-existent in South Africa. Understanding the occupational health risks of wastewater exposure in different settings will help design more practical, science-based guidelines to reduce exposure and provide safe working environments. Therefore, this study aims to evaluate the health risks associated with occupational exposures to biological contaminants in recycled water for non-potable use. The WRC funds the project for a period of two years, and the student (N Mamhlangu) received funding from the Department of Science and Innovation (DSI)/Water Research Commission (WRC) Research, Development, and Innovation (RDI) Roadmap Postgraduate Student Support. Treated wastewater effluent samples will be collected from discharge points at selected WWTPs supplying RW for nonpotable reuse and along the distribution system to the point of use. Samples will be analysed for Escherichia coli, total coliforms, Enterococci spp., Legionella pneumophila, amoeba, and Salmonella spp.

#### THE INVESTIGATION OF THE ANTIMICROBIAL ACTIVITY AND EFFECTIVENESS OF SURFACE DEFENCE SD-ST DISINFECTANT ON DIFFERENT SURFACES

**Study Team:** G Sandhelani<sup>1</sup>, O Matuka<sup>1</sup>, L Muleba<sup>1</sup>, D Jones<sup>1</sup>, T Singh<sup>1,2,3</sup>.

National Institute for Occupational Health (NIOH), a division of the National Health Laboratory Service<sup>1</sup>, Department of Clinical Microbiology and Infectious Diseases, University of the Witwatersrand<sup>2</sup>, Department of Environmental Health, University of Johannesburg<sup>3</sup>.

**Summary:** The study aimed to assess the efficacy of the test disinfectant (SD-ST) on different surfaces to determine the prolonged (90 days) antimicrobial activity claimed by the manufacturer. SD-ST did not meet the SANS 51276:2011 and SANS 1853:2020 requirements of 5 log (99.999%) for ESKAPE organisms. For SARS-CoV-2, SD-ST met the SANS 53610:2011 recommendation of 99.99% (4 log) for lower concentrations (1x103 and 1x104 copies/ml) on all surfaces. In addition, the effectiveness of SD-ST deteriorated from weeks 7 to 12 (35-84 days). The results were presented at the FIDSSA Congress 2022. The study formed part of the intern medical scientist training for G Sandhleni (medical intern scientist).

#### INVESTIGATING THE APPLICATION OF UVGI TECHNOLOGY TO EFFECTIVELY DE-ACTIVATE AIRBORNE BACTERIA IN A TAXI

**Study Team:** O Matuka<sup>1</sup>, T Duba<sup>1</sup>, L Muleba<sup>1</sup>, A Bilankulu<sup>1</sup>, T Singh<sup>1,2,3</sup>, J Pheiffer-Coetzee<sup>4</sup>, M Milovanovic<sup>4</sup>. National Institute for Occupational Health (NIOH), a division of the National Health Laboratory Service<sup>1</sup>, Department of Clinical Microbiology and Infectious Diseases, University of the Witwatersrand<sup>2</sup>, Department of Environmental Health, University of Johannesburg<sup>3</sup>, African Potential Management Consultancy<sup>4</sup>.

Summary: The risk of airborne TB transmission while using public transport such as minibuses has both occupational health and public health implications in South Africa. Poor indoor air quality in minibus taxis, the most common mode of transportation, increases the risk of transmitting airborne diseases. This study aimed to determine the proof of concept of UVGI technology in reducing airborne microbial particles (Mycobacterium tuberculosis and Mycobacterium fortuitum) in a stationary, unoccupied commuter taxi using aerobiology experiments. The aim was to assess the airborne disinfection performance of the SANI 36W 12V device over a set period and equate the performance to equivalent air changes per hour and an equivalent clean air delivery rate using the decay method. The results obtained from the MTB decay test demonstrated that the device could achieve an average of 7.978 ACHe and a CADRe of 32.280 l/s for MTB and 5.005 ACHe and a CADRe of 20.252 l/s for M.fortuitum in the commuter taxi with a volume of 14.566 m<sup>3</sup>. An average 3 log reduction (99.9%) for MTB and M.fortuitum was achieved after aerosolisation. The study was commissioned and funded by the African Potential Management Consultancy (AMPC).

#### OCCUPATIONAL RESPIRATORY DISEASES ASSOCIATED WITH HAZARDOUS BIOLOGICAL AGENTS AMONG HORSE GROOMS IN SOUTH AFRICA.

**Study Team:** T Duba<sup>1</sup>, N Naicker<sup>3</sup>, T Singh<sup>1,2,3</sup>. National Institute for Occupational Health (NIOH), a division of the National Health Laboratory Service<sup>1</sup>, Department of Clinical Microbiology and Infectious Diseases, University of the Witwatersrand<sup>2</sup>, Department of Environmental Health, University of Johannesburg<sup>3</sup>.

Summary: Grooms are workers who groom horses, and their tasks include live breeding, foaling, night watch duty, raising and training horses, mucking stalls, landscaping, and performing horse maintenance. However, horse stables are reported to have high organic dust levels, posing a risk to horse grooms. Previous studies found an association between working with horses and an increased risk of respiratory symptoms and/or organic dust toxic syndrome. Some studies demonstrated that horses were exposed to high levels of endotoxin as well as (1,3)-β-D-glucan in horse stables. This study aims to determine the association between working and living conditions and respiratory diseases among horse groomers at selected horse racing centres in South Africa. In the reporting year, a scoping review was performed. In addition, stakeholder engagement meetings were held to raise awareness of the study and seek gatekeeper permission.

#### **TEACHING AND TRAINING**

Teaching and training remained a priority for the Section, and we have re-initiated some of our training programmes from pre-COVID. Various occupational health professionals, employers, and employees across several sectors were trained. Training of intern medical scientists, which is accredited with the Health Professionals Council of South Africa (HPCSA), continued, and support was provided to the NHLS medical technologist training for a third year. The training prepares this cadre for employment in medical laboratories. The Section also supported occupational health curricula for various universities (e.g., Diploma in Occupational Health for the Universities of KwaZulu-Natal, Pretoria, and the Witwatersrand) and the Southern African Institute for Occupational Hygiene (SAIOH). The Section staff continued to receive recognition for their expertise and contributions to the field.

#### FORMAL TRAINING COURSE/WORKSHOP

The Section's Occupational Allergy Unit hosted an Occupational Allergy and Asthma short course (28 February – 2 March 2023). The course aimed to introduce Occupational allergic respiratory and skin diseases and the diagnosis thereof for nurses. Specialists from the NIOH Occupational Medicine Section and from the Division of Occupational Medicine and Centre for Environmental and Occupational Health Research, School of Public Health, University of Cape Town, participated in the programme. The course was attended by 14 delegates, primarily occupational health nurses. Positive feedback was received, and plans are in motion to host a similar course in the next financial year.

#### **PROFESSIONAL DEVELOPMENT**

Staff supervised post-graduates enrolled for various degrees at the University of Witwatersrand (1 PhD, 1 honours), University of Johannesburg (1 MTech, 10 MPH, 1 PhD), and University of North-West University (1 MSc). Staff also contributed to the supervision of four intern medical scientists.

#### SURVEILLANCE

The Section continued its occupational allergy disease surveillance activities, including its efforts to monitor trends in common allergens and the most common industries' referring patients.

## INFORMATION SHEETS & AWARENESS ACTIVITIES

Occupational health initiatives to heighten awareness of infection prevention and control resulted in increased queries related to mould contamination in the workplace. Key initiatives are listed below:

- Video entitled 'debunking the myths of handwashing' to raise awareness on international handwashing day. The video was shared via email to NHLS staff and on Twitter and YouTube. https://twitter.com/nioh\_sa status/1522127828854181888?t=OwgBKK4Cat1Aune5 waSeiA&s=19
- Video entitled 'Molds in the workplace' to raise awareness of occupational exposure to mould during fungal disease awareness week (19-23 September). This promotional item included 5 videos:
- Awareness of mould in the workplace: https://www. nioh.ac.za /wp-content/uploads/2022/09/Mold\_Video\_Part\_I.mp4
- Sources of mould: https://www.nioh.ac.za/wp-content/ uploads/2022/09/Mold\_Video\_Part\_II.mp4
- 3. Health effects: https://www.nioh.ac.za/wp-content/ uploads/2022/09/Mold\_Video\_Part\_Ill.mp4
- 4. Workplace at risk: https://www.nioh.ac.za/wp-content/ uploads/2022/09/Mould\_Video\_Part\_IV.mp4
- 5. Laboratory testing: https://www.nioh.ac.za/wp-content/ uploads/2022/09/Mold\_in\_the\_Workplace\_V.mp4

#### INFORM

- FS Maoko fulfilled all the requirements for a Microbiology Internship under the discipline of Medical Biological Science effective 12 April 2022, and is approved to register as a Medical Biological Scientist in Microbiology-Independent Practice.
- L Muleba graduated with a Masters in Technology from the University of Johannesburg 11 May 2022. Her research focused on the "Assessment of anti-bacterial effectiveness of hand sanitisers commonly used in South Africa".
- G Sandheleni fulfilled all the requirements for a Microbiology Internship under the discipline Medical Biological Science effective 22 November 2022, and is approved to register as a Medical Biological Scientist in Microbiology–Independent Practice.
- E Poopedi (a PhD student) was selected among 1500 applications to join the Global Young Scientists Summit (GYSS) 2023 online from 17 – 20 January 2023.



IMAGE 3: Photograph of delegates at the Occupational Allergy short course practical day. (Source: training team)

# <section-header>



#### HEAD PROF NISHA NAICKER

## EPIDEMIOLOGY AND SURVEILLANCE SECTION

The Epidemiology and Surveillance section studies and analyses the patterns, causes, and effects of occupational exposures on morbidity and mortality in occupational settings. The Section supports internal and external OHS stakeholders in research methodology and analyses of data to understand the risk factors and health outcomes associated with occupational and environmental exposures. This is important in establishing the burden of occupationally related diseases over time and allows for the planning and management of occupational diseases and injuries in South Africa.

#### SURVEILLANCE AND SERVICES

Technical research support is provided to all the NIOH sections and external clients in the public sector (national, provincial departments, parastatal departments, and science councils) and the private sector. Assistance is provided for study design, sample size determination, project management, data collection, data entry, data analysis, and scientific writing.

#### SERVICES

- 1. In 2022/2023, the Epidemiology team assisted the Gauteng Department of Health in several projects. The Gauteng Staff Satisfaction Survey is an annual survey conducted by the Employee Health and Wellness Programme (EHWP) Directorate. The Epidemiology Section staff designed the survey and produced reports per health facility for the directorate. Recommendations based on the results were made to each of the 42 participating health facilities. Overall, staff were satisfied with their work, although there were 14 facilities with percentages below satisfaction. Staff suggested that overall job satisfaction would improve with more equipment, training, and better management.
- A report was produced for the Gauteng Provincial Government describing the proportion of absences due to sickness, the proportion of absences due to COVID-19, and the distribution of disease conditions in men and women working at the Gauteng Provincial Government (Dr C Nyuyki, Dr D Ngubeni, Ms M Menze, Prof M Zungu).

- 3. The Epidemiology section provided support to the Minerals Council South Africa (Dr N Tlotleng, Dr KS Wilson, Ms L Monaiwa, Ms A Mkulisi and Dr C Nyuyki). The Minerals Council South Africa's Annual Milestone reports were compiled, and a three-year contract was signed with remuneration for the analysis and production of the reports. Three annual reports were compiled for the 2022 year for three key indicators: 1) The Masoyise Health Programme (MHP) report for compliance monitoring, the treatment and prevention of TB, HIV and Non-communicable Diseases (NCDs) across mining companies; 2) The Occupational Medicine Report for compliance and the reporting of occupational lung diseases (silicosis and pneumoconiosis); and 3) The Occupational hygiene milestone performance report on targets on noise, coal dust, silica dust, and platinum dust exposure measurement.
- 4. The Epidemiology Section (Dr KS Wilson, Mr V Ntlebi, and Dr C Nyuyki) provided support to two other NIOH sections in setting up internal surveillance programmes for all patients who visit the clinics. The Section produced the surveillance reports for the three internal surveillance systems at the NIOH, viz: PATHAUT, the autopsy database on occupational respiratory diseases at autopsy in miners; the Occupational Medicine annual surveillance report on occupational diseases diagnosed in the Occupational Medicine Section clinic; and the annual Occupational Allergies Report on allergies and conditions diagnosed by the Immunology Allergy Clinic.
- 5. The Epidemiology Section (Dr KS Wilson and Dr C Nyuyki) compiled a brief literature review on occupational reproductive health for the Casual Advice Workers Office, focusing on workers in a distillery and alcohol packing plant and a snack foods company. The review covered common reproductive health issues related to expected exposures at the two companies

#### SURVEILLANCE PROGRAMMES

South Africa does not have an optimally functioning national occupational health surveillance programme. However, the NIOH has implemented the following surveillance systems:

#### OCCUPATIONAL HEALTH SURVEILLANCE SYSTEM (OHSS)

**Study Team:** N Tlotleng<sup>1</sup>, N Naicker<sup>1,2</sup>, R Naidoo<sup>3</sup>, L Monaiwa<sup>1</sup>, A Jekwa<sup>1</sup>, V Ntlebi<sup>1</sup>, M Rambau<sup>1</sup>, J Mtsweni<sup>4</sup>, M Zungu<sup>1,5</sup>, S Kgalamono<sup>1</sup>, B Kistnasamy<sup>6</sup>, M Jeebhay<sup>7</sup>. National Institute for Occupational Health a division of the National Health Laboratory Service, South Africa<sup>1</sup>; University of Johannesburg, South Africa<sup>2</sup>, Discipline of Occupational and Environmental Health, University of Kwa-Zulu Natal, South Africa<sup>3,4</sup> Council for scientific and Industrial Research<sup>4</sup>, School of Health Systems and Public Health, University of Pretoria, South Africa<sup>5</sup>, National Department of Health, South Africa<sup>6</sup>; Occupational Medicine Division, University of Cape Town, South Africa<sup>7</sup>.

The occupational health surveillance system was initiated to monitor COVID-19 infection across workplaces in South Africa as well as to understand post-infection and return to work outcomes. Over the one-year period of data submission, COVID-19 cases by industry and occupation, commonly reported symptoms across workplaces, and employee vulnerabilities by job category in industrial sectors were reported. Two reports on OHSS have been published (bi-annual and annual report), and these are available on the NIOH website for stakeholders: https://www.nioh. ac.za/covid-19-information-resources/occupational-healthsurveillance-system-ohss-business-portal/

Non-compliance by workplaces to register and submit COVID-19 data was a huge limitation for the OHSS as a reporting tool, with the number of workplaces registered on the OHSS accounting for about 12% of registered workplaces in SA. The OHSS was officially closed on 31 December 2022, and a final report on all data submitted was released on 30 April 2023. A survey was sent out to stakeholders to assess their perceptions of the use of the OHSS.

#### THE OCCUPATIONAL HEALTH AND SAFETY INFORMATION SYSTEM (OHASIS) IN THE NHLS

**Study Team:** KS Wilson<sup>1</sup>, D Jones<sup>1</sup>, V Ntlebi<sup>1</sup>, N Sanabria<sup>1</sup>, J Joseph<sup>1</sup>, G Chin<sup>1</sup>, N Tlotleng<sup>1</sup>.

National Institute for Occupational Health a division of the National Health Laboratory Service, South Africa<sup>1</sup>.

OHASIS is an online reporting tool for all NHLS injuries and diseases related to the work environment. Ongoing analyses of this data set from 2012 to date have commenced and will form part of the internal NHLS surveillance programme. From this system annual reports with in-depth analyses are created on injury and disease prevalence, identifying common injuries, and the prevalence of occupational disease in the NHLS by the Epidemiology Section. The COVID-19 case and vaccination data was used to create monthly and then bi-monthly epidemiological reports on the prevalence in the NHLS and the prevalence in NHLS occupational groups during the pandemic.

#### HOSPITAL SURVEILLANCE ON COVID-19 – NATIONAL HEALTHCARE WORKER ADMISSIONS AND MORTALITY

**Study Team:** N Tlotleng<sup>1</sup>, J Ramodike<sup>1</sup>, A Mkulisi<sup>1</sup>. National Institute for Occupational Health a division of the National Health Laboratory Service, South Africa<sup>1</sup>.

The NIOH received data from the daily hospital surveillance for COVID-19 admissions (DATCOV) initiated by the National Institute for Communicable Disease on 1 April 2020. Data are submitted by public and private hospitals that have agreed to report COVID-19 admissions through DATCOV surveillance in all nine provinces of South Africa. Health Care Worker data is extracted, analysed, and the trends in admissions, demographic profiles, health outcomes based on severity of disease, and vaccine impact on HCW admission and mortality are reported in the monthly surveillance reports. Reports can be downloaded from https://www.nioh.ac.za/covid-19-occupational-healthsurveillance/.

The last report for the DATCOV HCW admission was on the 31 December 2022.

#### NATIONAL OCCUPATIONAL MORTALITY SOUTH AFRICA SURVEILLANCE

**Study Team:** KS Wilson<sup>1</sup>, N Tlotleng<sup>1</sup>, V Ntlebi<sup>1</sup>, C Nyuyki<sup>1</sup>, A Mkulisi<sup>1</sup>, J Ramodike<sup>1</sup>, N Naicker<sup>1</sup>. National Institute for Occupational Health, a division of the National Health Laboratory Service, South Africa<sup>1</sup>.

In the absence of a national occupational injury and disease surveillance system, the Epidemiology Section staff use the annual mortality data for South Africa, released by Statistics South Africa, to investigate the role of occupation in common diseases and occupational diseases and produce surveillance reports. The disease-specific reports are limited to the years 2013-15 due to the required level of occupation coding provided by Stats SA. Six reports were produced this year on Occupation and Road Injuries, Interpersonal Violence, Haematological Disorders, Malignancies, Liver Disease, and Cardiovascular Disease. These are published on the NIOH website for public dissemination.

#### **RESEARCH AND/OR SPECIAL PROJECTS**

The Section conducts primary research, research commissioned by governmental, parastatal, and private organisations, as well as secondary data analyses.

#### EVALUATION OF THE COVID-19 OCCUPATIONAL HEALTH SURVEILLANCE SYSTEM IN SOUTH AFRICA, 1 OCTOBER 2020 - 31 OCTOBER 2021

**Study Team:** A Chatika<sup>1</sup>, N Tlotleng<sup>1</sup>, T Zwane<sup>2</sup>, L Kuonza<sup>2</sup>, N Naicker<sup>1</sup>.

*Epidemiology and Surveillance Section, National Institute for Occupational Health*<sup>1</sup>, *Public Health Surveillance, National Institute for Communicable Diseases*<sup>2</sup>, - a Division of the NHLS.

#### Funding: NIOH

**Summary:** Conducting a surveillance system evaluation has proven to be an effective means of improving health surveillance systems, globally and in South Africa. The project will be undertaken by a Field Epidemiology student and will aim to evaluate the Occupational Health Surveillance System following the Centers for Disease Control and Prevention (CDC) guidelines. Attributes that may influence the efficient submission of COVID-19 data related to workplaces will be evaluated. A report will be compiled and submitted to the South African Field Epidemiology Training Programme (SAFETP) and will also be distributed to relevant stakeholders in the systems.

#### EVALUATION OF PSYCHOLOGICAL DISTRESS IN GAUTENG PUBLIC HEALTH CARE WORKERS DURING THE COVID-19 PANDEMIC

**Study Team:** KS Wilson<sup>1</sup>, A Chatika<sup>1</sup>, C Bernstein<sup>2</sup>, C Nyuyk<sup>1</sup>, J Spiegel<sup>3</sup>, A Yassi<sup>3</sup>.

Epidemiology and Surveillance Section, National Institute for Occupational Health - a Division of the NHLS<sup>1</sup>; University of the Witwatersrand, South Africa<sup>2</sup>; The University of British Columbia, Canada<sup>3</sup>.

#### Funding: University of British Columbia

**Summary:** A longitudinal survey was conducted in selected public health facilities in Gauteng, where all staff were invited to participate. Psychological distress was determined using the well-established tool, the General Health Questionnaire 12. Brief facility reports were prepared for the 15 facilities that participated. As part of an intervention, two posters were developed with links to organisations providing psychological support and links to recommended online resources. These were shared with the Employee Health and Wellness Programme (EHWP) Directorate. An analysis of psychological distress from one facility has been published: https://pubmed.ncbi.nlm.nih.gov/35955078/ and three students have completed their manuscripts on topics from the project, which will be submitted for publication.

#### REDUCTION OF SILICOSIS IN THE NON-MINING SECTOR

**Study Team:** N Naicker<sup>1</sup>, D Rees<sup>1</sup>, KS Wilson<sup>1</sup>, N Ndaba<sup>1</sup>, J Manganyi<sup>1</sup>, D Bouwer<sup>2</sup>, Z Ndlovu<sup>2</sup>, E Musenge<sup>2</sup>, S Kgalamono<sup>1</sup>, F Magweregwede<sup>3</sup>.

National Institute for Occupational Health, a division of the National Health Laboratory Services, Johannesburg, South Africa<sup>1</sup>, School of Public Health, University of Witwatersrand<sup>2</sup>, Council for Scientific and Industrial Research<sup>3</sup>.

Funding: National Department of Employment and Labour

**Summary:** This project was commissioned by the Department of Employment and Labour with the aim of providing baseline information on silicosis prevalence and silica-related death trends in the non-mining industrial sectors and to develop a strategy and occupational health programmes that will be used towards reducing exposure to silica and eliminating silicosis in South Africa by 2030. The NIOH, the Wits School of Public Health, and the Council for

Scientific and Industrial Research are collaborators on this project. The project commenced in 2021, and the final stages of data collection are in progress.

#### COVID-19 SURVEILLANCE IN A HEALTH CARE WORKER POPULATION: USE OF INFORMATION SYSTEMS, EXPERIENCES OF COVID-19 AND VACCINE UPTAKE AND HESITANCY

**Study Team:** N Naicker<sup>1,2</sup>, K Wilson<sup>1</sup>, N Sanabria<sup>1</sup>, D Jones<sup>1</sup>, G Chin<sup>1</sup>, J Spiegel<sup>2</sup> A Yassi<sup>3</sup>.

National Institute for Occupational Health - a Division of the NHLS<sup>1</sup>, University of Johannesburg<sup>2</sup>, The University of British Columbia, Canada<sup>3</sup>

**Funding:** Funding was obtained from the University of Johannesburg COVID-19 GES4.0 grant in 2022

**Summary:** This survey aimed to describe occupational health and safety in health workers within the NHLS in terms of perceptions, experiences, training, and reporting behaviour during COVID-19 and assessed vaccine uptake and hesitancy. Data collection was completed in November 2022. Only 29% of all participants selected completed the survey, indicating a poor response rate. The data is being analysed, and a report and manuscript is being written up.

#### **TEACHING AND TRAINING**

The Section continues its teaching and training on undergraduate and postgraduate academic programmes within the NIOH and at Wits University, the University of Johannesburg, and the University of Pretoria. All researchers in the Section are reviewers for international and national peer-reviewed indexed journals such as BMC Public Health, IJERPH, PLOS One, Environmental Research, etc., and a few serve as editors for SAMJ, PLOS ONE, BMC Public Health, and Frontiers of Public Health. In addition to serving as supervisors for postgraduate students, the staff are also examiners of Masters and PhD dissertations at academic institutions across South Africa.

In 2022/2023 financial year we contributed to the following programmes:

#### **UNDERGRADUATE**

- Lecture on determinants of health provided to GEMP 2 students School of Public Health, University of the Witwatersrand.
- Honours student project supervision and moderation.

#### POSTGRADUATE

- Provision of lectures in the Field Epidemiology Training Programme (SAFETP) for NICD and the University of Pretoria.
  - Overview of the Occupational Health Surveillance System" during a Disease Surveillance module to SAFELTP students.
- Dr Wilson and Prof Naicker form part of the postgraduate (Masters and PhD) assessor's committee at the School of Public Health, University of Witwatersrand.

- The Section was invited as a coordinator during a Research development module to MSc students at the School of Public Health, University of the Witwatersrand
- Lectures were conducted for the Occupational Medicine Diploma at the University of Pretoria on:
  - Health measurements I and II (Dr N Tlotleng);
  - Literature review for postgraduate students (Dr C Kufe); and
  - Occupational Outbreak Investigations (Dr KS Wilson)
- On 1 to 5 August 2022, the Section taught the Occupational Epidemiology module for the Diploma in Occupational Health at the University of Witwatersrand.
- Dr Nonhlanhla Tlotleng presented a lecture on "Translating research into Policy- evidence based research" at Sefako Mokgatho University for 2nd year MPH students on the 20 February 2022.
- Facilitation of University of Johannesburg Master of Public Health online modules in Epidemiology and Biostatistics Research Methodology and the Minor Dissertation Modules A to I.
- In addition, staff also support students from the NIOH with their project development and data cleaning and analyses.
- Currently the Section is hosting a FELTP student, a PhD candidate, and a Department of Science and Innovation (DSI) Human Sciences Research Council (HSRC) Intern.

# TRAINING FOR OCCUPATIONAL HEALTH STAKEHOLDERS

- The Section presented at the NIOH training webinar on the Occupational Health Surveillance System on several occasions to all businesses registered in the database.
- The Section facilitated an internal training to NIOH staff on Introductory Epidemiology and Biostatistics.

 A lecture on "The role of Epidemiological Research in preventing disease in the workplace was provided to stakeholders at the Gauteng Provincial Government Occupational Health and Safety Imbizo in January 2023.

#### **PROFESSIONAL DEVELOPMENT**

## Postgraduate (Diploma, Honours, Masters and Doctoral) research supervision:

The Section is currently supervising Postgraduate students:

- 1 Diploma in Occupational Medicine,
- 28 Master of Public Health (MPH),
- 5 Master of Science (MSc), and
- 7 Doctoral (PhD) students.

The topics range from occupational health and safety in various industries such as mining and the healthcare sector to environmental health, public health, and clinical medicine.

#### HONOURS

Dr CN Kufe obtained his PhD from Wits University on 12 December 2022.

Title of Thesis: Insulin sensitivity and response in middle-aged Black South African men and women: Associations with body fat distribution, menopause and objectively measured physical behaviours.

This thesis examined the differences in risk markers for type 2 diabetes (T2D) between middle-aged Black South African men and women, and between women at different stages of menopausal transition. It also examined sexspecific associations between these risk markers and body composition and objectively measured physical behaviours. In the publications emanating from this thesis, the work showed that with increasing adiposity, the men may be at higher risk of T2D than women, and engaging in active behaviours reduces T2D risk in men and women.

# OCCUPATIONAL HYGIENE SECTION

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#### HEAD MS JEANNETH MANGANYI

## OCCUPATIONAL HYGIENE SECTION

Occupational Hygiene refers to the anticipation, identification/recognition, evaluation, and control of workplace hazards, achieved through assessments and the recommendation of practical and cost-effective exposure control measures. The NIOH Occupational Hygiene Section performs a unique function within the institution by addressing occupational health hazards and promoting the health and well-being of internal and external clients. These functions are made possible by ongoing efforts to maintain the quality management system and recruit experienced technical personnel. In addition to performing exposure assessments, the Section provides research, training and teaching, non-medical sample analyses, and advisory support to stakeholders to fulfil the Institute's mandate.

#### SERVICES

The Occupational Hygiene Section maintained its accreditation under ISO/IEC 17020, following a successful third surveillance assessment in May 2022. The Section also maintained registration with the Department of Employment and Labour as an Approved Inspection Authority (AIA) and a Type C Inspection Body to provide occupational hygiene services to the private sector and its parent organisation, the NHLS. The X-Ray Diffraction (XRD) Laboratory also maintained accreditation under ISO/IEC17025 after a surveillance assessment in November 2022.

The Section's Asbestos Laboratory continued participating in the Asbestos Fibre Regular Informal Counting Arrangement (AFRICA) proficiency testing scheme run by the Institute for Occupational Medicine (IOM) in Edinburgh, UK. The laboratory participated in two rounds of proficiency testing and maintained a performance of a "1" rating in both rounds. The XRD/FTIR laboratory participated in the Air and Stack Emissions Proficiency Testing Scheme run by the Health and Safety Laboratory in the UK, and administered by the LGC group and obtained satisfactory ratings for all samples analysed. The proficiency test results continue to show the reliability of the results obtained from these laboratories.

#### EXPOSURE ASSESSMENTS

The Section continued to conduct exposure assessments at selected NHLS laboratories and risk assessments and

exposure assessments at the Department of Correctional Services as part of an existing service level agreement. The Section continued to contribute to patient reports on clinical health assessments by conducting workplace walkthrough assessments.

As indicator owner of the NIOH Annual Performance Plan (APP) KPI on occupational health and safety risk and exposure assessments, the Occupational Hygiene Section is responsible for keeping a record of the assessment reports it produces and reports compiled by other sections. The APP's annual target was exceeded, resulting in a positive variance. The Immunology and Microbiology Section and the Occupational Medicine Section's Ergonomics Unit contributed to reports compiled during the reporting year. Some of these reports are legal records that the Department of Employment and Labour requires as part of the employer's duties.



IMAGE 4: Noise monitoring at a biosafety cabinet at the NIOH Microbiology / Immunology Section.

#### **SAMPLE ANALYSES**

The XRD/FTIR and Asbestos laboratories analysed nonmedical samples, supporting the accredited scope of exposure assessment work performed by AIAs. Both laboratories analysed samples as part of service delivery, research support, and their participation in proficiency testing schemes. Following ISO/IEC 17025 accreditation, the number of samples analysed by the XRD Laboratory as part of service delivery continued to increase.

#### **RESPIRATOR FIT TESTING**

The Section continued to raise awareness of the positive contribution of respirator fit testing to employee protection through service delivery, research, training, and presentations on various platforms, including the NHLS and external clients. Respirator fit testing is a crucial component of a respiratory protection programme since it assists in matching the suitable respirator size or style to a specific individual's face to ensure that the necessary protection is obtained. Failure to confirm respirator fit using this test may give workers a false sense of security in the workplace, increasing their risk of exposure even when workers are issued proper respirators for the hazard.



IMAGE 5: Conducting respirator fit-testing at a private client.

#### **ADVISORY SUPPORT**

Occupational Hygiene staff continued to participate in various committees and strategic meetings, including professional and technical committees of the NIOH Occupational Health Outbreak Response Task Team (OHORT), SAIOH, Workplace Health Without Borders (WHWB), the Department of Employment and Labour, and SANAS. Activities performed included developing and reviewing training content for the NIOH OHORT, reviewing legislation, and providing expert input during participation in various strategic meetings.

The Section also plays a crucial role in outbreak response requests by government departments. One example was a response to the Tambo Memorial Hospital fire incident, where several staff members passed on and some departments burned down. The Section advised on the principles of indoor air quality and various measures that could be taken following the structure repairs to aid in the safe return of employees to their respective departments.

The Section responded to many inquiries regarding Occupational Hygiene training, health risk assessment, and concerns regarding potential asbestos exposure in both community and workplace settings. The Section offered technical advisory services to the National Social Security Authority (NSSA) of Zimbabwe and delegates from Malawi and Zambia as part of its ongoing support to the African Union Development Agency (AUDA-NEPAD). Further support was given to the Gauteng DoEL Provincial Management Committee to enhance awareness of the Basic Principles of Occupational Hygiene.



IMAGE 6: Hosting a delegation from Malawi and Zambia as part of ongoing support to AUDA-NEPAD.

#### RESEARCH

Many previously reported projects have progressed well during the reporting period, with two projects forming part of the academic research, in the final data processing and finalisation stages. The Section initiated two projects during the period under review. These are listed below:

#### A COMPARISON OF THE AMENDED OCCUPATIONAL EXPOSURE LIMITS (MAXIMUM LIMITS) PROMULGATED IN THE REGULATIONS FOR HAZARDOUS CHEMICAL AGENTS WITH INTERNATIONAL LIMITS AND THE ANTICIPATED IMPACT ON THE SOUTH AFRICAN INDUSTRY

**Study Team:** K du Preez<sup>1</sup>, N Claassen<sup>2</sup>. Occupational Hygiene Section, National Institute for Occupational Health, a Division of the NHLS<sup>1</sup>; University of Pretoria<sup>2</sup>. **Summary:** A study was conducted to identify exposure limits (maximum limits) that were lowered by more than 50% and investigate the impact they may pose on the industry. Limit values were compared with international limit values included in the online GESIS-ILV database. The revision of maximum limit values improved the alignment of South African occupational exposure limit values with international limit values, which translates into better protection of the workforce from occupational diseases. The study was successfully completed.

#### EVALUATION OF RESPIRABLE CRYSTALLINE SILICA EXPOSURE LEVELS IN SELECTED NON-MINING SUBSECTORS IN GAUTENG

**Study Team:** G Mizan<sup>1,2</sup>, L Ntlailane<sup>1</sup>, K du Preez<sup>1</sup>, J Shai<sup>1</sup>, N Makhubele<sup>1</sup>, T Nthoke<sup>1</sup>, D Singo<sup>1</sup>, L Sebola<sup>1</sup>, J Manganyi<sup>1,2</sup> Occupational Hygiene Section, National Institute for Occupational Health, a Division of the NHLS<sup>1</sup>;<sup>2</sup>University of the Witwatersrand<sup>2</sup>.

Collaborators: CSIR, NIOH and WHC

**Funding:** South African Department of Employment and Labour

**Summary:** This cross-sectional study aims to conduct a workplace respirable crystalline silica (RCS) exposure assessment in selected high-risk non-mining subsectors. A study protocol was developed, and ethics clearance was obtained from the University of the Witwatersrand. The study is in the planning stages for data collection. The study will describe exposure levels and suggest control measures to reduce exposure, therefore contributing to the workplace risk management process.

#### **TEACHING AND TRAINING**

The Occupational Hygiene Section continued to support academic teaching activities to facilitate capacity building. The academic institutions supported include the University of Johannesburg, the Wits University MSc (Exposure Science) and Postgraduate Diploma in Occupational Health (PG DOH) students, the University of Pretoria Diploma in Occupational Medicine and Health students, and students from Tshwane University of Technology's Department of Environmental Health. The Section supervised postgraduate students at various universities, including a review of research protocols. The Section continued to provide tutorials to Occupational Medicine registrars regarding occupational hygiene principles and measurement techniques.

The Section is one of the nine Approved Training Providers (ATPs) in South Africa to provide internationally recognised occupational hygiene modules. The Section presented the "Basic Principles in Occupational Hygiene" module as hybrid training to OHS delegates, with some attending in person at the NIOH premises and eleven attending online from various African countries, including Zambia, Tanzania, the Democratic Republic of the Congo, and the Ivory Coast.

#### HONOURS

Ms J Manganyi, Head of the NIOH Occupational Hygiene Section, received an award for Personality of the Year. This award is given to a SAIOH member in recognition of noteworthy efforts made nationally and/or internationally to promote occupational hygiene and/or SAIOH as an organisation.

Ms K du Preez, Technical Manager of the Occupational Hygiene Section, Approved Inspection Authority, has been nominated as SAIOH Vice President for 2023 and 2024.



IMAGE 7 (A AND B): Collecting airborne particulate samples in a community located in close proximity to gold mine tailing dumps.
# QUALITY ASSURANCE DEPARTMENT

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#### HEAD MR BONGINKOSI DUMA

## QUALITY ASSURANCE DEPARTMENT

Quality management in the NIOH has gone from strength to strength despite some challenges faced in the laboratories. The main challenges experienced were staff turnover and equipment breakdowns. The delays in the procurement of reagents and equipment and the renovation of laboratories had an impact on the scope. The NIOH is still accredited with all four standards: ISO 15189 (medical laboratories), ISO 17025 (testing laboratories), ISO 17020 (inspection bodies) and ISO 9001:2015 (quality management) and has managed to maintain all standards for the period under review.

During this financial year, the NIOH was awarded a certificate by the National Quality Awards for maintaining accreditation for 10 consecutive years in both internal and external audits. The NIOH remains the only institute in South Africa and Africa to hold and maintain an unprecedented four different accreditation standards.









#### SERVICES

Internal audits are conducted on an ongoing basis to ensure that quality management systems are maintained. This process includes personnel checks, calibration, and guality systematic checks. The Quality Assurance Department provides pre-SANAS internal audits, training, and support to the NHLS laboratories, including proficiency testing scheme guidance to staff. Quality Assurance is also responsible for coordinating external audits from SANAS and other different external clients for the NIOH. The Department ensures that all NIOH laboratories and other non-technical areas receive the necessary support to ensure that quality management systems are implemented, maintained, and upheld. The NIOH Quality Department also provides support to the NHLS laboratories to obtain SANAS accreditation for their quality management systems and technical competence. These laboratories are assisted with pre-assessments for SANAS audits, gap analyses, internal audits, Committee for Evaluations and Technical Function (CEFT) evaluations, and quality assurance training. The NIOH continued the provision of support for internal audits and the equipment tender process for the KwaZulu-Natal Public Health Laboratory, as well as assistance to the NICD for ISO 17025 and ISO 9001 implementation, respectively.



IMAGE 8: Quality Assurance staff (Left to right): Ms Musa Mokolokolo, Ms Naledi Mangqalaza, Ms Kebareileng Mogari and Mr Bonginkosi Duma.

#### **QUALITY ASSURANCE TRAINING**

The Quality Assurance Department has also provided internal training on a number of topics for the 2022/23 Financial Year. These topics ranged from identification of non-conformities, corrective and preventive action, continual improvement, root cause analysis, and risk management, to mention a few. Auditor witnessing is an important component of quality training. The Department trained and witnessed different auditors from the NHLS pre-SANAS, SHE auditors, and a technical auditor from the NIOH and the NHLS to ensure the completeness of audits.

#### **PERFORMANCE INDICATOR**

TABLE 2: Use of Quality Indicators (Turn Around Time (TAT), EQA, Specimen Rejection, IQC).

Departments	QI	Achieved	Target
Immunology/Microbiology (15189 & 17025)	TAT	98.8%	>85%
	EQA	91.7%	>80%
	IQC	100%	>80%
	CS	100%	>80%
Pathology	TAT	85.5%	>80%
	EQA	85.1%	>80%
	IQC	88%	>80%
	CS	100%	>95%
Analytical Services (15189 & 17025)	TAT	82.5%	>85%
	EQA	84%	>80%
	IQC	100%	>80%
	CS	100%	>95%
Occupational Hygiene (17020 &17025)	EQA	100%	>80%
	IQC	100%	>80%
	TAT	100%	>80%
	CS	100%	>80%

#### **SERVICE TO OTHER NHLS ENTITIES**

#### **Forensic Laboratories**

The NIOH Quality Assurance Department led a baseline audit at all the recently acquired Forensic laboratories to monitor compliance with ISO 17025. All Forensic auditors were first trained at the NIOH prior to conducting audits. The audited laboratories are based in Cape Town, Durban, Johannesburg and Pretoria. A 56-page report has been compiled and submitted to the NHLS Academic Affairs Research and Quality Assurance Department, highlighting the areas of concern and improvement.



IMAGE 9: QA Auditors (Left to right-R): Ms Musa Mokolokolo, Mr Bonginkosi Duma, Mr Henry Julius, Mr Matumi Maphogo and Ms Kebareileng Mogari.

#### TABLE 3: Accreditations for the period under review.

Accreditation	Region	Lab No	Laboratory name	Discipline/Scope
ISO5189 NIOH	NIOH	M0276	Analytical Services	Inorganic Chemistry
		M0276	Analytical Services	Organic Chemistry
	M0276	Immunology/Microbiology	Immunology	
		M0276	Pathology	Histology
		M0276	Pathology	Cytology
	·			

ISO17025	NIOH	T0660	Analytical Services	Water testing: mercury
		T0660	Analytical Services	Water testing: aluminium
		T0660	Occupational Hygiene	Environmental methods:
		T0660	Immunology/Microbiology	Microbiology: MTB
		T0660	Immunology	Water testing: Micro

ISO17020	NIOH	OH0079	Occupational Hygiene	Asbestos
		OH0079	Occupational Hygiene	Lead
		OH0079	Occupational Hygiene	Noise-Induced-Hearing-Loss
		OH0079	Occupational Hygiene	Hazardous Chemical Agents
ISO9001	NHLS-NIOH	Z19/21021	National Biobank	Biobank

#### **PROFESSIONAL DEVELOPMENT**

Ms Musa Mokolokolo qualified as a Southern African Auditor and Training Certification Authority (SAATCA) ISO 9001 auditor.

# HIV AND TB IN THE WORKPLACE UNIT

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#### HEAD PROF MUZIMKHULU ZUNGU

## HIV AND TB IN THE WORKPLACE UNIT

#### SERVICES

The Republic of South Africa (RSA) has, since the democratic dispensation in 1994, developed progressive legislation for occupational health and safety (OHS) in line with the International Labour Organization (ILO)'s Convention 155 of 1981. However, it has yet to develop a comprehensive national policy on OHS, which would guide the course of action to be adopted by organisations or individuals in order to achieve rational goals for OHS. This is despite the limited access to OHS services for both formal and informal economy workers in South Africa, at less than 15% access overall.

Thus, the HIV/TB in the workplace unit (herein referred to as 'the unit') uses HIV and TB as an entry point into assisting workplaces, including the government, in occupational health policy, systems and programme development, and implementation. The unit's reach to industries and government services is limited by resources, and as such, its projects do not always cover all industries and or government services.

#### **SERVICE DELIVERY**

#### 1. Coronavirus disease 2019 (COVID-19) in the workplace

The 2022/23 financial year was a better year for activities related to the COVID-19 pandemic, as our activities declined substantially with the following remaining:

- We provided strategic leadership, overall management and participated in some activities for the NIOH, National Economic Development and Labour Council (NEDLAC), and the Department of Employment and Labour (DoEL) COVID-19 legacy programme.
- Provided technical support to the Gauteng Premier's Advisory Committee on COVID-19 (PACC), which has since been suspended following the changes in the political leadership of the Gauteng Provincial Government.
- Provided advisory and technical support to the Gauteng and Mpumalanga Provincial Departments of Health's COVID-19 programmes for health workers.

- 2. Occupational Health policy, systems, and programmes including HIV TB in the workplace
- Health sector: The unit continues to provide advisory occupational policy, systems, and programme expertise to the Gauteng Provincial Department of Health (GPDoH), the Mpumalanga Provincial Department of Health (MPDoH), and the North West Provincial Department of Health (NWDoH). In both the GPDoH and the MPDoH, the unit supported the implementation of the WHO and the ILO's HealthWISE Tool, as well as the introduction, implementation, and utilisation of the Occupational Health and Safety Information System (OHASIS).
- Construction industry: The unit continues to serve on an advisory basis in the OHS meetings of the construction industry with the Master Builders Association North. Our role in these quarterly meetings is to provide support on occupational health issues pertinent to the industry, and where appropriate, advice on new developments related to occupational health for the sector.
- **Informal Economy:** The unit, in collaboration with the ILO, commemorated the 2023 World TB Day with the launch of its informal economy information, education, and communication (IEC) materials in Rustenburg, North West Province.
- Organisational management: The unit provided management and strategic support to the office of the Executive Director, NIOH/NHLS, including the planning for PathRed 2023 and NAPHISA-related activities.
- As an honorary staff member at the Walter Sisulu University (WSU), we are collaborating with the Nelson Mandela University, Fort Hare University, Rhodes University, and the Eastern Cape Department of Health in efforts to establish a South African Population Research Infrastructure Network (SAPRIN) node in the Eastern Cape Province.
- 3. Information, Education and Communication resources
- Video on informal economy workers:

The video clip focuses on the three pandemics that have collided (HIV, TB, and COVID-19), not only generally but in the workplace. It provides information to informal workers on the prevention of these pandemics. For the full video, please follow the link: https://www.youtube. com/watch?v=ZC\_AeXSop7M.

#### Posters/information leaflets

The unit led and/or participated in the development of several IEC materials including Tuberculosis in Ceramic Factory Workers, Workplace HIV and TB for Educators (https://www.nioh.ac.za/wp-content/uploads/2023/04/ Workplace\_HIV\_and\_TB\_for\_Educators.pdf),Tuberculosis prevention in the non-mining industries (https://www.nioh.ac.za/wp-content/uploads/2023/04/Tuberculosis\_prevention\_in\_the\_non-mining\_industries.pdf), Informal economy workers and HIV and TB (https://www.nioh.ac.za/wp-content/uploads/2023/04/TB\_and\_HIV.pdf), Wearing masks at work, and isolation, quarantine & contact tracing for COVID-19.

#### 4. SADC evaluation of the Centre of Excellence in Zambia

In collaboration with the New Partnership for Africa's Development (NEPAD)'s African Union Development Agency (AUDA), East, Central and Southern Africa-Health Community (ECSA-HC) and Zambian and Zimbabwean OHS experts evaluated the OHS cetre of excellence in Zambia, constituted out of the Southern African TB Health Systems Support (SATBHSS), a regional project. Which is a collaboration between Zambia, Republic of Malawi, the Kingdom of Lesotho and the Republic of Mozambique.

Zambia established the Centre of Excellence in Occupational Health and Safety with the following objectives:

- To improve the quality of medical and work environment surveillance for prevention and early detection of all cases of occupational lung diseases, including TB, in Zambia and the sub-region by 2021.
- To improve data capture, storage, analysis, and use at the OHSI through an integrated central management system by 2019.
- To increase human resource capacity and skills in selected fields in occupational health and safety as well as TB by 50% at the OHSI to support Zambia and the subregion by 2019.
- To develop a more patient-centred approach to occupational health examinations at the OHSI by 2019.

#### **RESEARCH AND/OR SPECIAL PROJECTS**

The unit has several completed and ongoing research projects, including:

#### AWARENESS AND ASSESSMENT OF THE HIV AND TB WORKPLACE HEALTH PROGRAMME IN THE CITY OF TSHWANE METROPOLITAN MUNICIPALITY, GAUTENG PROVINCE, SOUTH AFRICA

## **Study Team:** M Malotle<sup>1</sup>, M Zungu<sup>1, 2</sup>, P Chelule<sup>3</sup>, M Huma<sup>3</sup>, M Rammopo<sup>3</sup>.

National Institute for Occupational Health, a division of the National Health Laboratory Service<sup>1</sup>, School of Health Systems and Public Health, University of Pretoria, Pretoria, South Africa<sup>2</sup>, Sefako Makgatho Health Sciences University<sup>3</sup>.

**Summary:** This is a cross-sectional study that aims to assess the workplace HIV and TB programme and describe the utilisation of the services by employees in the City of

Tshwane Metropolitan Municipality. The study findings will be useful for promoting and strengthening workplace HIV and TB health services. Ethics approval has been granted by the Sefako Makgatho Health Sciences University (SMU).

#### STRENGTHENING OCCUPATIONAL HEALTH SYSTEMS AND SERVICES FOR HEALTH WORKERS DURING THE COVID-19 PANDEMIC AND BEYOND: THE ROLE OF OCCUPATIONAL HEALTH AND SAFETY INFORMATION SYSTEMS

**Study Team:** M Zungu<sup>1, 2</sup>, A Yassi<sup>3</sup>, J Spiegel<sup>3</sup>, Voyi<sup>2</sup>. National Institute for Occupational Health, a division of the National Health Laboratory Service;<sup>1</sup> School of Health Systems and Public Health, University of Pretoria, Pretoria, South Africa; University of British Columbia, Vancouver, Canada<sup>3</sup>.

**Funding:** the Canadian Institute of Health Research/ University of British Columbia

**Summary:** This study aims to assess the conditions and extent to which the introduction and implementation of OHASIS and the joint ILO WHO developed HealthWISE interventions will strengthen the occupational health system and/or services in South African health settings. We have produced a publication and submitted one manuscript for publication consideration.

#### INVESTIGATING SOCIAL AND STRUCTURAL DETERMINANTS OF HEALTH INEQUITIES IN HIV PREVENTION AND CARE AMONG FARMWORKERS IN SOUTH AFRICA

## **Study Team:** N Mlangeni<sup>1</sup>, O Adetokunboh<sup>2</sup>, M Lembani<sup>3</sup>, P Nyasulu<sup>2</sup>.

National Institute for Occupational Health, Division of National Health Laboratory Service, Johannesburg<sup>1</sup>, Stellenbosch University, Department of Global Health, Cape Town<sup>2,</sup> University of Western Cape, School of Public Health, Cape Town<sup>3</sup>.

**Summary:** The study aims to investigate the social and structural determinants of health impacting equity in HIV prevention, treatment, and care for farmworkers and the role of policy in addressing existing inequities. The study will provide scientific evidence of existing inequities and gaps in HIV prevention and control among farmworkers and will act as a basis for necessary interventions. This is an ongoing project that has produced one peer-reviewed publication and a draft manuscript.

#### MONITORING AND EVALUATION OF OCCUPATIONAL HEALTH SERVICES FOR HIV, TB, SILICOSIS AND SARS-COV-2 IN A MINING HOUSE IN SOUTH AFRICA

**Study Team:** J Ramodike<sup>1,2</sup>, N Mlangeni<sup>1</sup>, M Zungu<sup>1,2</sup>. National Institute for Occupational Health, a division of the National Health Laboratory Service<sup>1</sup> School of Health Systems and Public Health, University of Pretoria, Pretoria, South Africa<sup>2</sup>.

**Summary:** The study aims to develop a monitoring and evaluation tool for HIV, TB, silicosis, and SARS-CoV-2 health

services in a South African mine house. This will be a crosssectional study with the objective of monitoring and evaluating occupational health programmes for mitigating the mentioned diseases and their outcomes. Ethics approval has been granted from the University of Pretoria.

#### OCCUPATIONAL HEALTH INTERVENTIONS AND EMPLOYEES' ABSENTEEISM IN SOUTH AFRICAN HOSPITALS

**Study Team:** M Zungu<sup>1,2</sup>, N Tlotleng<sup>1</sup>, J Ramodike<sup>1,2</sup>. National Institute for Occupational Health, a division of the National Health Laboratory Service<sup>1</sup>, School of Health Systems and Public Health, University of Pretoria, Pretoria, South Africa<sup>2</sup>.

**Summary:** This cross-sectional study aims to determine the occupational health and safety (OHS) interventions implemented in two academic hospitals in Gauteng Province from 2014 to 2018 and to review the absenteeism trends over the same period. The study findings will be useful for planning to ratify OHS interventions that may reduce workplace absenteeism. A manuscript is being prepared for publication.

#### **TEACHING AND TRAINING**

#### ACADEMIC QUALIFICATIONS IN PUBLIC AND/ OR OCCUPATIONAL HEALTH

The unit coordinates the Diploma in Occupational Medicine and Health (DOMH) and teaches Occupational Health to undergraduate and postgraduate students on behalf of the School of Health Systems and Public Health (SHSPH), University of Pretoria. The unit is also a rotation site for practical training for Public Health Medicine Registrars from the University of Pretoria. The unit contributes to the ongoing training of Public Health Medicine registrars from the Sefako Makgatho Health Sciences University.

## PUBLIC HEALTH POST GRADUATE RESEARCH SUPERVISION

The unit is supervising three Master of Public Health (MPH) students and co-supervising three MPH students from the Universities of Limpopo and Pretoria; co-supervisesing an honours student from the University of Johannesburg, and graduated 21 DOMH students from the SHSPH University of Pretoria.

#### **EXAMINATION AND PUBLICATION REVIEWS**

- The unit examined the dissertation of the University of Johannesburg MPH student on "Common Mental Disorders among Healthcare Workers at a tertiary hospital in Zimbabwe during COVID-19: A Cross-Sectional Study".
- The unit was an examiner for the College of Public Health Medicine (CPHM) for the 2022 October exams (as an observer) and the 2023 February exams (as an examiner).

These are national exams that fall under the College of Medicine of South Africa.

- We reviewed a manuscript for publication in a peerreviewed journal:
  - Khosravi Y, Farshad AA, Gh MM, Faghihi M, Ezati E, Hassanzadeh-Rangi N, Yarmohammadi S. Explaining the role and responsibilities of the National Anti-Coronavirus Headquarters in prevention and emergency response to pandemics in the workplace: a qualitative study on COVID-19 experience in Iran. BMC Health Services Research. 2023 Feb 9;23 (1):137.

#### **UNDERGRADUATE TRAINING**

- The unit is giving public health lectures to second-year (MBCHBII) and fourth-year (MBCHBIV) medical students at the Sefako Makgatho Health Sciences University.
- Occupational Health teaching was provided to
  University of Pretoria second-year medical students.

#### TRAINING OF WORKERS AND MANAGEMENT IN OCCUPATIONAL HEALTH AND SAFETY SHORT COURSES

- The unit conducted a one-day workshop on OHS for the Gauteng Provincial Government (GPG). The aim of the workshop was to sensitise the 14 heads of departments (HODs) within the GPG on their responsibilities as appointed Section 16.1 appointees in line with the Occupational Health and Safety Act 85 of 1993.
- A workshop was conducted on the Workplace HIV and TB Health Programme at the Department of Basic Education in the North West province, in order to strengthen the workplace HIV and TB workplace programme. The workshop was held at the Zeerust Town Hall, North West Province. The target audience was Employee Health and Wellness Practitioners, Employee Assistance Practitioners, Safety Practitioners, and Safety Health Environment Risk and Quality Managers (Image 10).
- The unit provided four training workshops on COVID-19 in the workplace for the GPDoH and the MPDoH.
- The unit participated as a speaker and panellist in three training workshops for the DoEL: (1 x for health inspectors and 2 x for all workplace OHS stakeholders affected by the Hazardous Biological Agents regulations as promulgated in 2022).
- A half-day training was provided to the South African National Defence College on "Disease and effects on stability, security and prosperity". The target was senior military personnel including visitors from India, Nigeria, Eswatini, and Botswana.



IMAGE 10: Participants of the workplace HIV TB health program training for the Department of Basic Education, North West province.

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#### HONOURS

• Prof Zungu, who is a senior member of the ICOH Scientific Committee on Education and Training in Occupational Health, was appointed as the Chairperson of the Election Committee for the new Chairperson and Secretary of the Scientific Committee on Education and Training in Occupational Health. As chairperson of this committee, Prof Zungu presided over a successful election.

The unit was appointed as a scientific committee member leading the Public Health discipline for the PathReD Conference 2023.

# SAFETY, HEALTH AND ENVIRONMENT (SHE) DEPARTMENT



#### HEAD DAVID JONES

## SAFETY, HEALTH AND ENVIRONMENT (SHE) DEPARTMENT

COVID-19 has continued to be the primary focus of the SHE Department throughout the year under review; however, with cases tapering off, more attention could be given to pre-COVID-19 routine duties.

#### **STAFFING**

Staffing levels were stable during the year under review, with no resignations or new appointments being made. Because there was no backup doctor, during the months of December 2022 and January 2023, while the Occupational Medicine Practitioner was on annual leave, an occupational medicine practitioner was appointed on a sessional basis for business continuity. A nurse from the call centre also continued to assist the SHE Department with COVID-19 screening response, exposure risk assessment, and facilitating testing. This assistance ended at the end of March 2023.

#### **OCCUPATIONAL HEALTH**

The year under review continued to bring cases of COVID-19, with the numbers shadowing those of the caseload trends nationally, with the fifth wave occurring between weeks 17 and 22 of 2023 and the highest reported cases during that period occurring in week 20. As the Department of Employment and Labour updated legislation and the Department of Health issued new guidelines, the NHLS policies were continuously aligned. Although the need for compulsory COVID-19 screening ended in the year under review, the requirement for employees to report COVID-19 symptoms they may experience continued, and this process was facilitated through OHASIS, the occupational health and safety information system used in the NHLS since 2011. The SHE Department responded to all positive symptoms reported through the screening process; an exposure risk assessment was done, and, where appropriate, testing was offered without cost using in-house facilities. It is important to note that TB and other risk based medical surveillance continued. Occupational health staff continued to support the NHLS Human Resources Department in facilitating the reporting of work-related COVID-19 cases to the Compensation Commissioner. This remains an ongoing process.

## SPECIAL INVESTIGATIONS AND NIOH SUPPORT

The project with the NIOH Occupational Hygiene Section to measure the exposure levels of NHLS employees to formaldehyde and xylene resumed in the second half of the year under review. This project is a priority because new occupational exposure levels have been promulgated for formaldehyde.

A decision was made at the NHLS EXCO that the assessment for "Inland" Regions would be done by the NIOH, and the "Coastal" Regions would need to outsource the service. The specifications to appoint a service provider were done with the assistance of the NIOH Occupational Hygiene Section.

The Department's success also rests upon continued expert support from the various sections of the NIOH, including Occupational Hygiene, Occupational Medicine, Immunology, IT, HR and Finance. Examples of expert opinion and guidance related to:

- Case management for occupational incidents and disease investigations;
- Compliance with legal requirements regarding medical surveillance;
- Consulting with employees and their treating healthcare professionals who have specific occupational medical concerns;
- Ergonomic assessments;
- Immunology testing and advice;
- Ongoing development of OHASIS; and
- Recruiting sessional staff.

#### OCCUPATIONAL HEALTH AND SAFETY INFORMATION SYSTEM (OHASIS)

OHASIS has continued to prove itself to be an invaluable tool during the year under review. OHASIS has been used to provide weekly statistics for the NHLS EXCO for high-level decision-making.

OHASIS continued to be a valuable tool on the ground and has been used to:

- · Conduct health and safety audits of facilities;
- Report all health and safety incidents;
- · Investigate all health and safety incidents;
- Do COVID-19 staff symptom reporting;
- Screening for TB staff symptoms;
- Record COVID-19 and other vaccinations:
- Record results of chest X-Rays and COVID-19 tests; and



 Record hazardous and health care risk waste generated, treated and disposed of.

Employees are encouraged to report every incident, no matter how small or insignificant they think it may be, and OHASIS allows for this. The rationale for this approach is to encourage a culture of reporting and correction, rather than one that conceals and is punitive. Of the total 1070 incidents reported on OHASIS, 675 were positive COVID-19 cases, this includes all COVID-19 cases, including those acquired outside of the workplace, and 395 were unrelated to COVID-19. This equates to 63.5% of incidents reported being COVID-19 positive.



OHASIS has continued to prove itself to be an agile and adaptable health information system. The changes and updates developed and introduced at the beginning of the COVID-19 pandemic have provided an invaluable source of information for management.

#### SAFETY, HEALTH AND ENVIRONMENT AUDITS

The SHE Officers, under the supervision of the Deputy SHE Manager, were able to commence with onsite safety, health, and environment audits in June 2022 for this financial year. The standard operating procedure "GPS0048: SHE Audit Procedure" serves as a guidance document for this process. As of the end of this financial year, a total of 392 SHE audits were conducted in the NHLS, an increase of 67 facilities audited (20.6%) from the previous year.

Out of the 392 audits conducted, 2736 non-conformances were raised. The three regions that closed the most non-conformances were the Eastern Cape, followed by Limpopo/ Mpumalanga, and the Western/Northern Cape.

#### **RISK ASSESSMENTS (RA)**

NHLS facilities conduct risk assessments once every two years with a team comprised of trained and experienced staff. The standard operating procedure "GPS0039 - NHLS Risk Assessment" serves as a guide for this process. Regional SHE teams evaluate, facilitate, and approve risk assessments. At the end of the financial year, 368 facilities, an increase of 8.9%, had satisfactory and valid health and safety risk assessments.

#### HEALTH AND SAFETY REPRESENTATIVES (HSR) AND HEALTH AND SAFETY COMMITTEE (HSC) MEETINGS

In order to ensure compliance with the relevant legislation, the Regional SHE Officers coordinate and monitor the appointment of health and safety representatives. Regional SHE Officers receive and mark all HSR training modules and compile and issue training certificates to successful candidates. Regional SHE teams attend HSC meetings in an advisory capacity. Where they are unable to attend, they send their input in writing to the committee.

The NHLS has 455 active health and safety representatives of whom 439 are trained and serving on 36 health and safety

committees, all of which are active. Thirty of the committees successfully met at least four times in the year under review. The committees routinely identify and consolidate health and safety concerns and escalate them to management for resolution.

#### **HAZARDOUS WASTE**

The Waste Assurance Manager is constantly revising the NHLS waste management procedures to ensure that they are in accordance with the terms of the national waste management policy. NHLS facilities are being audited to monitor compliance, and waste management training is conducted to improve waste management standards within the NHLS.

Details of the generated hazardous waste continue to be captured on OHASIS by each of the facilities.

Region	Quantities of health care risk waste reported on OHASIS from 01 April 2020 to 31 March 2021 per area	Quantities of health care risk waste reported on OHASIS from 01 April 2021 to 31 March 2022 per area	Quantities of health care risk waste reported on OHASIS from 01 April 2022 to 31 March 2023 per area
Eastern Cape	246 869,25 kg	257 102,85 kg	239 484,95 kg
Free State and North West	189 669,51 kg	207 272,36 kg	190 423,08 kg
Gauteng	621 106,33 kg	616 457,13 kg	521 423,66 kg
Institutes and Corporate	59 948,38 kg	69 814,14 kg	44 242,86 kg
KwaZulu Natal	540 521,73 kg	600 632,58 kg	551 986,86 kg
Limpopo and Mpumalanga	347 696,19 kg	363 548,02 kg	474 133,37 kg
Western and Northern Cape	295 608,84 kg	303 832,87 kg	259 642,11 kg
Total	2 301 420,23 kg	2 442 930,48 kg	2 281 305,28 kg

TABLE 4: Quantities of hazardous waste generated in the NHLS by Region over the past three financial years.

The Waste Assurance section continues to engage with the relevant authorities and service providers to ensure that the facilities comply with the provisions of the legislation in order to keep up to date with new developments in the waste management sector.

#### **TEACHING AND TRAINING**

The SHE Manager, Mr David Jones, was invited by the World Health Organization to serve on a committee and contribute to the compiling of a new guide entitled "Caring for those who care: a Guide for the development and implementation of occupational health and safety programmes for health workers". The guide is available through the WHO's website: https://www.who.int/publications/i/item/9789240040779.

In addition to the above, Mr David Jones also continued to contribute to two SABS Technical Committees namely TC48, "Laboratory controlled environment" that provides support for clinical and diagnostic laboratories in the fields of safety and quality assurance of equipment. The other is TC1087 "Management of Health Care Waste" that develops South African National Standards for the safe and effective management of health care waste in order to reduce potential risks to people's health and risks to the environment. The aims of the committees are to keep abreast of international standards and ensure local standards are aligned where appropriate but tailored to local conditions.

The Waste Assurance Manager, Ms Mmashela Kgole, participated in the NICD project with the African Society for Laboratory Medicine and the Africa CDC to develop a Regional Training and Certification Programme for Biosafety and Biosecurity Experts, including Biological Waste Management. The programme aims to improve the management of healthcare risk waste on the African continent.

# ANALYTICAL SERVICES SECTION



#### HEAD DR BOITUMELO KGAREBE

## ANALYTICAL SERVICES SECTION

The Analytical Services Section consists of two units, namely the organics and metals (inorganics) laboratories, which together drive its mandate on the analysis of hazardous substances in biological and environmental media as a means of strengthening the assessment of workplace exposures to comply with the Regulations of Hazardous Chemical Substances. COVID-19 continued to impact several areas in the functions and outputs of the two units. That notwithstanding, the Section has continued to respond to requests for the provision of specialised laboratory tests, advisory services, and the support of private industries, government departments, and academic institutions in occupational and environmental health. Of key importance in monitoring analytical performance and competence in analysing and quantifying biomarkers in specimens, the laboratories continued to participate in Proficiency Testing Schemes (PTS) and External Quality Assurance (EQA).

## SPECIALISED LABORATORY TESTING AND DIAGNOSTIC SERVICES

Some 1996 tests (for diagnostic, surveillance, and research purposes) were completed during the reporting period, with an average 87.5 % tests within the requisite turn-around time.

#### **ADVISORY SERVICES**

In addition to the routine and specialised tests conducted, the Section received numerous requests to render advice and non-routine testing services to the private and public sectors. These included the analysis of arsenic, manganese, and mercury in blood, urine, hair, and nails, blood-lead (BI-Pb) and blood-uranium (BI-Ur) analysis in water-polluted mining areas. The Section was also urgently approached by Groote Schuur Hospital to assist in screening blood and urine samples and interpreting the results in a case of ingestion of multiple toxic chemicals. In yet another request from the Red Cross Children's Hospital, urgent assistance was required to monitor a patient's blood and urine mercury levels. The National Department of Health (NDoH) has continued to engage with the Section on "National Regulations Relating to Lead in Paint" as well as the provision of testing services for lead in paint. The Section has continued to provide updates on the progress of planned activities towards the implementation of the paint analysis service plan. To this end, a new Perkin Elmer PinAAcle 900T Dual Furnace/Flame Atomic Absorption Spectrophotometer has been procured and recently installed.

#### **TEACHING AND TRAINING**

The Section provided the annual training of the Witwatersrand University postgraduate students on Health and Safety Practices in Medical Laboratories, Good Laboratory Practice (GLP), analytical techniques, and research methodology as applied in chemical contaminants detection in the workplace and biological monitoring. The Section has also continued to host Witwatersrand University students to familiarise them with various practical aspects of an accredited laboratory. In the year under review, the training of Intern Medical Scientists for HPCSA registration in the category of Clinical Biochemistry continued with the admission of two new intern scientists.

The sixth edition of the course "Introduction to Applied Chemistry in Occupational and Environmental Health" for second-year undergraduate students (the University of the Witwatersrand) in Applied Chemistry was again updated and delivered in full face-to-face interactive mode; the practical aspect of the course was also delivered in full interactive mode.



IMAGE 11: Wits University second-year undergraduate students in Applied Chemistry

#### **RESEARCH OUTPUT**

In conjunction with the Wits Department of Forensic Medicine and Pathology, Faculty of Health Sciences, Dr Boitumelo Kgarebe and Dr Puleng Matatiele successfully supervised two research projects for BSc (Hons) students on "A retrospective study on the impact of COVID-19 on suicide-related deaths at the Johannesburg Forensic Pathology Service Medico-legal Mortuary (Ms Sabine Kirchner) and "A profile of unidentified and unclaimed bodies at the Johannesburg Forensic Pathology Services Medico-Legal Laboratory from 2017 to 2019 (Ms Sinethemba Mvelase).

Under the SAMRC Grants, Innovation and Product Development Self-Initiated Research (SIR) Grant Application, Dr P Matatiele was awarded R200 000 for her application for the Self-Initiated Research (SIR) Grant Application for the project titled, "Evaluation of occupational exposure to selected organic chemicals at wastewater treatment plants and recycled water use sites."

#### **Accreditation and Quality Assurance**

The Metals and Organic Units maintained their annual ISO 15189 accreditation status on 20 April 2022, further increasing their accredited scope of testing with nickel, copper, and zinc in urine tests. The Section was also audited by SANAS and maintained its second standard ISO/IEC 17025:2005 accreditation status for testing aluminium and mercury in water.

Regular internal audits were conducted throughout the year to maintain safety, quality, and competence in the laboratory.

In terms of PTS for monitoring laboratory analytical performance and competence in analysing and quantifying biomarkers in specimens, the Section continued with its participation in the following External Quality Assurance (EQA) programmes:

- New York State Department of Health for arsenic, cadmium, chromium, lead, manganese, and mercury in blood and urine and aluminium in serum and water,
- The South African Bureau of Standards, SABS-Water Check Scheme, and
- The National Metrology Institute of South Africa (NMISA) Proficiency Testing Scheme for the analysis of Ethanol (alcohol).

#### **PROFESSIONAL DEVELOPMENT**

The Section now boasts four new technical signatories for ISO 17025 water testing services and industrial effluents, which was obtained in the period under review. Mr L Sethosa, Ms S Moremi, and Ms AJ Mulaudzi are the new signatories for aluminium and Mr L Sethosa for mercury. In total, the Department now has six technical signatories.



IMAGE 12: Technical signatories (Left-Right), Ms AJ Mulaudzi, Mr L Sethosa and Ms S Moremi

#### **HONOURS**

The Organics Unit of the Analytical Services Section successfully passed the Inter-comparison programme 68, 2021, for the toxicological analyses of hexane exposure in biological materials as a reference laboratory. The programme is conducted by the German Institute and Outpatient Clinic for Occupational, Social and Environmental Medicine (GEQUAS). This marks the 11th consecutive year that Analytical Services has maintained its status as a reference laboratory for the analysis of urine for exposure to hexane.

Dr Kgarebe has been appointed to the Editorial Board of the Science Journal of Analytical Chemistry, for the two-year period 2023-2025.

# TOXICOLOGY AND BIOCHEMISTRY

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#### HEAD DR NATASHA SANABRIA

## TOXICOLOGY AND BIOCHEMISTRY

The NIOH's national and international research outputs, public engagement, and training outreach programmes as an institute have relied heavily on biochemistry and/ or toxicology-related applications in the public health sector. Although there was a drive to return to normal work production, remaining activities related to the COVID-19 pandemic were still focused on guidance related to toxic exposures and associated risks, (refer to the NIOH website). Moving forward, the Section prioritised healthcare surveillance and translation collaborative research projects. Previously established collaborations with local and international institutions were also maintained to provide learning activities for staff and postgraduate students in the fields of general occupational toxicology and nanotoxicology. The Section continued to work towards SANAS accreditation for Good Laboratory Practice (GLP) based on OECD principles. Towards the end of the financial year, Dr N Sanabria transitioned from the HOD position to an honorary Research Associate position to conduct research overseas, where Dr W Utembe remained as the senior member of staff to lead the Section and maintain business continuity.

#### **RESEARCH AND/OR SPECIAL PROJECTS**

The Toxicology and Biochemistry section produced the most publications per department, which constitutes approximately 30% of the institute's output during the period under review. The Section conducts primary research, research commissioned by governmental, parastatal, and private organisations, as well as secondary data analyses. The staff supported public engagement and presented their research findings at both international and national conferences, as well as local research days and workshops. Dr N Sanabria and Dr J Joseph were awarded research grants as Principal Investigators by the South African National Research Foundation (NRF), i.e., the competitive support for unrated researchers (CSUR) and Thuthuka grant, respectively.

The staff were also involved in the NIOH Research Day event, which was coordinated by Dr N Sanabria as the current Research Committee Chairperson. This national event showcased the broad research scope of the Institute and facilitated opportunities to network and engage with external researchers. It also provided an opportunity for young, emerging researchers or junior staff to present their research and empower them to develop their research careers. The senior researchers served as reviewers and mentors, which facilitated skill transfer. The event was well received and generated renewed interest within the scientific community.

#### VALIDATE NON-SMALL CELL LUNG CARCINOMA (NSCLC) BIOMARKERS VIA A NETWORK OF FUNCTIONAL GENES AND KEY METABOLIC PATHWAYS

**Study Team:** N Sanabria<sup>1</sup>, D Govind Lakhoo<sup>1</sup>, R Meyer<sup>2,3</sup>. NIOH, a division of the National Health Laboratory Service<sup>1</sup>, Chemical Sciences Department, University of Johannesburg<sup>2</sup>, Shimadzu, South Africa<sup>3</sup>.

**Summary:** The aim is to conduct a preliminary study of genes and metabolites to identify and validate biomarkers for NSCLC. Combinations of these potential biomarkers will represent signature profiles. Genomics is the main tool for cancer study but usually focuses on mutation screening, e.g., for Tyrosine Kinase Inhibitor (TKI)-resistance, to improve NSCLC therapy. In addition, next-generation sequencing (NGS) is useful for profiling an individual patient's signature for early detection. In contrast, metabolomics enables the use of biological fluids for continuous monitoring (i.e., essential for occupational surveillance programs). A novel aspect of this study is the use of in silico informatics tools for toxicological analyses of profiles for monitoring and surveillance.

#### NANOPARTICLE TESTING IN SH-SY5Y CELLS

**Study Team:** N Sanabria<sup>1</sup>, J Joseph<sup>1</sup>, S Magogotya<sup>1</sup>, J Burns<sup>2</sup>, S Bardien<sup>2</sup>.

NIOH, a division of the National Health Laboratory Service<sup>1</sup>, Stellenbosch University, Division of Molecular Biology and Human Genetics, Faculty of Medicine & Health Sciences<sup>2</sup>.

**Summary:** A visiting researcher was trained onsite in how to test the toxicity of three of their engineered nanoparticles as drug-carriers for Parkinson's disease, via in vitro impedance assays and cellular internalization/localization via dark field microscopy. This allowed for skills transfer, the establishment of a new collaboration between institutions, and the expansion of the NIOH/NHLS's research network and scope of work in non-communicable diseases.

## THE OCCUPATIONAL HEALTH INFORMATION SYSTEM (OHASIS) IN THE NHLS

**Study Team:** KS Wilson<sup>1</sup>, D Jones<sup>1</sup>, V Ntlebi<sup>1</sup>, N Sanabria<sup>1</sup>, J Joseph<sup>1</sup>, G Chin<sup>1</sup>, N Tlotleng<sup>1</sup>. *NIOH, a division of the National Health Laboratory Service*<sup>1</sup>.

**Summary:** OHASIS is an online reporting tool for all NHLS injuries and diseases related to the work environment. Ongoing analyses of this data set from 2012 to date have commenced and will form part of the internal (NHLS) surveillance programme. From this system, annual reports with in-depth analyses are created on injury and disease prevalence, identifying common injuries and the prevalence of occupational disease in the NHLS, by the Epidemiology Section. The COVID-19 case and vaccination data were used to create monthly and then bi-monthly epidemiological reports on the prevalence in the NHLS and the prevalence in NHLS occupational groups during the pandemic.

#### INNOVATIVE NANO-INFORMATICS MODELS AND TOOLS: TOWARDS A SOLID, VERIFIED AND INTEGRATED APPROACH TO PREDICTIVE (ECO)TOXICOLOGY (NANOSOLVEIT)

**Study Team:** M Gulumian <sup>1,2</sup>, N Sanabria<sup>1</sup>. NIOH, Division of the National Health Laboratory Service<sup>1</sup>, Haematology and Molecular Medicine, University of the Witwatersrand<sup>2</sup>.

**Summary:** NanoSolvelT introduces a ground-breaking in silico Integrated Approach to Testing and Assessment (IATA) for the environmental health and safety of nanomaterials (ENM), implemented through a decision support system packaged as both stand-alone open software and via a cloud platform. Thus, the project delivers a validated, sustainable, multi-scale nano-informatics IATA, tested and demonstrated at TLR6 via OECD-style case studies, to serve the needs of all stakeholders at each stage of the ENM value chain for the assessment of potential adverse effects of ENM on human health and the environment.

#### EVALUATION OF THE EFFECTS OF CLASSROOM CHALK DUST EXPOSURE AND THEIR RELATED HEALTH RISK ASSESSMENT

**Study Team:** J Thobejane<sup>1</sup>, R Nathan<sup>1</sup>, T Msagati<sup>2</sup>, J Joseph<sup>3</sup>. Wits University<sup>1</sup>, UNISA<sup>2</sup>, NIOH, a division of the National Health Laboratory Service<sup>3</sup>.

**Summary**: Chalk produces dust when used, which is particulate matter. This will alter the air quality of classrooms and can cause health hazards for teachers. Classroom teaching with the aid of chalk is popular in many developing countries. During the teaching process with chalk, a large amount of chalk dust, including submicrometer particulate matter (PM), is generated in a classroom. Submicrometer PM can penetrate the human respiratory system and reach the lung alveoli; they have the capacity for bioaccumulation in tissues or organs and oxidative damage to the respiratory system. Yet, no known study has been conducted regarding the effects of chalk dust exposure among teachers and learners in South Africa and this creates a challenge in

formulating any regulation or policy to promote safe practices in classrooms.

#### CHEMICAL COMPOUND PROFILING, CYTOTOXICITY, AND ANTICANCER ACTIVITIES OF TRADITIONAL PLANT EXTRACTS

**Study Team:** O Fagbohun<sup>1</sup>, J Joseph<sup>2</sup>. Wilmington College, USA<sup>1</sup>, NIOH, Division of the National Health Laboratory Service<sup>2</sup>.

Summary: Medicinal plants absorb trace elements and metals available in the soil solutions in ionic, complexed, or chelated forms and can either be deficient or toxic for human and animal consumption via plant-based medicines as supplementation or prescribed medication. Therefore, screening these medicinal plants for trace elements or metals is important according to the recommendation of the WHO and European legislation (1881/2006/EC). In this study, the concentrations of 12 trace elements and metals were determined from Kigelia africana leaf and fruit extracts using an Agilent 700 series inductively coupled plasmaoptical emission spectrometer (ICP-OES) coupled with an ultrasonic CETAC U-6000AT+ Nebulizer after microwaveassisted acid digestion of the plant samples with the MDS-6G closed microwave digester. The study revealed that K. africana extracts have significant trace elements, with the fruit extracts having high concentrations of the required trace elements. Barium (Ba), Beryllium (Be), Tellurium (Te), and Thallium (TI) are known toxic metals when accumulated in the human body and were found in low concentrations in this study. This study revealed that trace elements are positively correlated when analyzed with principal component (PCA) and hierarchical cluster (HCA) analyzes. This shows that K. africana plant extract can be considered one of the most important medicinal plants, with several therapeutic benefits. The concentrations of several trace elements according to the recommended dietary allowance (RDA) as well as the correlation between these metals and metalloids are reported for the first time using PCA and HCA.

#### THE EFFECT OF *DICOMA ANOMALA* AND *MELIA AZEDARACH* TO INDUCE CELL DEATH IN LUNG AND BREAST CANCER CELLS

Study Team: B George<sup>1</sup>, J Joseph<sup>2</sup>.

University of Johannesburg<sup>1</sup>, NIOH, Division of the National Health Laboratory Service<sup>2</sup>.

**Summary:** The alarming mortality rate among cancer patients indicates the need for effective therapeutic alternatives. Studies show that the bioactive compounds in plants may serve as effective chemotherapeutic agents that are less harmful to normal tissues and are inexpensive. The effect of different doses of the extract on breast and lung cancer cells will be analyzed via various in vitro assays to support the dose-response analysis. Immunofluorescence and Flow cytometry analysis of apoptotic proteins expressed in cancer conditions will be done to determine the cell death mechanisms. The study will propose a new scheme of treatment against breast and lung cancer using plant extracts.

## OBESITY AMONG SCHOOL-GOING CHILDREN IN MASERU, LESOTHO

**Study Team:** P Mothibeli<sup>1</sup>, J Joseph<sup>2</sup>. University of Johannesburg<sup>1</sup>, NIOH, Division of the National Health Laboratory Service<sup>2</sup>.

Summary: The World Health Organization (WHO) defines an overweight condition as having a body mass index (BMI) equal to or above 25kg/m<sup>2</sup>, and an obese condition as having a BMI of 30kg/m<sup>2</sup> and above. Children are now more likely to be overweight or obese, which has raised concerns about worldwide public health. The rising prevalence of overweight and obesity among youngsters in developing countries with burgeoning economies presents a substantial challenge to the healthcare system. The risk factors of childhood obesity and overweightness include adult-onset metabolic syndrome, poor physical health, mental illnesses, respiratory issues, and glucose intolerance. Insufficient nutrition, physical inactivity, a high socioeconomic position, living in an urban area, conventional wisdom, and the marketing of transitional food producers are the key factors that contribute to childhood overweight and obesity. This study is aimed at identifying the prevalence of obesity among school-going children in Maseru. Three schools located within the city were randomly selected to participate, and the students will undergo biometric measurements (i.e., weight and height) and be given a questionnaire to complete. With various diversity in diet lately, the chances of having an obese generation are extremely high, and therefore the study aimed at finding the possibilities of diet and lifestyle changes in modern life to reduce obesity, especially in a developing country like Lesotho.

#### THE AWARENESS AND PERCEPTION OF YOUNG FEMALES (AGES 18 TO 24) ON THE UTILISATION OF PRE-EXPOSURE PROPHYLAXIS (PREP) FOR HIV/AIDS PREVENTION IN GERT SIBANDE TVET COLLEGE

#### Study Team: P Mothibeli<sup>1</sup>, J Joseph<sup>2</sup>.

University of Johannesburg<sup>1</sup>, NIOH, Division of the National Health Laboratory Service<sup>2</sup>.

**Summary:** The purpose of this study is to comprehend PrEP awareness, knowledge, and acceptability among TVET College students. In this research study, the researcher is going to use a mixed-methods approach. A questionnaire will be utilised to collect data. The questionnaire will be divided into sections: demographics (age, gender, race, home language, academic year, sexual orientation), HIV risk perception, PrEP knowledge and awareness, and PrEP acceptability (Prep intake and continuity). The questionnaire will have both open-ended and closed-ended questions.

#### IN VITRO ASSESSMENT OF THE CYTOTOXICITY AND CELLULAR UPTAKE OF TUNABLE COBALT FERRITE NANOPARTICLES (COFE NPS) IN CANCER CELL LINES

**Study Team:** SL Lebelo<sup>1</sup>, A Oladipo<sup>1</sup>, and J Joseph<sup>2</sup>. UNISA<sup>1</sup>, NIOH, a division of the National Health Laboratory Service<sup>2</sup>. Summary: One of the deadliest characteristics of cancer cells is their ability to spread from their origin to adjacent tissues/ organs of the body, termed "metastasis", thus responsible for the highest number of deaths. One promising concept for killing cancer with concurrent high treatment efficacy and minimal side effects on normal cells/tissues would be chemodynamic therapy based on Fenton reaction-based nanomaterial comprising spinel ferrite-structured nanorod light absorbers and magnetic heat inductors as oxidation nanocatalyst to generate highly toxic hydroxyl radicals. For optimal treatment performance, efficient improvement in the Fenton reaction conditions is required. In this project, these objectives will be achieved by incorporating cobalt (Co) ions into ferrous (Fe) ions to give CoFe nanocubes (NCs). Therefore, this proposal presents the development of new technology for the treatment of deeply-seated metastasis and should combine the expertise of the applicant in materials science and hyperthermia reactions in the development of redoxactive, built-up, responsive nanosystems for biomedical applications.

#### EVALUATING THE ASSOCIATION BETWEEN INDOOR RADON EXPOSURE AND SELF-REPORTED LUNG CANCER RISK IN RESIDENTIAL HOUSES PROXIMAL TO GOLD MINE TAILINGS IN GAUTENG

**Study Team:** Mphaga KV<sup>1</sup>, W Utembe <sup>1,2</sup>, P Rathebe<sup>1</sup>. Department of Environmental Health, Faculty of Health Sciences, Doornfontein Campus, University of Johannesburg<sup>1</sup>, NIOH, Divion of National Health Laboratory Service<sup>2</sup>.

**Summary:** Radon is the leading cause of lung cancer in non-smokers and the second-leading cause in smokers. Gold-mine tailings are considered a prime source of radon because they contain large amounts of uranium, the natural source of radon gas. In South Africa, radon gas is regulated among other radioactive materials. Yet, there has been no formal assessment of the association between indoor radon exposure and self-reported lung cancer proximal to gold mine tailings. Local-based research will help in understanding the relationship between indoor radon exposure and lung cancer as well assist with the development of feasible indoor radon control interventions.

#### FACTORS AFFECTING PULMONARY TUBERCULOSIS (PTB) TREATMENT OUTCOMES IN MAMELODI TOWNSHIP

**Study Team:** TJ Khumalo<sup>1</sup>, W Utembe<sup>1,2</sup>. Department of Environmental Health, Faculty of Health Sciences, Doornfontein Campus, University of Johannesburg<sup>1</sup>, NIOH, Division of National Health Laboratory Service<sup>2</sup>.

**Summary:** Tuberculosis (TB) is one of the major causes of death in South Africa. Therefore, monitoring medication outcomes is important to investigate treatment efficiency and management. A retrospective quantitative cross-sectional population-based study was carried out utilising regularly collected data in the NHLS CDW FM10069 database and the ETR.Net electronic register. The rate of successful TB treatment outcomes among Mamelodi Township patients was higher than the target set by the WHO. Age group, HIV positivity, and location (residing in Stanza B) were the only

variables significantly associated with poor TB treatment outcomes. Located in Stanza B, unemployed, with a secondary education, never married, and having unknown HIV status, new cases within an age group of 18 to 29 were found to be factors associated with successful TB treatment outcomes.

#### ASSESSMENT OF KNOWLEDGE, ATTITUDES, AND SAFETY PRACTICES ON HANDLING AND USING PESTICIDES AMONG CROP FARM PESTICIDES APPLICATORS IN THE LIMPOPO PROVINCE

#### Study Team: Maja L<sup>1</sup>, W Utembe<sup>1,2</sup>.

Department of Environmental Health, Faculty of Health Sciences, Doornfontein Campus, University of Johannesburg<sup>1</sup>, NIOH, Division of National Health Laboratory Service<sup>2</sup>.

Summary: The use of pesticides in agriculture immensely contributes to food security and the enhancement of better health. It is, however, noted that inadequate knowledge, negative attitudes, and unsafe practices are responsible for most pesticide poisonings that result in pesticide-related morbidity and mortality. The study used was a cross-sectional study where data was collected through intervieweradministered semi-structured questionnaires. The study recruited 366 participants, 44.0% of whom were not aware of the pesticide's hazards, while 68.3% did not use safe pesticide handling methods. This study revealed gaps in knowledge, attitudes, and practices among pesticide applicators in Limpopo. Therefore, there is a need to implement pesticide safety awareness campaigns, integrated pesticide management, and risk factor surveillance and monitoring among agricultural communities.

#### INSTITUTIONAL BARRIERS TO EFFECTIVE MUNICIPAL SOLID WASTE MANAGEMENT IN NGAKA MODIRI MOLEMA DISTRICT MUNICIPALITY, SOUTH AFRICA

#### Study Team: Tsotetsi KA<sup>1</sup>, W Utembe<sup>1,2</sup>.

Department of Environmental Health, Faculty of Health Sciences, Doornfontein Campus, University of Johannesburg<sup>1</sup>, NIOH, Division of National Health Laboratory Service<sup>2</sup>.

**Summary:** Solid waste management (SWM), which includes waste collection, transportation, processing, and disposal, is critical for both occupational and environmental health. However, social-cultural, technical, financial, institutional, legal-political, and other barriers often hinder effective SWM in many countries. Therefore, the aim of this study was to assess institutional barriers to municipal SWM in the Ngaka Modiri Molema District Municipality (NMMDM). The study utilised a mixed-method design using a semi-structured questionnaire, an interview guide, and a SWOT analysis. The NMMDM faces a number of challenges in its mandate to manage solid waste. Greater levels of priority and political will are needed to enhance this very important public health mandate. There is also a need to develop and enhance the formal and informal recycling sectors in the areas.

#### DETERMINATION OF THE FACTORS ASSOCIATED WITH NEEDLESTICK INJURIES AMONGST HEALTHCARE WORKERS (HCWS) AT MORGENSTER HOSPITAL IN MASVINGO, ZIMBABWE

Study Team: Katsamba G<sup>1</sup>, W Utembe<sup>1,2</sup>.

Department of Environmental Health, Faculty of Health Sciences, University of Johannesburg<sup>1</sup>, NIOH, Division of National Health Laboratory Service<sup>2</sup>.

**Summary:**Needlestickinjuries(NSIs)includeallpercutaneous injuries and penetrations of the skin by a needle or any sharp object that has been exposed to tissue, blood, or other body fluids. The study seeks to explore the prevalence and factors that are associated with NSIs at Morgenster Hospital, which is in the Masvingo District in Zimbabwe. The study population will consist of HCWs who are involved in the use of needles and exclude those who do administrative work in the hospital and the new student nurses who are yet to begin working in the wards. Information on the prevalence and risk factors will be used to address knowledge and practice gaps with regard to the safe handling of needles in the workplace. It will also be used to design interventions that address both behavioural issues and compliance with universal precautions. The study will go a long way in addressing the uptake of prophylaxis against diseases that are posed by NSIs, either pre-injury vaccinations or post-exposure treatments.

#### INVESTIGATION OF NOISE EXPOSURE LEVELS IN AN AIRCRAFT MAINTENANCE ORGANIZATION IN GAUTENG

Study Team: Phakathi BAM1, W Utembe<sup>1,2</sup>,

J Manganyi<sup>1,2</sup>.

Department of Environmental Health, Faculty of Health Sciences, Doornfontein Campus, University of Johannesburg<sup>1</sup>, NIOH, Division of National Health Laboratory Service<sup>2</sup>.

Summary: To verify an aircraft's airworthiness, aircraft maintenance technicians (AMTs) play a crucial role in the aviation industry. These AMTs are exposed to the loud workplace noise produced by airport operations or maintenance equipment. The study aimed to investigate the occupational noise exposure levels among aircraft maintenance technicians in Gauteng. In this quantitative descriptive cross-sectional study, data was collected from two hundred-eight (n=208) AMTs using questionnaires. The noise levels at the aircraft maintenance organisation (AMO) are at or above the South African regulated NRL, and those exposed to occupational noise are more likely to develop noise-induced hearing loss (NIHL). Noise levels at the AMO are at or above the legislated NRL of 85 dBA. As a result, if employees work 8 hours or more without adhering to the current control measures and the HCP in place, AMTs may experience noise-induced hearing loss over time.

#### ENGAGEMENT

The Toxicology and Biochemistry staff were recognised for their expertise and were honoured with appointments at various tertiary education institutions, e.g., the College of Agriculture and Environmental Sciences at UNISA, the School of Health Systems and Public Health at the University of Pretoria, and the Division of Environmental Health within the School of Public Health and Family Medicine at UCT. This demonstrates the Section's interdisciplinary work and relevance to multiple stakeholders.

The staff members also participated in, or contributed to, several technical committees to provide support, peerreview activities, and subject matter expertise to all external clients in the public sector; these are listed below:

- IJERPH Special Issue on "Respiratory Health Effects of Environmental and Occupational Exposures,
- Centre for Disease Control Foundation Public Health Bulletin (PHB),
- F1000Research Nanoscience & Nanotechnology Gateway,
- International Commission on Radiological Protection (ICRP) Task Group 125 Ecosystem Services in Environmental Radiological Protection,
- South African Water Research Commission (WRC),
- Institute for Nanotechnology and Water Sustainability (iNanoWS),
- Metabolomics South Africa, South African Council for Natural Scientific Professions (SACNASP),
- Pathology Research and Development Congress (PathReD2023) Discipline-specific Advisory Committee (DAC),
- NHLS Research and Development committee (RDC) and Research and Innovation committees (RIC), and
- NHLS-AARMS, NIOH-OHORT, and NIOH OccuZone newsletter.

#### **TEACHING AND TRAINING**

The Section continues to support academic programmes within the NIOH and at various universities. All researchers in the Section are reviewers for international and national peer-reviewed, indexed journals. In addition to serving as supervisors to postgraduate students (i.e., four PhD students and seven MPH students). The staff are also examiners of MSc, MPH, and PhD dissertations at academic South African institutions. In 2022/2023, we contributed to the following programmes:

#### Postgraduate

- Introduction to environmental and occupational toxicology, Wits University Postgraduate Diploma in Occupational Health (Dr N Sanabria).
- The (Internal) Exposome, Wits University MSc Medical Exposure Science Postgraduate Course (Dr N Sanabria).
- Electronic Tool for Safety Data Sheets, Wits Postgraduate Diploma in Occupational Health (Dr J Joseph).

- CytoViva research applications, sterile technique and cell culture, UNISA workshop principles (Dr J Joseph and M Magogotya).
- Monitoring and surveillance for Pesticide Risk Management, University of Cape Town Postgraduate Diploma program in Pesticide risk management (Dr W Utembe).
- Globally Harmonized System Safety Data Sheets, Wits University Postgraduate Diploma in Occupational Health (Dr W Utembe).
- Toxicity of Nanomaterials, 6th Summer NanoSchool (DSI / NNTPPT) (Dr C Andraos).

#### **Occupational Health stakeholders**

- Fundamentals of Toxicology, W202\_KA02 Occupational Hygiene Training Association (OHTA) Basic Principles in Occupational Hygiene Course (Dr N Sanabria).
- Material Safety Data Sheet (MSDS), W202\_KA02 Occupational Hygiene Training Association (OHTA) Basic Principles in Occupational Hygiene Course (Dr W Utembe).
- COVID-19 Policy Updates: The Code of Practice, virtual ECHO training session hosted by the NIOH (Dr C Andraos).
- Secondary Data Analysis: Using Routinely Collected Data to Answer Research Questions, NHLS project ECHO platform (Dr N Sanabria and Dr Ravesh Singh).

#### SURVEILLANCE AND SERVICES

#### **MINE HEALTH AND SAFETY COUNCIL**

The Section represented the NIOH, attended exhibitions, and participated in discussions at the Mine Occupational Health and Safety Tripartite Summit at Gallagher Convention Centre, which was organised by the Mine Health and Safety Council (MHSC). The Section further liaised with the MHSC regarding quarterly reporting for the CytoViva 3-D upgrade, including the training of students and the use of equipment by industry stakeholders.

#### **HONOURS**

Dr W Utembe and Dr N Sanabria were awarded with the best paper at the 4th International Electronic Conference on Environmental Research and Public Health — Climate Change and Health in a Broad Perspective.



IMAGE 13: The NIOH supported and participated in the Mine Health and Safety Tripartite Summit held in October in Midrand. From left to right: Dr P Matatiele, Dr J Joseph, S Yako, M Magogotya, Dr W Utembe, Dr C Andraos.

# NHLS BIOBANK

HEAD MR BONGINKOSI DUMA

## **NHLS BIOBANK**

The Biobank operates as a non-profit organisation, utilising a cost-recovery model. The National Biobank provides the following services:

- Sample collection, processing, and short-term or longterm storage
- Material transfer agreements that comply with ethical and legal requirements
- The provision of a wide variety of samples
- Sample logistics and preparation
- Research activities and collaboration

The Biobank's website can be accessed at www. nationalbiobank.nhls.ac.za.

There has been an increase in requests for the use of Biobank services by both public and private entities. The new clients added to our list of those storing samples for short and longterm research and preservation purposes include African Institute for Everyone Genome (AIEG) and the UK's Omnigen project. Applications to make use of the Biobank services are through the NHLS AARMS website.

Health Technology Assessment Projects are also using the Biobank for the collection and storage of specimens that are used during technology assessment within NHLS. The University of the Witwatersrand HRU has signed a Service Level Agreement with the Biobank as a backup for all its projects and disaster management. The Biobank has increased its storage capacity to 80 degrees Celsius and its capacity to store vaccines and samples for laboratory analysis. Furthermore, the Biobank implemented a system that allows for the coding and tracking of samples. This two-dimensional bar-coded system assists with the storage, tracking, and retrieval of biospecimens from ultra-freezers.

#### **RECENT BIOBANK VISITS BY STAKEHOLDERS**

Biobank visits have resumed after the COVID-19 lockdown resulted in the halt of visits. Some visits by key stakeholders are detailed below:

## South African National Defence Force (SANDF) – South African Military Health Services (SAMHS) visit

The newly appointed SANDF South African Military Health Services management visited the Biobank to check on the ongoing project between NHLS and the SANDF that includes the collection and storage of samples from the PHIDISA project.



IMAGE 14: The SANDF visit to the Biobank (from left to right): Surgeon General Dr Maphaha, NIOH Executive Director Dr Spo Kgalamono, Biobank Manager Mr Bongi Duma and Major General Dr Simelane (Force Preparation).



IMAGE 15: The AIEG visit to the Biobank (from left to right): Mr B Duma, Joe Mojapelo (AIEG CEO), Dr Wilhase and US visitors.

#### **Biobank quality management system**

It is important for biorepositories to have quality management systems and adhere to a set of standard operating procedures, as well as ethical and legal considerations. A quality management system enables the long-term preservation of specimens, stability, quality, and confidence in the data of the stored specimens.

The WHO recognises the pivotal role that biobanking plays in society and has proposed a global governance framework for biobanks. The framework encompasses elements of participant confidentiality, ethics, safety, sample, and data quality for biobanks. The Biobank maintained its ISO 9001:2015 accreditation for the period under review. This makes it the only biobank in Africa accredited with this standard.

- Maintaining high-quality samples and adding value.
- Ensuring the necessary biosafety and biosecurity standards.
- The ability to map population flows, the evolution of disease, and the sources of epidemics.
- Promoting the early development of prevention and treatment strategies through the application of modern technology.
- Accelerating opportunities for global collaboration and the secondary use of samples to increase statistical confidence.

#### **Biobank membership**



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The benefits of the quality processes at the Biobank include the following:

Saving time and money.

The African Union, in conjunction with the Africa CDC, had its first meeting on Biobanks in Lusaka on 25 to 27 July2022. The focus of the meeting was on developing a framework for a biobanks, and the appointment of a new committee that will drive the African Network forward.



IMAGE 16: Delegates at the Africa CDC meeting in Lusaka in July 2022.

#### The National Society for Research Platforms (NSCRP)

The Department of Science and Innovation has established a committee to look at the funding of a research platform under medical research. These research platforms include biobanks. To ensure alignment with international standards, the NHLS Biobank maintains its membership with the International Society for Biobanking (ISBER) and the European, Middle Eastern, and African Society for Biopreservation and Biobanking (ESBB). Mr B Duma is a member of the ISBER Standards Committee, which recently developed a new biobanking standard, ISO 20387. This standard will help international biobanks with auditing and accreditation.



#### **PROFESSIONAL DEVELOPMENT**

#### **Biobank Journal Club**

A Biobank Journal Club has been initiated to discuss the developments and research on all biobank-related matters internationally. The Biobank Journal Club is open to Biobank staff, and CPD points are allocated for any attendees of the Journal Club. Mr B Duma has completed a MSc (Biobanking) degree at the University of Graz in Austria and graduated in September 2022.



IMAGE 17: (Left to right: Dr Sabine Vogl,Vice Rector, Mr B Duma (Graduate) Lecturers: Prof Bethold Huppertz and Prof Karine Sargsyan.

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## INFORMATION SERVICES & TRAINING SECTION

Information Services serves as an enabling partner providing support to the NIOH and the NHLS, and acts as a gateway to occupational health information, not only for the organisation but also for external patrons throughout South Africa and the SADC region.

The Section provides support through:

- South Africa's national reference library for occupational health, the AJ Orenstein Memorial Library, the only specialist reference library in Southern Africa dealing exclusively with occupational health topics, housing an extensive collection of information resources in occupational health both in print and electronic formats;
- A query-handling service, which is aimed at responding and facilitating access to technical and scientific occupational health (OH) information, guidance, and expert advisory services offered within the institute;
- An archive, which is aimed at comprehensively collecting, documenting, and preserving the character and identity of the organisation and providing evidence of the historical development and changes of the organisation over time;
- The institutional repository, which is a digital collection of the organisation's intellectual output; and
- The training unit, which is aimed at providing technical OHS training for the NIOH stakeholders, plays an integral part in the NIOH as it is a key function of the institute.

In addition, the Section provides seamless and consistent access to information resources (electronic and print) throughout the NHLS and the NICD to support and enable researchers to conduct world-class and innovative research. The Section serves the information needs of all NHLS staff, including those located in laboratories, and the eight medical schools throughout South Africa as well as the NICD. Under the leadership of the NIOH Information Services since 2011, the Section has extended its offerings to include access to the library collections of the NHLS (formally known as the SAIMR Library), located in Braamfontein. The expansion also covers NICD library collections, which are housed at the NIOH resource centre, with an extensive remote information service provided to the NICD community.

#### SERVICES

Information Services offers its knowledge and information to all stakeholders, both internal and external, to support the promotion of good occupational health practices. The Section ensures the provision of comprehensive resources and services in support of the research, teaching, and training activities of the organisation and is a national resource and service dedicated to the collection, access to, and dissemination of information on the prevention of occupational diseases and accidents in workplaces. The primary objective of the service is therefore to collect, access, and disseminate information in support of occupational health services and activities throughout South Africa and the SADC region.

Realising this, a wide variety of information resources are provided. These include electronic databases, scientific periodicals, and monographs, both in print and electronic formats. The NIOH's AJ Orenstein Memorial Reference Library continued its principal function of searching, retrieving, and disseminating information in support of occupational health services throughout South Africa and the SADC region. Through various library interventions, the skills needed to source information in occupational health were shared with occupational health professionals, university students, workers, management, health and safety representatives, and labour union officials.

The Information Services Section continued to receive and respond to requests for technical and scientific information on occupational health issues through its query-handling service. The total number of queries received for the reporting year was 564. Of the 564 requests received, 466 were fulfilled. This number includes the queries that come through the NIOH library and those that come through the Query Handling Service. In the reporting year, with the easing of restrictions and lifting of the National State of Disaster, we saw a significant decline in the number of COVID-19 related queries as compared to the last two years of the pandemic. COVID-19 related queries received in the reporting year were mostly about updated regulations on quarantine and isolation periods; COVID-19 leave; whether or not workplaces are still expected to continue with OHSS registrations and daily screenings; return to work, etc. These questions came from both employers and employees, occupational health practitioners, health safety representatives, and the general public.

All the above-mentioned queries were in addition to our usual queries, which included but were not limited to:

- Requests for occupational hygiene and ergonomic surveys;
- Requests for training on the handling of asbestos or advice on how best to handle asbestos-containing materials in homes and workplaces, and risks related to asbestos-containing materials in homes;
- Referrals to the NIOH clinic;
- Requests for information about the Diploma in Occupational Health and Master of Public Health qualifications;
- Requests for advice from both employers and employees on occupational health related issues in the workplace;
- Training intervention requests; and
- Pathology follow-ups, and many more.

These queries came from all SA provinces, from both employers and employees, occupational health practitioners, health and safety representatives and the public. It is also worth noting that queries received originated from other African countries and from countries outside Southern African boarders.

The Section also handled requests for scientific information through the NHLS and the NICD libraries. Combined, these two libraries responded to 246 requests for journal articles.

The Section maintained its library collections and enabled ease of access to full-text scientific journal articles through its subscription to the American Society for Microbiology (ASM) database in support of research activities. This database provides access to full-text articles from various medical journal titles. Open-access electronic resources/ databases and a few trial databases were also added to the library collection, which researchers can access through the library page on the intranet. Information Services continued to support researchers by providing the necessary literature to carry out their research projects. Researchers also received training on how to utilise these resources, with a total of 13 information literacy training interventions hosted. These training interventions also included training on the use of Zotero, a bibliographic reference management tool, and the development and viewing of a video on how to access the Taylor & Francis journals' database.

During the reporting year, the Section hosted one student from the University of Limpopo for an experiential learning programme. The programme offers practical training to final-year Information Science students in a quest to balance theoretical knowledge with hands-on experience in the field of information science. In addition to this, the Section hosted 18 postgraduate Information Science students and two senior lecturers from the University of Limpopo for a physical tour of our libraries in July 2022. The libraries further provided library orientation and induction to new employees and interns in the organisation. In an effort to reach a large number of library patrons, the Section developed a virtual tour, which was a video of all Information Services units, including the libraries. This video was published on the institute's YouTube channel as well as the library intranet page to showcase the services and resources offered by the Information Services section.

From the research projects conducted, the annual target of 27 publications for 2022/23 was overachieved by 14 publications, giving a total of 41 publications produced in the reporting year. All 41 publications were uploaded on the NIOH website for ease of access, and disseminated to external stakeholders from various government departments, researchers from various SA universities, occupational and public health practitioners, labour organisations, and other organisations dealing with OHS, as well as through the institute's newsletter, the OccuZone.



IMAGE 18: University of Limpopo postgraduate students, senior lecturers, and staff of the Information Services Section during the library tour.

#### **PROFESSIONAL DEVELOPMENT**

For the year under review, one staff member obtained a Master's Degree in Information Science, while the other member completed a BA Honours Degree in Archives and Records Management, both from the University of South Africa.

#### **TEACHING AND TRAINING**

The NIOH's Training Unit, a sub-unit of the Information Services Section, coordinated and delivered free online COVID-19 training webinars directed at occupational health and safety (OHS) stakeholders during the preceding period dominated by the novel SARS-CoV-2 virus and the ongoing COVID-19 pandemic to strengthen the OHS stakeholder communities' capacity to improve prevention and emergency preparedness in the workplace. At the start of the year under review, the NIOH hosted a centenary webinar celebrating 100 COVID-19 webinars since the beginning of the pandemic in March 2020. This event was coordinated and hosted by the Section. The centenary webinar, which was opened by the Chairperson of the NHLS Board of Executives, was a huge success. This set the tone for future online training sessions at the Institute.

#### **TRAINING INTERVENTIONS**

For the year under review, six online webinars were completed, including the COVID-19 Centenary Webinar (21 April 2022). These sessions reached 4555 attendees (an average of 759.1 attendees per session; 379.6 per month). The topics covered included COVID-19 guidelines, policy updates, national summative overviews and reflections on the two-year COVID-19 experience, minimum OHS services for workplaces, and OHS compliance in the workplace. The COVID-19 webinar series has drawn an audience from the public and private sectors, mainly from within the borders of South Africa, the SADC Region, and the African continent, as well as from other continents across the globe. The webinars are conducted on the Zoom and Microsoft Teams platforms.

Additional information resources (such as webinar video and audio recordings, presentations, and supporting documentation/reports) are subsequently made available on the NIOH website at www.nioh.ac.za, our X (formerly Twitter) feed https://twitter.com/home, and YouTube channel.

Post-webinar training feedback surveys and online tests for continuous professional development (CPD) accreditation are circulated.

The Section further coordinated nine training workshops for external partners. These included:

- Occupational Medicine Specialist Presentation for the NUM Gauteng Region's - Regional Health and Safety Structure (REHSCO) workshop;
- Occupational Hygiene Training Association (OHTA) Training;
- Workplace stressors impacting work performance and psychological well-being for the workshop of the Gauteng Provincial Management Committee (PMC) of the Department of Employment and Labour (DoEL); and
- Minerals Council of South Africa's (MCSA) online training webinar on Noise Induced Hearing Loss (NIHL) to mention a few.

#### **PROFESSIONAL DEVELOPMENT**

The NIOH, in partnership with the National Economic Development and Labour Council (NEDLAC) and the Compensation Fund, launched the COVID-19 Related Occupational Health and Safety Education and Awareness programme that builds upon the achievements and momentum of the previous two years COVID-19 training webinars. A series of training webinars were delivered to equip various work industries with the tools required to protect and promote workers' health and safety. The NEDLAC and NIOH online webinar series is aimed at NEDLAC stakeholder constituencies, the NIOH stakeholder communities, and in particular workplace-based audiences.

The target audience includes:

- Employees; supervisors and managers; safety, health and environment (SHE) representatives; trade union representatives/shop stewards, office-bearers and officials.
- Health and safety (H&S) officers; employee health and wellness (EHW) practitioners; and human resource (HR) management practitioners.
- Occupational medicine practitioners (OMP); Occupational health nursing practitioners (OHNP); and Occupational hygiene practitioners OHP) etc.

# INTERNATIONAL LIAISON

#### MANAGER DR NATASHA SANABRIA

## INTERNATIONAL LIAISON SECTION

International networks and collaborations are vital to sustain research innovation and development. Thus, the NIOH continues these associations by making concerted efforts to renew and maintain ties with important international organisations. These organisations include, but are not limited to, the World Health Organization (WHO), the International Labour Organization (ILO), the African Union Development Agency (AUDA-NEPAD), the International Commission on Occupational Health (ICOH), the National Institute for Occupational Safety and Health (NIOSH-CDC) in the USA, the Health and Safety Laboratory (HSL) of the UK, and Workplace Health Without Borders (WHWB).

## THE NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH

NIOSH is the United States federal agency responsible for conducting research and making recommendations for

the prevention of work-related injuries and illnesses. The NIOH and NIOSH signed and finalised an MoU to renew collaborative work, where NIOSH encourages "Total Worker Health" (TWH) approaches that value a work-life balance and improve overall worker well-being. NIOSH is part of the Centres for Disease Control and Prevention (CDC) and uses the Burden, Need and Impact (BNI) method to identify its research priorities. The NIOSH Priority Goals for Extramural Research fill research gaps that are currently not being addressed by NIOSH intramural or internal research. The following extramural research goals align with the work conducted at NIOH: reduction of occupational cancer, cardiovascular disease, adverse reproductive outcomes, and other chronic diseases; reduction of occupationalrelated hearing loss; and the reduction of dermal disease, occupational-related musculoskeletal disorders, and/or respiratory disease.



IMAGE 19: NIOH Executive Director, Dr Spo Kgalamono, and Dr Stephen Sawyer at the signing of the NIOSH Memorandum of Understanding.

## CENTRES FOR DISEASE CONTROL AND PREVENTION

The NIOH contributed valuable insight regarding the theme "Beyond the Pandemic: Building on Lessons Learned" (and NHLS experiences) at the 17th Centres for Disease Control and Prevention (CDC) International Symposium on Biosafety, which offered pre-conference training related to biosafety challenges and emergency preparedness strategies. Two members of the SHE Department were invited to attend this symposium, i.e., National Manager Mr D Jones and Occupational Medicine Practitioner Dr G Chin. They networked with Ms LouAnn Burnett, i.e., the current President of the American Biological Safety Association and a member of the Global Chemical and Biological Security Program, at Sandia National Laboratories.

A new Public Health (Surveillance) Bulletin is being developed in collaboration with the NICD. The project is under the direction of Dr Kimberly Koporc (Public Health Bulletin Project Manager, Senior Technical Advisor, CDC Foundation) to conduct a Reviewer Roundtable in South Africa. The Reviewer Roundtable was developed by the CDC Foundation, in collaboration with the CDC's National Public Health Institutes Program. It was made possible with financial support from Bloomberg Philanthropies' Data for Health Initiative.

The NIOH, through Dr N Tlolteng, Prof N Naicker and Dr N Sanabria contributed towards implementation thereof, and this activity is strategically important for the upcoming implementation of NAPHISA.

#### WORLD HEALTH ORGANIZATION

The WHO aims to work towards occupational health and safety for all. The NIOH's participation in the network in the past was vital to ensuring decent work for all in South Africa. In line with this, members of the NIOH/NHLS SHE Department were invited by the WHO to serve on a committee and contribute towards compiling a new document entitled "Caring for those who care: a Guide for the development and implementation of occupational health and safety programmes for health workers".

The NIOH has successfully been awarded the re-designation as the World Health Organisation Collaborating Centre for Occupational Health for the next four years. The Global Network of WHO Collaborating Centres' aim is to stimulate networking between participating institutions and international partners to provide a substantial contribution to the WHO's overall goal. To date, collaboration on several research projects has been instrumental in networking and creating a platform to showcase the Sub-Saharan Region's. Dr Sanabria compiled and submitted the annual report regarding the four ongoing research projects. Networking activities related to the first and second projects have included international collaboration with the University of British Columbia (UBC). Networking related to the third project included collaboration with the Department of Employment and Labour and the ILO. The projects listed below are currently in their fourth and final year of progress:

#### LEAD: DR MUZIMKHULU ZUNGU (PROJECT 28609):

In support of WHO's work on occupational health and safety of health workers, to identify and analyze lessons learned from the development and implementation of the national programme for occupational health of health workers in South Africa

Work continued within the health sector to improve the occupational health of health workers through a national audit of the occupational health services as well as health and safety committees in the health sector, with a specific emphasis on COVID-19. The NIOH also trained all the health facilities within two health districts in the Mpumalanga Provincial Department of Health on OHS interventions in line with HealthWISE. The collaborative work resulted in a publication, i.e., Organizational Factors Associated with Health worker Protection During the COVID-19 Pandemic in Four Provinces of South Africa (https://doi.org/10.1186/s12913-021-07077-w). Another final manuscript is in preparation regarding pre- and post-intervention changes on OHS implementation.

#### LEAD: DR MUZIMKHULU ZUNGU (PROJECT 28610):

## Provision of technical inputs to support WHO's work towards the development of the WHO/ILO global report on occupational health of health workers

The study on "Strengthening occupational health systems and services for health workers during the COVID-19 pandemic and beyond: the role of occupational health and safety information systems" is ongoing. The study utilized a mixed methodological approach, which compared changes in OHS systems (policy, leadership, and coordination; financing; human resources; infrastructure, technology, and medicines; information management; and services) in health facilities following the concurrent implementation of two interventions (the OHASIS and HealthWISE tools). It has three phases: (1) pre-intervention baseline research; (2) intervention; and (3) post-intervention. Phases one and two have been completed, i.e., pre-intervention baseline research and intervention research. A manuscript has been submitted for publication of the results.

#### LEAD: DR NISHA NAICKER (PROJECT 28612):

#### To support WHO's work on the informal economy, focusing on research and policy development

There are very few studies that have compared health outcomes between the informal economy workers and the formal economy workers. Thus, the NIOH has developed projects to address this gap. The informal economy survey has been completed. Waste pickers working on landfill sites in Johannesburg have been interviewed, and an occupational hygiene hazard identification and a walk through risk assessment have been completed. The formal economy (workers at waste recycling buy-back centres) study has been completed. The data has been analysed and a report produced. The results have also been published in several international and national journals. The formal economy (i.e., workers at waste recycling buy-back centres) study has also been completed, and the first publication has been drafted for submission. Post data analyses, additional results for the formal economy as well as comparisons between the informal and formal economies will be disseminated. Thereafter, plans have been made for research translation and the further dissemination of results.

#### LEAD: DR TANUSHA SINGH AND DR NISHA NAICKER (PROJECT 28614):

To provide technical inputs in support of WHO's activities towards providing guidance and policy options for action by the health sector to improve the health and safety of poor informal economy workers

A systematic review of health services use and health outcomes among workers in the informal economy was published (Naicker et al., 2021. DOI: 10.3390/ijerph18063189). The planned future work includes a systematic review of the intervention's effectiveness and a report on these case studies.

## INTERNATIONAL COMMISSION ON OCCUPATIONAL HEALTH

ICOH is one of the oldest scientific associations in the field, with around 2000 members from over 100 countries worldwide. ICOH is an NGO recognised by the United Nations and has a close working relationship with the ILO and WHO. The NIOH has a long-standing history of supporting ICOH initiatives. Therefore, Dr S Kgalamono was recently nominated to serve as a member of the Trustees Committee of the ICOH 2024 Congress. Dr T Singh was recently appointed secretary of the ICOH scientific committee for Biohazards and Occupational Health for the current triennium (2022-2024).

## INTERNATIONAL COMMISSION ON RADIOLOGICAL PROTECTION

Dr W Utembe was invited to be a member of the International Commission Radiological Protection (ICRP) task group on Ecosystem Services in Environmental Radiological Protection. This Task Group (TG) will explore and share knowledge on ecosystem services by providing background and general recommendations on how ecosystem services can support a holistic approach to environmental radiological protection (ERP) and, as specifically relevant to ERP, explore how the system of radiological protection contributes to the delivery of sustainable development. There has been increasing interest in incorporating ecosystem service monitoring and assessment in many contexts related to environmental protection and policymaking. This activity is strategically important for the upcoming implementation of NAPHISA.

#### INNOVATIVE NANO INFORMATICS MODELS AND TOOLS: TOWARDS A SOLID, VERIFIED, AND INTEGRATED APPROACH TO PREDICTIVE (ECO) TOXICOLOGY

This NanoSolveIT project has been funded by the European

Union, where Prof M Gulumian, Dr C Andraos, Mr K Boodhia and Dr N Sanabria represented South Africa within the international consortium. The project received numerous extensions due to delays and complications surrounding nationwide COVID-19 lockdowns, but the deliverables will be met in the near future, i.e., WP-1 focused on NanoSolveIT Knowledge Infrastructure (open science approaches and FAIR data management plans), WP2 focused on experimental data gap filling to support *in silico* models, and WP5 focused on predictive nano-informatics modelling using AI methodologies. All collaborative meetings and various research activities enabled skills transfer and capacity building while maintaining and increasing international networks, e.g., joint work with other EU groups including NanoCommons, RiskGone, and Gov4Nano.

## F1000RESEARCH: NANOSCIENCE & NANOTECHNOLOGY GATEWAY

Dr N Sanabria was invited to be a member of the Nanoscience and Nanotechnology Gateway and represent South Africa. The Gateway aims to help the research community meet key challenges and accelerate the pace of discovery through the open sharing of fundamental and applied research, data and code. By adopting this approach, including the dissemination of useful methods and protocols, researchers can maximize the potential of their findings, collaborate across the various disciplines involved in nanotechnology, and improve our understanding of nanoscale materials.

## INTERNATIONAL ORGANIZATION FOR STANDARDIZATION

Dr C Andraos worked with Prof M Gulumian and other ISO TC229 experts regarding Workgroup 3: Health, Safety and Environmental Aspects of Nanotechnologies.

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#### **Oral presentations international**

Andraos C. *Opportunities and limitations on SbD approaches for nanomaterials*. The XVIth International Congress of Toxicology, Maastricht, the Netherlands, from 18 – 21 September 2022.

Boodhia K. Distribution and Uptake of Gold Nanoparticles under Air-Liquid Interface and Submerged Conditions, investigated using the Conventional Inverted microscopy and CytoViva 3D Technology. The XVIth International Congress of Toxicology, Maastricht, the Netherlands, from 18 – 21 September 2022.

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Fourie A, Kirsten Z. *PPE and adverse skin reactions to be undertaken at the hospitals*. Meeting with hospital CEO's and Occupational health practitioners from the Mpumalanga provincial hospitals regarding a research study. Mpumalanga, 26 November 2022.

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Monatisa, L. Spectrophotometric method development and validation for application in occupational exposure assessment of trichloroethylene (TCE). NIOH Biennial Research Day, Braamfontein, Johannesburg, November 2022. Ms L. Monatisa obtained the best oral presentation award for the event, for her presentation.

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Zungu M: Risk based medical surveillance a key to unlocking occupational hygiene in the workplace. SAIOH conference, 26 – 28 October 2022.

#### **Poster presentations international**

Joseph J. Exercise increases the expression of glucose transport and lipid metabolism genes at optimum level time point 6 h post-exercise in rat skeletal muscle. 14th International Congress of Human Genetics (ICHG), Cape Town, South Africa, (23-25 Feb 2023.

Joseph J. Role of exercise-induced calmodulin protein kinase (CAMK) II activation in the regulation of omega-6 fatty acids and lipid metabolism genes in rat skeletal muscle. 14th International Congress of Human Genetics (ICHG), Cape Town, South Africa, 23-25 February2023.

#### **Poster presentations national**

Joseph J. Exercise increases expression of glucose transport & lipid metabolism genes, 6h post exercise in rat skeletal muscle. NIOH Biennial Research Day, Braamfontein, Johannesburg, 30 November 2022.

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RP204/2023 ISBN: 978-0-621-51271-7



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