

ivision of the National Health Laboratory Service

NATIONAL INSTITUTE FOR OCCUPATIONAL HEALTH ANNUAL REVIEW

2019 - 2020





Division of the National Health Laboratory Service



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LIST OF ABBREVIATIONS

16S rRNA	16S Ribosomal Ribonucleic Acid
AAS	African Acedemy of Sciences
ABSA	American Biological Safety Association
ACM	Asbestos-Containing Material
AESA	Alliance for Accelerating Excellence in Science in Africa
AFRICA	Asbestos Fibre Regular Informal Counting Arrangement
AIA	Approved Inspection Authority
AIMS	Asbestos in Materials International Quality Assurance Scheme
ALK	Anaplastic Lymphoma Kinase
AO	Adverse Outcome
AOP	Adverse Outcome Pathway
aOR	Adjusted Odd Ratio
APHL	Association of Public Health Laboratories
AR	Annual Report
ARAOH	African Regional Association for Occupational Health
ART	Asbestos Relief Trust
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
AU	African Union
AUDA-NEPAD	African Union Development Agency
BOHS	British Occupational Hygiene Society
BRICS	Brazil, Russia, India, China and South Africa
BTech	Bachelor of Technology
CC	Collaborating Centre
CDC	Centers for Disease Control and Prevention, US
CEI	Cumulative Exposure Index
СНВН	Chris Hani Baragwanath Hospital
CEO	Chief Executive Officer
CHPC	Centre for High Performance Computing
CKDu	Chronic Kidney Disease of Unknown Origin
CMD	Common Mental Disorder
CMJAH	Charlotte Maxeke Johannesburg Academic Hospital
CMSA	Colleges of Medicine of South Africa
CoBNeST	First Conference of Biomedical and Natural Sciences and Therapeutics
CoJ	City of Johannesburg
COPD	Chronic Obstructive Pulmonary Disease
COSATU	Congress of South African Trade Unions
CPD	Continuing Professional Development
CSIR	Council for Scientific and Industrial Research
СТ	Computed Tomography
CXR	Chest X-ray
DAFF	Department of Agriculture, Forestry and Fisheries

DCS	Department of Correctional Services
DEA	Department of Environmental Affairs
DMRE	Department of Mineral Resources and Energy
DoH	Department of Health
DOH	Diploma in Occupational Health
DOHM	Diploma in Occupational Health and Medicine
dsDNA	Double-stranded Deoxyribonucleic Acid
DSI	Department of Science and Innovation
DUT	Durban University of Technology
EHWP	Employee Health and Wellness Programme
EOC	Emergency Operations Centre
EPA	Environmental Protection Agency, US
EQA	External Quality Assurance
ESBB	European, Middle Eastern and African Society for Biopreservation and Biobanking
EU	European Union
FED	Formidable Epidemic Disease
FIOH	Finnish Institute for Occupational Health
FTIR	Fourier Transmission Infrared Spectroscopy
GEMP	Graduate Entry Medical Programme
G-EQUAS	German External Quality Assessment Scheme
GLP	Good Laboratory Practice
HAVS	Hand-arm Vibration Syndrome
HBA	Hazardous Biological Agent
HCAI	Healthcare Associated Infection
HCW	Healthcare Worker
HIV	Human Immunodeficiency Virus
HOSPERSA	Health & Other Services Personnel Trade Union of South Africa
HPCSA	Health Professionals Council of South Africa
HRA	Health Risk Assessment
HSE	Health, Safety and Environment
HSL	Health and Safety Laboratory, UK
HTS	High-throughput Screening
IAEA	International Atomic Energy Agency
IAP	International Academy of Pathology
ICOH	International Commission on Occupational Health
ICP-MS	Inductively-coupled Plasma Mass Spectrometry
ICT	International Congress of Toxicology
ILO	International Labour Organization
IMMS	International Mass Spectrometry Society
IPC	Infection Prevention and Control
ISBER	International Society for Biological and Environmental Repositories
ISO	International Organization for Standardization
IT	Information Technology



Ιυτοχ	International Union of Toxicology
KE	Key Event
KER	Key Event Relationship
KRT	Kgalagadi Relief Trust
LAMP	Lead and Multi-element Proficiency Program, CDC
LMP	Lysosomal Membrane Permeabilization
MA	Master of Arts Degree
MBA	Master Builders Association
MBOD	Medical Bureau for Occupational Diseases
MEd	Master of Education Degree
MHSC	Mine Health and Safety Council
MM	Master of Management Degree
MMed	Master of Medicine Degree
MMPA	Mine Medical Professionals Association
MN	Manufactured Nanomaterial
MPH	Master of Public Health Degree
MRC	Medical Research Council
MSc	Master of Science Degree
MSIT	Master of Information Science Degree
MTech	Master of Technology Degree
NCAS	National Council Against Smoking
NCR	National Cancer Registry
NGO	Nongovernmental organisation
NHLS	National Health Laboratory Service
NICD	National Institute for Communicable Diseases
NIHL	Noise-induced Hearing Loss
NIOH	National Institute for Occupational Health
NIOSH	National Institute for Occupational Safety and Health (US)
NMISA	National Metrology Institute of South Africa
NMMU	Nelson Mandela Metropolitan University
NOMS-SA	National Occupational Mortality Surveillance South Africa
NRF	National Research Foundation
NRGM	Nano Risk Governance Model
NSCLC	Non-small Cell Lung Carcinoma
NUM	National Union of Mineworkers
NWIP	New Work Item Proposal
NWU	North-West University
OA	Occupational Asthma
OCSA	Occupational Care South Africa
ODMWA	Occupational Diseases in Mines and Works Act 78 of 1973
OECD	Organisation for Economic Co-operation and Development
OEHS	Occupational and Environmental Health and Safety
OHASIS	Occupational Health and Safety Information System

OHN	Occupational Health Nurse
OHORT	Occupational Health Outbreak Response Task Team
OHS	Occupational Health and Safety
OHTA	Occupational Hygiene Training Association
OMP	Occupational Medicine Practitioner
OPCW	Organization for the Prohibition of Chemical Weapons
OPS	Optical Particle Sizer
OSD	Occupational Skin Disease
PATHAUT	Pathology Disease Surveillance Database
PathReD	Pathology Research and Development Congress
PCM	Phase Contrast Microscopy
PCR	Polymerase Chain Reaction
PDTC	Program Delivery Technical Committee
PHASA	Public Health Association of South Africa
PhD	Doctor in Philosophy Degree
PMR	Proportional Mortality Ratio
PPE	Personal Protective Equipment
PTS	Proficiency Testing Scheme
QA	Quality Assurance
QC	Quality Control
QMS	Quality Management System
qPCR	Quantitative Polymerase Chain Reaction
R&D	Research and Development
RCS	Respirable Crystalline Silica
RMA	Rand Mutual Assurance
RSR	Railway Safety Regulator
RW	Reclaimed Water
SAASTA	South African Agency for Science and Technology Advancement
SABS	South African Bureau of Standards
SACNASP	South African Council for Natural Scientific Professions
SADC	Southern African Development Community
SAFCEC	South African Forum of Civil Engineering Contractors
SAFETP	South African Field Epidemiology Training Programme
SAGS	South African Genetics Society
SAHR	South African Health Review
SAIMR	South African Institute for Medical Research
SAIOH	Southern African Institute for Occupational Hygiene
SAMHS	South African Military Health Services
SANAS	South African National Accreditation System
SANDF	South African National Defence Force
SANTACO	South African National Taxi Council
SARS-CoV-2	Severe Acute Respiratory Syndrome Coronavirus 2
SASBi	South African Society for Bioinformatics

SASOHN	South African Society of Occupational Health Nursing Practitioners
SASOM	South African Society of Occupational Medicine
SATBHSS	Southern Africa Tuberculosis and Health Systems
SATIBA	South African Tissue Bank
SDG	Sustainable Development Goal
SDS	Safety Data Sheet
SETAC	Society of Environmental Toxicology and Chemistry
SFSA	Science Forum South Africa
SG8	Steering Group 8
SGTA	Steering Group on Test Guidelines
SHE	Safety, Health and Environment
SHSPH	School of Health Systems and Public Health
SIA	Safe Innovation Approach
SKA	Square Kilometre Array
SLA	Service Level Agreement
SMME	Small, Medium and Micro Enterprise
SMLTSA	Society of Medical Laboratory Technology of South Africa
SMP	Scanning Mobility Particle
SOC	State-owned Company
SOP	Standard Operating Procedure
SOT	Society of Toxicology
SPT	Skin Prick Testing
SRA	Society of Risk Analysis
SU	Stellenbosch University
TAT	Turnaround Time
ТВ	Tuberculosis
THRIP	Technology and Human Resources for Industry Programme
TUT	Tshwane University of Technology
UBC	University of British Columbia
UCT	University of Cape Town
UFS	University of the Free State
UJ	University of Johannesburg
UK	United Kingdom
UL	University of Limpopo
UN	United Nations
UNGA	United Nations General Assembly
UNISA	University of South Africa
UP	University of Pretoria
URL	Uniform Resource Locator
USA	United States of America
UVGI	Ultraviolet Germicidal Irradiation
VHF	Viral Haemorrhagic Fever
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

*Throughout this Annual Review the NIOH is using the current nomenclature for all Government Departments.

Executive Director's Overview



Executive Director's Overview

Dr Spo Kgalamono (Acting)

The National Institute for Occupational Health (NIOH) is recognised as a centre of excellence for occupational health and functions as a national and regional source of knowledge and expertise to the South African government, industry and labour, the Southern African Development Community (SADC) countries and the African continent. It provides advice and assistance, conducts research and develops capacity, through teaching and training, for the purpose of promoting healthy conditions in the workplace and improving occupational health.

Under the leadership of the NHLS, the NIOH had numerous highlights in the area of Occupational Health and Safety (OHS) during the period under review. The multidisciplinary teams of the institute participated in a substantial number of OHS engagements, in both the public and private sectors, ranging from partaking in cutting-edge research at a national and global level, to supporting innovative programmes to assist vulnerable workers. In the process, the NIOH collaborated with a significant number of key workplace role-players; locally, nationally and internationally. This in turn contributed to the institute gaining a new body of knowledge that will enhance and supplement our future efforts to help ensure good OHS in all workplaces.

The NIOH implemented several targeted programmes, including training, for our key partners, local societies and stakeholders during the reporting period. These included collaborations and partnerships with:

- The Departments of Health (national and provincial);
- The Department of Employment and Labour and the Department of Mineral Resources and Energy (DMRE);
- The South Africa Society for Occupational Medicine (SASOM); the African Regional Association for Occupational Health (ARAOH);
- The South African Society for Occupational Health Nursing (SASOHN);
- The Southern African Institute for Occupational Hygiene (SAIOH);
- The Mine Medical Professionals Association (MMPA);
- The African Union Development Agency New Partnership for Africa's Development (AUDA-NEPAD); and
- Academia, trade union representatives, employers, employees, and public and private sector groups.

During the year under review, the NIOH put emphasis on industrial sectors that are known to be poorly covered by occupational health and safety services. These included the informal, construction, and agricultural sectors. These sectors have workplace health risks that are inadequately quantified and new emerging risks that require attention, for example: artificial stone production causing silicosis. The NIOH has programmes in all three sectors but the extension of basic occupational health services to prevent injury and disease and promote better health in these vulnerable, underserved workers requires a considerable multi-stakeholder, national effort.

There were some notable developments in occupational health and safety (OHS) in South Africa where NIOH played a role. A number of staff members represented the NIOH at the Department of Employment and Labour technical committees, drafting and revising occupational health legislation. The NIOH also launched its inaugural newsletter called the NIOH OccuZone. This newsletter, which has been welcomed by our partners, is disseminated quarterly and serves as a platform for sharing information about the institute's activities, events and accomplishments. The publication details research underway, specialised service delivery and teaching & training activities of the Institute, as per our core mandate. This newsletter creates awareness around emerging researchers and their work. In addition, the NIOH has increased its digital footprint through the effective utilisation of the social media platforms Twitter and YouTube. These communication channels provided the opportunity for networking on a global scale, assisted with targeting specific stakeholders through tailored communication, and provided a diverse PR platform to share information.

In 2020, the NHLS purchased the intellectual property of the Occupational Health and Safety Information System (OHASIS) so as to take sole ownership of this user-friendly system that supports surveillance, compliance with OEHS legislation, enables online training and provides information for research analysis. It is increasingly being rolled out to several provinces as well as in neighbouring countries. Recently, the OHASIS has been adapted to cater for the new challenges posed by COVID-19.

Coronavirus disease activities

Along with much of South Africa, the latter part of the period under review was dominated by the COVID-19 pandemic. Although the country's first patient was diagnosed in the last month of the reporting period, as was the declaration of a national State of Disaster, preparation to respond to the impending epidemic and its effects on workplaces and working life began some months prior. The establishment of an Occupational Health Outbreak Response Team in February was opportune in the provision of information, advisory services and evidence for the formulation of policies, statutes, standards of practice and guides for workplaces.

The NIOH played a crucial role in the training of various occupational groups across numerous sectors, in an effort to equip industry with the tools required to protect and promote workers' health and safety, including the safe return to work, during the pandemic. As the demand for online COVID-19 training increased, the online training platform capacity had to be amplified to cater for more participants. A dedicated workplace hotline, specifically for occupational health professionals, employees and employers, had to be established also. In the month of March, over 8000 participants were trained on COVID-19 topics and several guidelines and fact sheets were developed and translated into local languages. All these materials are accessible via the NIOH's zero-rated website.

The provision of occupational health and safety specialised services, biobanking, information and advisory services, and teaching and training continued during the year as did substantial support to government departments, both nationally and provincially. The research of the Institute, which is cross-cutting and a core mandate of NIOH needs special mention.

Research and surveillance

Producing new knowledge to prevent ill health and injury and to promote good health is typically a fundamental task of national institutes for occupational health. Taken together, the sections' reports that follow describe a large and varied inter-disciplinary research programme covering many issues important to the improvement of worker's health and the health of communities living around workplaces. The topics of the scientific articles published over the year reveal the large variety of research needs in occupational health and safety in the country. There were 33 peer-reviewed articles published, an increase from the previous year.

Surveillance of occupational health, morbidity, injury and mortality is inadequate in South Africa. Contributing to improved surveillance is a long-standing but increasingly important part of the work of the NIOH - hence concerted efforts are being made to increase the publication of surveillance reports.

International

The NIOH fostered strong international relationships through dedicated collaboration and networking efforts with key international agencies such as the World Health Organization (WHO); the International Labour Organization (ILO); the International Commission on Occupational Health (ICOH); the National Institute for Occupational Safety and Health, of the Centers for Disease Control & Prevention (NIOSH-CDC), USA; the Finnish Institute for Occupational Health (FIOH); the Health and Safety Laboratory (HSL) of the UK, Workplace Health Without Borders (WHWB) and the Organization for Economic Co-operation and Development (OECD). The NIOH was re-designated as a Collaborating Centre in Occupational Health by the World Health Organization during the period under review. This is a welcomed recognition of the NIOH's achievements in supporting the Occupational Health programmes of the WHO, and the continuation of opportunities for partnerships and projects with the network of Collaborating Centres around the world. The NIOH had a prominent role in the WHO's programme on vulnerable workers, such as those in the informal economy. The ILO invited the NIOH to partner with them on a mission to Ethiopia to advise the Ethiopian Department of Labour and Social Affairs on the establishment of an Ethiopian Institute for Occupational Safety and Health. The project is ongoing and NIOH continues to offer support.

Moving to the new financial year - COVID-19 and a changing world of work

It is expected that COVID-19 and the consequent changing world of work will preoccupy much of the NIOH's planning, re-organisation and work for the near future. Many technical questions on protecting employees and employers from infection and its consequences need to be answered. The research projects listed in the Immunology and Microbiology Section's report are illustrative of them. All of working life may be altered to some extent: the way we work in the informal economy, businesses of all sizes, factories, mines and offices will change in unpredictable ways, and the work-related health effects that accompany these changes – some bad and some good - will need to be assessed and managed. South Africa is, unfortunately, all too familiar with unemployment and under-employment. But the expected increase will have many negative consequences for workers. Although new to the NIOH, aspects of unemployment and worker health may need consideration by the Institute, preferably in collaboration with more experienced partners. The informal economy, large already, will probably expand rapidly and the NIOH's programmes on this economic sector will need to be reviewed.

Appreciation

I wish to thank the NHLS and the NIOH management team for the strategic leadership that enabled the NIOH to deliver excellent results under resource-constrained circumstances. Staff at NIOH continue to strive for excellence in their work and I appreciate their contribution and thank them for their hard work in the contribution towards ensuring healthy, safe and ultimately sustainable workplaces. Our partners, collaborators and stakeholders are acknowledged for contributing to the successes of the NIOH.

Pathology Division



Pathology Division

Head: Dr Anita Gildenhuys

The origins of the Pathology Division lie in the Pneumoconiosis Research Unit that was founded in 1953 to conduct research into dust-induced lung diseases in mine workers. While working at this unit, Dr J C 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 mine workers.

Through expertise gained in lung pathology the division has become a referral centre for lung biopsies obtained at surgery. In 2017, the Pathology Division was appointed as a provider of pathology services to the Centre of Pulmonary Excellence (Lung Laboratory Research and Intervention Centre). The division has been assisting with diagnostic surgical pathology services for the Limpopo Province. In addition to these pathology services, the division offers analytical electron microscopy services.

The service work of the division provides data and material for teaching, research and surveillance purposes. The quality of the work in the laboratories of the division is maintained through participation in external quality assurance (EQA) schemes and accreditation with SANAS in accordance with the recognised international ISO 15189:2007 standard.

DIAGNOSTIC SERVICES

Autopsies

In terms of the Occupational Diseases in Mines & Works Act: Act 78 of 1973, the Pathology Division continues to execute the statutory requirement of examining the cardio-respiratory organs of deceased miners. A pathology report of this examination is sent to the Mines Medical Bureau for Occupational Diseases (MBOD) to assist with the compensation process for families of deceased mine workers.

To promote the use of the autopsy service, presentations and workshops were presented to stakeholders to raise awareness and educate clients about the services provided by the NIOH. Despite these efforts, the number of autopsies continue to decline. In the 2019/2020 financial year, only 748 autopsies were performed, which is a decrease from the 776 performed in the previous financial year. While this may reflect the decreasing number of miners working in the industry, there is a recognised need to facilitate access to the compensation system.

The autopsy service generates a great deal of information about the lungs that are examined. Approximately 200 items of information are carefully recorded by the examining pathologists. This information is entered into the Pathology Division database (PATHAUT). PATHAUT is a national resource and contains unique information about disease in the mining industry. The database has been and continues to be used extensively for research in collaboration with local and international collaborators and over 150 peer-reviewed publications have been produced, using the data. The database has been maintained since 1975 and has been used to show disease trends in the mining industry. It is also an important tool for disease surveillance. Annually, detailed disease surveillance reports are compiled from PATHAUT, providing demographic data and disease rates. These are



made available in the public domain through the NIOH website, at the following URL: <u>http://www.nioh.ac.za/wp-content/uploads/2019/05/2017-PATHAUT.pdf</u>

Surgical Pathology

The division has vast experience of lung pathology and is recognised as a centre of excellence. A diagnostic service is offered to satisfy the demand for opinions on lung biopsies, fine needle aspirates and bronchial washings. Due to a lack of capacity at the NHLS laboratories, the NIOH Pathology Division accepted the request in October 2017 to be the service provider for general surgical pathology to Limpopo Province. This has resulted in an improved pathology service to the province. The general surgical pathology specimens received from Limpopo Province affords pathologists at the NIOH an opportunity to examine a broad range of general pathology.

Electron Microscopy

The Electron Microscopy Section functions within the division and supplements the service work of the Pathology Division by determining the asbestos fibre concentrations in lung tissue to assist with diagnoses of asbestos-related disease.

The section conducts qualitative and quantitative analyses for the presence of asbestos fibres. Analyses are conducted on bulk materials and air samples, which are obtained on filters. These analyses are performed for other divisions of the NIOH and external clients including national, provincial and local government, nongovernmental organisations (NGOs), universities and private businesses. The section participates in an external quality assurance scheme and has maintained its satisfactory rating in the Asbestos in Materials international quality assurance scheme coordinated by the Health and Safety Laboratory, UK.

The service to analyse samples for asbestos was first offered in 2003. Since then, data generated from the samples submitted for analysis has been stored and entered into a database. This database is unique in South Africa and its interrogation provides information about the legacy of asbestos in the country. To date, the database contains over 3000 entries with information regarding the type of sample, where it originates from, and the type of industrial sector, as well as the activity that was performed, such as the renovation of an asbestos-containing structure. This information has been used to produce an annual surveillance report which is available in the public domain through the NIOH web site at the following URL: http://www.nioh.ac.za/asbestos-surveillance-reports/

RESEARCH

Research relevant to the health of South African workers is executed by members of the Pathology Division staff. Material and data from the service work of the division provides a good deal of information for research projects. Current areas of interest are centred on diseases of the lung in mine workers caused by exposure to silica dust or asbestos fibres. The division has collected data on women employed in mining since 2005 and this data is currently being analysed.

Ms Z Maseko is an intern medical scientist at the division. She is working on a research project entitled: "Correlation between asbestos bodies on histology and asbestos fibre on electron microscopy in individuals occupationally exposed to asbestos". Her research protocol is complete, was corrected by supervisors, and will be sent for ethical approval by the University of Witwatersrand (Wits), Human Research Ethics Committee (Medical) at the end of May.

Ms Ntebogeng Kgokong, a medical scientist at the division, is completing a research project entitled: "Women in South African mines" which was submitted to "Occupational Health Southern Africa". She completed the dissertation for her master's degree and is awaiting registration for submission (title: Patterns of tissue damage caused by insect activity using pig carcasses as human analogies. A macroscopic and microscopic analysis).

Ms Michelle McCabe, a medical scientist at the division is completing her Doctor in Philosophy Degree (PhD) entitled "Molecular profiling of colorectal carcinoma in SA". She has published two articles thus far, and is busy with her third final article for publication.

Ms Lucia Mhlongo, a medical scientist at the division, is currently working on two projects, both at a development stage, entitled "Cardiovascular conditions in South African miners" and "Common conditions associated with manganese exposure in deceased South African miners".

The division collaborates with other sections within the NIOH and assists with projects that involve the enumeration and identification of asbestos. Links are fostered with local and international institutions, which currently include:

- The Centre for Scientific and Industrial Research (CSIR);
- Wits Schools of Pathology, Public Health, Clinical Medicine and Archaeology;
- The University of Johannesburg (UJ): Faculty of Health Sciences;
- Health and Safety Laboratory, UK;
- Occupational and Environmental Lung Injury Centre, Sheffield University, UK;
- University of Wales, UK;
- Harlan Laboratories, Switzerland;
- Dokkyo University School of Medicine, Japan;
- London School of Hygiene and Tropical Medicine, University College, London, UK;
- Brooklyn College, City University of New York, USA;
- Sciences Po University, Paris, France; and
- Environmental and Occupational Health Sciences, School of Public Health, Chicago, Illinois.

The division also receives visitors from these local and international institutions.

TEACHING AND TRAINING

The division plays a role in teaching and training through workshops, presentations and formal lecturing to professional bodies, universities and teaching hospitals. Prof J Murray is an Associate Professor at the School of Public Health.

Staff members participate in the mentoring, teaching and supervision of Masters' and PhD students at Wits and UJ. Teaching is also provided to Diploma in Occupational Health (DOH) students, medical students and allied healthcare students from Wits.

The pathologists actively participate in and present cases at regular clinical pathology meetings with doctors from the Johannesburg teaching hospitals. Specialised small group training is provided to healthcare professionals, mine workers, organised labour, and mortuary and funeral parlour staff. In collaboration with trade unions, members of the Pathology Division also conducted workshops focusing on lung disease.

PROFESSIONAL DEVELOPMENT

During the financial year under review, the division enrolled three postgraduates as follows:

- One for a PhD in Anatomical Pathology at Wits;
- One for a Master of Science Degree (MSc) (Med) in Forensic Science at Wits; and
- One for a Master of Public Health Degree (MPH) at the University of Cape Town (UCT).

Occupational Medicine and Epidemiology Division



Occupational Medicine and Epidemiology Division

Head: Prof David Rees

The division comprises three sections: Epidemiology and Surveillance; Immunology and Microbiology; and Occupational Medicine. The sections' annual reports follow this brief introduction which focuses on some notable aspects of the sections' work during the reporting year.

Dr Nisha Naicker and the Epidemiology and Surveillance Section had a very fruitful research year as staff contributed to 19 publications; which is a substantial increase from previous years. The section has an impressive research programme for a relatively small unit.

Surveillance of occupational health, morbidity, injury and mortality is inadequate in South Africa. Contributing to improved surveillance is a longstanding but increasingly important part of the work of the section. The development and implementation of the National Occupational Mortality Surveillance South Africa (NOMS-SA) programme by Epidemiology and Surveillance is thus a very welcome development. NOMS-SA is a nationwide, evidence-based surveillance system that measures primary and common risks associated with specific occupations and industries using mortality data from Statistics South Africa (Stats SA). The section issues reports and formal peer-reviewed publications. Eight reports have been issued, that are listed in the report for this financial year and that can be found on the NIOH website (www.nioh.ac.za).

Communicating research findings to those who can act on them to improve health and safety is a fundamental, but often neglected, obligation. The section's Caddie Empowerment Workshops which arose from its research on the working lives of caddies is laudable. Six workshops were held in the reporting period which aimed to communicate research findings and promote changes to improve the health and safety of caddies.

As was the case during the 2018/2019 financial year, the section conducted a large number of workshops and teaching and training activities during this reporting year. Dr Tanusha Singh, head of the section, and the staff of the section made a substantial contribution to this aspect of the NIOH's work through high quality courses and workshops on issues directly relevant to improving occupational health and safety (OHS) practice.

In doing so, the section also contributed to the development of OHS professionals and practitioners, which is a key task of the NIOH.

The topics that were predominantly covered, were topics that are generally inadequately dealt with by other entities in the country, despite their importance. This included:

- Occupational allergies and asthma;
- Reclaimed water (RW) and occupational health risks;
- Fungal disease in the workplace;
- Hand hygiene for healthcare workers (HCWs); and
- Biorisk management (including a five-day workshop).

Topics covered later in the financial year under review, were presciently appropriate for the COVID-19 pandemic. The section reacted rapidly to gaps in knowledge about severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and developed a collaborative research programme. Five such projects are described in the section's report, all of them directly relevant to knowledge for controlling the spread of the virus

For much of the reporting year, Dr Busisiwe Nyantumbu-Mkhize acted as Head of Occupational Medicine because Dr Spo Kgalamono was appointed as Interim Executive Director of the NIOH. As reported by Dr Busisiwe Nyantumbu-Mkhize, the Ergonomics Regulations, 2019 were promulgated in terms of the Occupational Health and Safety Act by the Department of Employment and Labour. The regulations have wide scope and will require substantial responses from a multitude of enterprises. The NIOH has a well-established and productive Ergonomics Unit, but it is small. The NIOH will need to consider how the national institute can collaborate with others, both internally and externally, and notably, the Department of Employment and Labour, social partners and tertiary training institutions, to promote the effective application of the new regulations.

Along with the other sections in the division, teaching and training was a notable feature of the year under review. A notable capacity development activity was the four-day course on computed tomography (CT) for occupational and environmental lung disease, which was presented by Dr Kurt Hering, an international expert from Germany.

Due to relative scarcity and cost constraints, CT chest imaging in occupational medicine is not widely used in South Africa, but it is increasingly being used globally. This is partly because it is more sensitive than routine radiography in the detection of occupational lung diseases. South Africa needs to prepare for more widespread application of this method. Support from the OHS inspectors from the Department of Employment and Labour is ongoing and is expected to continue growing in the coming years.

Occupational Medicine Section



Occupational Medicine Section

Head: Dr Busisiwe Nyantumbu-Mkhize (Acting)

The Occupational Medicine Section has an important role in the development of occupational health in South Africa. Teaching and training are performed to produce and increase the number of qualified occupational health professionals. Research is conducted to inform occupational health policy and practice while specialised services such as diagnosis of referred workers through clinical assessments and ergonomic services are provided to support workplaces in their responsibilities to maintain work environments that are safe and without risk to the health of the workforce.

In the period under review, teaching and training of occupational health professionals as well as doctors and nurses studying towards acquiring occupational health qualifications remained a priority of the section. Research activities focused on disseminating research findings to local and international occupational health communities. The provision of diagnostic services as well as close cooperation with government departments continued.

DIAGNOSTIC SERVICES

The Occupational Medicine Referral Clinic is the largest and oldest in the country dating back to the early years of the NIOH. The clinic performs comprehensive clinical assessments, which include special investigations and health hazard evaluations in conjunction with the Ergonomics Unit and Occupational Hygiene Section. Of critical importance in the work of the clinic, is that the referred workers are taken as sentinel cases, which are used to identify other workers who may be similarly affected so that preventative strategies are directed to all workers and not only the worker who visited the clinic.

In the 2019/2020 financial year, 160 new patients were seen at the clinic. The largest proportion of these workers, namely 77 (48%) were working in mining, followed by 30 (19%) in manufacturing and 16 (10%) in construction. The remaining 37 (23%) were distributed in different sectors, with three (2%) in health, two (1%) in hospitality and others.

The workplaces of these workers were situated in six provinces of the Republic of South Africa (Figure 1). Most of these workers, namely 83 (51%) were working in Gauteng, followed by 50 (31%) in Mpumalanga and 19 (12%) in North West. The remaining eight (6%) workers were working in Limpopo, with 4% in the Free State and 0.6% in Northern Cape.

The outcomes of the clinical assessments of the 160 workers seen in the clinic were categorised into occupational, non-occupational and outcomes awaiting diagnosis.

Out of these 160 workers, 84 (52%) were confirmed as having occupational conditions, while 49 (31%) as having non-occupational conditions. The remaining 27 (17%) were awaiting final diagnosis. Figure 2 shows the outcomes of the assessment summarised into these different categories.



Figure 1: Distribution of workers by province



Figure 2: Categories of diagnostic outcomes



Figure 3: Categories of body systems affected by occupational conditions

The occupational conditions were further categorised into body systems affected. The majority of workers, namely 55 (65%) had conditions affecting the respiratory system, followed by 25 (30%) with musculoskeletal system conditions and four (5%) with other system conditions.

Out of 55 workers with respiratory conditions, 31 (56%) had asthma and the remaining 24 (44%) had other respiratory conditions - of which five (21%) had COPD and six (25%) had other respiratory conditions in combination with COPD.

The 25 workers with musculoskeletal system conditions included four (16%) with hand arm vibration syndrome (HAVS). The four workers with other system conditions, one (25%) had conjunctivitis, one (25%) had irritant contact dermatitis and two (50%) had stress.

SUPPORT TO GOVERNMENT DEPARTMENTS

The section is committed to working with government departments at national and provincial levels in matters relating to OHS in South Africa. Cooperation with and support to a number of government departments have been done in various areas including: compliance with legislation, legislation reform and review, and policy and statutory responsibilities.

The Department of Employment and Labour, Compensation Commissioner and Gauteng Department of Infrastructure Development were offered technical support relating to compensation and the protection of employee health, respectively. Legislation was reviewed and reformed to remain up-to-date with OHS practice. The section participated and contributed to the Technical Committee working on the Occupational Health and Safety Act 1993 (OHASA) and the Hazardous Chemical Substances Regulations, 1995. Working with the Occupational Health Forum, the document on "Occupational Health Service Providers" was finalised.

Occupational health-related input was provided to the Department of Health (DoH) Directorate on Malaria, Vector Borne Diseases and Zoonosis for the compilation of a South African National Vector Borne Disease Strategy for 2019-2023. Input was also provided to the Gauteng DoH on the medical surveillance of HCWs after an outbreak of a bacterial infection in one of the Gauteng provincial hospitals.

Mineworkers who contract occupational diseases and become unable to continue working depend on compensation determined through the processes of the MBOD. The Code of Practice which is used to apply consistent criteria for assessment of mineworkers' diseases for compensation purposes is under review with support from the Occupational Medicine Section.

Occupational medicine specialists in the section are involved in important work in collaboration with the MBOD, who has a statutory responsibility to certify current and ex-mineworkers for compensation of occupational diseases contracted in the mines. As members of the Occupational Diseases in Mines and Works Act Medical Reviewing Authority, they investigate and review cases who object to outcomes from the MBOD Certification Committee. During the year under review, 24 cases were dealt with. These specialists were re-appointed by the Minister of Health in December 2019 to continue performing their work as members of the Medical Reviewing Authority for the 2020-2022 period, in line with the Occupational Diseases in Mines and Works Act 1993, as amended.

RESEARCH

Research activities in the section covered the dissemination of findings of completed research at local and international conferences, producing publications from this research in peer-reviewed journals and embarking on a new research project.

Research titled: "Environmental dust exposure from gold mine waste dumps and respiratory health effects in Johannesburg, South Africa" and "Changes in kidney function among sugarcane cutters on a moderately hot sugar plantation in South Africa" were presented at the 27th International Symposium on Epidemiology in Occupational Health in Wellington, New Zealand from 29 April to 2 May 2019.

Related titles namely: "Respiratory health in a community living in close proximity to gold mine waste dumps, Johannesburg, South Africa" and "Kidney function changes in sugarcane workers in the South coast, Kwa-Zulu Natal, South Africa" were respectively presented at the 15th Annual National Public Health Association of South Africa (PHASA) Conference which took place from 16-18 September 2019 in Athlone, Cape Town in South Africa and at the Biennial Research Day of the Wits School of Public Health which took place in August 2019. This research emanated from occupational medicine registrars' Masters of Medicine Degree (MMed) projects.

Two research papers were published as follows:

- "Respiratory health in a community living in close proximity to gold mine waste dumps, Johannesburg, South Africa" was published in the International Journal of Environmental Research and Public Health; and
- "A case control study of night shift work on breast cancer in a large referral hospital in Johannesburg, South Africa" was published in Occupational Health Southern Africa Journal". This paper emanated from an MMed research project of a former occupational medicine registrar who is now an occupational medicine specialist.

New research project

The new research project was initiated by the Safety, Health and Environment Department. The NHLS employs a large number of workers throughout South Africa, and needed to analyse employee sickness absenteeism. This project seeks to address this issue.

Assessment of sickness absence in NHLS employees

Assessing specific risk factors for sickness absence is an important strategy to prevent and decrease sickness absence and to ensure early return-to-work strategies. A detailed sickness absence report may help establish trends, "hot-spots" and "hot-periods" of short-term sickness absence which may assist in the formulation of new standard operating procedures (SOPs) to address sickness absence such as instituting action thresholds for management review and/or automatic referral to the occupational health service. This research aims to describe sickness absence of NHLS employees.

This study will be a cross-sectional secondary data analysis of the Human Resource Department Oracle software data which captures sick leave absence (including injury-on-duty absence) over a five-year period from 1 April 2013 - 31 March 2019 for all employees of the NHLS across South Africa.

The study population will include all contract/permanent and fulltime/part-time staff employed by the NHLS, from all job and grade categories, who have applied for leave in the study period. It is envisioned that the results of this proposed study will help assist with evidence to inform SOPs for sickness absence management which will in turn assist the SHE Department and Occupational Medicine Section to identify risk factors for sick absence, so control measures can be instituted.

TEACHING AND TRAINING

The section aims to create an environment that is conducive for learning by public health medicine and occupational medicine registrars who are completing their rotation and MMed degrees, respectively. Training is done by experienced occupational medicine specialists, who are affiliated to the Colleges of Medicine of South Africa (CMSA).

Interesting cases from the Occupational Medicine Referral Clinic are used for experiential learning by the registrars and continuing professional development (CPD) of occupational medicine doctors. Formal and informal teaching and training of OHS professionals is done at postgraduate level and through workshops that cover various topics on occupational health.

The section's specialists were instrumental in providing training to different groups of workers including health and safety workers in the current COVID-19 pandemic. In the early stages of the pandemic in South Africa, the specialists geared up to prepare workplaces to be able to contain the spread of SARS-CoV-2 through teaching and training. They produced information materials such as fact sheets, guidelines and posters to use in the fight against COVID-19. They also performed teaching and training of different occupational groups of workers, including dentists, emergency medical services workers, health and safety workers, HCWs and teachers and educators.

Teaching and training at postgraduate level were done at Wits and the University of Pretoria (UP). The section is an active partner in delivering and teaching the postgraduate DOH at the Wits School of Public Health. Lectures were also offered to nurses enrolled in Master of Occupational Health Degrees (MOHs) and the Masters' programmes in Exposure Science. Various lectures were conducted for DOH doctors at UP, covering topics such as HAVS, health effects of solvents, lung function tests and occupational asthma.

As the section recognises the importance of remaining abreast of new developments in the field for OHS professionals, regular CPD workshops are held. During the year under review, 10 workshops were conducted for Department of Employment and Labour inspectors, occupational health nurses (OHNs), occupational medicine practitioners (OMPs) and radiologists. Topics covered in these workshops include: high resolution CT interpretation, lung function interpretation, occupational lung diseases, respirator fit testing and types of surveillance data.

Other recipients of the teaching and training offered by the section were representatives of the National Union of Mineworkers (NUM). In a workshop on OHS which was hosted especially for them, the occupational medicine (OM) specialists presented on various OHS topics.

HONOURS

Both of the OM registrars, Dr Samantha Iyaloo and Dr Mollen Magombo obtained distinctions for their MMed research reports.

PROFESSIONAL DEVELOPMENT

Two OM registrars from the section passed their MMed in Occupational Medicine final examination to become OM specialists.

ERGONOMICS UNIT

The Ergonomics Unit operates under the Occupational Medicine Section where it is involved in offering ergonomic services to South African industries in conjunction with the Occupational Medicine (OM) Clinic. The unit also performs work related to research and teaching and training. Service work is channelled directly from industry and through the clinic. Research encompasses supervision of postgraduate students' research projects and conducting self-initiated research with related presentations at local and international conferences and publishing articles in peer-reviewed journals. Teaching and training activities are performed to build capacity in ergonomics in various groups, including labour inspectors, OHS professionals and union representatives.

A notable milestone occurred on 10 March 2020, when South Africa saw the launch of the Ergonomics Regulations by the Department of Employment and Labour. The regulations were promulgated on 6 December 2019, thus changing the SA OHS legislative landscape. It is expected that this change will also lead to an increase in the demand for ergonomics services and teaching and training activities.



Image 1: Minister of Employment and Labour at the launch of the Ergonomics Regulations at Destiny Hotel in Kempton Park

SPECIALISED SERVICES

The unit offers two types of services, namely: ergonomic risk assessments and HAVS standardised testing. The testing is performed on referred workers suspected of having HAVS from using vibrating hand tools in their jobs. HAVS falls under work-related musculoskeletal disorders.

Thirty percent of workers diagnosed with occupational conditions in the OM Clinic in 2019/2020 financial year, had work-related musculoskeletal disorders which included HAVS. Assessments in the jobs and workstations of 25% of workers without HAVS were performed to identify risk factors associated with musculoskeletal disorders. These workers were mainly working in the mining and manufacturing industries. From these assessments, one ergonomic risk assessment report and two walkthrough reports were produced.

The rest (three) of the ergonomic risk assessments were performed at NHLS. Two were in office environments while the other focussed on manual handling. This assessment was converted into a document titled: "Guidance on manual handling at NHLS". Based on this document, a presentation was produced for training of NHLS workers on manual handling, which also includes toolbox talk questions. All the materials produced are available on the intranet for OHS training purposes.

RESEARCH

The unit supports and contributes to the development of new knowledge related to ergonomics. In the year under review, research activities in the unit included support to postgraduate students for their research projects, dissemination of research findings from the unit's research to the wider scientific community and cross-cultural adaptation of an instrument for use in the assessment of workers for work disability management.

In the reporting year, the unit supervised a research report on mine office workers and a protocol on hospital laundry workers from MPH (Industrial Hygiene) students from the Wits School of Public Health. The research report was submitted for examination and the protocol was submitted for ethics approval.

Completed research entitled: "Prevalence of musculoskeletal disorders and associated factors in South African workers" from the unit was shared with the global scientific community at the Prevention of Work-Related Musculoskeletal Disorders Conference in Bologna, Italy, under the auspices of the International Ergonomics Association and International Commission on Occupational Health.

Research entitled: "Suitability of reception bench height to the working height of workers in an NHLS laboratory" emanating from the service component of the unit was also presented at PathReD 2019 which took place in Kempton Park, Gauteng, South Africa.

The Work Role Functioning Questionnaire was simultaneously translated and culturally adapted from the source country to South Africa as the target country. The process followed was that used by the American Association of Orthopaedic Surgeons Outcomes Committee which culminated in the production of the prefinal version of the questionnaire. The purpose of this process is to maximise the attainment of semantic, idiomatic, experiential and conceptual equivalence between the source and target questionnaires.

TEACHING AND TRAINING

The Ergonomics Unit is involved in teaching and training on ergonomics at institutions of higher learning, public and private entities and union representative platforms.

Teaching and training activities on ergonomics in the 2019/2020 financial year includes formal training of: doctors studying for the DOH; postgraduate students completing their MMed in Medicine; and occupational hygienists completing their MPH.

Informal teaching and training was performed for public entities including: Department of Employment and Labour inspectors; hospital doctors and nurses; and NHLS SHE Department occupational nurse managers and SHE officers.

Teaching and training was also conducted for OHS personnel and OHS nurses at private entities, as well as union representatives from the mining sector, in different regions of South Africa.

Immunology and Microbiology Section



Immunology and Microbiology Section

Head: Dr Tanusha Singh

The novel COVID-19 has raised several challenges for managing exposure and work-related disease. In the last quarter of the financial year under review, the section therefore focused on infection prevention and control (IPC) measures across various industrial sectors. New ways of operating had to be explored as the Immunology and Microbiology Section remained determined to promote and protect workers' health.

Each unit within the section, including Bioaerosols, Occupational Allergies and Waterborne Pathogens played a pivotal role in NIOH's fight against SARS-CoV-2. The contributions were centred on teaching and training, consultations and efficacy testing of devices purported to inactivate the coronavirus.

The section also performed its routine occupational allergies testing. Staff furthermore participated in many technical committees contributing to several guidance documents on workplace preparedness in outbreak situations. In addition, Dr T Singh was appointed as Chair of the NIOH Occupational Health COVID-19 outbreak response team.

DIAGNOSTIC SERVICES

A worker-centred approach to tailored testing for occupationally-related respiratory and skin disease was provided, including useful information on the specific occupational allergies suffered by workers. Through this service, common allergens and risk occupations can be identified, as well as industrial sectors where exposure to certain allergens are problematic.

Sterility testing of nanoparticle samples were conducted. The laboratory was audited by the South African National Accreditation System (SANAS) and was recommended for accreditation for the ISO 15189 of 2012 standard. This marked the 13th consecutive year of accreditation, which reinforces the quality of the testing service to clients.

RESEARCH

Research remained a priority and focused on prevention of workplace exposure with specific reference to hazardous biological agents (HBAs) that cause infections and allergies. The research conducted involved section-supported and collaborative projects with stakeholders across various disciplines, including OM, occupational hygiene, infection control and engineering. The ongoing projects that the section is involved in, were postponed to prioritise COVID-19 research activities. Details of the new research projects are summarised below.

Validation of three decontamination methods for respirators used in South Africa to address stock shortages during the COVID-19 pandemic

Collaborative study team: T Singh^{1,2}, T van Reenen³, Z Masuko⁴, E Ratshikhopha^{1,2}, O Matuka¹, T Duba¹, Z Ngcobo¹, L Muleba¹, J Manganyi¹, P de Jager³, D Jones¹

National Institute for Occupational Health¹, University of the Witwatersrand², Council for Scientific and Industrial Research³, National Institute for Communicable Diseases⁴

Background: The study aims to validate methods that are used to extend the life of filtering facepiece respirators (FFRs) after decontamination, thus preserving stock levels and ensuring availability and access to much-needed respirators for frontline workers. The three methods including UVGI, H2O2 and moist steam are included as this allows flexibility and accessibility. Upon completion, the project results will inform decisions on whether to reuse respirators. Ordering has begun and sampling will commence as soon as the equipment is received.

Environmental exposure assessment in health facilities treating COVID-19 patients

Collaborative study team: T Singh^{1,2}, T van Reenen³, E Ratshikhopha^{1,2}, T Duba¹, Z Ngcobo¹, L Muleba¹, J Manganyi¹, P de Jager³, D Jones¹,

National Institute for Occupational Health¹, University of the Witwatersrand², Council for Scientific and Industrial Research³

The common mode of transmission of SARS-CoV-2 is through droplet spread and contact. However, airborne transmission remains a contentious issue among researchers across the globe. This study aims to determine whether SARS-CoV-2 can remain airborne and how far it can travel from an infectious source. The protocol has been developed and samples will be collected using relevant collection methods such as air sampling, surface swabs, water sample collection bottles, etc. The study will be conducted in isolation wards treating COVID-19 patients in Gauteng and will inform prevention protocols for various workplaces.

Evaluation of health risks associated with occupational exposures to biological and chemical contaminants at wastewater treatment plants and recycled water use sites

Collaborative study team: N Gomba¹, L Singh¹, T Singh^{1,2}, T Duba¹, P Matatiele¹, P Moodley³, I Arshad⁴, T Barnard⁵

National Institute for Occupational Health¹, University of the Witwatersrand², Golder Associates Africa Pty Ltd³, National Institute for Communicable Diseases⁴, University of Johannesburg⁵

Water is a scarce resource in South Africa and wastewater treatment plants (WWTPs) play an extremely important role in shaping modern society's health and environmental wellbeing through the safe disposal of various wastewater streams. Wastewater naturally contains both microbial and chemical contaminants that can result in a wide range of adverse health effects when inhaled, ingested or absorbed through the skin. The use of reclaimed water (RW) carries health risks, as several studies have confirmed RW systems as important reservoirs of pathogens including SARS-CoV-2, Legionella, Pseudomonas aeruginosa, non-tuberculous Mycobacteria, Acanthamoeba spp., Staphylococcus aureus, and protozoa. The proposed project achieved its first deliverable, namely a literature review on the topic. The study was also extended to include the detection of SARS-CoV-2 in wastewater which is recycled for reuse.

Assessment of anti-bacterial efficacy of hand sanitisers commonly used in South Africa

Collaborative study team: *L Muleba¹, T Singh^{1,2}, J Pienaar³, R Van Wyk³, D Matuka¹* National Institute for Occupational Health¹, University of the Witwatersrand², University of Johannesburg³

Hand sanitisers are designed for application to the hands for reducing the number of viable microorganisms; they are the alternative to hand washing with soap and water (Centre for Disease Control and Prevention, 2002). This study now more than ever has shown its relevance due to the global recommendation to hand sanitise when soap and clean water is not available. Whilst data on the effectiveness of the hand sanitiser is essential, its availability in South Africa is absent. Various types of hand sanitisers that are commercially available to the public were sourced. Several experiments were conducted and will continue in the new financial year.

Taxi cleaning, disinfection and high-touch surface study

Collaborative study team: N Ndaba¹, P de Jager², T van Reenen², T Kumirai², T Molefi², Y Pillay³, N Moloi⁴, N Xulu¹, T Singh¹

National Institute for Occupational Health¹, Council for Scientific and Industrial Research², National Department of Health, Department of Transport³, South African National Taxi Council⁴

The South African taxi industry transports millions of people daily. Social distancing is problematic at many taxi ranks. Commuting poses a high risk for both the driver and passengers. As such, and to reduce the potential spread of infection among passengers, the National Department of Health and the Department of Transport have established mandatory practices for taxi drivers, passengers, cleaners, and marshals; however, these measures are highly dependent on compliance from both the workers and the passengers. It is therefore important to identify the high touch surfaces and develop an effective control measure that is less dependent on behavioural issues to ensure effectiveness and reduce transmission. The proposal was developed and approved by all collaborating parties. Sampling with begin in the new financial year.

TEACHING AND TRAINING

The section delivered and participated in several teaching and training events including COVID-19 programmes. Various OHS professionals, employers and employees across several sectors were trained. Support of the HPCSA medical intern scientist training continued. The section also supported occupational health curricula for various universities (e.g. DOH for North-West University (NWU), UP and Wits).

The key events apart from lectures and ad hoc presentations include:

• Occupational allergies and asthma workshop - 17 April 2019

Occupational allergies and asthma are of concern in the workplace as they are often under-recognised, under-diagnosed, under-reported and under-compensated. This workshop was conducted in collaboration with the OM Section, to address these issues. The new Cecilia Makiwane Hospital in East London, is a state-of-the-art hospital and is the second biggest hospital to Chris Hani Baragwanath Academic Hospital (CHBAH). The training covered an overview of NIOH followed by technical presentations on topics such as: occupational asthma (OA) and compensation circular instructions for OA, diagnostic tests for Immunoglobin E (IgE) mediated allergy, occupational skin diseases (OSDs) and tests for OA and OSDs.

• Hand Hygiene Day - 18 April 2019

Healthcare-acquired infections (HCAIs) are a major concern despite several interventions globally. HCWs can carry many types of microorganisms on their hands, which can be a source of contamination of patients and themselves. Despite the health benefits, hand hygiene remains a challenge as many HCWs do not practise proper hygiene or proper handwashing techniques. The objective of the awareness workshop in East London was to reinforce the basic principles of effective handwashing as a key mitigation strategy in infection control. The event was mainly attended by enrolled nurses, cleaning staff, a few professional nurses and one doctor.

Reclaimed water workshop - 25 July 2019

The Waterborne Pathogen Unit hosted the 2nd Reclaimed Water and Occupational Health Risks Workshop which was aimed at developing a body of knowledge on water reuse in South Africa, particularly with regards to the potential occupational health risks associated with the use of RW in different industries, including but not limited to agriculture, mining, and power stations. A range of topics including water reuse status in South Africa, emerging contaminants, antibiotic resistance, microbiological water quality monitoring, guidelines and standards, and research collaborations were explored through presentations from leading experts and professionals. The workshop brought together a total of 61 external participants representing various sectors such as municipalities, water utilities, industry, solution providers, researchers and academia.

• Allergies in the workplace: a diagnostic approach – 15 August 2018

Occupational allergies and asthma are a concern in the workplace as there are hundreds of workplace agents that can cause or aggravate allergies and asthma. It is therefore important to diagnose the worker's condition, which can inform preventative measures to reduce exposure as well as clinically manage the worker. This workshop was conducted in Bloemfontein, in collaboration with the OM Section and was very similar to the workshop, described above, which was conducted in East London.

• Fungal disease in the workplace – awareness week, 1–5 October 2019

The CDC began an initiative in 2017 to raise awareness of fungal diseases. The section saw this as an opportunity to expand on the initiative and raise awareness of fungal diseases in the workplace; and the importance of preventing exposure so that workers' health is protected and improved. Exposure is associated with allergies, infections, neurologic and toxic effects. This was an online and social media initiative utilising the NIOH website and twitter platforms.

• Workplace biorisk management course, 7–11 October 2019

This five-day programme marked the third annual biorisk course and was attended by 42 OHS professionals including OHS nurses, doctors, labour inspectors, occupational hygienists and environmental health practitioners. The course was a great success and yielded excellent feedback. The institute received several service requests post the course for OHS services pertaining to biorisk management.

• Hand hygiene mini-workshop - 15 October 2019

The event was held at the Rahima Moosa Mother and Child Hospital to commemorate Global Handwashing Day and to entrench the importance of handwashing in preventing infections. The workshop was well received by the 45 healthcare professionals who attended and there was a request for more such events to be hosted.

• Workplace biorisk management short course, 20–21 February 2020

A two-day biorisk management training programme was held for the Netcare occupational health and infection control nurses. The course was well received and generated interest in medical surveillance and respirator fit testing, which was referred to the relevant NIOH sections.



Image 2: Delegates at the biorisk management course, 5-11 October 2019



Image 3: Delegates at the Global Handwashing Day, 15 October 2019

Information sheets

The section produced the following information sheets: Photo Allergy Contact Dermatitis for the World Allergy Week; and Occupational Allergies and Hazardous Biological Agents for Health and Safety Day. A number of information sheets on COVID-19 workplace preparedness and prevention were also developed.

T Singh attended the second technical meeting on the formulation of the ILO technical guidelines on occupational exposures to biological hazards which took place from 21-22 November at the ILO offices in Geneva. The meeting was very productive and good progress was made by members on allocated chapters.

HONOURS

T Duba received an award for best poster presentation in the Microbiology discipline at PathReD 2019.

PROFESSIONAL DEVELOPMENT

During the year under review, the section enrolled six postgraduates as follows:

- Three at UJ (two for a Master of Technology Degree (MTech) and one for a PhD);
- Two for an MPH at Wits; and
- One for an MPH at UCT.

Epidemiology and Surveillance Section



Epidemiology and Surveillance Section

Head: Dr Nisha Naicker

The Epidemiology and Surveillance Section studies and analyses the patterns, causes, and effects of exposures on health, morbidity and mortality in occupational settings. This is important in establishing the burden of occupationally-related diseases over time and allows for appropriate allocation of funds for preventative measures as well as interventions.

SURVEILLANCE AND SERVICES

Surveillance programme

South Africa does not have an optimally functioning national occupational health surveillance programme. However, since 2018/2019, this section has had consultations with several stakeholders to incorporate occupational health information in current longitudinal surveillance programmes or in new surveillance programmes that are being established. The stakeholders that have currently expressed an interest in providing OHS data are:

- The Office of Health Standards Compliance (OHSA);
- MBOD; and
- The Department of Employment and Labour Compensation Fund).

Current surveillance programmes are detailed below.

National Occupational Mortality Surveillance South Africa (NOMS-SA)

National Occupational Mortality Surveillance South Africa describes the relationship between work and wellbeing to inform policy development to improve worker safety and health, and enable research and prevention strategies. NOMS-SA uses mortality data with occupation information from Stats SA, which is a South African national statistical entity responsible for recording vital events annually. The underlying cause of death coding used, was provided by the South African National Burden of Disease Study (NBD).



The NOMS-SA data categorises the causes of death into four groups, namely: communicable, non-communicable, unnatural and ill-defined. Proportional mortality ratios (PMRs) were calculated. PMRs are a simple and potentially useful way of portraying the burden of a specific disease within a population. These were calculated to estimate where excess mortality by occupation is found. PMR also provides a way to compare occupations.
Continuous surveillance of mortality by occupation is a low-cost method that provided a more comprehensive picture of the burden and distribution of potentially work-related illness. Reports from 2009 to 2016 can be accessed from the website at the following URL: <u>http://www.nioh.ac.za/national-occupational-mortality-surveillance-south-africa-noms-sa/</u>

The Occupational Health Information System

OHASIS is an online reporting tool for all NHLS incidents, 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. To date, the rate of tuberculosis (TB) in NHLS staff has been analysed and data published. During the study period, there were 92 cases of TB identified in the OHASIS database. General workers, rather than skilled and unskilled laboratory workers and medical staff, had the highest incidence rate (422 per 100,000 person-years). OHASIS data revealed subgroups that seemed to be well protected, while pointing to exposure situations that beckoned policy development, and identified subgroups of workers for whom better training is warranted. Work on the reported occupational injuries in NHLS workers is currently being written up.

Research support services

The section provides epidemiological and biostatistical support to sections within the NIOH, various government entities, parastatals and private organisations. Assistance was provided for study design, sample size determination, project management, data collection, data entry, data analyses and scientific writing.

Within the NIOH, the Epidemiology and Surveillance Section has provided support to the following sections over the past year: Occupational Medicine, Occupational Hygiene, Immunology and Microbiology, SHE, HIV & TB and Pathology. This includes analysing clinical data for annual occupational and health surveillance reports.

In 2019/2020, the section assisted the Gauteng DoH with training staff on how to capture questionnaire data in an electronic format. The Gauteng staff satisfaction survey is an annual survey conducted by the Employee Health and Wellness Programme (EHWP) Directorate. Staff from the directorate were trained on how to enter data into the RedCap (Research Electronic Data Capture) system. The entered data was then analysed by the Epidemiology and Surveillance Section staff, and a report for overall satisfaction in the Gauteng DoH was produced for the Directorate. Individual facility and district reports will be completed by May 2020.

In addition, the development of a standardised validated staff satisfaction questionnaire is being developed by Dr KS Wilson. This will be used in the 2020/2021 Gauteng DoH staff satisfaction survey.

RESEARCH

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

Primary research

Determine the knowledge, awareness and perceptions of occupational health and safety in the NHLS using the online OHS information system (OHASIS).

Collaborative study team: *Tlotleng N¹, Naicker N¹, Jones D¹* National Institute for Occupational Health, Johannesburg, South Africa¹

An information system on occupational injuries, near hits and disease is essential for any large employer to effectively manage and mitigate injuries and diseases in the workplace. It allows for a targeted and focused strategy to improve health and safety. The information provided by a system is only as good as the information entered into the system. The system was designed to be user-friendly, but staff attitude towards the system and surveillance is important for the programme to work effectively. The system was evaluated in 2013 (post implementation) and in 2015. However, it has undergone a few changes and access to the system has improved. The aim of this repeat survey in 2019/2020 was to describe OHS in the NHLS in terms of perceptions, experiences, training and reporting behaviour among NHLS staff. The survey was completed in March 2020. Data analyses is currently in progress.

Informal economy

Studies on the working environment in waste pickers and golf course employees (informal and formal) was completed in 2019 and the results have been published in peer-reviewed journals.

At the beginning of 2020, the section has commenced on developing a study on occupational hazards and health outcomes in petrol station attendants in Johannesburg South, Africa.

The increased use of petroleum products in automobiles and industry has led to the deterioration in air quality and human health.

Collaborative study team: *Kootbodien T^I, Wilson KS^I, Ntlebi V^I, Naicker N^I.* National Institute for Occupational Health, Johannesburg, South Africa¹

These products contain some toxins that are considered to be carcinogenic to humans. Exposure to petrol is known to contribute to neurological, haematological, inhalation, and teratogenic disorders. Biomonitoring of exposure in workplaces has gained importance in the evaluation of human health hazards. This study thus aims to determine the occupational hazards and health outcomes associated with working as a petrol attendant. Fieldwork will commence as soon as the COVID-19 crisis is under control.

A systematic review of the health outcomes and healthcare utilisation of the informal economy workers

Collaborative study team: *Naicker N¹*, *Pega F ²*, *Rees D¹*, *Kgalamono S¹*, *Alfers L³*, *Singh TS¹* National Institute for Occupational Health, Johannesburg, South Africa¹ Department of Public Health, Environmental and Social Determinants of Health, World Health Organization, Geneva, Switzerland², WIEGO, Johannesburg, South Africa³

This is a joint project between the NIOH, WHO and WIEGO. The aim is to systematically review, and metaanalyse evidence from any quantitative studies on health services use and health outcomes among informal economy workers, compared with formal economy workers, published between 1 May 1998 and 30 June 2018. The write up of the analyses has commenced and is currently being reviewed by all collaborators.

The sources of asbestos exposure in patients with malignant mesothelioma in South Africa.

Collaborative study team: *Tlotleng N¹*, *Wilson KS¹*, *Naicker N¹*, *Koegelenberg CFN²*, *Rees D¹*, *Phillips JI¹*, Wong M³

National Institute for Occupational Health, National Health Laboratory Service, Johannesburg, South Africa¹, Department of Medicine, Faculty of Medicine and Health Sciences, Stellenbosch University, South Africa², Department of Medicine, Faculty of Health Sciences, Chris Hani Baragwanath Hospital, University of Witwatersrand, South Africa³

This was a two-year national study involving tertiary and academic hospitals in South Africa that was concluded on the 31st of December 2019. The study describes occupational and non-occupational asbestos exposure in patients diagnosed with malignant mesothelioma. Based on the outcome, the NIOH will develop guidelines on the safe management of domestic asbestos-containing materials. The study will also provide evidence that could inform policy decisions regarding the control of asbestos exposure in the country. The study was only able to obtain data from the Western Cape and Gauteng hospitals. Over the two-year period, there were 17 cases reported. One peer-reviewed paper on "The significance of non-occupational asbestos exposure in women with mesothelioma in respirology case reports" has been published from the data that has been analysed so far, in 2019.

Occupational health and safety of female miners

Collaborative study team: *Wilson KS¹, Makhubele M¹, Naicker N¹* National Institute for Occupational Health, Johannesburg, South Africa¹

Based on the dearth of data on mortality and morbidity affecting female miners, the Minerals Council South Africa (MCSA) commissioned a study to assess health outcomes in female mine workers over the past 13 years. The Epidemiology and Surveillance Section is thus currently conducting a study with the following objectives: to determine the nature and prevalence of fatal injuries in a sample of female and male miners from 2005 to

2017, to determine the underlying risk factors for fatal injuries/and disease in the sample of female and male miners, to assess the differences in health outcomes between male and female miners, and to assess the types of health outcomes processed for compensation in female workers compared to male mine workers. This is a mixed-methods study involving four mining houses from the four largest commodities in South Africa, namely: gold, platinum group metals, coal and diamonds.

Ekurhuleni Occupational Cancer Project.

Collaborative study team: Kootbodien T¹, Ntlebi V¹, Naicker N¹, Singh E²

National Institute for Occupational Health, National Health Laboratory Service, Johannesburg, South Africa¹, National Cancer Registry, National Health Laboratory Service, Johannesburg, South Africa²

This is a collaborative study between the NIOH and the National Cancer Registry (NCR). It is estimated that between two and eight percent of cancers worldwide are related to occupational exposure. However, there is a dearth of information on occupational cancers in South Africa. The NCR collects information on cancer incidence; however, lifetime occupational history is not available on the cancer notification forms. This study aims to assess the incidence of occupational cancers in patients residing in the Ekurhuleni District in Gauteng, South Africa, from 2017 to 2019. Fieldwork is currently in progress.

Working conditions and self-reported illnesses among waste recyclers at waste recycling buy-back centres, Johannesburg, South Africa

Collaborative study team: Gumede R¹, Naicker N², Keretetse G¹

School of Public Health, University of the Witwatersrand, Johannesburg, South Africa¹

National Institute for Occupational Health, National Health Laboratory Service, Johannesburg, South Africa²

There were no known studies assessing the working conditions and potential health outcomes at the recycling centres, therefore more research on the recycling industry in South Africa is needed to better understand the industry and its operations and to address this gap in the literature. This study is a follow-up study assessing formal workers in the waste management industry. Previously a study was conducted on informal waste pickers/ reclaimers in Johannesburg. The aim of the study is to assess working conditions and self-reported health status among waste handlers at recycling buy-back centres in Johannesburg, South Africa. Field work will commence as soon as the COVID-19 pandemic is under control. The data obtained will be used for Mr Gumede's MPH research report.

Lead exposure and cognitive impairment in older people living in communities located near mine tailings in Johannesburg project.

Collaborative study team: Naicker N¹, Nkosi V², Mathee A², Todd A³

National Institute for Occupational Health, National Health Laboratory Service, Johannesburg, South Africa,¹ Environment and Health Research Unit, South African Medical Research Council, Johannesburg, South Africa,² Mount Sinai University, New York, USA³

Collaborators on this project include the South African Medical Research Council, Environmental and Health Research Unit and Mount Sinai University, New York, USA. Exposures from mining activities and mine tailing dumps may result in poor health outcomes of people within the communities surrounding the mines. Lead is one of the contaminants that have serious but preventable neurological effects. Data collection for this study has been completed, and analyses of data are in progress.

Assessment of noise exposure among drill operatives in opencast PGM and chrome mining in the Bojanala district in 2020

Collaborative study team: Zamisa T¹, Made F²

Division of Occupational Health, Wits School of Public Health, University of Witwatersrand¹ National Institute for Occupational Health, National Health Laboratory Service, Johannesburg, South Africa²

Noise exposure is an occupational health issue as it can lead to the development of an irreversible noiseinduced hearing loss which is classified as a work-related disability. Drilling is one of the main operations for opencast mining. Many studies found in literature focus on the underground activity of drilling with limited studies addressing the noise exposure of opencast drill rig operators and assistants. This study will assess and compare noise level with data from the Department of Mineral Resources and Energy (DMRE). This is important for improving interventions aimed at reducing excessive noise. The study participants are opencast drill rig operators and assistants as they form part of the most important core operations in opencast mining.

Secondary research

Ongoing analyses of the OHASIS data

To date, the first paper on TB in laboratory workers has been published. Analyses of occupational injuries and an overview of the usefulness of the data is currently in progress.

Statistics South Africa mortality data

In addition to the NOMS-SA reports, this data has been analysed and published on the following topics: "Suicide mortality" and "Mortality in female miners".

Association between bone lead levels and aggression in the birth to twenty plus cohort

Collaborative study team: Tlotleng N¹, Naicker N¹, Mathee A², Norris S³, Todd A⁴

National Institute for Occupational Health, National Health Laboratory Service, Johannesburg, South Africa,¹ Environment and Health Research Unit, South African Medical Research Council, Johannesburg, South Africa,² Developmental Pathways for Health Research Unit, University of the Witwatersrand, Johannesburg, South Africa,³ Mount Sinai University, New York, USA⁴

The study seeks to investigate the association between bone lead levels and aggression among young males and females in Johannesburg, South Africa. This was a quantitative study that conducted bone lead x-ray fluorescence (XRF) measurements on 21-year-old participants to determine cumulative lead levels. A validated structured questionnaire was used to assess for aggressive behaviour and confounding factors. The data is currently being analysed.

TEACHING AND TRAINING

The section continues its teaching and training in undergraduate and postgraduate academic programmes within the NIOH and at Wits, UJ, and the UP Field Epidemiology Training Programme (SAFETP), the latter for which lectures are also provided.

The section furthermore assists the Wits School of Public Health with facilitating lectures in the GEMP programme and the DOH and participates in the postgraduate assessors' committees. Staff also support academic institutions as examiners for masters and PhD theses.

Staff from the section currently supervise 11 PhD and master students from Wits, UP and UJ. The section had two NRF interns that commenced in April 2019 and will complete the year-long programme on 31 March 2021, as well as a SAFETP student who completed her training in December 2019. In addition, staff also support students from the NIOH with their project development and analyses of their data.

A workshop on analysis and interpretation of routine surveillance data to improve occupational health and safety in the workplace was conducted from 25-27 February 2020. The workshop aimed to equip delegates with the knowledge required through lectures and exercises on epidemiology and biostatistics to analyse and interpret surveillance findings and communicate them effectively to those who can make use of the information and those who need to know the findings. The feedback received from the delegates was very positive and a second workshop will be held in October 2020.

Caddie empowerment workshops which was part of our research translation efforts were conducted at various golf courses in Johannesburg. The NIOH Epidemiology and Surveillance Section has been involved in a project aimed at assessing the working conditions and health outcomes of caddies working in golf courses in the City of Johannesburg.

Several workshops were developed to empower caddies to:

- Communicate the outcomes of the NIOH working conditions and health outcomes survey;
- Create an open forum to discuss the areas of concern emerging from the survey;
- Realise their power as entrepreneurs and make them accountable for their own choices;
- Understand behavioural and attitudinal changes that are empowering for them; and
- Create a healthy environment for open discussion on any other issues pertaining to them.

Workshops commenced in April 2019, and to date, six workshops have been conducted which yielded a positive response from both caddies and golf course management. These workshops were funded by Mr J Van Rooyen.



Image 1: Caddies attending an empowerment workshop

PROFESSIONAL DEVELOPMENT

During the year under review, the section enrolled four postgraduates as follows:

- Two for PhDs in Public Health at Wits and UCT; and
- Two for a Master of Epidemiology and Biostatistics Degree at Wits.

One postgraduate student from the section completed a Master of Field Epidemiology Degree at UP.

Occupational Hygiene Section



Head: Mrs Jeanneth Manganyi

The NIOH Occupational Hygiene Section continues to contribute towards the health and wellbeing of employees at various workplaces both nationally and globally. The section continues its efforts to retain experienced professional staff to enable a high-level output for tasks performed.

The functions of the Occupational Hygiene Section focus on the prevention of occupational diseases which include hazard identification, evaluation of exposure hazards and recommendation of cost-effective and practical control measures which aim to mitigate exposure.

In addition to exposure assessments, the section conducts research, training and teaching, non-medical samples analyses, as well as advisory support to employees and employers, which are functions that contribute to the operational mandate of the institute.

SERVICES

The Occupational Hygiene Section participated in a SANAS re-assessment (ISO 17020), following a successful completion of the first four years' accreditation cycle. The section was recommended for continued accreditation and registration as an Approved Inspection Authority (AIA) with the Department of Employment and Labour, following a successful audit by the department.

In addition to the AIA status, the section has two laboratories namely: The Asbestos Laboratory and the X-ray Diffraction (XRD)/ Fourier Transmission Infrared Spectroscopy (FTIR) Laboratory that are respectively managed by Mr Gabriel Mizan and Mr Jonas Shai. These two laboratories operate within the Occupational Hygiene Section, under direct supervision of the head of the section.

The Asbestos Laboratory continues to participate in the Asbestos Fibre Regular Informal Counting Arrangement (AFRICA) asbestos proficiency testing scheme run by the Institute for Occupational Medicine (IOM) in Edinburgh, UK. The Asbestos Laboratory has been consistent in maintaining a "1" (Good Performance) rating.

The position that has been vacant for most of the previous financial year in the XRD/FTIR Laboratory was filled during the reporting period. As part of the preparations for SANAS assessment, the newly appointed scientific analyst in 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. The analyst has maintained a Z-score of 2 which is regarded as a satisfactory performance.

Exposure assessments

The section conducted and reported on a total of 17 exposure assessments, which included health risk assessments and workplace hazard monitoring surveys. The majority of these assessments were performed for the Department of Correctional Services (DCS) as part of the existing service level agreement (SLA), as well as assessments conducted within the NHLS laboratories. The section also provided occupational hygiene services to the private sector, in line with the AIA function and SANAS accreditation status, i.e. being a Type C Inspection Body which allows for the provision of services within the NHLS, as well as to the private sector.



Image 1: Conducting a noise survey at a boiler room

Samples analyses

The section conducted analyses of non-medical samples which aimed to estimate employees and environmental (public) exposure to hazardous substances in the air. These analytical services complement the function of the exposure assessment performed under the section's AIA scope of work.

The XRD/FTIR Laboratory provided gravimetric sampling analysis for 122 samples. The laboratory analysed 77 samples for respirable crystalline silica (RCS) in support of internal research. As part of method validations which is a key requirement in preparation for the SANAS assessment, the laboratory has analysed a total of 1367 samples which included: gravimetric weighing = 240, RCS by FTIR = 550, RCS by XRD = 547 and RCS for standards preparations = 30. The XRD/FTIR Laboratory also analysed 16 samples (XRD = 8, FTIR = four and four samples for gravimetric weighing) which were analysed as part of participation in the proficiency testing scheme (PTS). Thirty-four air samples, which included two rounds of proficiency testing participation (20 sample slides) and service work (14 samples) were analysed for asbestos by the Asbestos Laboratory using phase contrast microscopy (PCM).



Image 2: Performing RCS analysis using the XRD analyser



Image 3: Asbestos analysis using phase contrast microscopy

Respirator fit testing

The section continues to promote awareness on respirator fit testing as it forms an important part of any respiratory protection programme. A total of 137 employees were fit tested during the reporting period. This was part of service provision, mainly in support of research work or as part of the respiratory protective programmes implemented by private companies, including Setshaba Research Centre and Coca Cola Eswatini. The section also supported requests for fit testing employees within the NHLS.



Image 4: Respirator fit testing of internal staff

Advisory support

Section staff have been serving on a number of professional and technical committees as well as participating in strategic meetings, in particular for SAIOH, SANAS, SABS, AUDA-NEPAD and various committees within the Department of Employment and Labour. The section provided advisory support to government and public by responding to queries and providing necessary information and guidance. A total of 14 queries regarding asbestos were processed and documented.

RESEARCH

Research projects undertaken by staff form part of academic studies or were executed in collaboration with other sections/ stakeholders. The aim is to publish research findings in national or international journals and to present at relevant platforms such as workshops and conferences. Some of the research studies are ongoing with data collection currently underway. The research studies detailed below were initiated during the reporting period.

Thermal comfort and associated factors in a mechanically ventilated building

du Preez KL

This MPH study aims to identify factors that may influence office occupants' perceptions of the thermal environment at the workplace. This will provide a better understanding of indoor air quality parameters that can be adjusted to improve thermal comfort. The study is in protocol development phase, and it should be submitted to the UP Faculty of Health Sciences Research Ethics Committee by August 2020.



Occupational noise exposure among groundskeepers at a public university in Gauteng, South Africa *Mokone M*

The aim of this study is to evaluate noise exposure levels for groundskeepers who operate different types of powered lawn maintenance machines at a public university in Gauteng and estimate their risk of noise-induced hearing loss (NIHL). The study is in its early stages and the protocol has been assessed. The researcher will apply for ethics approval at Wits thereafter. Data collection is anticipated to commence in November 2020.

TEACHING AND TRAINING

The NIOH Occupational Hygiene Section hosted 40 undergraduate students from UJ for annual experiential exposure in occupational hygiene services. Other support included academic teaching and practical support to the MPH and DOH at Wits and UP. The section provided advisory support for the occupational and environmental health curriculum development by the Department of Physiology and Environmental Health from the University of Limpopo (UL).

The section contributed to a number of workshops and training sessions hosted by the NIOH, including the NUM national OHS workshop, asbestos training for labour inspectors and the workplace biorisk management course. Section staff members participated and presented on occupational hygiene-related topics. Two section staff members presented to OHS professionals at the SAIOH Gauteng branch meetings.



Image 5 & 6: Participants in Mozambique and Malawi conducting site visits during training provided in support of AUDA-NEPAD.

The section participated in two one-week training programmes of OHS inspectors and SHE officials in Mozambique and Malawi that was organised by AUDA-NEPAD. The section also provided technical support to the Ministry of Labour in Mozambique. These activities contributed to the memorandum of agreement between the NIOH and AUDA-NEPAD.

The section hosted Prof Fuller from Workplace Health Without Borders (WHWB), through the British Occupational Hygiene Society (BOHS), who facilitated a week-long internationally recognised module on OHTA W502 – Thermal Environment. This was part of an ongoing effort to improve and maintain section staff's understanding and knowledge of most recent national and global occupational and environmental health and safety best practices.

The NIOH Occupational Hygiene Section was granted an Approved Training Provider status by the BOHS Chartered Society for Worker Health Protection. The approval was for the W201 and W500 series modules and will allow the section to train on these internationally recognised courses within the Southern African Development Community (South Africa, Botswana, Namibia, Lesotho, Swaziland, Angola, Democratic Republic of the Congo, Madagascar, Malawi, Mauritius, Mozambique, Seychelles, Tanzania, Zambia and Zimbabwe).



Image 7: Participants at the OHTA W502 - Thermal Environment course presented at the NIOH



Images 8 and 9: Poster presentation at international conferences

HONOURS

Mr Moses Mokone was appointed as a Council Member by the Southern African Institute for Occupational Hygiene (SAIOH). Mrs Karen du Preez was appointed as Vice Chair for the SAIOH Professional Certification Committee for a period of two years.

PROFESSIONAL DEVELOPMENT

During the year under review, the section enrolled seven postgraduates as follows:

- Two for PhDs in Public Health at Wits;
- Three for an MPH in Environmental and Occupational Health at UP; and
- Two for an MPH in Occupational Hygiene at Wits.

Quality Assurance Department



Head: Mr Bonginkosi Duma

In the financial year under review, the NIOH Quality Assurance Department (QA) increased its number of recognised accreditation systems from three to four. Previously, the NIOH was accredited for the following standards: ISO 15189, ISO 17025 and ISO 17020. It is now also approved for the additional ISO9001:2015 standard. As such, the NIOH is the only institute within the NHLS that is accredited for four different systems by third-party assessment bodies. This is an unprecedented milestone in the history of the NHLS.

SERVICES

The expertise of NIOH QA is continually requested by the NHLS to assist with preparing other laboratories for accreditation. These laboratories, that are based in other provinces, are assisted with pre-assessments for SANAS audits, GAP audits, CEFT evaluations and QA training. The QA Department also embarked on a customer survey to obtain feedback internal customers and learn about their concerns.

The NIOH uses a quality improvement process to maintain its different ISO systems. The process flow is illustrated below:



Figure 1: Audit quality improvement process flow for the NIOH

Implementation of ISO 9001 in other support departments

In 2018, it was decided to implement the ISO 9001: 2015 standard in support departments of the NIOH. To date, the Biobank is the only department that has achieved accreditation for the ISO 9001 standard. Overall, there has however been good progress, right through from training, to implementation.

One of the departments that has made considerable progress in this regard, and is starting the process of implementation of ISO 9001, is NIOH Support Services i.e. procurement and finance departments. To receive ISO 9001 certification, the other departments will have to pass the first two stages of the initial assessment by the external body. The following departments must still implement the ISO 9001 standard: Epidemiology, Information Services, SHE, Information Technology (IT), Procurement, OM and HIV and TB in the Workplace. Currently, there are resource constraints that impact the speed of implementation.

Risk related to quality

There were no changes in quality-related risks during the period under review.

Risk	Root cause	Consequence	Mitigation	Status
In-transit temperature monitoring	Transportation of specimen	Deterioration of specimen	Use of digital thermometers for specimen monitoring	Continues monitoring through the use of digital thermometers
Power failure	Interrupted power supply from utilities	Damage to electrical equipment	Use of power generators	Continued operations due to the use of generators
IT system malfunction	Insufficient maintenance of the system	Data loss and delays in TATs	Manual capturing of data	Regular maintenance of systems

TEACHING AND TRAINING

The QA Department continued to conduct teaching and training on quality-related topics. During the reporting year, training was conducted on the following topics, as part of the continuing professional development (CPD) of staff: good laboratory practice (GLP) OECD; documentation; personnel files; writing of non-conformances and SANAS R80.

ACHIEVEMENTS

The department continued to render support to other NHLS public health laboratories, and more tests were added to expand its capacity and scope for food and water testing. During the year under review, legionella and bacillus tests were added to the test repertoire, as well as technical signatories to these tests. The KZN Public Health Laboratory remains the only public health laboratory that is accredited for the ISO 17025 standard, and together with the NIOH, it is one of only two NHLS entities that are accredited for this standard.

PROFESSIONAL DEVELOPMENT

The NIOH represents the NHLS on the ISO TC 212 Committee. This committee reviews different international standards and makes recommendations on which standards should be adopted or rejected by the country.

The QA Department coordinated training by SANAS for Toxicology staff on GLP OECD to improve their knowledge of quality as part of their CPD. NIOH staff were trained to progress from the ISO 17025:2005 standard to the new ISO 17025:2017 standard, which includes risk management.

During the year under review, the NIOH also completed all its SANAS applications online, through the new online system that was developed by SANAS as a replacement of the previous manual application process.

HIV and TB in the Workplace Unit



HIV and TB in the Workplace Unit

Head: Dr Muzimkhulu Zungu

The unit was formed in 2013 to respond to the burden of disease and its impact on workers as a result of the human immunodeficiency virus (HIV) and tuberculosis (TB). With the understanding that these issues require a strong and efficient health system, the unit adopted a health systems approach. Based on the early successes of utilising this approach; the unit has since extended its role into the development of occupational health policy, systems and services as part of its mandate.

As a result, the unit comprises the following sub-sections: HIV and TB in the Workplace and Occupational Health Policy, Systems and Programmes. The unit works both in the public and private sectors; primarily with stakeholders in construction, health, the informal economy, mining and municipal services.

SERVICE DELIVERY

Occupational health systems and programmes for the health sector

The unit provides occupational medical practitioner (OMP) support services to the Gauteng and Mpumalanga Departments of Health.

For the Gauteng DoH, the unit provided supervisory and ad hoc OMP support at Dr George Mukhari Academic Hospital and Kalafong Provincial Tertiary Hospital. The support entailed working with the provincial DoH and the hospital OHS teams to plan and implement OHS services at the hospitals. This included: policy review/ training; OHS health promotion; HRA/interpretation; medical surveillance implementation; referral support for workers with complicated occupational diseases and workers' compensation.

In addition, the united supported both the Gauteng and Mpumalanga Departments of Health with the implementation of the WHO and ILO's HealthWISE Tool. The HealthWISE tool is a practical workplace improvement tool aimed at assisting HCWs to understand most aspects of their work environment and the associated impact on their OHS. This in turn enables HCWs to identify basic ways to improve their work environment, and in particular, OHS in their workplaces.

The unit also contributed to the implementation of the workplace HIV and TB programme for the Gauteng and Mpumalanga Departments of Health. This was achieved through supporting the HIV and TB policy and programme development/review; workplace assessments; HIV and TB health promotion; HIV and TB IPC; TB screening and treatment support; HIV counselling and testing (HCT); HIV and TB medical surveillance; etc.

Ad hoc workplace HIV, TB and OHS policy, systems and programmes support

The unit was appointed as a technical expert on OHS policy, systems and programmes that form part of the Employee and Wellness Programme (EWP) of the Gauteng Provincial Government (GPG) and assisted the province with strategic planning for the programme.

The unit provides ongoing and ad hoc advisory support on HIV and TB to the national and provincial Departments of Health, The Department of Employment and Labour, the trade unions; and employers.

In collaboration with the UP School of Health Systems and Public Health (SHSPH), the unit provides expert professional services (occupational health systems, occupational medicine and epidemiology) to the Masoyise Health Programme. The Masoyise Health Programme is a wellness approach that incorporates non-communicable diseases and occupational lung diseases in the previous Masoyise iTB project.

The unit hosted an HIV and TB health promotion day for informal workers that are located around the Natalspruit Taxi Rank, in Katlehong, Ekurhuleni. This initiative is in line with the ongoing Informal Economy HIV TB Workplace Programme, which seeks to improve inequitable access to health services for informal economy workers without compromising their businesses and income generation. It is also in line with the unit's commitment to support World TB Day which takes place in March every year. In the month of March 2020, the unit also rendered TB health promotion services to health practitioners at the Kalafong Provincial Tertiary Hospital.

The unit continues to serve in an advisory capacity at OHS meetings of construction industry partners, namely the Master Builders Association (MBA) North and the South African Forum of Civil Engineering Contractors (SAFCEC). The unit's role at these quarterly meetings is to provide support on OHS issues pertinent to the industry and where appropriate, advise on new OHS developments in the sector.

RESEARCH

The unit is involved in ongoing research projects that are currently at various stages. These projects, that are listed below, are undertaken in both the formal and informal economy within health, mining, construction and other sectors.

Knowledge, attitudes, practices and HIV prevalence survey among farm workers: Limpopo and Mpumalanga Province

Collaborative study team: *Mlangeni M¹, Zungu M¹* National Institute for Occupational Health, National Health Laboratory Service, Johannesburg, South Africa¹

The aim of this survey is to gain insights to improve access to basic health services for the agricultural workers. The data collection for the survey was conducted between October 2018 and March 2019 and is currently in the data analysis and manuscripts development phase. The survey is done in collaboration with the SAMRC.

HIV services for street vendors in Ekurhuleni

Collaborative study team: *Mlangeni M¹, Zungu M¹* National Institute for Occupational Health, National Health Laboratory Service, Johannesburg, South Africa¹

This is an ongoing study which is conducted among street vendors based around the Natalspruit Taxi Rank in Katlehong, Ekurhuleni, which aims to understand factors affecting access to HIV TB services for the informal workers. This study is currently in manuscript writing phase.

Occupational health interventions and employees' absenteeism in South African hospitals, 2019

Collaborative study team: *Ramodike J¹, Zungu M¹* National Institute for Occupational Health, National Health Laboratory Service, Johannesburg, South Africa¹

This is a baseline study aimed at understanding the levels of sickness absenteeism in Gauteng hospitals, as well as the effect of availability of OHS services in the hospitals. The study currently is in the data collection phase.

TB health promotion among health workers

Collaborative study team: *Malotle M¹, Zungu M¹* National Institute for Occupational Health, National Health Laboratory Service, Johannesburg, South Africa¹

The aim of this project is to increase awareness and change behaviour of HCWs who are involved with TB treatment at Dr George Mukhari Academic Hospital. The project is in its early stages and awaiting funding.

HIV and TB in the Workplace Programme: review tool, 2019

Collaborative study team: *Malotle M¹, Zungu M¹.* National Institute for Occupational Health, National Health Laboratory Service, Johannesburg, South Africa¹

The aim of this project is to develop and test the HIV and TB in the Workplace Programme audit tool. The study currently is in the manuscript writing phase.

Evaluation of the HIV and TB workplace programme in the City of Tshwane Metropolitan Municipality, Gauteng Province, South Africa, 2019

Collaborative study team: *Malotle M¹, Zungu M¹* National Institute for Occupational Health, National Health Laboratory Service, Johannesburg, South Africa¹

The aim of the project is to determine the availability and effectiveness of an HIV TB programme for a municipality. The study currently is in the protocol development and approval phase.

TB treatment outcomes in the mining industry

Collaborative study team: *Zungu M¹, Mlangeni N¹, Ramodike J¹, Malotle M¹* National Institute for Occupational Health, National Health Laboratory Service, Johannesburg, South Africa¹

The project is aimed at assessing the effectiveness of the TB control programme in the mining industry. The project currently is in the manuscript preparation phase.

Silica and tuberculosis in a silica exposed workforce

Collaborative study team: *Zungu M*¹ National Institute for Occupational Health, National Health Laboratory Service, Johannesburg, South Africa¹

The study aims to determine the relative risk of acquiring TB disease in crystalline silica-exposed workers without radiological silicosis as opposed to workers not exposed to crystalline silica; and the cumulative dose of crystalline silica exposure associated with the subsequent increase of TB disease in crystalline silica-exposed workers without radiological silicosis to levels above those in the general population; and to determine the risk of TB diseases recurrence in silica-exposed workers without radiological silicosis over time. This study currently is in the manuscript writing phase.

HealthWISE and the working environment of health workers

Collaborative study team: Zungu M¹, Yassi A², Seabelo L³, Spiegel J², Mabhele S⁴, Wilcox E²

National Institute for Occupational Health, National Health Laboratory Service, Johannesburg, South Africa,¹ School of Population and Public Health, University of British Columbia, Vancouver, British Columbia, V6T 1Z3, Canada,² Dr George Mukhari Academic Hospital, Gauteng Department of Health South Africa,³ International Labour Organization, Decent Work Team for East and Southern Africa, Pretoria, South Africa⁴

This is a collaborative project with multiple subprojects studying the impact of using the HealthWISE tool in different environments. The aim is to determine the factors associated with successful implementation of HealthWISE and the role of HealthWISE in different resource settings; as well as its effectiveness. The collaborators are ILO, University of British Columbia (UBC) and UP. This study currently is in the manuscript writing phase.

TEACHING AND TRAINING

Academic qualifications in public and/or occupational health

The unit coordinates the Diploma in Occupational Health and Medicine (DOHM), and teaches occupational health to undergraduate and postgraduate students on behalf of the SHSPH, UP. The unit was a rotation site for practical training to public health medicine registrars from UP. The unit also contributes to the ongoing training of public health medicine registrars from the Sefako Makgatho Health Sciences University.

Public health postgraduate research supervision

One registrar from the unit graduated with an MSc in Public Health Medicine and 10 students obtained their DOHM from the SHSPH at UP. The unit is currently also supervising the research projects of three postgraduate students who are enrolled for their MPH and one who is enrolled for an MSc, as well as three who are enrolled for their DOHM.

Training of workers and management in occupational health and safety short courses

The unit organised and coordinated a one-week EWP and OHS strategic training workshop for the GPG's EWP and OHS teams. The training covered topics such as OHS policy and legislation, health systems and programmes (hazard identification and risk assessment; medical surveillance and waste management). This training was attended by all departments and organised labour who form part of the GPG.

In collaboration with the Health & Other Services Personnel Trade Union of South Africa (HOSPERSA), the unit conducted three training workshops for HCWs on an HIV and TB workplace programme. These workshops were held in Johannesburg and eThekwini respectively, and covered topics such as: the importance of a workplace HIV and TB programme for HCWs, what such a programme should consist of, how to deal with stigma and discrimination, and monitoring and evaluation of the programme.

The unit also conducted training workshops on the HealthWISE tool for the Mpumalanga DoH, covering all three districts, namely Ehlanzeni, Nkangala and Gert Sibande. The training was attended by all categories of HCWs, including security guards, porters, clerks, radiographers, pharmacists, cleaners, nurses, and medical doctors.

In addition, the unit co-organised an international conference parallel session on the HealthWISE tool at the ICOH 11th Joint Conference on Occupational Health for Health Workers, which took place in Hamburg, Germany, in October 2019. The session was attended by participants from at least 14 countries across the globe.

Members of the unit formed part of the organising committee for the inaugural conference of Occupational Safety and Health in Africa (OSHAfrica) which was hosted in Johannesburg in September 2019. OSHAfrica is an African regional professional society for OHS professionals, which aims to share academic and technical expertise among its members with the aim to strengthen OHS capacity in Africa.

The unit is furthermore part of the organising committee of the ICOH History 2020 conference which was scheduled for 27-29 May 2020, but had to be postponed due to COVID-19 pandemic.

In collaboration with other NIOH units, the unit also contributed to a one-week workshop on HIV, TB and silicosis to members of NUM.

PROFESSIONAL DEVELOPMENT

In the reporting year, the unit enrolled three staff members for postgraduate studies as follows:

- One for an MPH at UP;
- One for an MMed in Public Health Medicine at the Sefako Makgatho Health Sciences University; and
- One for a PhD in Public Health at Stellenbosch University (SU).



Image 1: Participants at the HealthWISE tool training session in Mpumalanga



Image 2: NHLS HIV and TB training in JHB

Safety, Health and Environment Department



Safety, Health and Environment Department

Head: Mr David Jones

The NIOH SHE Department was established to provide nationwide safety, health and environmental services to the NHLS. The department comprises the following sections: Safety, Occupational Health and Waste Assurance.

The scope of the department's services include, but is not limited to: SHE policy, standards and procedure formulation, facilitating risk assessments, health and safety audits, incident management and investigations, SHE training, occupational health surveillance, facilitating cradle-to-grave management of hazardous waste and implementation of OHASIS (an occupational health and safety information system).

STAFFING

The year under review saw the filling of two OHN Manager posts. The first was to replace the position which became vacant in Limpopo in the Mpumalanga region in the previous financial year, and the second was a new post that was specifically created for the NICD.

CLINICAL

Under the leadership of the NHLS's OMP, the department continued to provide guidance and expert medical support for specific cases and incidents.

Of particular significance were:

- Possible exposure to Brucella;
- Possible exposure to Congo Fever;
- Employees diagnosed with TB;
- Employees diagnosed with Hepatitis B;
- Ergonomic incidents and issues;
- Exposure or possible exposure to other biological agents as well as chemicals and noise; and
- COVID-19 (during the last quarter of the reporting year).

The OHN Managers are continuing with the ongoing project of checking the levels of compliance with regard to Hepatitis B immunisation and surveillance for TB. The information collected is captured on the OHASIS employee health module.

The level of compliance for Hepatitis B immunisation for employees at risk, including those who have recently received vaccinations, has increased to 97.26%. The number of NHLS employees who have undergone baseline chest x-rays (CXRs), has increased to 97%.

SPECIAL INVESTIGATIONS AND SUPPORT FROM OTHER DEPARTMENTS

There was continued expert support from the various departments in the NIOH, including Occupational Hygiene, Occupational Medicine, Immunology, IT and Finance. Examples of such expert opinions and guidance provided, related to:

- Case management for occupational incidents and disease investigations;
- Fit testing of N95 respirators for staff;
- Compliance with legal requirements regarding medical surveillance;
- Consulting with employees and their treating healthcare professionals who have specific occupational medical concerns;
- Noise surveillance;
- Chemical exposure monitoring;
- Ergonomic assessments;
- Immunology advice; and
- Ongoing development of OHASIS.

OCCUPATIONAL HEALTH AND SAFETY INFORMATION SYSTEM

The department continued to train relevant staff on the use of the online training facilities that are available via the intranet.

As at 31 March 2020, 1275 employees (up from 1072 in the previous financial year) have been trained and loaded as users of OHASIS. In practise, this means they are able to capture data on the incident reporting and investigations and waste tracking modules and that they are able to access reports.

Four years ago, the facility to self-report an incident was added to OHASIS, with the aim to reduce the underreporting of incidents. Each self-report on disease is reviewed by an OHN Manager and all other reports are reviewed by a SHE officer. The importance of self-reporting is evident from the graph below.



Figure 1: Number of incident self-reports and other reports by a user



Figure 2 below demonstrates a slight reduction in the number of incidents reported on OHASIS during the year under review, when compared to the previous financial years.

Figure 2: Year-on-year reporting of incidents on the OHASIS from 2016/2019-2019/2020

Employees are encouraged to report every incident, regardless of how insignificant it may appear to be. The rationale for this is to establish a culture of reporting and correction rather than hiding and punishment. A breakdown of the types and number preventive measures identified over the corresponding time is indicated below.



Figure 3: Preventive measures identified up to 31 March 2019

Due to the outbreak of the COVID-19 pandemic, the OHASIS information system is being updated to provide for the new challenges. A screening tool for use by employees is currently in development. Upon completion, this will allow employees to screen for symptoms online and in the event of a 'yes' response to any question, an OHN manager will receive an email notification to respond.

The waste module was also adapted to specifically capture COVID-19 related waste. In addition, COVID-19 was included as a specific outcome for capturing any incident and a dashboard to reflect COVID-19 statistics was created on the system.

During the year under review, the NHLS also purchased the intellectual property of OHASIS from the University of British Columbia, with the aim to take sole ownership of the system.

OHASIS beyond the NHLS

There is an increasing interest for OHASIS to be rolled out to other entities such as the Western Cape and North West Departments of Health and Gauteng Office of the Premier. On an international front, negotiations are underway through the AUDA-NEPAD, for rollout of the system to other countries such as Mozambique, Lesotho, Malawi and Zambia.

SAFETY, HEALTH AND ENVIRONMENT AUDITS

During the period under review, the SHE Officers audited all the facilities which scored less than 95% in their safety audits in the previous financial year, as well as all the TB culture laboratories and 50% of all the other laboratories.

A total of 222 SHE audits were conducted, based on the type of information that the Department of Employment and Labour will take into consideration, as well as the requirements of relevant legislation and NHLS safety policies.

The audit comprises a total of 265 questions, of which 27 pertain to TB culture laboratories only. All reports are generated through OHASIS and are forwarded to the relevant facility and Business Managers. The Deputy SHE Manager also provides monthly updates on the number of outstanding non-conformances to the respective executives.

SAFETY, HEALTH AND ENVIRONMENT AUDIT SUMMARY – YEAR-ON-YEAR COMPARISON

2018/2019	EASTERN CAPE	FREE STATE AND NORTH WEST	GAUTENG	CORPORATE	NICD	NIOH	SAVP	KWA- ZULU NATAL	LIMPOPO	WESTER AND NORTHERN CAPE	TOTAL
NO OF AUDITS COMPLETED	41	21	35	3	13	6	5	38	39	35	236
NO OF NON-CONFORMANCES (NCs) RAISED	276	245	217	93	86	105	96	398	507	281	2304
NO OF NCs CLOSED	221	170	99	21	82	73	9	317	328	226	1546
% NCs CLOSED	80%	69%	46%	23%	95%	70%	9%	80%	65%	80%	67%
AVERAGE NO OF NCs PER FACILITY	7	12	6	31	7	18	19	10	13	8	10

2018/2019	EASTERN CAPE	FREE STATE AND NORTH WEST	GAUTENG	CORPORATE	NICD	NIOH	SAVP	KWA- ZULU NATAL	LIMPOPO	WESTER AND NORTHERN CAPE	TOTAL
NO OF AUDITS COMPLETED	31	18	34	4	9	6	3	37	44	36	222
NO OF NCs RAISED	294	221	196	118	53	100	68	456	554	279	2339
NO OF NCs CLOSED	212	130	68	7	48	41	2	272	335	239	1354
% NCs CLOSED	72%	59%	35%	6%	91%	41%	3%	60%	60%	86%	58%
AVERAGE NO OF NCs PER FACILITY	9	12	6	30	6	17	23	12	13	8	11

RISK ASSESSMENTS

The SHE Department continued to evaluate the risk assessments done by the various facilities, in an ongoing effort to ensure legal compliance and assess the level of risk that employees are exposed to. The department also facilitated risk assessments for the facilities that have not completed any. A total of 224 risk assessments were evaluated for compliance and where necessary, improvements were recommended.

HEALTH AND SAFETY COMMITTEE MEETINGS

To ensure compliance with the relevant legislation, the SHE Department monitors and attends the meetings of the Health and Safety Committee (HSC). During the year under review, 111 HSC meetings were held, of which the SHE Department attended 102. In addition, the SHE Department attended a wide variety of other stakeholder meetings of the Area Managers, the Management Committee (MANCO) and the HR Department, to discuss health and safety incidents which affected employees.

HAZARDOUS WASTE

The Waste Assurance Manager is continuously reviewing the NHLS waste policy, audit checklist and online training course on waste management. The aim is to ensure that the waste practices are in line with the latest provisions of the legislation and policy framework on the management of waste, and to improve the waste management standards in the NHLS.

Each of the facilities continuously capture the details of generated hazardous waste on OHASIS. The following table provides information on the quantity of hazardous waste generated by the NHLS by waste category, over the past three years.

Category of waste	Quantity of healthcare risk waste reported on the OHASIS from 1 April 2017 - 31 March 2018	Quantity of healthcare risk waste reported on the OHASIS from 1 April 2018 - 31 March 2019	Quantity of healthcare risk waste reported on the OHASIS from 1 April 2019 - 31 March 2020	
Anatomical waste	141 277,76 kg	184 782,15kg	217 780,12 kg	
COVID-19 waste	N/A	N/A	41, 70 kg	
Chemical waste	85 454,36 kg	120 773,74 kg	92 601,35 kg	
Formidable Epidemic Disease/Viral Haemorrhagic Fever (FED/VHF) waste	23 885,27 kg	32 696,12 kg	9 739,99 kg	
Genotoxic/ cytotoxic waste	0 kg	3,40 kg	511 40 kg	
Infectious waste	1 024 117,20 kg	1 027 850,14 kg	1 076 337,68 kg	
Pharmaceutical waste	586,45 kg	7 828,86 kg	8 141,45 kg	
Sharps waste	317 480,10 kg	353 494,05 kg	362 573,36 kg	

Table 1: Comparison of the quantity of hazardous waste captured on OHASIS over the past three financial years

Area	Quantity of healthcareQuantity of healthcareisk waste reported on therisk waste reported on theDHASIS from 1 April 2017 -OHASIS from 1 April 2018 -March 2018 per area31 March 2019 per area		Quantity of healthcare risk waste reported on the OHASIS from 1 April 2019 - 31 March 2020 per area	
Eastern Cape	161 100,60 kg	214 438,33 kg	244 324,52 kg	
Free State and North West	153 991,78 kg	151 739,53 kg	165 536,36 kg	
Gauteng	492 952,19 kg	513 100,39 kg	476 695,58 kg	
Institutes and Corporate	59 925,89 kg	71 061,25 kg	64 099,77 kg	
KwaZulu- Natal	376 568,03 kg	401 703,12 kg	444 452,95 kg	
Limpopo and Mpumalanga	118 573,80 kg	121 181,84 kg	103 878,96 kg	
Western and Northern Cape	229 688,85 kg	254 204,01 kg	267 829,34 kg	
TOTAL	1 592 801,14 kg	1 727 428,47 kg	1 766 817,48 kg	

Table 2: Quantity 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 legislation and to remain abreast of new developments in the waste management sector.

CONFERENCES AND TRAINING

Training within the NHLS

Since the outbreak of the COVID-19 pandemic, the SHE Department presented three online training events to address related health and safety in the NHLS, as follows:

- On 24 February 2019, a course was presented on the ECHO platform, in conjunction with the Biosafety and Biosecurity Department of the NICD; and
- Two events were hosted via Zoom on 19 March and 26 March 2020, respectively.

A training course that specifically covers management's responsibilities in terms of COVID-19 health and safety, is also planned for the first month of the new financial year.

The department continued to coordinate online training of health and safety representatives and managers via the intranet during the year under review. Two hundred and eight (208) employees completed the online training course which was developed and assessed by the SHE Department.

Training and conference opportunities outside the NHLS

Two members of the SHE Department were funded by the Defense Threat Reduction Agency (DTRA) to attend the American Biological Safety Association (ABSA) annual conference, including the three days of preconference training which took place in the USA.

During the year under review, the Waste Assurance Manager conducted two online presentations at the African Society for Laboratory Medicine (ASLM) Laboratory Systems Strengthening Community of Practice (LabCoP) meetings which took place in August and October 2019. The topics respectively covered were: "Healthcare Waste Management Practices in the NHLS" and "Healthcare Waste Management Policy & Regulatory Framework."

The Waste Assurance Officer also presented on the topic of "Healthcare Waste Management in the NHLS" at the National Health Care Risk Waste Forum meeting which was held in Pretoria in December 2019.



Image 1: The SHE team meets with colleagues in Kitwe, Zambia to discuss the possible rollout of OHASIS

Analytical Services Section



Head: Dr Boitumelo Kgarebe

During the reporting period, the Analytical Services Section continued with its mandate to focus on the analysis of hazardous substances in biological and environmental media as a way of strengthening the assessment of workplace exposure in compliance with the OHASA Regulations for Hazardous Chemical Substances.

The section also provided specialised laboratory tests, advisory services and training in support of private industries, government departments, and academic institutions in occupational and environmental health.

In addition, the laboratories regularly participated in PTS/EQA exercises, which is key in monitoring analytical performance and competence in analysing and quantifying biomarkers in specimens.

SERVICES

Diagnostic services

The section performed a total of two thousand two hundred and ninety-eight (2298) tests (for diagnostic, surveillance and research purposes) during the reporting period.

Specialised laboratory testing

During the year under review, the Analytical Services Section achieved an overall average TAT of 80% for specialised laboratory tests, which is lower than the overall target of 90% that was set by the institution for the 2019/2020 financial year. This underachievement was mainly due to equipment downtime, because of ageing and obsolete instrumentation.

Advisory services

The section rendered advice to both the private and public sectors during the reporting year. Of note is that the DoH engaged the section for advice on "National Regulations Relating to Lead in Paint" in the previous financial year, which has since been followed up with a formal request for testing services from the Metals Unit.

RESEARCH AND SPECIAL PROJECTS

In response to a request from the Tshwane Academic Core Laboratory at Steve Biko Academic Hospital, the section provided urgent analyses and reports on patient-poisoning samples.

As part of a major international collaboration, the section provided testing and analysis services for Leigh Day Solicitors (UK), for a class action lawsuit, involving 246 blood-lead measurements on residents, especially children, in and around the town of Kabwe in Zambia. The residents have been exposed to lead from previous mining activities for an extended period and dangerously high lead levels have been reported in the past.

Research output

The section worked on a prospective study, led by Dr Kgarebe, in collaboration with the Wits Division of Forensic Medicine and Pathology, entitled: "A post-mortem cohort study comparing ethanol concentrations in two different matrices, blood and vitreous humour." The work was presented at the Toxicology Symposium 2019, which was hosted by the UCT Faculty of Health Science on 12 April 2019. The authors were: Gareth Riley, Bianca Southon, Lerato Mochaki, Jared Pillay, and Boitumelo Kgarebe.

ACCREDITATION AND QUALITY ASSUARANCE

The Metals and Organic Units maintained its annual ISO 15189 accreditation status. The section was also audited by SANAS and maintained its ISO/IEC 17025:2005 accreditation status for testing aluminium and mercury levels in water.

In a drive for improved TATs and greater efficiency, the department expanded its testing scope by adding three kit-based methods, which were approved for accreditation by SANAS. The new methods are: Kit 1 (mandelic acid, hippuric acid, phenylglyoxylic acid and methylhippuric acids in urine), Kit 2 (phenol and o-cresol in urine), and Kit 3 (t,t-muconic acid in urine).

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

In line with the prescriptions of the PTS for monitoring laboratory analytical performance and competence in analysing and quantifying biomarkers in specimens, the section participated in the following EQA programmes:

- i. The New York (NY) State Department of Health EQA scheme for arsenic, cadmium, chromium, lead, manganese and mercury in blood and urine and aluminium in serum and water;
- ii. The German EQA scheme (G-EQUAS) for mandelic acid, phenol, o-cresol, hexanedione, 1-hydroxypyrene and methylhippuric acid in urine;
- iii. The SABS Water Check EQA scheme; and
- iv. The National Metrology Institute of South Africa (NMISA) PTS for the analysis of ethanol (alcohol).

TEACHING AND TRAINING

The section met its teaching and training targets during the year under review. Staff from the section conducted the annual training of postgraduate students on GLP, risk assessment, analytical techniques and research methodology, as applied in the detection of chemical contaminants in the workplace and for biological monitoring. The section also hosted students for exposure to various practical aspects of an accredited laboratory. On request from the Department of Zoology, at the NWU, Ms Lerato Manamela and Ms Angela Mawela provided training for postgraduate research students, on protocols, instrument stability, calibration and sample analyses using the PerkinElmer mercury analyser.

The third edition of the course "Introduction to Applied Chemistry in Occupational & Environmental Health" was delivered in October 2019 to second-year undergraduate students in Applied Chemistry, at Wits.

HONOURS

In January 2020, the Organics Unit of the Analytical Services Section successfully passed the 63rd G-EQUAS inter-comparison programme 2019 as a reference laboratory for the toxicological analysis of 2,5-hexanedione in urine (exposure to hexane). The programme is conducted by the German Institute and Outpatient Clinic for Occupational, Social and Environmental Medicine in Nuremburg, Germany. This marks the eighth consecutive year that the Analytical Services Section has maintained its status as a reference laboratory for the analysis of urine for exposure to hexane.

PROFESSIONAL DEVELOPMENT

Dr Puleng Matatiele and Mr Gareth Riley completed their internships and obtained their HPCSA registration as medical biological scientists in the category of Independent Practice – Clinical Biochemistry. This brings the total of HPCSA Medical Scientists trained in the department to five (5) over the last six (6) years.

Ms Angela Mawela, Ms Avhadiphi Mulaudzi and Ms Sesitjie Moremi obtained their Society of Medical Laboratory Technology of South Africa (SMLTSA) qualifications, which is the HPCSA board qualification for medical technicians.

Ms Bianca Southon was the South African nominee to attend the prestigious 2019 (20th) edition of the Organization for the Prohibition of Chemical Weapons (OPCW) Associate Programme. The programme contributes to the development of chemistry and chemical engineering in member states, with special emphasis on chemical safety. For the two-week industrial segment of the programme, Ms Southon was based at a polymer factory in Santiago, Chile.

Through a competitive process, Mr Gareth Riley secured partial funding from the International Mass Spectrometry School (IMSS), to attend training on fundamental and new trends in mass spectrometry instrumentation. The event, which was followed by the 4th IMSS, was held in Barcelona, Spain. The Wits Division of Forensic Medicine and Pathology funded the balance of the meeting.

Three BSc Health Sciences Honours (Hons) postgraduate students who were co-supervised with the Wits Division of Forensic Medicine and Pathology, graduated in December 2019.



Image 1: Ms B Southon from Analytical Services Section at NIOH represented South Africa and participated in the Organisation for the Prohibition of Chemical Weapons (OPCW) Associate Programme 2019.

Toxicology and Biochemistry Section



Toxicology and Biochemistry Section

Head: Dr Natasha Sanabria

During the financial year under review, all activities of the Toxicology and Biochemistry Section have been focused on research, teaching and training, and consultation to several government departments and industry stakeholders, as well as specialised service delivery. This work was conducted through the section's four specialised units, namely: Genotoxicity, HRA, Nano- and Microparticle Toxicity, and Toxicogenomics.

Similarly, established collaborations with local and international institutions were maintained, which allowed for training of staff and postgraduate students in the field of general occupational toxicology and nanotoxicology. The innovative approach of conducting computational toxicology studies was further developed, where predictive tools are used to prevent disease. For this reason, numerous meetings were held within the International NanoSolveIT consortium (a European Union (EU) H2020 project) for implementation of computational models based on measurements from the various research projects.

An Amnis practical data analysis workshop was also organised for research scientists. In addition, the Section met with the previous US Environmental Protection Agency (EPA) regional citizen science coordinator and current director of Environmental Consulting LLC (USA).

A tour and short presentation of the CytoViva applications was organised for international guests of SASOM and MEDICHEM, including Dr TL Guidotti (an international consultant in occupational and environmental health and a recognised physician, occupational epidemiologist and toxicologist) and Dr M Coombs (a private OH consultant who was nominated as an executive of SASOM in 1990).

Lastly, Prof M Gulumian was invited to visit the laboratories of Prof F Cassee at the National Institute for Public Health and the Environment (RIVM) in The Netherlands, to discuss collaborative work.



Image 1: Dr N Sanabria with the presenters for the AMNIS workshop that was co-hosted by Luminex, Mr. John Walters (Flow Cytometry Sales and Applications Manager for the African region) and Dr. Owen Hughes, (Technical Sales Specialist for Luminex Corporation, which includes supporting development of the AMNIS business throughout eastern Europe, Russia, the Middle East and Africa).

SERVICE DELIVERY

Lung Cancer Research Unit (Helen Joseph Hospital)

The collaboration between the Pathology and Toxicology Sections at the NIOH was among others strengthened through the following activities by Dr Sanabria:

- Participation in inter-laboratory verification procedures between local and international laboratories;
- Submission of SOPs and validation reports to the QA Department; and
- Completion of costing for the four new proposed tests, namely: multiplexed probe-based quantitative polymerase chain reaction (qPCR) for the qualitative detection of somatic mutations within non-small cell lung carcinomas (NSCLCs).

Dr Sanabria also attended meetings with Dr A Gildenhys, Dr N Vorajee, Dr D Lakhoo, Dr J Linden, Mr J Hira, TrakCare and various staff from NHLS laboratories, and representatives from different departments at Wits, as well as industry service providers, to discuss genetic analyses options. These new qPCR tests will form part of the services provided to government hospitals that are serviced by the NHLS, as part of the current work performed within the Pathology Department, which is in collaboration with the Lung Cancer Research Unit.

Mine Health and Safety Council

The NIOH liaised with Mine Health and Safety Council (MHSC) representatives throughout the year regarding popularising the services that the NIOH will offer to the industry following the CytoViva 3D system upgrade.

Dr M Vetten regularly presented to the MHSC Program Delivery Technical Committee (PDTC). The service is generally aimed at occupational medical practitioners and occupational hygienists, but additional projects have also been explored with UNISA. In addition, validation of the use of specialised dyes for intracellular localisation analyses was initiated.

South African Medical Research Council

Dr C Andraos attended a meeting at the SAMRC during which the recommendations of the South African Human Rights Commission (SAHRC) on the underlying socio-economic challenges of mining-affected communities in South Africa was discussed. The purpose of the meeting was to provide guidance, give recommendations and elaborate on the studies that have already been conducted by the NIOH, SAMRC and NCR, to avoid unnecessary repetition of published work.

National Research Foundation

Prof Gulumian received substantial funding from the NRF to support human capital development for research in the priority area of nanotechnology for 2020 and to train postgraduate students on nanotechnology.

Prof M Gulumian, Dr N Sanabria, Dr M Vetten and Dr Andraos, organised and hosted a collaborators' meeting with principle investigators at the University of the Free State (UFS), UP, Wits and the University of South Africa (UNISA) to discuss and facilitate the supervision of NRF-funded PhD students.

Dr C Andraos also submitted SOPs to the QA Department for the interference assessment of particles with conventional toxicity assays

RESEARCH

The collaborative efforts between Prof Gulumian and Dr Sanabria created a highly productive team that produced 10 publications, which constitutes 30% of the NIOH's output during the period under review. The section's staff also supported public engagement and served as reviewers for international journals. The research output of the team included 12 presentations at international conferences and four at national/local conferences.

INTERNATIONAL COLLABORATIONS

The Brazil, Russia, India, China and South Africa multilateral project

Prof Gulumian, Dr Andraos, Dr Vetten and Dr Sanabria continued to contribute to a collaborative nano hybrid project related to nanotechnologies, namely: New core-shell hybrid nanostructures: Evaluation of surface coating impact to biosafety and potential therapeutic applications.

In addition, the department had a discussion with UP to facilitate the supervision of PhD students on research pertaining to a collaborative project between Brazil, Russia, India, China and South Africa (BRICS) that relates to the elucidation of intracellular mechanisms involved in the toxicity of nanomaterials. The research output is being developed for implementation as part of the departments' service delivery quota. Dr C Andraos liaised with members and submitted financial reports.

European Union projects

EU H2020 research grants were awarded for projects related to the study of the toxicity and the risk assessment of engineered nanoparticles and nanotechnologies. Consequently, Prof Gulumian participated in a number of meetings with EU partners to discuss collaboration on current and new projects.

These meetings debated measures that the NIOH should implement to investigate the *in vitro* delivered dose of dispersed nanomaterials, as well as the review of requests for high-throughput screening (HTS) and adverse outcome pathways (AOPs). Dr C Andraos also liaised with members and submitted financial reports.

International Organization for Standardization

As the head of delegation of the ISO/TC 229 Working Group (WG3) for "Health, Safety and Environmental Aspects of Nanotechnologies" Committee, Prof Gulumian, attended numerous WebEx and teleconference meetings throughout the year. She participated as an expert at these international forums.

International Union of Toxicology

Prof Gulumian, Dr Sanabria and Dr Andraos attended the International Union of Toxicology (IUTOX) meeting held in Hawaii (USA), to present their research findings and network with toxicologists. Prof Gulumian was an invited speaker at the 15th International Congress of Toxicology (ICTXV). Dr Andraos attended the CPD course entitled: "What Is an Adverse Effect for Human Health: Defining Adversity in Risk/Safety Assessments" at the 15th ICTXV. Dr Sanabria attended the IUTOX AOP Satellite Session: "AOP Hands-on Training: Building the Foundation for Predictive Toxicology".

Organisation for Economic Cooperation and Development

The section participated in the activities of the OECD Working Party on Manufactured Nanomaterials (WPMN), of which Prof Gulumian is a participating member and head of the South African delegation. This required attendance at many meetings and teleconferences throughout the year, to discuss AOPs for nanomaterials, as well as key events (KEs) of relevance to an adverse outcome (AO) induced by nanomaterials, to identify the relevance of this KE for future key event relationship (KER) development and for NM regulatory decision-making.

Through the NIOH, South Africa will continue to contribute to the collection of data for exposure modelling projects. These meetings are important for the approval of nanomaterials that are intended for export to the EU, as well as other OECD countries, including South Africa.
Innovative nano informatics models and tools: Towards a solid, verified and integrated approach to predictive (eco) toxicology (NanoSolveIT)

Dr Sanabria and Prof Gulumian are participating members of the international consortium NanoSolveIT (an EU H2020 project). The general assembly was conducted in Cyprus, where they presented on behalf of the NIOH/ NHLS. Dr Sanabria and Prof Gulumian also attended numerous teleconferences and webinars with other active members of the consortium. Prof Gulumian was given the task of assessing the quality of data available to be utilised for predictive modelling of the toxicity of nanomaterials, i.e. Work Package 2. Dr C Andraos liaised with members and submitted financial reports.

World Health Organization

The NIOH continued to contribute as a WHO Collaborating Centre (CC), where Prof Gulumian is an expert in nanotoxicology and will participate in the WHO Chemical Risk Assessment Network until 31 July 2022.

NATIONAL COLLABORATIONS

Department of Science and Innovation

In collaboration with Mintek, NWU, CSIR and UP, the section continued to execute work for two projects that are funded by the Department of Science and Technology (DST), namely:

- "Risk assessment of gold nanomaterials: An OECD sponsorship programme"; and
- "Nanotechnology health, safety and environment (HSE) risk research platform."

Prof Gulumian attended DST meetings to discuss progress on EU collaborative projects. Additional projects were discussed with the Department of Nanotechnology and Water sustainability at UNISA, as well as the Director of the Tygerberg Poisons Information Centre in collaboration with the Faculty of Medicine and Health Sciences at SU.

Prof Gulumian and Dr Andraos organised and hosted the second DST-funded one-day Health Safety and Environment (HSE) workshop, which provided a platform for all the consortium members on this project (i.e. NWU, UP and UNISA) to discuss their milestones and deadlines for the next three years. In addition, the section hosted the annual departmental research progress workshop.

Dr Vetten also advised collaborators at UP with regards to their cell culturing requirements for research purposes.

The Council for Scientific and Industrial Research

The section liaised with CSIR regarding collaborative work related to nanotoxicology. In addition, Dr Andraos and Mr J Sethowa are actively involved in the HSE risk research platform at CSIR, to analyse data for exposure assessment to nanomaterials.

African Innovation Laboratory Network

Prof Gulumian, Dr Sanabria, Dr Vetten and Dr Andraos organised and hosted a meeting with representatives of the African Innovation Laboratory Network (iLEAD) to discuss collaboration on future nano-related projects and continued to liaise with members of the Wits-led African Innovation Laboratory Network to provide support and guidance as required.

The South African Bureau of Standards

Prof Gulumian continued to provide guidance and recommendations to SABS on the following ISO documents:

- ISO/TR 19057:2017 (Nanotechnologies: Use and application of cellular in vitro tests and methodologies to assess nanomaterial biodurability, which will be adopted by SABS as a national standard); and
- ISO/TS 21633 (Nanotechnologies: Label-free impedance technology to assess the toxicity of nanomaterials *in vitro*, which is currently under development).

She also provided input in a new ISO 229 project proposal, namely the ISO new work item proposal (NWIP): "Nanotechnologies: Lung burden measurement of nanomaterials for inhalation toxicity studies," which was proposed by South Africa.

The Society of Risk Analysis Africa

Prof Gulumian was elected as the president of the Society of Risk Analysis (SRA) Africa. She participated in WebEx meetings and teleconferences to discuss joint programmes between the SRA and the Society of Environmental Toxicology and Chemistry (SETAC), as well as training of African students during the 5th World Congress on Risk, which was co-hosted by SRA and SETAC.

The South African Council for Natural Scientific Professions

There are very few registered toxicologists in South Africa. Both Dr Sanabria and Dr Vetten are registered professional natural scientists in the field of toxicology, where Prof Gulumian continues to serve as a council member of the South African Council for Natural Scientific Professions (SACNASP) where she provides expert knowledge and contributes to strategic meetings. Prof Gulumian attended the Candidate Mentoring Programme (CMP) which was presented at the 1st Voluntary Association (VA) biennial meeting which forms part of CPD. She also reported on the visit of Deputy Minister of Higher Education, Science and Innovation.

TEACHING AND TRAINING

Postgraduate students

Dr J Joseph conducted Western blot training at UNISA, as well as inhouse training on the Synergy™ HTX Multi-Mode Microplate Reader, statistical analysis for xCELLigence data, the Cecil UV-spectrum acquisition and CytoViva hyperspectral imaging acquisition.

Dr W Utembe participated as the external examiner of MPH projects at UJ. Dr Sanabria provided postgraduate training to students and staff members on nucleic acid isolation, quantification and amplification, associated with inhouse training on NSCLC-related mutation analyses.

Dr Sanabria also presented at UJ as part of the biochemistry-related "Industry Engagement" lecture series for the BSc Hons in Biochemistry students on the following topics:

- Classical molecular diagnostics for disease;
- Specific nucleic acid amplification methods for disease;
- Basics of qPCR and data interpretation for disease; and
- The role of toxicology and biochemistry at the NIOH.

In addition, Dr Sanabria presented a molecular diagnostics talk to the BSc Hons in Molecular Medicine students at Wits. Prof Gulumian supervised five PhD and three MSc students at different universities, including UNISA, UFS, UP, and UJ.

Undergraduate students and visitors

The section hosted visiting students and guests at the NIOH for various events, which included:

- A tour for the Tshwane University of Technology (TUT) fourth-year environmental health students;
- The NUM national OHS workshop on "Interpretation of Material Safety Data Sheets;"
- The NIOH Webster Day which was organised by Dr Vetten and Mrs S Hampson, with management of the registration process and logistical support on the day of the event provided by Dr Joseph, Dr Andraos, Ms. M Magogotya and Ms N Miya;
- An AMNIS imaging cytometry and applications for (nano)-Toxicology workshop for practical data analysis, presented by Mr John Walters and Dr Owen Hughes of Luminex Corporation, which was attended by scientists from UNISA, SAHPRA, Nabio Consulting, UP, NWU and the Wits School of Molecular and Cell Biology and Somatic Cell Genetics, as well as TUT,
- A tour for the health systems science programme course coordinator at Wits.

PROFESSIONAL DEVELOPMENT

The section invested substantial efforts in professional development and skills transfer as part of its succession planning.

Prof Gulumian provided onsite supervision to six postgraduate students as follows:

- Five who are enrolled for PhDs (three at Wits, one at UJ and one at UNISA); and
- One who is enrolled for an MTech at TUT.

In addition, Prof Gulumian supervised a total of eight postgraduate students at other institutions such as UP and UFS.

Dr Andraos and Dr Vetten graduated with PhDs from Wits and Dr D Masekameni graduated a PhD from UJ.



Image 2: Dr M Vetten and Dr C Andraos after the ceremony on the steps of The Great Hall (Wits)

The staff also attended numerous training activities which includes:

- The SAIOSH Seminar at the A-OSH EXPO which took place from 14-16 May 2019 at the Gallagher Convention Centre in Johannesburg;
- The 3rd annual OncoDay hosted by Thermo Fisher Scientific, which took place on 12 November 2019, at The Maslow, Time Square, in Pretoria;
- The "Probabilistic Low-dose Extrapolation Using the Bayesian Benchmark Dose Modeling System" webinar presented by Prof Weihsueh Chiu, from the Veterinary Integrative Biosciences Faculty at the College of Veterinary Medicine and Biomedical Sciences, Texas Agricultural and Mechanical University;
- The "Human Health and Ecological Risk Assessment" workshop which was presented at the Fifth World Congress on Risk which took place in Cape Town from 6-8 May 2019;
- The "Advanced Image Analysis and Artificial Intelligence in Microscopy" presentation by Dr Sven Terclavers at Wits Medical School;
- The basic operation of the Synergy HTX multi-mode microplate reader training session, provided by Kerry Burke from Analytical & Diagnostic Products, in Johannesburg;
- The programmes applicable for statistical analysis of micronucleus assay results at TUT;

- A "Root Cause Analysis" workshop hosted by Ms K Mogari from the QA Department;
- SANAS ISO/IEC 15189:2012 training;
- Presentations at the Analytica Lab Africa Expo, at Gallaghar Convention Centre in Midrand, on
 - i. Storage of flammable materials;
 - ii. Good weighing practices; and
 - iii. ISO/IEC 17025 compliance.
 - iv. Hazards in the Laboratory; and
 - v. Hazard Analysis and Critical Control Point and beyond;
- Presentations at PathReD 2019, including:
 - i. Crafting your Career in Science: Writing Successful grant application for grant funding;
 - ii. Do's and Don'ts: Preparing for Ethics Submission;
 - iii. Work Ethics and Time Management;
 - iv. Biobanking Seminar;
 - v. Basic Clinical Chemistry Laboratory Statistics;
 - vi. Risk management in a Clinical Laboratory;
 - vii. Scientific forum of Occupational Health;
 - viii. Basic Clinical Chemistry Laboratory Statistics; and
 - ix. Risk Management in a Clinical Laboratory.
- The supervisors' workshop at the School of Public Health, Wits;
- The MEDICHEM pre-congress workshop on "Chemicals: From Environment to Epidemiology", in Johannesburg;
- The TDNet training on retrieval of library electronic resources;
- The 4th Annual Biobanking Course which took place at Wits on 23 August 2019, with presentations from Prof C Penny, Prof JW Schneider, Prof S Silver (USA), Prof M Labuschaigne, Dr M Sanderson and Prof K Mlisana;
- The NHLS Super-Users Skills Inventory Tool workshop;
- The maiden OSHAfrica 2019 conference, which took place from 18-20 September 2019 in Johannesburg;
- The Zotero reference manager training conducted by the NIOH Library;
- A "Correlation and Regression Analysis" workshop by Juliana Van Staden at UJ;
- A "Basics of Microscopy" workshop by the Life Sciences Imaging Facility at Wits;
- A compulsory workshop on the NHLS Oracle template (i.e. Requisitioner/Receiver) by NHLS System Administrator: IT Oracle ERP;
- "Secure Cyber-Infrastructure within Fast Converging Platforms" workshops at the 13th Centre for High Performance Computing (CHPC) 2019 national conference which took place in December 2019;
- The SANAS ISO/IEC 17025:2017 Laboratory System Course;
- A computer programming workshop on the topic of computational modelling that has applications in risk assessment of chemicals at Wits;
- The SACNASP CPD accredited event: "Igniting conversations about science for innovation with impact" at CSIR;
- The InChiKey workshop by NovaMechanics via the NanoSolveIT consortium;
- The Sabinet training on retrieval of published articles;
- The 1st Nanotechnology Symposium in Health, Safety and Environment (HSE) by NRF and the South African Agency for Science and Technology Advancement (SAASTA) which took place in Pretoria on 10 February 2020;
- A webinar on "How Best Can We Achieve a Universal Health System: A Public Conversation" presented by the South African Health Review (SAHR);
- Numerous presentations at the NIOH monthly research forum and the Departmental Journal clubs, where public speaking, information dissemination, analyses of data and critical review skills are developed; and
- The NIOH/SHE COVID-19 related training at the NIOH.



Images 3, 4 and 5: Toxicology staff, Dr Andraos and Dr Sanabria at the 15th International Congress of Toxicology (ICTXV) poster presentation and Prof Gulumian at the oral presentation sessions held in Honolulu, Hawaii from 15-18 July 2019



Image 6: Mr Jonas Sethowa, Prof Gulumian and Ms Millicent Magogotya at the 10th International Congress of the Turkish Society of Toxicology, 16-19 October 2019, Antalya, Turkey

HONOURS

Prof Gulumian was the recipient of the 2019 SOT Endowment/IUTOX Global Scholars Award as well as the NRF Incentive Fund. Prof Gulumian was also appointed to the Professional Advisory Committee (PAC) for Toxicological Sciences within SACNASP. In addition, she was appointed as member of the Editorial Board of the Jacobs Journal of "Nanomedicine and Nanotechnology", as well as the Editorial Board of the Journal "Toxicology". She was furthermore nominated for the 2018/2019 NSTF-South32 Lifetime Award. She was an expert speaker for the Carte Blanche investigation into microplastics.

Dr Sanabria was awarded an IUTOX Travel Award to attend the 15th ICTXV (Hawaii, USA), based on outstanding qualifications as a scientist in a country where toxicology is underrepresented and based on the research programme and practice of toxicology. In addition, Dr Sanabria was the recipient of an OSHAfrica 2019 Scholarship.



Image 7A and B: Dr Sanabria is one of two South Africans participating in the NanoSolveIT International Consortium (EU H2020 Project), where Prof Gulumian is the other SA representative as well as being the Principle Investigator.

National Biobank



Manager: Mr Bonginkosi Duma

SERVICES

The NHLS Biobank collects and stores different specimens from NHLs clients, different government entities and private clients. The current storage capacity is at four million specimens, and as at 32 March 2020, the Biobank stored 1.2 million samples, which is an exponential increase from the previous financial year.

This is due to the development of extended storage capacity, to meet the increasing demands from clients.

Training

The NHLS Biobank provides training services in Vietnam on behalf of the US CDC. During the reporting year, the facility conducted a five-day training workshop, which consisted of four days of theoretic training in Hanoi and one day of practical training in Nha Trang.



Image 1: 34 Vietnamese candidates from various Vietnam provinces who attended the Biobank training.



Image 2: A question and answer session at the Biobank training workshop in Vietnam, facilitated by an interpreter



Image 3: From L-R: Dr E Conradie from North-West University (NWU) and Mr B Duma from the NHLS Biobank at the launch of the NWU Biobank for rare diseases

Biobank quality management system

It is important for biorepositories to have a quality management system (QMS) and adhere to a set of SOPs, as well as relevant ethical and legal considerations. A QMS enables 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. This framework encompasses elements of participant confidentiality, ethics, safety, sample and data quality for biobanks.

In the reporting year, the NHLS Biobank achieved ISO 9001:2015 accreditation, which makes it the only biobank in Africa that is accredited for this standard.

Benefits of quality processes at the biobank

- Saves money and time;
- Maintains high quality samples and adds value;
- Ensures necessary biosafety and biosecurity standards;
- Enables mapping of population flows, evolution of disease and sources of epidemics;
- Promotes the early development of prevention and treatment strategies through application of modern technology; and
- Accelerates opportunities for global collaboration and secondary use of samples to increase statistical confidence.

The DST visited the Biobank on 3 July 2019 for a tour of the facilities. The purpose of the visit was to strengthen and build research infrastructure across South Africa.



Image 4 and 5: Bongi Duma with Ntombi Dithlopo from DST conducting a site visit of the Biobank, which is a member of the International Society for Biological and Environmental Repositories (ISBER) and the European, Middle Eastern and African Society for Biopreservation and Biobanking (ESBB).

Biobank membership

To ensure that its operations are aligned with international standards, the NHLS Biobank continues to maintain its membership of the International Society for Biological and Environmental Repositories (ISBER) and the European, Middle Eastern and African Society for Biopreservation and Biobanking (ESBB).

ISBER developed a new biobanking standard, namely: ISO 20386. The standard will help international biobanks to be audited and obtain accreditation. Mr B Duma is part of the ISBER Standards Committee and provided input in the development of the standards.

The Biobank website can be accessed at: <u>www.nationalbiobank.nhls.ac.za</u>

PROFFESIONAL DEVELOPMENT

During the year under review, the department enrolled one staff member for an MMed in Biobank Ethics at Wits.

Information Services Section



Information Services Section

Head: Ms Angel Mzoneli

The Information Services Section serves as an enabling partner that provides support to the NIOH and the NHLS, and acts as a gateway to OHS information, not only for the these organisations, but also for external clients.

The services rendered by the section, includes:

- South Africa's national reference library for occupational health, namely the AJ Orenstein Memorial Library which is the only specialist reference library in Southern Africa that exclusively deals with OHS topics, and houses an extensive collection of information resources in OHS, both in print and electronic formats;
- A query-handling service which aims to respond and facilitate access to technical and scientific OHS information and to provide guidance and expert advisory services;
- An archive, which serves to ensure the comprehensive collection, documentation and preservation of the character and identity of the organisation and to provide evidence of its historical development and changes over time; and
- The institutional repository, which is a digital collection of the organisation's intellectual output.

In addition, the section provides seamless and consistent access to information resources (electronic and print) throughout the NHLS to support and enable researchers to conduct world-class and innovative research.

The Information Services Section furthermore expanded its offering to include access to the library collections of the NHLS (formally known as the South African Institute for Medical Research (SAIMR) Library), which is in Braamfontein.

The section also serves the needs of all NHLS staff, including those located in laboratories, and the eight medical schools throughout South Africa, as well as the NICD. The NICD's collections are housed at the NIOH resource centre and forms part of critical information that is remotely provided to the NICD community. The section also established a dedicated training unit to provide technical OHS training for NIOH stakeholders.

SERVICES

The Information Services Section provides its knowledge and information to all stakeholders, both internally and externally, to support the promotion of good OHS practice. To this end, the section:

- Ensures provision of comprehensive resources and services in support of the research, teaching and training activities of the organisation;
- Serves as a national resource and service dedicated to the collection; and
- Provides access to and enables the 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 OHS services and activities throughout South Africa and the SADC region.

To fulfil this mandate, the section provides a wide variety of information resources, through the following:

- Electronic databases and scientific periodicals and monographs both in print and electronic formats; and
- The NIOH Library, which deals exclusively with OHS topics and is the only specialist OHS reference library in South Africa.

During the year under review, the section continued its principal function of sourcing, retrieving and disseminating of information in support of OHS services throughout South Africa and the SADC region. Through various library interventions, the section provided training on the necessary skills to effectively source information on occupational health to OHS professionals, university students, workers, management, health and safety representatives and labour union officials.

The section continuously received and responded to requests for technical and scientific information on OHS issues through its query-handling service. These queries are channelled via the interactive web-based system which enables government departments, employers, employees, OHS practitioners, labour unions and the general public to seamlessly submit OHS information queries and requests online. The system automatically issues query tickets, which ensues a maximum response TAT of 24 hours. Some of the queries received in the reporting period, includes but are not limited to requests for:

- Occupational hygiene surveys;
- Training on handling of asbestos;
- Advice on how to best handle asbestos-containing materials in homes;
- Information on risks related to asbestos-containing materials in homes and workplaces;
- Advice from both employers and employees on OHS-related issues in the workplace;
- Cancer statistics in South Africa;
- Assistance to the Occupational Hygiene section to conduct risks assessments in workplaces;
- Information, training and guidance on OHS asbestos-related topics such as regulations governing the removal of asbestos and how to register as an asbestos contractor, etc;
- Assisting university students with research guidelines;
- Information on training interventions offered by the institute;
- Information on autopsy services offered by the NIOH to ex-miners;
- Information held by the MBOD and outcomes of applications for compensation of second-degree benefits;
- Information about the DOH and MPH;
- Referrals to the NIOH clinic; and
- Information on COVID-19-related issues, training materials and workplace assistance.

Importantly, queries received via the system overall, originate from provinces throughout the country (university students, government departments, private industry, construction and mining companies, occupational health practitioners, doctors, and academic institutions); neighbouring countries, and some overseas countries in America, Europe and Asia and many more, all of which iterates the critical role of the Information Services Section, both locally and internationally.

During the reporting year, the NIOH Library and the Query-Handling Service collectively received 521 queries, of which 516 were successfully resolved.

In support of research activities, the section maintained its library collections and enabled ease of access to full-text scientific journal articles through its subscription to the MEDLINE Complete database and a clinical e-book collection provided by EBSCO Information Services, which comprise more than 2 400 full-text medical journal titles and medical/clinical electronic books. Open-access electronic resources/databases were also added to the library collection, which researchers can access through the library page on the intranet.

The Information Services Section continued to provide researchers with the necessary literature to execute their research projects. The target for publications produced by researchers for the reporting period was 27, but 33 publications were produced, which constitutes an overachievement of 22%. All 33 publications were also uploaded onto the NIOH website for ease of access and were disseminated to external stakeholders from various government departments, researchers from various South African universities and other organisations dealing with OHS.

The section also led the development and production of the institute's first ever newsletter called the NIOH OccuZone, coordinated by an editorial team that consists of members from various sections of the institute. This newsletter, which is distributed quarterly, aims to:

- Keep stakeholders up to date of the latest developments at the institute;
- Establish a platform for disseminating information about the institute's activities, events, accomplishments (research, service delivery and teaching and training); and
- Create awareness of the work of the institute and profile the institute' emerging researchers and their research work.

Supported by the NICD IT department, the section effectively developed the Institutional Repository, which is an electronic platform that showcases the institute's research output, as well as the intellectual output of the NICD.

TEACHING AND TRAINING

At the beginning of the reporting year, the Training Unit of the institute was incorporated into the Information Services Section. The Training Unit aims to provide technical OHS training to NIOH stakeholders. The unit coordinated several training events during the year under review, including a substantial number of training sessions on responding to COVID-19 in the workplace. These training sessions were conducted online via Zoom, which enabled the institute to reach thousands of employees and employers across various industries and professional categories.

A total of 1627 participants were reached through these training sessions. Below are some of the COVID-19 webinars conducted during the reporting period.

- 1. Contact tracers and donning and doffing of PPE
- 2. What EMS needs to know about Corona Virus
- 3. What Education Officials and Teachers need to know about Corona Virus
- 4. COVID-19 Information Session for Health Care Workers
- 5. COVID-19 and Workplaces Train-the-Trainer Sessions
- 6. COVID-19 and Labour Relations Session
- 7. COVID-19 Session for NHLS employees
- 8. COVID-19 and Risk Assessment: Security Officers and Cleaners
- 9. COVID-19 and Workplaces Train-the-Trainer Sessions (Repeat)
- 10. OVID-19 Session for NHLS employees (Repeat)
- 11. Preparing GP & Dentist Practices on issues of OHS

For the past eight years, the section has partnered with the South African Universities' Schools of Information Science, to afford students an opportunity to gain workplace experience. During the reporting year, the section hosted two groups of final-year science information students as part of an experiential learning programme. These groups consisted of ten (10) students from Durban University of Technology (DUT) and four (4) from UL. The programme offers practical training and hands-on experience in the field of information science, to complement their theoretical knowledge and prepare them for the workplace. The students were also introduced to the various sources of occupational health information training that is available to them.



The libraries further provided training to new employees and interns on information search tools, such as the EBSCO MEDLINE Complete database, the TDNet system, etc. Staff from various sections were also trained on the revamped query ticket system, including how to accurately capture and respond to queries on the system.

The Information Services Section hosted library orientation sessions for OHNs, registrars, and officials from provincial government departments, health practitioners, university students and international visitors.

The section also coordinated an OHS training workshop for the National Union of Mineworkers (NUM) leadership, shop stewards and OHS representatives, and conducted a presentation on sources of OHS information at this workshop.



Promoting Healthy, Happy, Safe and Sustainable Work

Image 1: Participants at the NUM National OHS Workshop.

PROFESSIONAL DEVELOPMENT

In line with the overall staff development objectives of the institute, CPD is a key priority at the section. As such, staff of the section attended numerous training interventions and workshops throughout the financial year under review, to enhance their skills in sourcing information and improve their efficiency. This included training on use of the EBSCO MEDLINE Complete database; completion of the InMagic Genie cataloguing training module; various SABINET workshops, and training sessions on reference management tools. The section enrolled eight staff members for postgraduate studies as follows:

- Four for Master of Information Science degrees (MSITs) at UNISA;
- One for a MSIT at UL;
- One for a Master of Management Degree (MM) at Wits;
- One for a Master of Education Degree (MEd) at Wits; and
- One for a Master of Arts (MA) in Heritage Degree at Wits.

Graphics, Marketing and Communications Section

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Graphics, Marketing and Communications Section

Manager: Mrs Shanaz Hampson

The section aspires to build the NIOH's reputation and brand awareness through proactive marketing, communication and information dissemination to internal and external stakeholders, to support the NIOH and NHLS strategic objectives.

The section also manages and coordinates the NIOH programme for CPD through the HPCSA, and provides support to the NIOH's OHS Training Unit, for the various capacity building initiatives undertaken by the departments within the NIOH.

The central function of the section is to convey the organisation's key messages to internal and external stakeholders through various communication channels available, which include the intranet, newsletters, e-mail, internet and social media platforms. The section also plays an important role in media relations.

During the period under review, the section expanded its service capacity through the employment of an editorial specialist who also has extensive media relations experience to assist in strategically positioning the Institute. Plans are underway to also employ a graphic designer, who will provide transversal support for both the NIOH and its sister institute, the NICD.

SERVICES

Good communication is an essential tool to optimise productivity within any workplace, improve morale and commitment and maintain strong working relationships at all levels. The Graphics, Marketing and Communication Section provides a support function to the NIOH and the NHLS in this regard. Its primary objectives are the promotion of good OHS practices through a preventive approach and through national and international training, outreach programmes and information dissemination.

During the reporting period, staff of the section contributed to the management and provision of content for the websites of the NIOH and NHLS, as well as the NHLS intranet. The website platforms serve as robust information dissemination portals, and the section ensured consistency of content, layout and design, both in alignment with the corporate identity of the NHLS, as well as through the activation of topical content for all stakeholders.

During the last quarter of the period under review, and in consultation with the NIOH Occupational Health Outbreak Response Task Team (OHORT), a requirement was identified for a thorough redesign and development of the NIOH website's landing page. The purpose of this project was to enhance the brand identity and position the institute's website portal as a critical "touchpoint" for quality OHS guidance and information dissemination at a time when many workplace stakeholders required access to reliable COVID-19 information. This was done through topical multimedia website content and quick access to toolkits and information fact sheets – thereby enabling focused, tailored communication to stakeholders.

In collaboration with the Training Unit, the section continues to coordinate training programmes for the NIOH, organise programmes for visitors, and provide an event management, marketing, communications, public relations and graphic design service internally and externally, locally and internationally.

The NIOH increased its digital footprint through the effective utilisation of its social media platforms Twitter and YouTube, which were launched in the 2018/2019 reporting period. These communication channels provided the opportunity for networking on a global scale, assisted with targeting specific stakeholders through tailored communication, and provided a diverse public platform to share information such as:

- The institute's strategic direction;
- Research projects that are currently underway; and
- The institute's stance on current affairs and topical issues relating to OHS.

It is imperative for the NIOH to support all efforts to nurture a culture of sustainable prevention of occupational injuries and diseases, as well as non-communicable diseases that may be exacerbated by conditions at work. Looking ahead, the institute plans to increase its contributions to raise the profile and support efforts related to inequality at work and OHS in the informal economy, by addressing the decent work deficit in the country.

MARKETING AND STAKEHOLDER RELATIONS

Media management and monitoring

During the reporting period, a draft media strategy was developed which also provides for the adoption of an earned media approach. To this end, the section developed an extensive media contact list and proactively sought appropriate opportunities for effective media engagement, to profile the institute. The section facilitated several media interactions, which included television, radio and print interviews by the NIOH Executive Director and NIOH subject matter experts.

During the third quarter, the communication team tested the earned media approach at the Lead Poisoning Prevention Week (20-26 October 2019). To this end, an opinion-editorial (op-ed) was drafted and sent to various media houses (including community, provincial, national and Pan-African media) that own media such as broadcast channels as well as print and digital publications. The consumer education op-ed was authored by Dr Nisha Naicker, Head of Epidemiology and Surveillance, who spoke about the consequences of lead exposure for children and adults. The op-ed was used in its entirety by the following media:

- Cape Argus (early and late print edition) https://www.pressreader.com/south-africa/capeargus/20191024/281719796365760
- First Mining-DRC Zambia journal http://fmdrc-zambia.com/2019/10/op-ed-lead-exposure-can-havedire-consequences-for-children-and-adults/
- Farmers Review Africa magazine https://www.farmersreviewafrica.com/health-focus/2019/10/23/op-ed-lead-exposure-can-have-dire-consequences-for-children-and-adults/
- Independent Online (IOL) https://www.iol.co.za/capeargus/opinion/headway-has-been-made-tomitigate-lead-exposure-35867955
- **BusinessGhana** https://www.businessghana.com/site/news/general/198823/Op-ed%3A%20Lead%20 exposure%20can%20have%20dire%20consequences%20for%20children%20and%20adults
- Voices 360 https://www.voices360.com/self/lead-exposure-can-have-dire-consequences-for-childrenand-adults-35696927

We furthermore participated in a media interview with SABC Radio's Umhlobo Wenene FM. The station interviewed NIOH epidemiologist Vusi Ntlebi on lead exposure and its consequences in Nguni. Through this initiative, the NIOH reached an audience of just over 5.9 million in total, of which the advertising value equivalent (AVE) was calculated at R257 863.

In another media initiative, the section also worked with the Epidemiology and Surveillance Section to profile their surveillance research project "NOMS-SA". The press release was used by the following media:

Africa.com	https://www.africa.com/the-national-institute-for-occupational-health-pilots-new-national-surveillance-project/
Herald LIVE	https://www.heraldlive.co.za/news/2019-11-10-sa-health-body-wants-to-find-out-if-your-job-really-is-making-you-sick/
Times LIVE	https://www.timeslive.co.za/news/south-africa/2019-11-10-sa-health-body-wants-to-find-out-if-your-job-really-is-making- you-sick/
The Sowetan	https://www.sowetanlive.co.za/good-life/health/2019-11-10-sa-health-body-wants-to-find-out-if-your-job-really-is-making- you-sick/?device=feature_phone
Farmers Review Africa	https://www.farmersreviewafrica.com/health-focus/2019/11/08/the-national-institute-for-occupational-health-pilots-new- national-surveillance-project/
Mining Review Africa	https://www.miningreview.com/southern-africa/new-surveillance-project-monitors-mortality-statistics-in-south-africa/
Dispatch Live	https://www.dispatchlive.co.za/news/2019-11-10-sa-health-body-wants-to-find-out-if-your-job-really-is-making-you-sick/
Medical Brief	https://www.medicalbrief.co.za/archives/sas-occupational-health-authority-initiates-national-disease-surveillance-project/

Significant media exposure was obtained for the NOMS-SA project, with an overall reach of more than 9.3 million people around South Africa and an AVE calculated at R878 095. The section furthermore executed a series of radio and television interviews with the following media in English, Nguni, Pedi and Tswana: Umhlobo Wenene FM (SABC Port Elizabeth); Power 98.7; Motsweding FM SABC North West; eNCA; SAfm Sunrise with Stephen Grootes; and the SAfm Afternoon Drive.

Going forward, the NIOH Graphics, Marketing and Communications team will continue to leverage earned media efforts to increase OHS awareness and enhance stakeholder engagement. The section will also ensure that media training is conducted for internal stakeholders and subject matter experts in the new year.

Query handling

Throughout the reporting period, the section dealt with a number of queries from the media and OHS professionals from various industries, in both public and private sectors, for printed and audio-visual marketing material and technical and scientific information on a variety of OHS-related issues. These queries originated from the website or were sent directly to the section. The staff cultivated relationships with numerous OHS-related organisations and societies who make relevant information available via the NHLS and NIOH websites, which collectively serve as a single source of these information resources.

INFORMATION DISSEMINATION

The section is responsible for coordinating visits by key stakeholders, to re-establish relationships and initiate new collaborative endeavours. During the reporting year, meetings were conducted with representatives from:

- The Department of Employment and Labour;
- The Compensation Commissioner;
- MBOD;
- SASOHN;
- SASOM;
- SAIOH;
- NIOSH-CDC, [US];
- WHO;
- ILO;
- WHWB;
- The African Academy of Sciences (AAS);
- Women in Informal Employment Globalizing and Organizing (WIEGO);
- Provincial occupational health coordinators;
- The Minerals Council of South Africa (MINCOSA);
- MHSC;



- Pikitup Johannesburg;
- Asbestos Relief Trust (ART),
- Kgalagadi Relief Trust (KRT),
- Q(h)ubeka Trust; and
- Tshiamiso Trust.

The primary purpose of these visits is to provide insights into the occupational health and other specialised, relevant services provided by the NIOH.

With the intention of building more OHS capacity within the country, the section also coordinated visitor programmes for both undergraduate and postgraduate students as follows:

- OHN students from Wits and from industry;
- Postgraduate OHS nursing students from Occupational Care South Africa (OCSA);
- DOH students from UP, SHSPH and the Wits School of Public Health;
- Occupational medicine registrars from SU, Wits and UP;
- Fourth-year environmental health students from TUT;
- Visiting academics from the Health System Science Programme at Wits; and;
- International guests such as the Board of Medichem and members of the ICOH Scientific Committee.

The section also welcomed and participated in awareness raising campaigns and exhibitions at the following events during the reporting period:

- The SASOM Annual Conference, which took place from 31 July 3 August 2019 at the Protea Hotel by Marriott, at OR Tambo International Airport;
- The Plastics Colloquium 2019, hosted by the Department of Environment, which took place from 21-22 November 2019 at the Birchwood Conference Centre; and
- The SAIOH branch meeting, which was conducted at the NIOH.

LOCAL AND INTERNATIONAL COLLABORATION IN OCCUPATIONAL HEALTH

Together with other sections at the NIOH, international relationships were fostered through dedicated collaboration and networking efforts with key international organisations such as WHO; ILO; ICOH; NIOSH-CDC, USA; FIOH; the HSL of the UK, WHWB and OECD.

Relationships were also maintained with local societies and stakeholders, namely the national and provincial departments of health; the departments of employment and labour and mineral resources; SASOM; ARAOH; SASOHN; SAIOH; MMPA, AUDA-NEPAD, academia, trade union representatives, employers, employees, and public and private sector groups.

Chest x-ray and computed tomography imaging in occupational and environmental respiratory diseases

The NIOH Occupational Medicine Section hosted an advanced training session on chest x-ray and CT scan reading for occupational and environmental lung diseases. Within South Africa, there is a legacy of occupational lung diseases and in particular pneumoconiosis, which continues to be a source of morbidity and mortality in the country. Chest x-ray and more recently CT imaging of the chest, are increasingly important diagnostic tools for occupational lung disease. This three-day workshop aimed to provide delegates with the skills to confidently understand and interpret occupational lung diseases using these diagnostic tools.

Training was facilitated by national as well as international specialists in the area and was led by Dr Kurt Hering, a world-renowned expert on imaging and occupational lung disease. Over the years, Dr Hering has made substantial contributions to developing the ILO's classification of radiographs of pneumoconiosis and the newer system for classifying CT images. The workshop, which was held from 11-13 April 2019, was attended by OMPs from both industry and the academia, as well as compensation bodies and radiologists with an interest in occupational lung diseases.

NIOH and MBOD collaborative workshop - "Kitso ke Tshiamiso"

In a collaborative initiative between the DoH's Occupational Health cluster under the auspices of the MBOD and the Pathology Section of the NIOH, a one-day workshop on post-mortem examinations was held in May 2019. The theme of the workshop was *"Kitso ke Tshiamiso", translated as "Knowledge applied, justice served",* in cognisance of the growing awareness of the health of mineworkers, particularly that of former mineworkers.

The standards applied in the certification of compensable diseases at post-mortem examination in line with the Occupational Diseases in Mines and Works Act 78 of 1973 (ODMWA), are described in the *"Code of Practice on Medical Examinations and Standards applicable in the Certification of Compensable Diseases"* of 1999. This workshop was an integral component to the current review process of this code. ODMWA section 43 requires that standards are set for the certification of compensable diseases. The ultimate interpretation and application of these standards contribute to fair adjudication of submitted cases of occupational lung diseases by certification committee members, appointed under ODMWA section 39(2)(a).





Image 1A and B (left to right): Dr Vanessa Govender with display of real diseased lungs and participants at the "Kitso ke Tshiamiso" workshop

ODMWA provides for benefit medical examinations during all phases of the mineworker's mining life cycle, that is, from exposure until death. Accordingly, ODMWA section 33 requires that medical practitioners submit a case of occupational lung disease on consideration or suspicion. It is thus critical for medical practitioners and particularly OMPs, to familiarise themselves with ODMWA and its

Code of Practice. OMPs need to understand the MBOD and NIOH services provided under ODMWA, including pathology assessments of the cardio-respiratory organs. The overall aim of this workshop was thus to support the MBOD's ongoing scientific journey to review and develop certification standards that are evidence-based and objective.

Reclaimed water workshop

The NIOH Waterborne Pathogen Unit hosted the second Reclaimed Water and Occupational Health Risk Workshop on 25 July at the NHLS Sandringham, PRF Auditorium. The workshop was aimed at developing a body of knowledge on water reuse in South Africa, and particularly with regards to the potential occupational health risks associated with the use of RW in different industries such as agriculture, mining, and power generation.

Leading experts and professionals conducted presentations on a range of topics including:

- Water reuse status in South Africa;
- Emerging contaminants;
- Antibiotic resistance;
- Microbiological water quality monitoring; and
- Guidelines and standards.

The workshop was attended by 61 external participants representing various sectors such as municipalities, water utilities, industry, solution providers, researchers and academia and also provided a platform for exploring research collaborations.



Image 2: Participants networking at the Reclaimed Water Workshop

Southern Africa Tuberculosis and Health Systems Training - Malawi

The NIOH Occupational Hygiene Section (OHyS) participated in training by the AUDA-NEPAD Southern Africa Tuberculosis and Health Systems (SATBHSS). The training was conducted by Mr Moses Mokone of the NIOH OHyS over a period of one week, from 11-15 November 2019 and was hosted in Malawi.

The focus was on capacity building related to occupational HRA, workplace controls and the use of occupational hygiene monitoring equipment among public sector agencies such as ministries of labour, health and mines responsible for OHS inspections in mines and non-mining sectors in Malawi.

The training was attended by 32 delegates from the three ministries and covered topics such as:

- Principles of occupational HRA;
- Practical demonstrations on the use of occupational hygiene instruments;
- The role of occupational hygienists in the mining regulatory framework;
- Inspectors' code of ethical behaviour;
- Legal frameworks; and
- Dealing with vulnerable workers.



Image 3: Participants at the Southern Africa Tuberculosis and Health Systems training session in Malawi.

The programme also included a day visit to a nearby quarry to observe OHS practices and to assist OHS inspectors in learning how to apply HRA principles using some of the monitoring equipment in the field. Feedback from the delegates was positive and indicated a need for additional training on specific topics in the field of occupational hygiene.

Inspectors training on occupational health and hygiene - Mozambique

In an effort to build and strengthen capacity in OHS in the African region, and in particular the sub-Saharan region, Mr Gabriel Mizan from the Occupational Hygiene Section conducted a one-week training programme for Mozambican OHS inspectors and SHE officials that was hosted by AUDA-NEPAD in Maputo, Mozambique.

The primary focus of the training programme was to promote HRA-related capacity building through workplace controls and the use of occupational hygiene monitoring equipment. Topics included:

- Principles of occupational HRA;
- Practical exercises on the use of some environmental and occupational health monitoring equipment;
- The legal framework; and
- Dealing with vulnerable workers.

The programme also included a day visit to a nearby quarry to observe OHS practices and test the monitoring equipment in the field.

Key objectives of the programme were to provide OHS inspectors and SHE officials from the Mozambique Departments of health, labour and mining with some tools to conduct effective OHS inspections and audits of workplaces and enable them to perform basic measurement of occupational stressors.

Thirty delegates from the ministries of health, labour, and mining attended the training. The overall feedback was positive and the requirement for additional training on specific topics in the field of occupational hygiene was identified.



Image 4: Day visit by participants at a quarry in Mozambique

The National Institute for Occupational Health Biennial Webster Day

Over the years, the institute has successfully hosted Webster seminars in memory of one of the NIOH's directors, Prof Ian Webster, an early pioneer of lung disease research in South Africa. The theme for 2019 was: "The Changing World of Work", with the focus on workplace mental health. Guest speakers included: Dr Sumaya Mall from the Epidemiology and Biostatistics Division at Wits' School of Public Health; Dr Thabiso Mokola, a public health medicine specialist; and Dr Colleen Bernstein from Wits' Psychology Division.

These speakers provided insightful perspectives on the topic based on their various fields of expertise. Dr Mall discussed occupational mental health at the hand of studies that relate to the causality of mental disorders and the possibility that the occupational environment and mental disorders may have a bi-directional relationship.

Dr Makola spoke about the importance of diversity in the workplace, specifically due to shifting paradigms, changing demographics, globalisation, generational gaps, and religious/spiritual diversity. Dr Bernstein conducted an interactive session on the issue of bullying and emotional abuse in the workplace, including the toxic effect it has on health.

The event was well-attended and highlighted the requirement for mental health in the workplace to enjoy a greater priority in South Africa. The NIOH looks forward to continuing discussions on this topic and exploring areas of collaboration with stakeholders.



Image 5: Planning committee with Prof Morris and Dr Mayet from the National Institute for Communicable Diseases

Workshop on Actions for Protecting and Promoting the Safety and Health of Workers in the Informal Economy

The NIOH co-hosted a workshop entitled "Actions for Protecting and Promoting the Safety and Health of Workers in the Informal Economy" with WHO at the OSHAfrica 2019 Conference which took place in Johannesburg on 18 September. The workshop was also supported by the ILO. The main objective was to learn about best practices for policies and interventions to effectively protect and promote the safety and health of workers in the informal economy.

Speakers included:

- Dr Nisha Naicker from the NIOH;
- Namakau Kaingu, Chair of the Mining Industry Association of Southern Africa, Zambia;
- Chimwemwe Chamdimba, Principal Policy Specialist at AUDA-NEPAD in South Africa;
- Charles Akong, Technical Officer from Public Health and Environment at WHO-AFRO in Congo; and
- Franklin Muchiri, from the ILO in Geneva.
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Actions were identified for inclusion in a global strategy which will enable countries to improve universal health coverage and working conditions which should be informed by informal economy worker communities themselves.

National Union of Mineworkers training

The NIOH conducted a week-long national OHS workshop for NUM representatives at Elijah Barayi Memorial Training Centre in Midrand in Gauteng from 28 October to 1 November 2019.

The programme comprised input from the NIOH's multi-disciplinary OHS team from different sections which included topics related to:

- Occupational lung diseases and ergonomics;
- Occupational hygiene;
- HIV and TB in the workplace;
- Epidemiology and surveillance;
- Occupational skin diseases;
- Toxicology and biochemistry; and
- Information Services.

Additional input was provided by presenters from MBOD, Rand Mutual Assurance (RMA) and the National Council Against Smoking (NCAS), as well as a medical inspector form DMRE.

The training session, which was coordinated by the NIOH Training Unit, introduced the union's OHS leadership in mining, energy and construction to a range of key occupational health topics. The 23 participants included fulltime OHS shop stewards and represented the union's OHS structures at branch, regional and national levels, of whom approximately a third were from the union's women's structures. Overall, the feedback was positive and NUM requested for this to become an annual event.

Basic Analysis of Routine Surveillance Data in Occupational Health and Safety Workshop

From 25-27 February 2020, the NIOH, through the Epidemiology and Surveillance Section, hosted a threeday workshop on "Basic Analysis of Routine Surveillance Data in OHS." The workshop aimed to provide OHS professionals and HR practitioners with the necessary skills to make the best use of routinely collected occupational health data for improved OHS and productivity in the workplace. Topics included: surveillance systems, basic epidemiology, basic statistics, trend analysis, databases and occupational health ethics.



Image 6A: Dr S Iyaloo conducting a lecture on Hazard Surveillance at the Basic Analysis of Routine Data Workshop.



Image 6B: Participants at the Basic Analysis of Routine Data Workshop.

University curriculum development

Representatives from the NIOH Occupational Hygiene Section attended a two-day Occupational and Environmental Health Curriculum Development Workshop facilitated by staff from the Department of Physiology and Environmental Health at UL.

Along with other experts such as an associate professor from Brigham Young University (USA), the NIOH was invited to provide input and advisory support for the development of a unique four-year degree programme that will attract aspiring students to the field of occupational hygiene. The NIOH is earmarked as a potential future employer for graduates from this programme. The workshop took place at Park Inn, Polokwane in Limpopo Province, from 22-23 July 2019.



Image 7: Capacity development at the University of Limpopo

PROFESSIONAL DEVELOPMENT

Mrs S Hampson was invited to attend the two-day Behaviour Change, Risk Communication & Outbreak Response training session, which took place in Addis Ababa, Ethiopia, from 10-11 July 2019. The training was sponsored by the African Union (AU), Africa CDC and Public Health England to further communication professionals' knowledge and skills in risk communication and behaviour change science.

In general, there is a poor understanding of the integral and oftentimes fundamental role of communication leading up to and during times of outbreak. Similarly, behaviour change science is also often overlooked and universally, it was recommended that outbreak response centres throughout the African region should collaborate and share existing messaging and resources moving forward.

As such, a community of practice was devised out of this workshop for all Emergency Operations Centres (EOCs) operating in Africa. In preparation, moving forward, communication practitioners and behavioural scientists should form part of the EOC structure at all times to ensure consistency and accuracy of messaging to build trust and improve message uptake.

The inclusion of these careers in emergency preparedness is vital and allows for scientific support to be provided through evidence-based research for any given intervention. The workshop was attended by 37 public healthcare specialists from across Africa, some of whom are country leads in terms of outbreak response. The workshop was facilitated by individuals and experts from Public Health England and Africa CDC.



Image 8A and B (left-right): Participants at the behaviour change, risk communication and outbreak response training session in Ethiopia and Mrs Hampson receiving a certificate of attendance after the training.

International Liaison



Managers: Dr Tanusha Singh and Dr Natasha Sanabria

WORLD HEALTH ORGANIZATION PROJECTS

Redesignation as a WHO Collaborating Centre for Occupational Health

The NIOH has been re-designated as a WHO CC in occupational health for the fourth successive cycle. The aim of the Global Network of WHO CCs is to stimulate networking between participating institutions and international partners to provide substantial contribution to the WHO's goal of "occupational health and safety for all". WHO estimates that only about 10 to 15% of workers worldwide have some kind of access to occupational health services, and extending coverage remains a key challenge. The institute's participation in the network is therefore vital to ensuring decent work for all. The below projects are currently underway:

Lead: Dr Muzimkhulu Zungu (Project 28609)

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

Collaborators: Zungu M, Yassi A, Malotle M, O'Hara L, Bryce E, Mlangeni N, Kisting S

The NIOH published work which identified that leadership by management and organised labour is a key driver for implementing occupational health and safety (OHS) programmes; a high staff turnover is detrimental to OHS services; and conducting long-term interventional research on OHS services, without integrating the research findings as they become available, is an opportunity lost. (Zungu M, Yassi A, Malotle M, O'Hara L, Bryce E, Mlangeni N, Kisting S. An occupational health service intervention to improve TB infection prevention and control among South African health workers. Occupational Health Southern Africa vol 25 (5); 2019 Sept/Oct17 – 21).

Lead: Dr Muzimkhulu Zungu (Project 28610)

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

In 2019, the NIOH reached an agreement with the Mpumalanga and Gauteng Departments of Health to provide training and support for the implementation of the HealthWISE tool. Subsequently, at least 90 HCWs have been trained. A draft manuscript on HIV and TB stigma among HCWs has also been produced for publication in 2020. Future activities planned include producing manuscripts for sharing information related to protecting HCWs from HIV and TB infections due to the COVID-19 pandemic.

Lead: Dr Tanusha Singh and Dr Nisha Naicker (Project 28614)

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

The systematic review paper on the health outcomes of informal versus formal sector workers has progressed, and comments from co-authors are expected for the paper to be submitted in 2020. Dr Frank Pega from WHO also facilitated training on the topic in September 2019. A 'round table' session was held at the OSHAfrica 2019 conference which generated a constructive discussion and recommendations on addressing key challenges. Regular meetings were held with the core NIOH team and meetings were also scheduled with WHO and WIEGO.

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Lead: Dr Nisha Naicker (Project 28612)

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

There are very few studies that have compared health outcomes between the informal economy worker and the formal economy worker. The NIOH developed projects to address this gap. The first phase of the project assessed 365 waste pickers working informally at landfill sites in Johannesburg, South Africa. This phase has been completed and findings show an increased prevalence of common mental health disorders, acute respiratory symptoms and outcomes related to poverty, such as food insecurity. The second phase of the project will assess formal workers at waste recycling buy-back centres in Johannesburg. Field work will commence after the national COVID-19 lockdown has been lifted. The outcomes from this project will provide an evidence base for policy development relating to the provision of and access to OHS services for the informal economy.

Lead: Prof Mary Gulumian (Project 22071)

WHO safety of nanomaterials in the workplace

The NIOH contributes to the assessment of the safety of nanomaterials in the workplace, via the activities of the Guideline Development Group and contributed to the compilation a document entitled: "WHO Guidelines from Potential Risks on Protecting Workers of Manufactured Nanomaterials". The document can be accessed at: https://apps.who.int/iris/bitstream/handle/10665/259671/9789241550048-eng.pdf

WHO Risk Assessment Network

Prof M Gulumian is a member of the WHO Risk Assessment Network where she participates in discussions on exposure assessment, biomonitoring, biomarkers, key needs and/or other strategic aspects for developing countries, as well as computational and experimental toxicology. She also contributes to web-based training courses on these topics.

In addition, Prof M Gulumian liaised with WHO and participated in discussions related to the EPA Risk Assessment Forum (cancer guidelines update), as well as discussions on emerging risks including nanotechnlogies, chemicals and climate change, and microplastics.

ORGANISATION FOR ECONOMIC COOPERATION AND DEVELOPMENT PROJECTS

Prof M Gulumian is the Head of the South African delegation of the WPMN. This group works on Adverse Outcome Pathways (AOPs) of nanomaterials to be used for regulatory and risk assessment purposes. A technical report was produced as an output of this work.

INTERNATIONAL UNION OF TOXICOLOGY PROJECTS

Prof M Gulumian is a member of the Scientific Programme Committee for IUTOX. As an IUTOX advisor, she participated in the ICTXVI planning (for the meeting to be held in March 2022) to discuss logistics, finances, the scientific program, and educational courses.

EUROPEAN-UNION PROJECTS

Innovative nano informatics models and tools: Towards a solid, verified, and integrated approach to predictive (eco) toxicology

Prof M Gulumian and Dr N Sanabria are the only two South African members of the NanoSolveIT international consortium. The project has been divided into ten work packages, and the NIOH is predominantly involved in WP2 and WP8, with *ad hoc* contributions to the other work packages when required.

WP1 focusses on NanoSolveIT knowledge infrastructure where open science approaches and FAIR data are central, with a data management plan that applies to computational data, as well as experimental datasets.

WP2 focusses on the design of experiments for data gap filling to support an *in silico* model. Emphasis is for example placed on the collection of data from various sources to initiate the modelling work, which is required to close gaps identified as roadblocks to modelling.

WP5 focusses on predictive nano-informatics modelling using AI methodologies, including an overview of current state-of-the-art technologies in the field of nano-descriptors, image analysis, and grouping approaches based on omics data.

All collaborative meetings strengthen research activities by engaging discussion of data, sharing of information for skills transfer and capacity building, maintaining, and increasing networks. Joint meetings are for example held with other EU groups including NanoCOMMONS, RiskGONE and Gov4Nano.

Gov4Nano

Prof M Gulumian and Dr C Andraos are involved in this EU-funded project and contribute to work plans 2, 4 and 7, which is executed in collaboration with the French Centre for Research and Teaching in Environmental Geoscience. The aim of this project is to develop the first future-proof operational Nano Risk Governance Model (NRGM) that addresses the needs of the transdisciplinary field of nanotechnology.

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION

Prof M Gulumian worked with ISO TC229 experts regarding "WG 3/PG 31 – ISO/DTS 23034 – Method to estimate cellular uptake of carbon nanomaterials using optical absorption". Prof M Gulumian and Dr C Andraos also reviewed an ISO draft document in which the assessment of particle interference with a conventional toxicity assay (DCFH-DA) was discussed. A technical report was produced as an output of this work (see below).

TECHNICAL GUIDELINES AND REPORTS - INTERNATIONAL

OECD Technical Report

Prof M Gulumian compiled a report for the OECD that highlighted the suitability of a new assay developed by the Toxicology and Biochemistry Department at the NIOH, which includes information on the ability of biopersistent/bio-durable manufactured nanomaterials (MNs) to induce lysosomal membrane permeabilization (LMP) as a prediction of their long-term toxic effects. 2019, OECD.

ISO Technical Report

Prof M Gulumian compiled a report for ISO that highlighted the applications of technology housed within the Toxicology and Biochemistry Department at the NIOH, namely: Nanotechnologies – Label-free electrochemical impedance technology to assess the toxicity of nanomaterials *in vitro*. 2020, ISO

ILO Technical Guidelines

Dr T Singh attended the second technical meeting on the formulation of the ILO technical guidelines on occupational exposure to biological hazards, from 21-22 November, at the ILO offices in Geneva. The meeting was very productive and good progress was made by members on allocated chapters.

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NOTES



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