MHSC Research Projects – Airborne Pollutants

Zamaswazi Nkosi

MINERALS COUNCIL
SOUTH AFRICA

BIOGRAPHY

Zamaswazi Nkosi, is a Professional Natural Scientist, geoscientist committed to addressing geological and geotechnical challenges within the mining sector to enhance mining safety.

She joined the MHSC in January 2024 as a Research Delivery Specialist - Mine Safety. She holds a Master's degree (MSc - Cum Laude) in Geology Currently, she is pursuing a PhD in Geology, specialising in Geology, Geophysics, and Rock Engineering.

With hands-on experience in participating in international and South African mining and geotechnical projects, Zamaswazi has demonstrated her expertise across various mining-related fields. Her professional experience extends to advanced mining research, where she has conducted geophysical surveys, seismic imaging, and subsurface characterization. Zamaswazi has contributed to various research projects, publishing her findings in peer-reviewed journals and presenting at industry conferences and workshops. Zama plays a vital role in advancing mining research initiatives, ensuring compliance with regulatory standards, and fostering collaboration among project teams.

MHSC
Mine Health and Safety Council

MHSC Research projects related to mine dust

Presenter: Zamaswazi Nkosi

MOSH Mine Dust Conference, 21 June 2024, Emperors Palace

Every mine worker returning from work unharmed every day. Striving for zero harm in our lifetime.

PRESENTATION OUTLINE

- Background
- MHSC's research related to dust
- Current MHSC dust related projects
- New research opportunities
- Conclusion

BACKGROUND

- One of MHSC's main mandates is to undertake health and safety research and advice the Minister on its outcomes

- The research evidence assist in:

  - Adding to existing knowledge or providing new knowledge on a specific health and safety issue
  - Quantifying and providing better understanding of specific health and safety issues employees are faced with
  - Providing answers to specific health and safety issues in the SAMI
  - Informing interventions to be put in place
  - Over the years, MHSC research outcomes have informed industry's legislation and policy, awareness material, training material and of recent Intellectual Property

BACKGROUND CONT..

- MHSC undertakes its research under the Safety In Mines Advisory Committee (SIMRAC)
- The research is outsourced from research service providers and managed under SIMRAC's Centre of Excellence
- MHSC's research is undertaken under the 9 thrust areas including:

Thrust Area 6 **And** **Thrust Area 8**

Airborne Pollutants ***Occupational Diseases***

MHSC's DUST RELATED RESEARCH PROJECTS OVER THE YEARS

- MHSC has been conducting research on mine dust as early as 1996 and some of the research outcomes remain relevant to the SAMI:

Identification and investigations

- **SIM 020604** Inherent Respirable Dust Generation Potential (IRDGP) of South African Coal – WITS, 2003
- **HEALTH 804** Identification of health hazards in mineral processing plants relating to chronic exposure to multiple chemicals – Infotox (Pty) Ltd, 2003
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- **SIM 020603** SIMRAC Silicosis Control Programme: Phase 1 – CSIR, 2003

CoE 180607 “REVIEW THE CURRENT AIRBORNE EXPOSURE LIMITS (AELS) AS LISTED IN SCHEDULE 22.9(A)” – EUP, 2021

Purpose of the study:

- To determine the impact of the current airborne pollutant exposure limits on employees’ short- and long-term health.
- To recommend appropriate OELs for the SAMI in line with Schedule 22.9(A) of the MHSA, including but not limited to, classification bands in terms of exposure risks.
- To develop a cost-benefit analysis to establish the financial impact of changing airborne pollutants OELs.

Findings and Recommendations:

- Short-term and long-term health effects primarily involve the respiratory tract and the skin.
- A total of 212 airborne pollutants were identified to be prioritised for review.
- It is recommended that additional target organs/systems are included in the medical surveillance programmes following a comprehensive risk assessment of exposure to airborne pollutants.
- It is recommended that the cost-benefit analysis framework is made available to the government and industry for them to conduct a more comprehensive financial impact analysis when a revised OEL is implemented.

Final report: https://mhsc.org.za/research-document/coe-180607-milestone-5/

CoE 190605 “IS THE CURRENT CRYSTALLINE SILICA DUST EXPOSURE MEDICAL SURVEILLANCE SYSTEM IN THE SAMI COMPREHENSIVE TO MONITOR ALL ORGANS ADVERSE HEALTH OUTCOMES?” – MUNDELE BUSINESS CONSULTANCY, 2022

Purpose of the study:

- To identify if the current medical surveillance in SAMI is adequate to monitor all other organs affected by crystalline silica dust
- For the new body of knowledge to improve current medical surveillance and existing legislation on medical surveillance of crystalline silica

Outcomes:

- Lit review indicates that the cardiorespiratory system is the primary body system affected by RCS.
- The cardiovascular system, the renal system, autoimmune system may also be at risk.
- COPs follow a risk-based assessment approach to medical surveillance which mainly consists of chest x-rays and lung function tests.
- Both Invasive and non-invasive medical surveillance techniques were found to be used in SAMI to detect RCS.

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Recommendations:

- For relevant Mandatory COPs on medical surveillance on RCS to be reviewed considering recommendations.
- Regulation 11.7 of the MHSA to include cardiovascular examinations to detect Cor Pulmonale and CVD, renal examinations to detect CKD and ESRD and autoimmune examinations.
- Future research to cover noise and coal systems of medical surveillance.

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Purpose of the study:

- To investigate and develop a business model, operating model, and corresponding financial model, as well as a verification strategy/procedure, for an analytical reference laboratory to be established at the Kloppersbos facility
- The intended purpose of the Kloppersbos Analytical Laboratory (KAL) will be to verify the results reported by mines to the Department of Mineral Resources and Energy (DMRE) on employee exposure to hazardous airborne pollutants, to determine whether mines are accurately analysing, testing and reporting said results.

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Outcomes:

- A verification strategy for total dust, silica and metal/welding fume results.
- A business model for the potential hosting of a verification laboratory at Klopperbos, for these scenarios: fully sustainable or capital-funded.

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CURRENT MHSC DUST RELATED RESEARCH PROJECTS

Recently awarded

- CoE 180605 “Developing a standard operating procedure that will assist in developing and implementing a standardised monitoring strategy for respirable crystalline silica in the SAMI” - aims to develop and implement a standardised monitoring strategy for respirable crystalline silica in the SAMI”

Ongoing work

- Review of the airborne pollutants occupational exposure limits (OELs) and process assisting in how future OELs will be reviewed – *be on the lookout for documents from 28 June 2024*

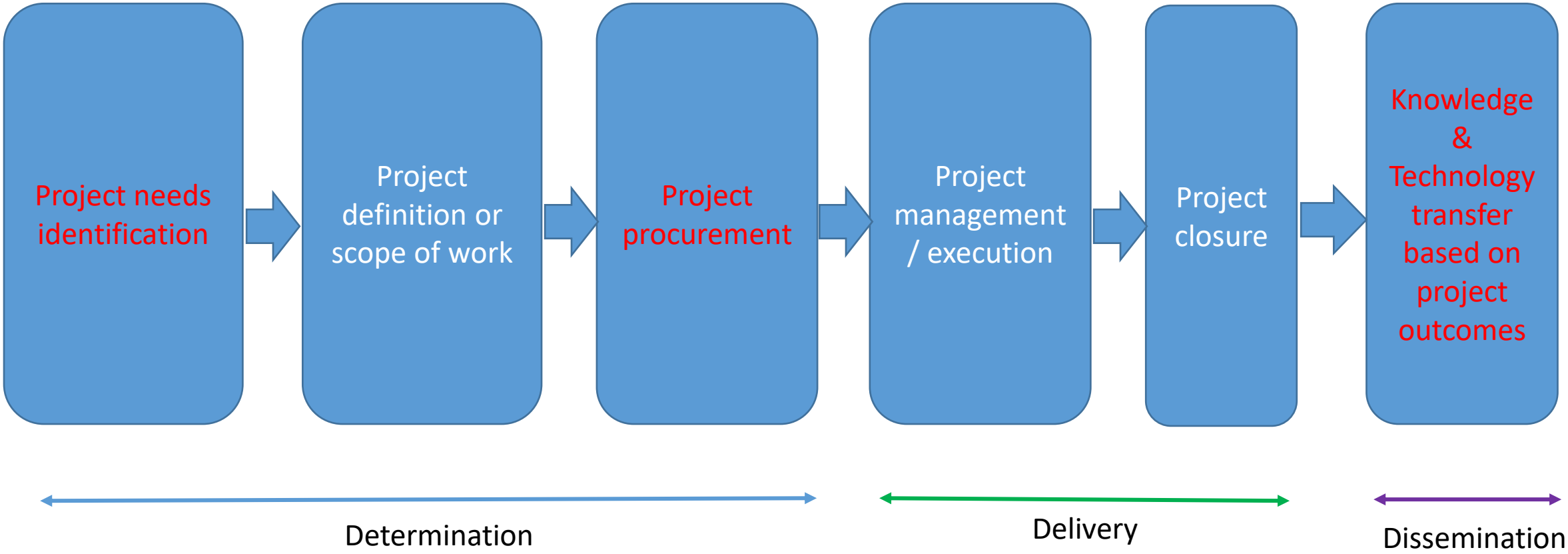
Under procurement

- CoE 190401 “Develop a design and assessment tool that will provide improved, specific guidance to mine ventilation”

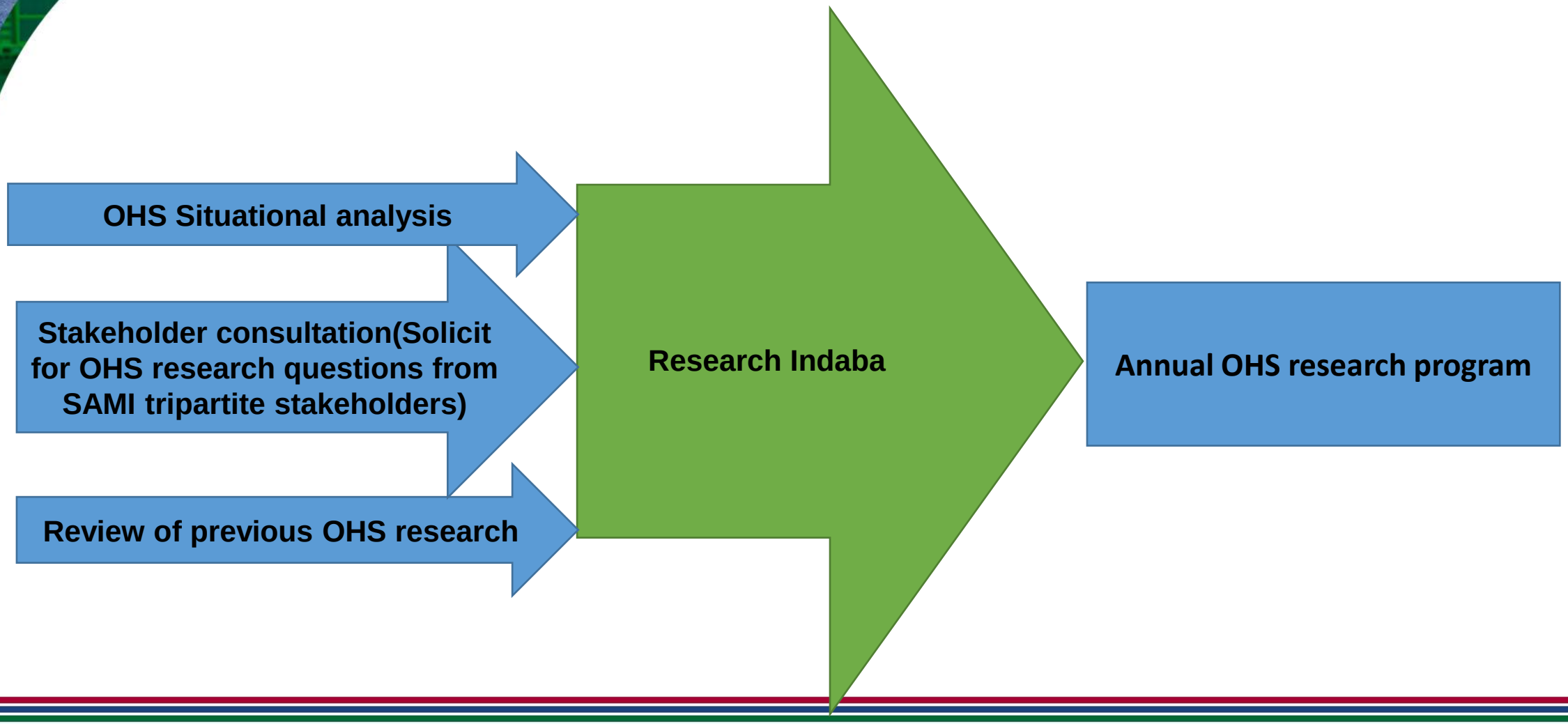
CONCLUSION

- MHSC research continues to play a crucial role in informing H&S decision-making in SAMI
- There are gaps in research related to new dust risks posed by new processes, machinery, new mining methods etc. and new dust controls/evaluation of existing controls
- New research is also needed on measures to support upcoming new OELs and milestones
- To increase research outcomes adoption: Stakeholders need to be involved in formulating clear and high-impact research scopes, and subject matter experts are encouraged to bid for projects to ensure implementable outcomes
- Stakeholders to submit research topics when the opportunity arises

The MHSC Project value chain



OHS Research Determination Process



Situational analysis (industry needs)

- Emerging risks affecting OHS in the SAMI
- Mining incidents root cause analysis (Sec. 54/55)
- Department of Mineral Resources Energy report and OHS stats
- Local and international trends analysis on impacts OHS
- Overview of SAMI
- Critical OHS challenges in the SAMI
- Review of other factors that might have an impact on OHS (social, economic, etc.)
- Opportunities presented by technology and 4IR
- Matters from regional tripartite forums (RTFs) and MHSC committees
- Review recommendations from previous research

MHSC research thrust areas

Safety

Rock falls

Rock burst

Explosions and Fires

Machinery and Transport

Occ. Health

Airborne pollutants

Physical hazards

Occupational diseases

Other

Human factors / behavioral safety

Special projects (eg. 4IR, emerging risks)

Stakeholder Consultation

- Consultation Plan – audiences will include tripartite stakeholders
  - State
  - Organized labour
  - Employers
  - Other (e.g, strategic partners, OEMs)
- Present situational analysis outputs
- Finalise thrust areas for the year

Situational analysis targeted audiences

Table 2: Identified targeted stakeholders of the SAMI

Item	Stakeholder
1.	Department of Minerals Resources and Energy (DMRE)
2.	Minerals Council South Africa
3.	Organised Labour
4.	Safety in Mines Research Advisory Committee (SIMRAC)
5.	Culture Transformation Advisory Committee (CTAC)
6.	Mining Occupational Health Advisory Committee (MOHAC)
7.	The Mining Industry TB, HIV and AIDS Advisory Committee (MITHAC)
8.	Women in Mining Advisory Committee (WIMAC)
9.	Mine Occupational Safety Advisory Committee (MOSAC)
10.	Mining Regulation Advisory Committee (MRAC)
11.	Mandela Mining Precinct
12.	Coaltech Research Association
13.	Mining Qualifications Authority (MQA)
14.	Mining Equipment Manufacturers of South Africa (MEMSA)
15.	South African National Institute of Rock Engineering (SANIRE)
16.	Aggregate and Sand Producers Association of Southern Africa (ASPASA)
17.	Mine Ventilation Society of South Africa(MVSSA)
18.	Association of Mine Managers of South Africa (AMMSA) Free State
19.	Association of Mine Managers of South Africa (AMMSA) Randfontein
20.	Northern Cape Mine Managers Association
21.	Anglo American Tripartite Steercom Meeting
22.	South African Colliery Managers Association (SACMA)
23.	South African Colliery Engineers Association (SACEA)
24.	Association of Mine Resident Engineers of South Africa (AMRE)
25.	South African Mining Development Association (SAMDA)
26.	South African Institute of Occupational Safety and Health (SAIOSH)
27.	Mine Medical Professionals' Association (MMPA)
28.	South African Society of Occupational Medicine (SASOM)
29.	Medical Bureau for Occupational Diseases (MBOD)
30.	Rock Engineering Technical Committee
31.	Anglo-American Escalading/Cascading Forum Meeting
	Regional Tripartite Forums (RTFs)

Evidence based research motivation template

Stakeholders are requested to submit evidence-based research motivations for the 2026/2027 MHSC annual OHS research programme as per the template below. Completed motivations are to be submitted to the MHSC website by the **30th of September 2024.**

Please note that the evidence-based research motivations will be pre-selected based on the MHSC pre-selection criteria, and the proposers/originators of the research topics will be invited to do a presentation of their proposed research topics during the Research Indaba that will be held in **November 2024**. The Research Indaba can be attended in-person or virtually. Only research topics that are presented at the Research Indaba will be evaluated further.

MOTIVATION FOR EVIDENCE-BASED RESEARCH TOPIC
1. Proposed title of research / study to be investigated
Example answer: 1. *Investigating the relationship between long term exposure to respirable crystalline silica (RCS) and the development of occupational lung diseases including silicosis.*
2. **What is the problem / challenge which need to be addressed?**
Example answer: 1. *The relationship between the duration of exposure to RCS and the development of occupational lung diseases is not well understood.* 2. *Occupational lung diseases resulting from RCS exposure often have a long latency period, meaning symptoms and disease may not appear until years or even decades after initial exposure.* 3. *An investigation is needed to better understand how the varying durations and intensities of RCS exposure impact the development of occupational lung diseases.*

3. **How does the problem/challenge highlighted in question 2 affect OHS?**
Example answer: 1. *Breathing RCS particles causes multiple diseases, including silicosis, an incurable lung disease that leads to disability and death. RCS also causes lung cancer, chronic obstructive pulmonary disease (COPD), and kidney disease.* 2. *Exposure to RCS is related to the development of autoimmune disorders and cardiovascular impairment. These occupational diseases are life-altering and debilitating disorders that annually affect thousands of mine workers in South Africa and globally.* 3. *These conditions not only affect the health and well-being of workers but also lead to increased absenteeism, reduced productivity, and potential long-term disability.*
4. How will the research improve OHS?
Example answer: 4. *Enhance regulatory compliance by creating guidelines to limit overexposure to RCS.* 5. *Implement effective control measures to decrease RCS exposure. This includes engineering controls, personal protective equipment (PPE), educational awareness, and health monitoring interventions.*

5. Please provide references/source or evidence to support the problem/challenge (if any)
Example answer: 1. *Rumchev, K., Hoang, D.V. and Lee, A. (2022). Case Report: Exposure to Respirable Crystalline Silica and Respiratory Health Among Australian Mine Workers. Frontiers in Public Health, 10. doi:https://doi.org/10.3389/fpubh.2022.798472* 2. *Health and Safety Executive (2021). Silicosis - Lung disease. [online] www.hse.gov.uk. Available at: https://www.hse.gov.uk/lung-disease/silicosis.htm.* 3. *Hoy, R.F., Jeebhay, M.F., Cavalin, C., Chen, W., Cohen, R.A., Fireman, E., Go, L.H.T., León-Jiménez, A., Menéndez-Navarro, A., Ribeiro, M. and Rosental, P. (2022). Current global perspectives on silicosis—Convergence of old and newly emergent hazards. Respirology, 27(6). doi:https://doi.org/10.1111/resp.14242.*
6. Name and contact details of the originator of the project
Example answer: *Name: Silence Ngobeni* *Phone: 011 656 1797* *Email address: sngobeni@mhsc.org.za*

Research workshop Indaba and needs analysis

- Breakaway sessions per focus area to refine the topics and develop proposals
  - Representation from all tripartite stakeholders
  - Workshop to be facilitated by specialists and technical experts

Output - evidence based research motivation (proposals)

- Facilitators will present proposed topics (per situational analysis results)
- Ranking by selected nominees from technical committees

Development of Research Programme

- Submit to RDTC to collate inputs from all Stakeholders and prepares Situational Analysis Report
- RDTC develop a Research Programme (Including Summit action Plan topics and recommended topics from previous research)
- SIMRAC approval - Board approval - Minister approval
- Development and implementation of procurement plan

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MHSC

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MHSC Research projects related to mine dust

Presenter: Silence Ngobeni (Research Determination Specialist)

MOSH Mine Dust Conference, 21 June 2024, Emperors Palace

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PRESENTATION OUTLINE

- Background
- MHSC's research related to dust
- New research opportunities
- Way forward

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Recommendations:

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- Regulation 11.7 of the MHSA to include cardiovascular examinations to detect Cor Pulmonale and CVD, renal examinations to detect CKD and ESRD and autoimmune examinations.
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Way forward

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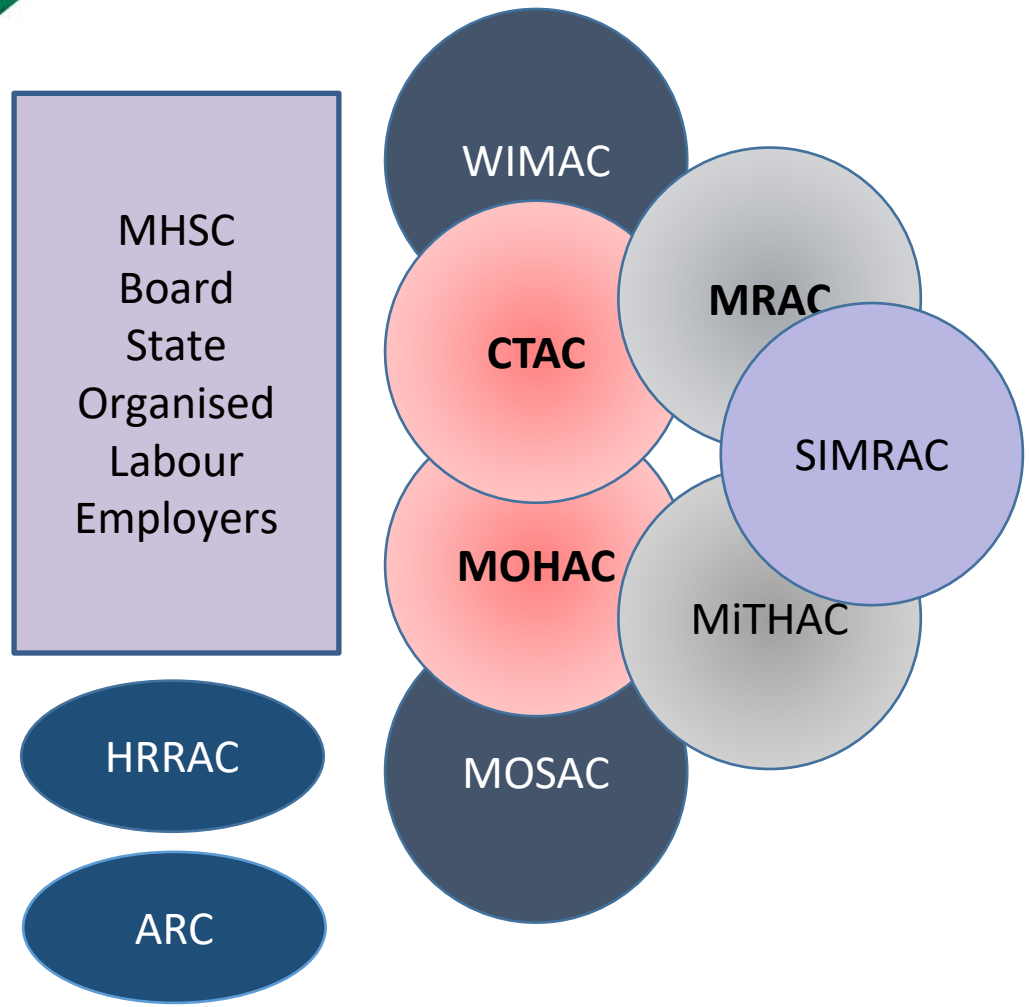
- Stakeholders to submit research topics when the opportunity (How, where, when)

Presentation Outline

- The Mine Health and Safety Council structure
- The MHSC Project value chain
- Research determination process
- Situational analysis
- MHSC thrust areas
- Targeted audiences
- Consultation
- Research Indaba
- Evidence-based motivation survey

The Mine Health and Safety Council structure

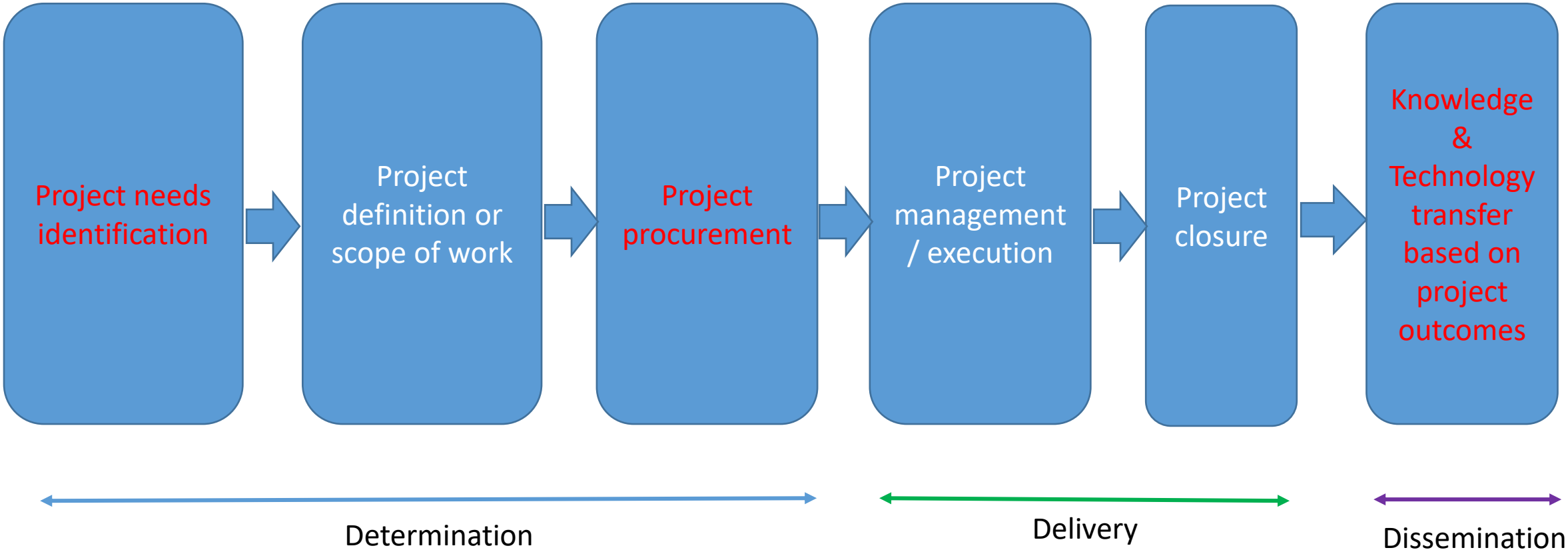


Centre of Excellence (CoE)

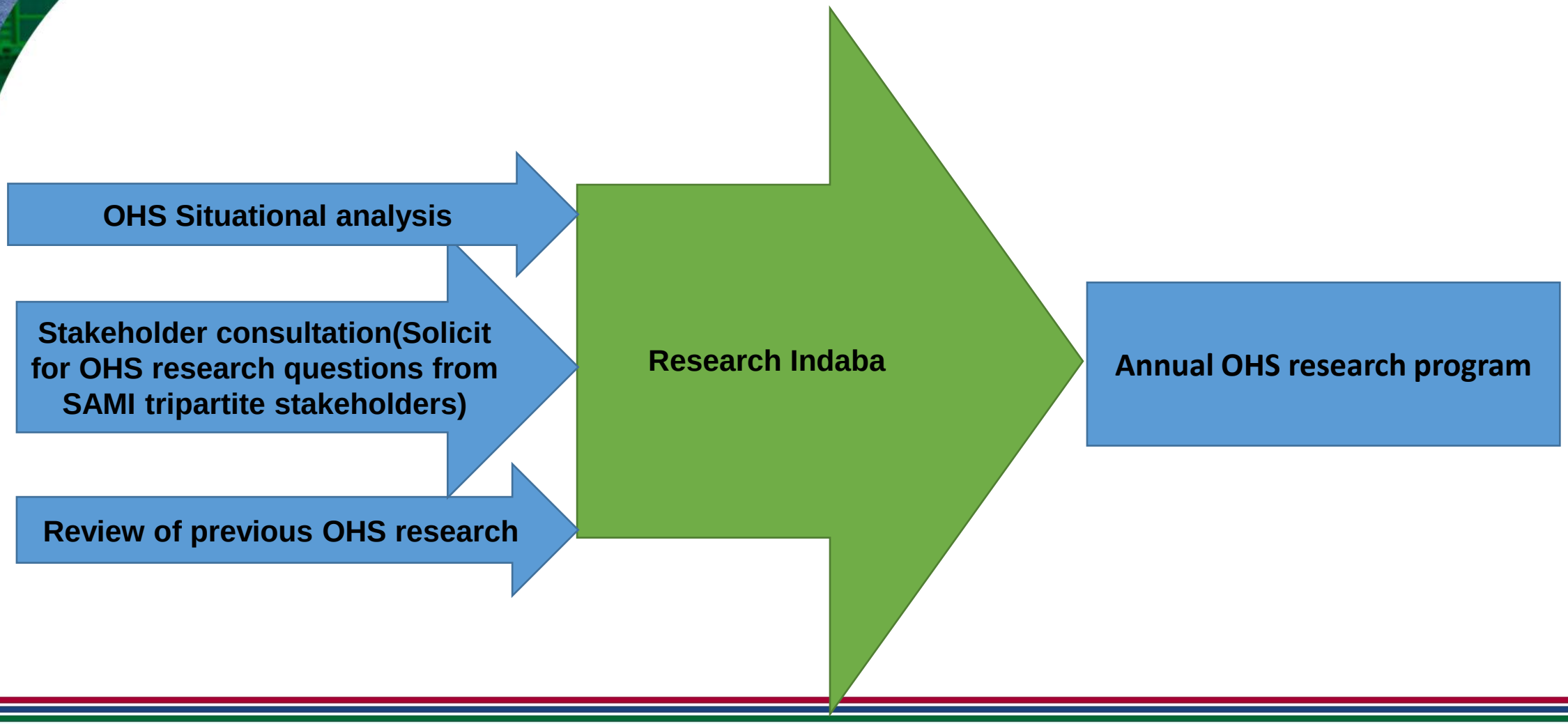
- RDTC
- PDTC
- RODTC

- **Advise the Minister**
- **Review and develop legislation (reg)**
- **Promote health and safety culture**
- **Oversee research**

The MHSC Project value chain



OHS Research Determination Process



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- Overview of SAMI
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- Review of other factors that might have an impact on OHS (social, economic, etc.)
- Opportunities presented by technology and 4IR
- Matters from regional tripartite forums (RTFs) and MHSC committees
- Review recommendations from previous research

MHSC research thrust areas

Safety

Rock falls

Rock burst

Explosions and Fires

Machinery and Transport

Occ. Health

Airborne pollutants

Physical hazards

Occupational diseases

Other

Human factors / behavioral safety

Special projects (eg. 4IR, emerging risks)

Stakeholder Consultation

- Consultation Plan – audiences will include tripartite stakeholders
  - State
  - Organized labour
  - Employers
  - Other (e.g, strategic partners, OEMs)
- Present situational analysis outputs
- Finalise thrust areas for the year

Situational analysis targeted audiences

Table 2: Identified targeted stakeholders of the SAMI

Item	Stakeholder
1.	Department of Minerals Resources and Energy (DMRE)
2.	Minerals Council South Africa
3.	Organised Labour
4.	Safety in Mines Research Advisory Committee (SIMRAC)
5.	Culture Transformation Advisory Committee (CTAC)
6.	Mining Occupational Health Advisory Committee (MOHAC)
7.	The Mining Industry TB, HIV and AIDS Advisory Committee (MITHAC)
8.	Women in Mining Advisory Committee (WIMAC)
9.	Mine Occupational Safety Advisory Committee (MOSAC)
10.	Mining Regulation Advisory Committee (MRAC)
11.	Mandela Mining Precinct
12.	Coaltech Research Association
13.	Mining Qualifications Authority (MQA)
14.	Mining Equipment Manufacturers of South Africa (MEMSA)
15.	South African National Institute of Rock Engineering (SANIRE)
16.	Aggregate and Sand Producers Association of Southern Africa (ASPASA)
17.	Mine Ventilation Society of South Africa(MVSSA)
18.	Association of Mine Managers of South Africa (AMMSA) Free State
19.	Association of Mine Managers of South Africa (AMMSA) Randfontein
20.	Northern Cape Mine Managers Association
21.	Anglo American Tripartite Steercom Meeting
22.	South African Colliery Managers Association (SACMA)
23.	South African Colliery Engineers Association (SACEA)
24.	Association of Mine Resident Engineers of South Africa (AMRE)
25.	South African Mining Development Association (SAMDA)
26.	South African Institute of Occupational Safety and Health (SAIOSH)
27.	Mine Medical Professionals' Association (MMPA)
28.	South African Society of Occupational Medicine (SASOM)
29.	Medical Bureau for Occupational Diseases (MBOD)
30.	Rock Engineering Technical Committee
31.	Anglo-American Escalading/Cascading Forum Meeting
	Regional Tripartite Forums (RTFs)

Evidence based research motivation template

Stakeholders are requested to submit evidence-based research motivations for the 2026/2027 MHSC annual OHS research programme as per the template below. Completed motivations are to be submitted to the MHSC website by the **30th of September 2024.**

Please note that the evidence-based research motivations will be pre-selected based on the MHSC pre-selection criteria, and the proposers/originators of the research topics will be invited to do a presentation of their proposed research topics during the Research Indaba that will be held in **November 2024**. The Research Indaba can be attended in-person or virtually. Only research topics that are presented at the Research Indaba will be evaluated further.

MOTIVATION FOR EVIDENCE-BASED RESEARCH TOPIC
1. Proposed title of research / study to be investigated
Example answer: 1. *Investigating the relationship between long term exposure to respirable crystalline silica (RCS) and the development of occupational lung diseases including silicosis.*
2. **What is the problem / challenge which need to be addressed?**
Example answer: 1. *The relationship between the duration of exposure to RCS and the development of occupational lung diseases is not well understood.* 2. *Occupational lung diseases resulting from RCS exposure often have a long latency period, meaning symptoms and disease may not appear until years or even decades after initial exposure.* 3. *An investigation is needed to better understand how the varying durations and intensities of RCS exposure impact the development of occupational lung diseases.*

3. **How does the problem/challenge highlighted in question 2 affect OHS?**
Example answer: 1. *Breathing RCS particles causes multiple diseases, including silicosis, an incurable lung disease that leads to disability and death. RCS also causes lung cancer, chronic obstructive pulmonary disease (COPD), and kidney disease.* 2. *Exposure to RCS is related to the development of autoimmune disorders and cardiovascular impairment. These occupational diseases are life-altering and debilitating disorders that annually affect thousands of mine workers in South Africa and globally.* 3. *These conditions not only affect the health and well-being of workers but also lead to increased absenteeism, reduced productivity, and potential long-term disability.*
4. How will the research improve OHS?
Example answer: 4. *Enhance regulatory compliance by creating guidelines to limit overexposure to RCS.* 5. *Implement effective control measures to decrease RCS exposure. This includes engineering controls, personal protective equipment (PPE), educational awareness, and health monitoring interventions.*

5. Please provide references/source or evidence to support the problem/challenge (if any)
Example answer: 1. *Rumchev, K., Hoang, D.V. and Lee, A. (2022). Case Report: Exposure to Respirable Crystalline Silica and Respiratory Health Among Australian Mine Workers. Frontiers in Public Health, 10. doi:https://doi.org/10.3389/fpubh.2022.798472* 2. *Health and Safety Executive (2021). Silicosis - Lung disease. [online] www.hse.gov.uk. Available at: https://www.hse.gov.uk/lung-disease/silicosis.htm.* 3. *Hoy, R.F., Jeebhay, M.F., Cavalin, C., Chen, W., Cohen, R.A., Fireman, E., Go, L.H.T., León-Jiménez, A., Menéndez-Navarro, A., Ribeiro, M. and Rosental, P. (2022). Current global perspectives on silicosis—Convergence of old and newly emergent hazards. Respirology, 27(6). doi:https://doi.org/10.1111/resp.14242.*
6. Name and contact details of the originator of the project
Example answer: *Name: Silence Ngobeni* *Phone: 011 656 1797* *Email address: sngobeni@mhsc.org.za*

Research workshop Indaba and needs analysis

- Breakaway sessions per focus area to refine the topics and develop proposals
  - Representation from all tripartite stakeholders
  - Workshop to be facilitated by specialists and technical experts

Output - evidence based research motivation (proposals)

- Facilitators will present proposed topics (per situational analysis results)
- Ranking by selected nominees from technical committees

Development of Research Programme

- Submit to RDTC to collate inputs from all Stakeholders and prepares Situational Analysis Report
- RDTC develop a Research Programme (Including Summit action Plan topics and recommended topics from previous research)
- SIMRAC approval - Board approval - Minister approval
- Development and implementation of procurement plan

Every mine worker returning from work unharmed every day.
Striving for zero harm in our lifetime.

MHSC

Mine Health and Safety Council