SCAN QR CODE FOR AGENDA

# THE MINERALS COUNCIL WELCOMES YOU

MINERALS COUNCIL SOUTH AFRICA

MOSH MINING INDUSTRY OCCUPATIONAL SAFETY & HEALTH

# NOISE INDUCED HEARING LOSS SYMPOSIUM 2024


Sedibelo Platinum Mines – Pilanesberg Platinum Mine

# NOISE INDUCED HEARING LOSS SYMPOSIUM

## SETTING THE SCENE

Kagisho Motseme, Adoption Team Specialist

25 April 2024, Emperor’s Place, Johannesburg

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# NOISE INDUCED HEARING LOSS REGRESSION

CREAMER MEDIA'S MINING WEEKLY

AFRICA AMERICAS AUSTRALASIA EUROPE SET DEFAULT EDITION

MINE SAFETY AND HEALTH

BACK

## Noise-induced hearing loss now highest priority mining health condition, Indaba hears

CAPE TOWN (miningweekly.com) – Noise-induced hearing loss has displaced tuberculosis (TB) and silicosis as the top priority health threat in the South African mining industry.

"I'm emphasising noise-induced hearing loss because the other diseases have gone down markedly whereas noise-induced hearing loss has not gone down as much," Minerals Council South Africa health department head Dr **Thuthula Balfour** revealed on day two of the Investing in African Mining Indaba in Cape Town.



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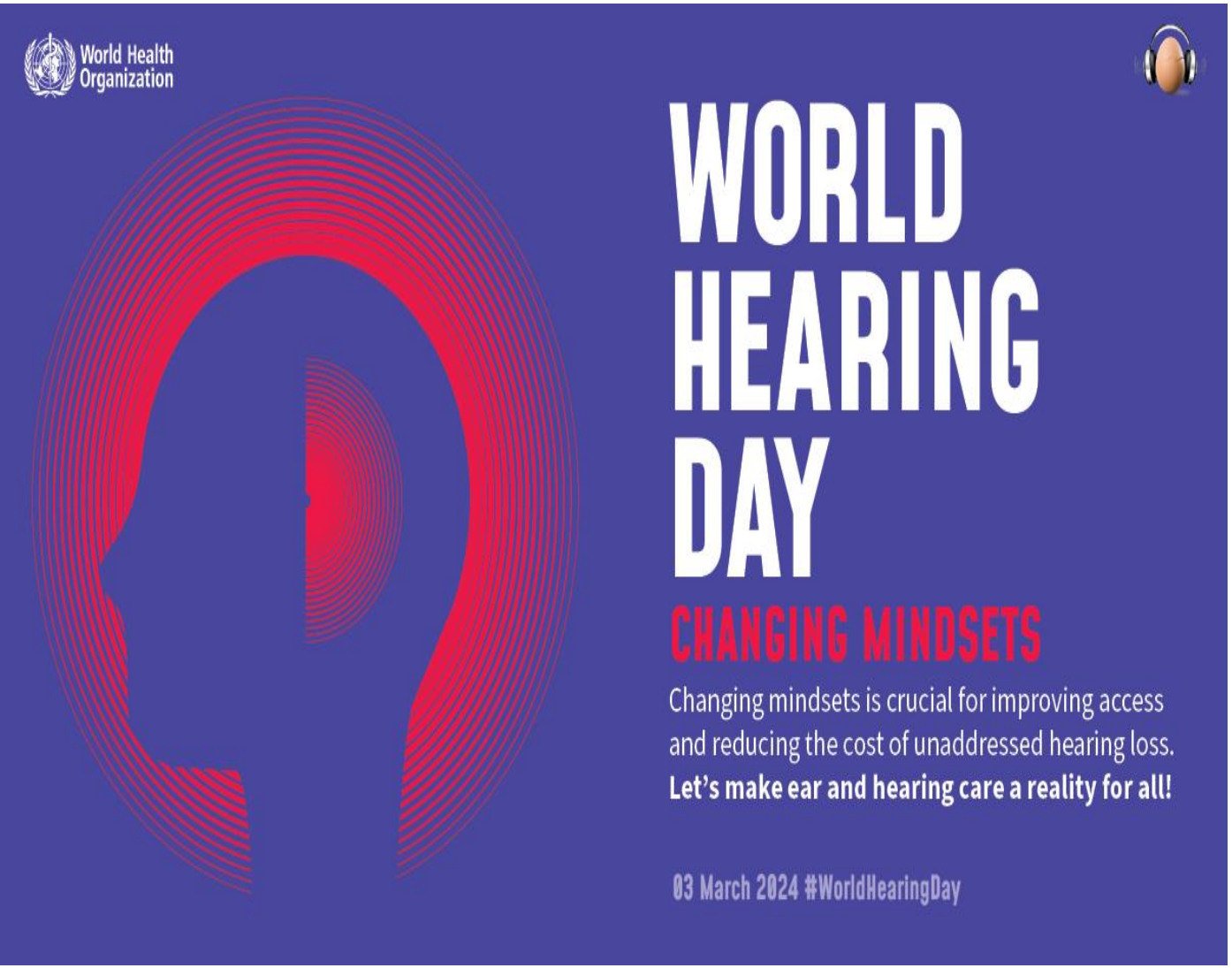
# WORLD HEARING DAY




## Did You Know…?

- Globally, more than 1 billion people (15% of the population) have some degree of hearing loss
- By 2050, this number is expected to double to 2.5 billion, according to the WHO
- One billion young adults are at risk of preventable hearing loss due to unsafe listening practices
- Many people with hearing loss are never tested or treated



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Anglo American Platinum – Dishaba Mine

# Thank you

#MiningMatters

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# INDUSTRY NIHL PERFORMANCE



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# MOSH Noise Symposium

## Department of Mineral Resources and Energy

### Occupational Health Performance

### Ms Bridget Novolo

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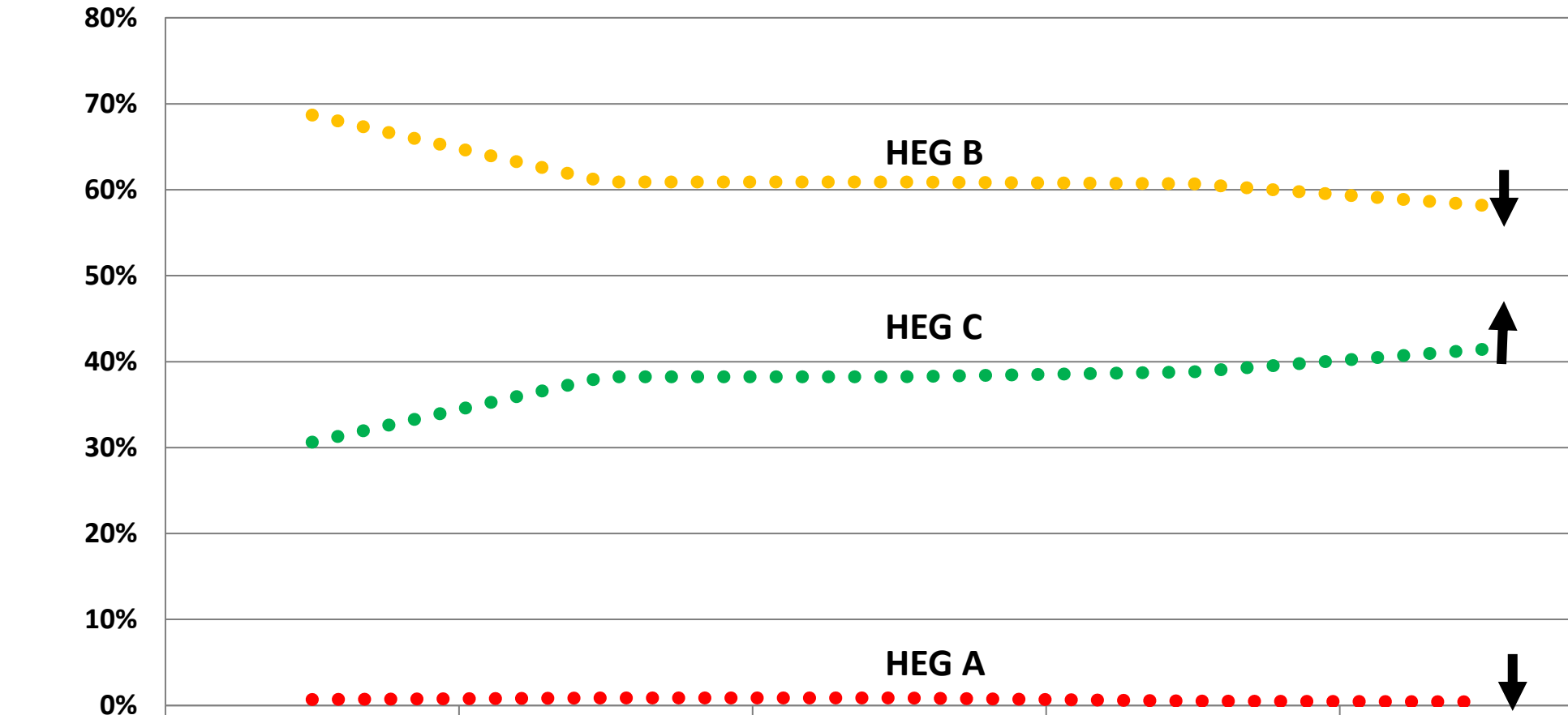
# PRESENTATION LAYOUT

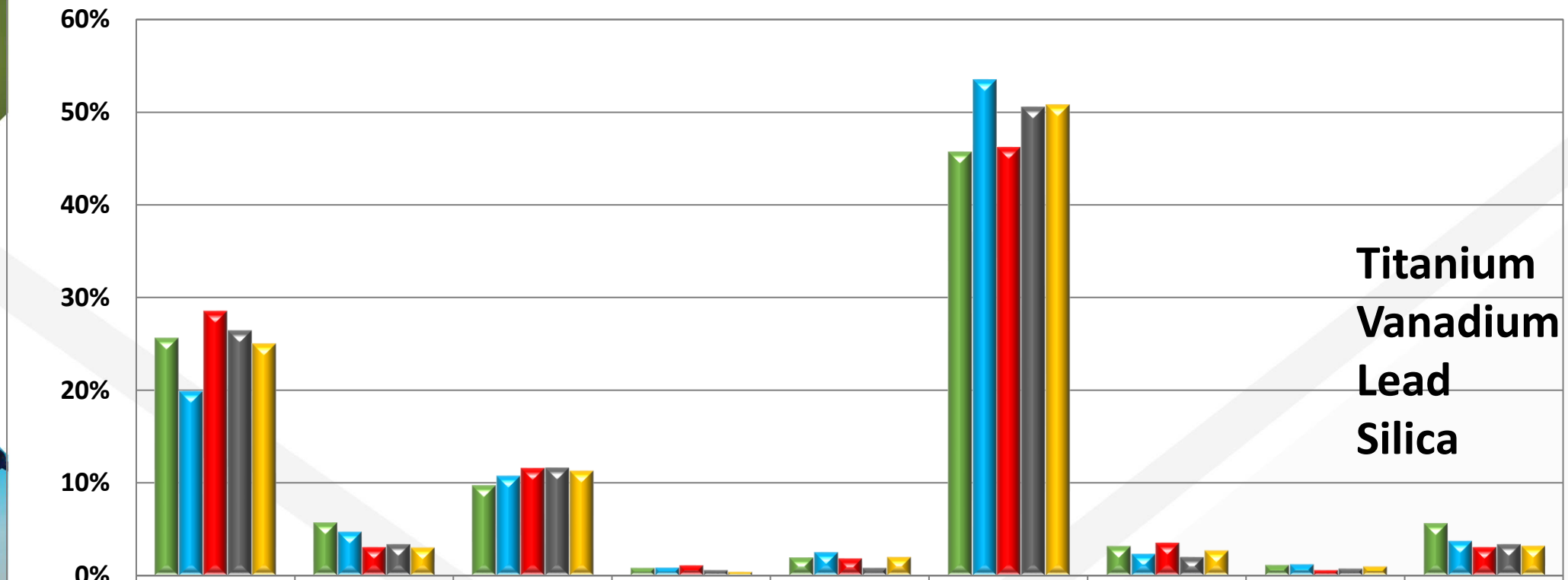
1. Performance trends – Noise Exposures
2. Performance trends – NIHL Cases
3. Challenges

# NOISE: 2018 - 2022




| | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|
| HEG A | 0,67 | 0,87 | 0,87 | 0,51 | 0,41 |
| HEG B | 68,70 | 60,90 | 60,90 | 60,68 | 58,14 |
| HEG C | 30,62 | 38,24 | 38,24 | 38,80 | 41,45 |

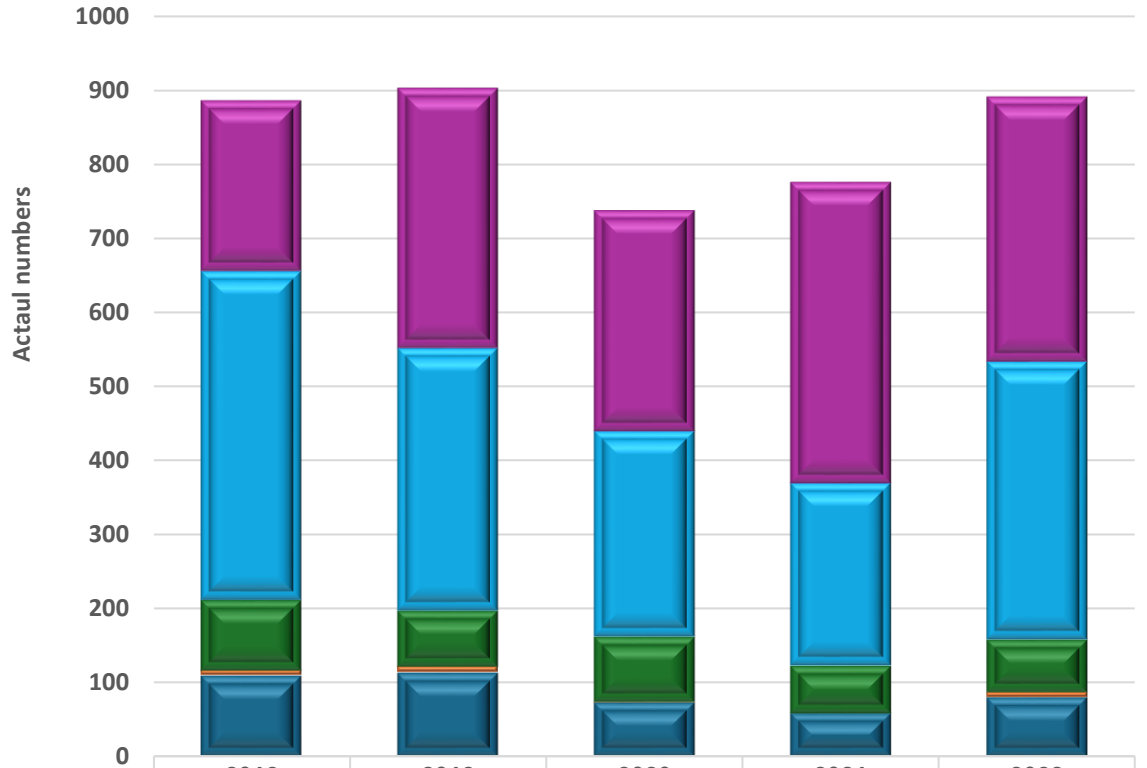
# NOISE: 2018 - 2022




| | Gold | Chrome | Coal | Copper | Iron-Ore | PGM | Diamonds | Manganese | Other |
|---|---|---|---|---|---|---|---|---|---|
| 2018 | 25,73 | 5,76 | 9,80 | 0,87 | 1,98 | 45,78 | 3,22 | 1,17 | 5,70 |
| 2019 | 19,97 | 4,77 | 10,81 | 0,89 | 2,57 | 53,56 | 2,38 | 1,27 | 3,79 |
| 2020 | 28,62 | 3,12 | 11,67 | 1,14 | 1,88 | 46,25 | 3,61 | 0,61 | 3,11 |
| 2021 | 26,50 | 3,43 | 11,69 | 0,63 | 0,86 | 50,62 | 2,04 | 0,79 | 3,44 |
| 2022 | 25,13 | 3,07 | 11,38 | 0,43 | 2,04 | 50,89 | 2,76 | 1,03 | 3,27 |

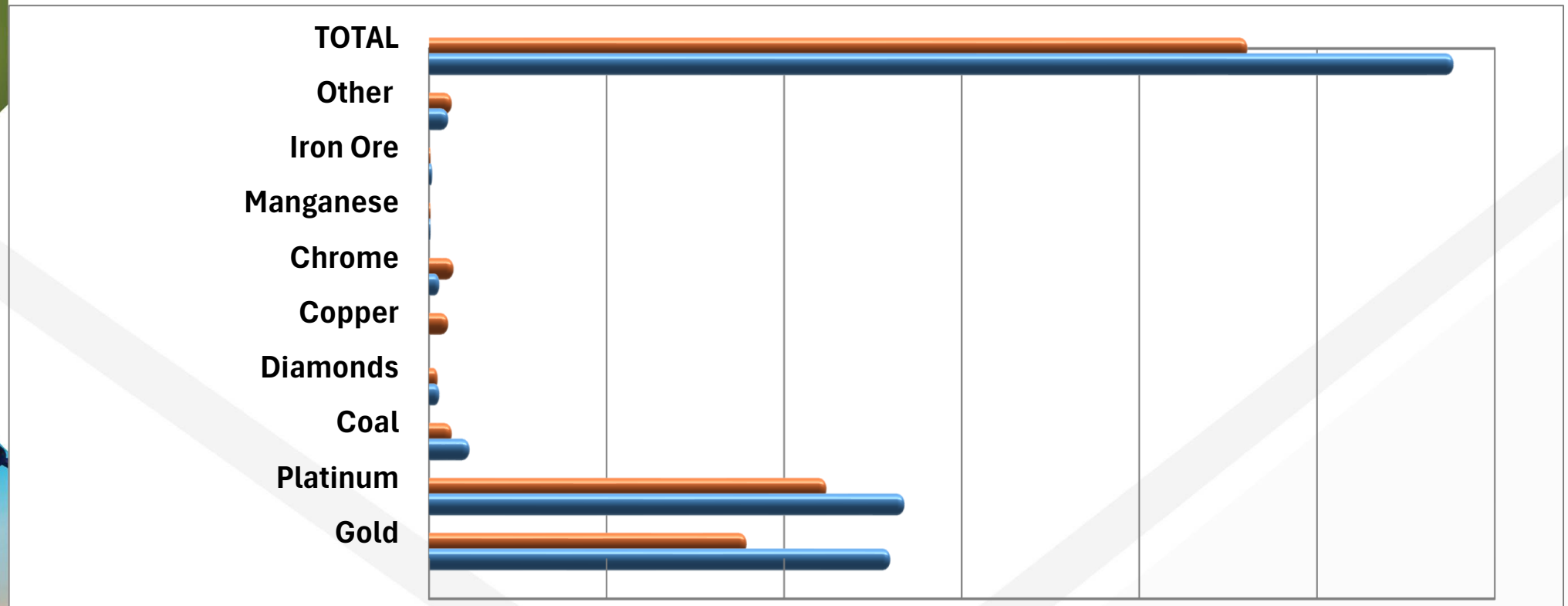
# NIHL reported from AMRs by commodity: 2018-2022

- 14.82% increase in NIHL cases in the mining sector, from 776 in 2021 to 891 in 2022.
- Gold mines reported a -12.1% decrease, from 406 in 2021 to 357 in 2022.
- 23.81% increase in the chrome mines, from 21 in 2021 to 26 in 2022.
- 10.94% increase in the coal sector, from 64 in 2021 to 71 during 2022.
- 52.23% increase in the PGM sector from, 247 in 2021 to 376 in 2022.



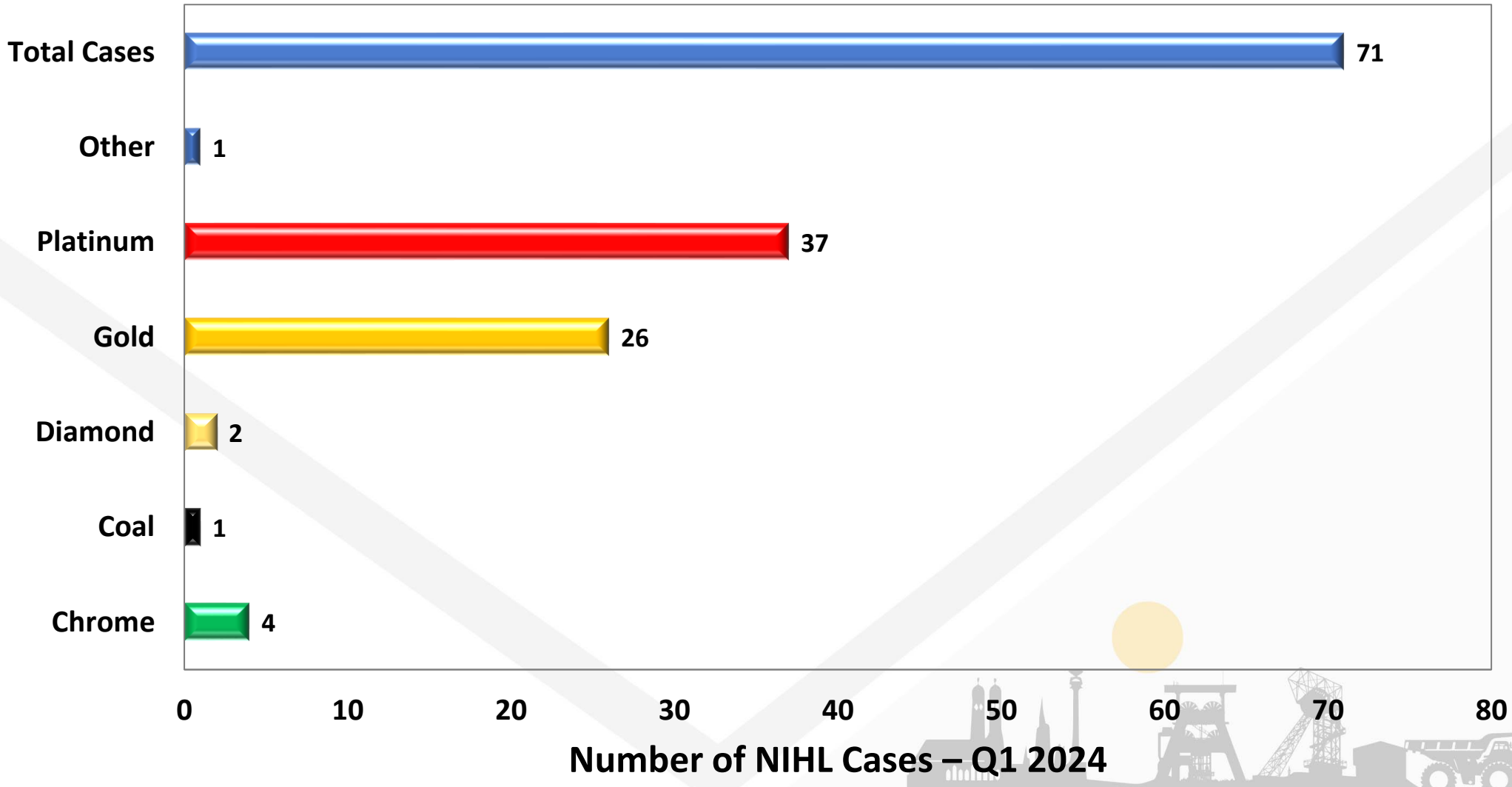

| | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|
| Gold | 230 | 351 | 298 | 406 | 357 |
| Platinum | 445 | 355 | 278 | 247 | 376 |
| Coal | 95 | 76 | 88 | 64 | 71 |
| Diamonds | 7 | 8 | 1 | 0 | 7 |
| Other mines | 109 | 113 | 73 | 59 | 80 |

# NIHL cases by commodity

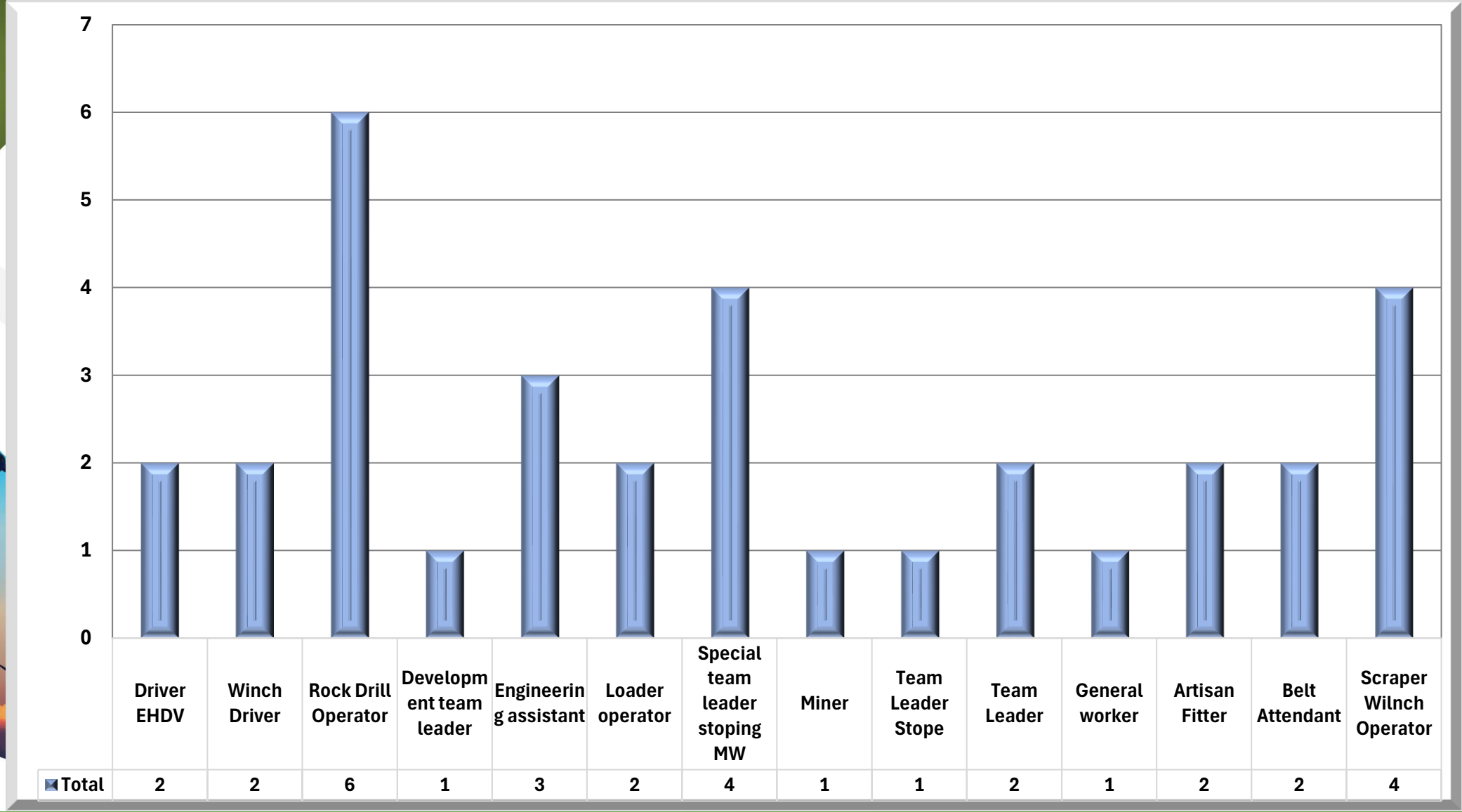



| | Gold | Platinum | Coal | Diamonds | Copper | Chrome | Manganese | Iron Ore | Other | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|
| April 2023-March 2024 HIRs | 179 | 224 | 13 | 5 | 11 | 14 | 1 | 1 | 13 | 461 |
| April 2022-March 2023 HIRs | 260 | 268 | 23 | 6 | 0 | 6 | 1 | 2 | 11 | 577 |

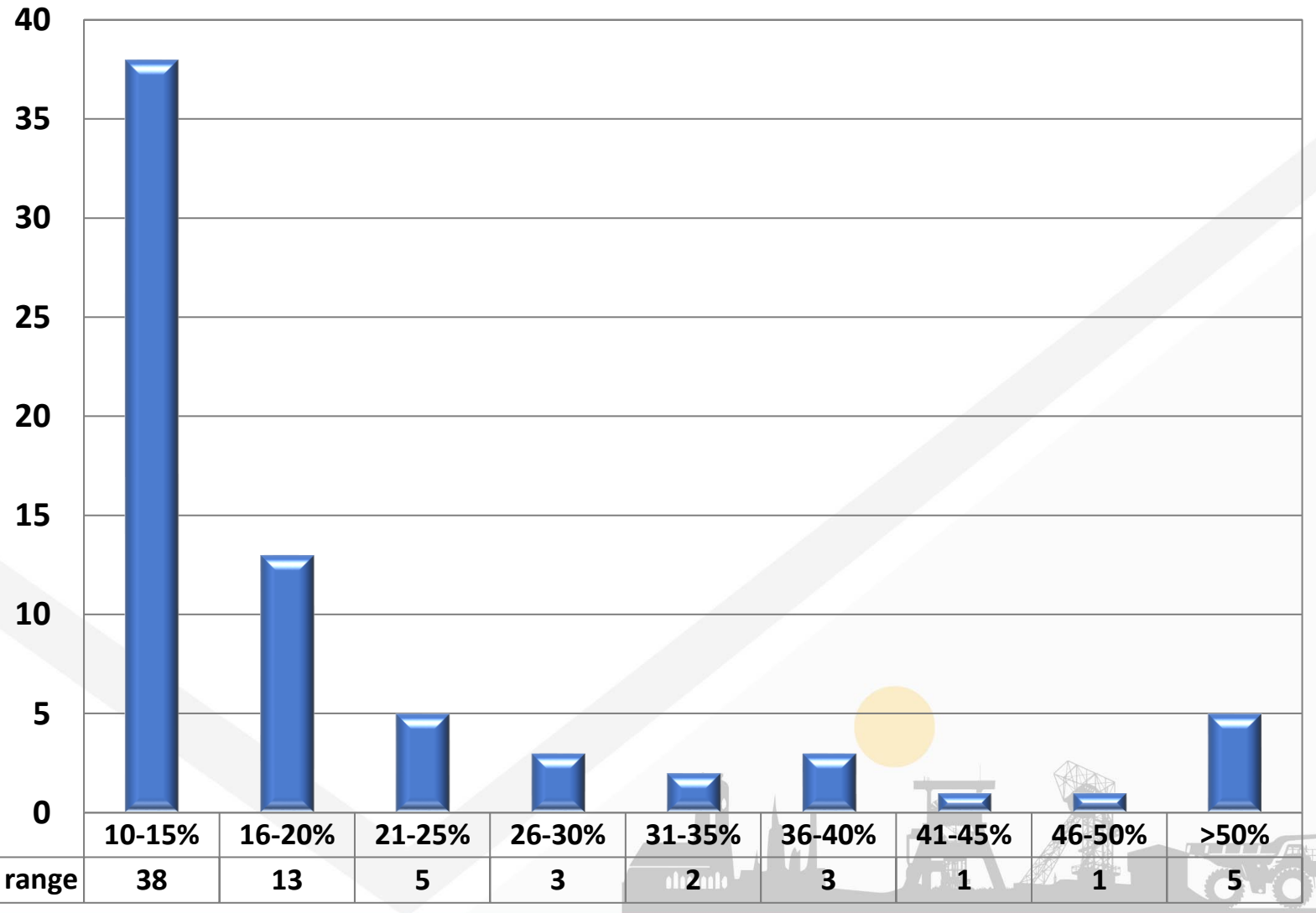
# NIHL cases by commodity



# Key occupations for NIHL reported: January-March 2024

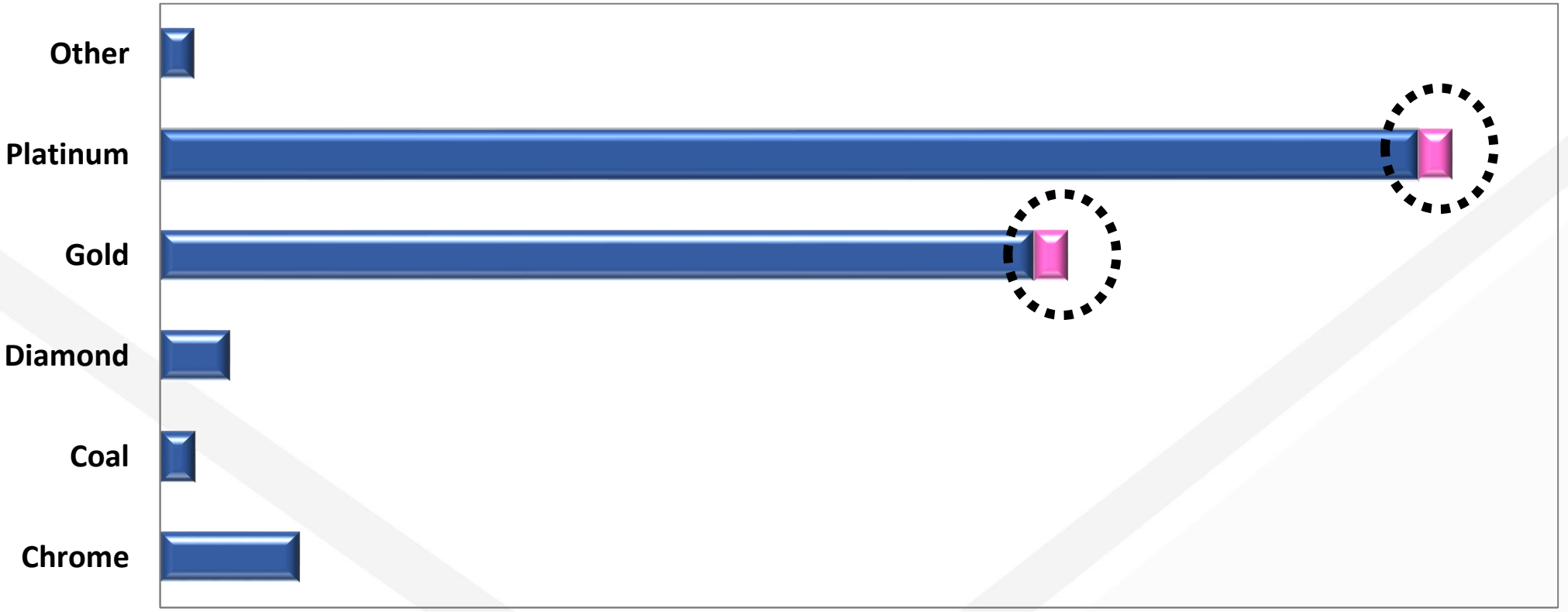


# Employees per PLH range



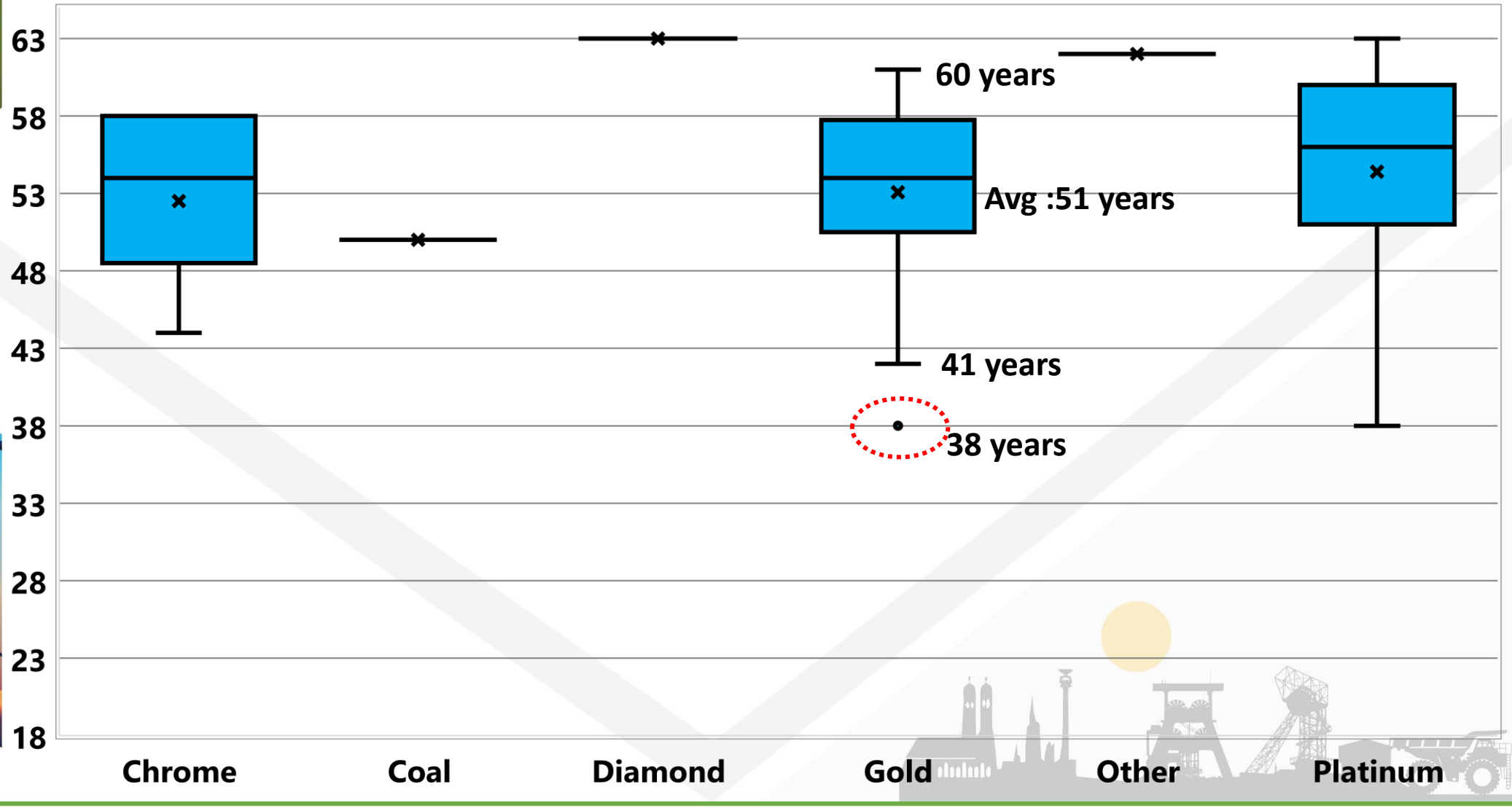

| | 10-15% | 16-20% | 21-25% | 26-30% | 31-35% | 36-40% | 41-45% | 46-50% | >50% |
|---|---|---|---|---|---|---|---|---|---|
| No. of employees per PLH range | 38 | 13 | 5 | 3 | 2 | 3 | 1 | 1 | 5 |

# NIHL cases by sex

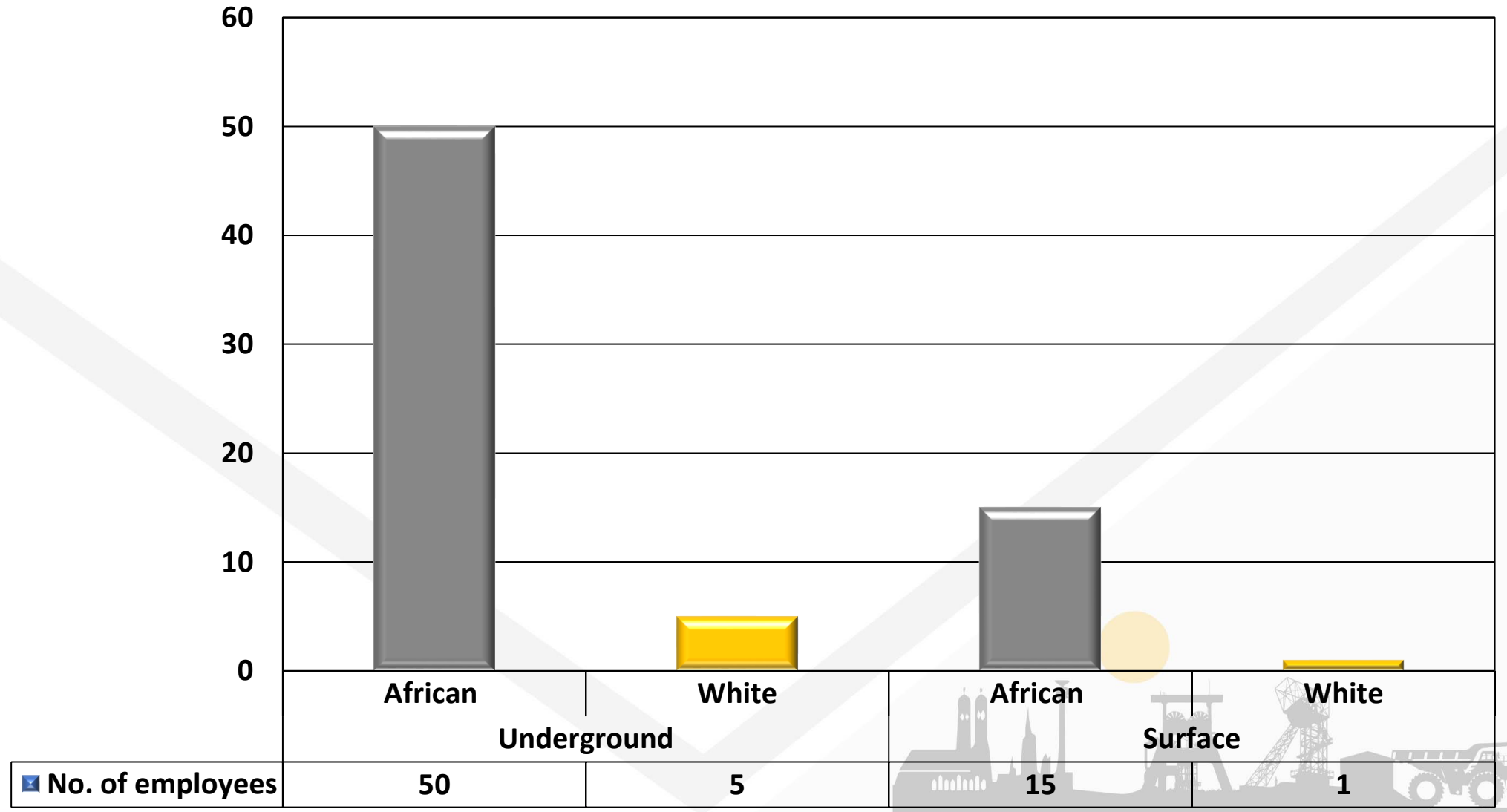



| | Chrome | Coal | Diamond | Gold | Platinum | Other |
|---|---|---|---|---|---|---|
| Male | 4 | 1 | 2 | 25 | 36 | 1 |
| Female | 0 | 0 | 0 | 1 | 1 | 0 |

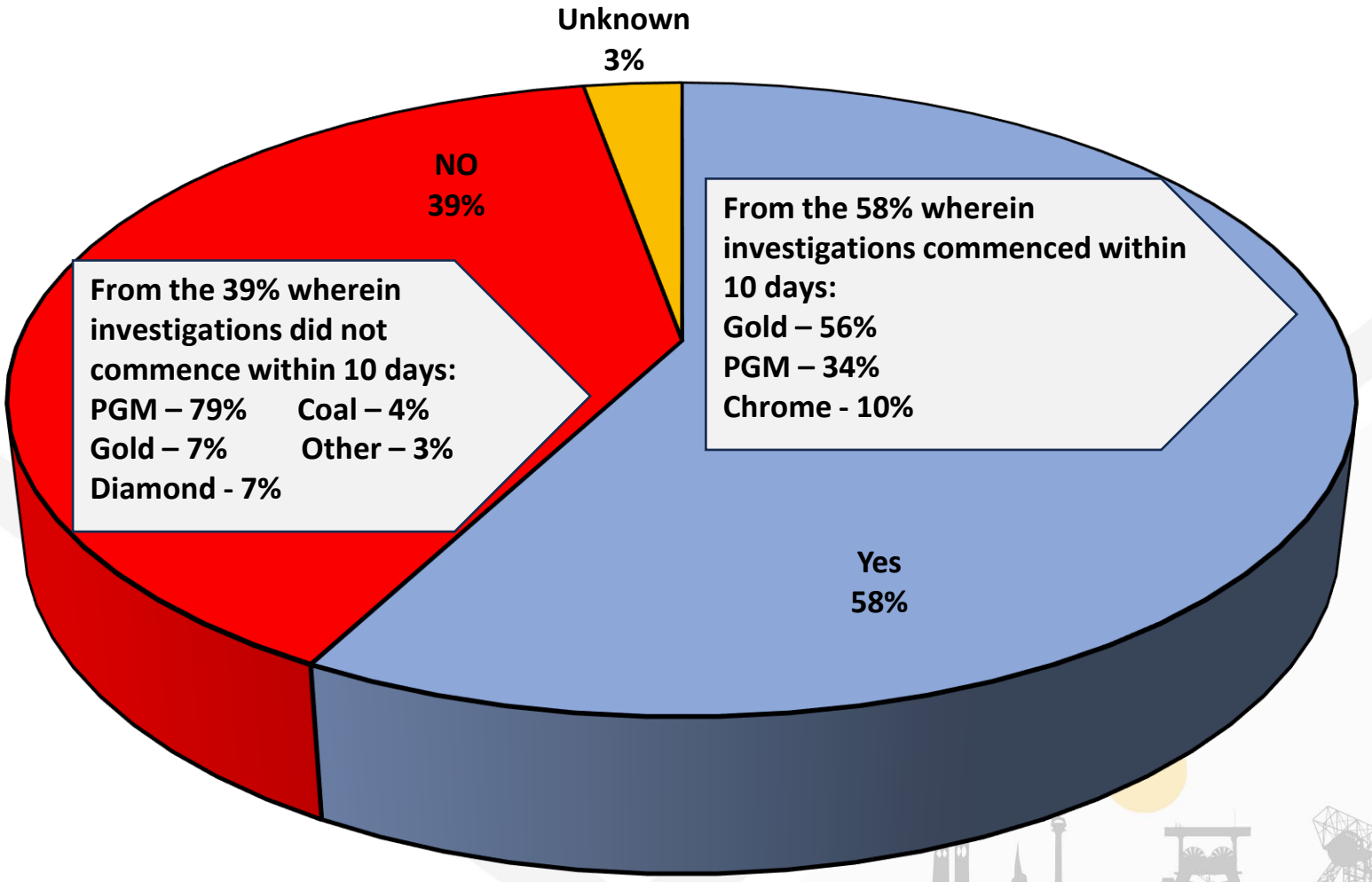
# NIHL cases by age



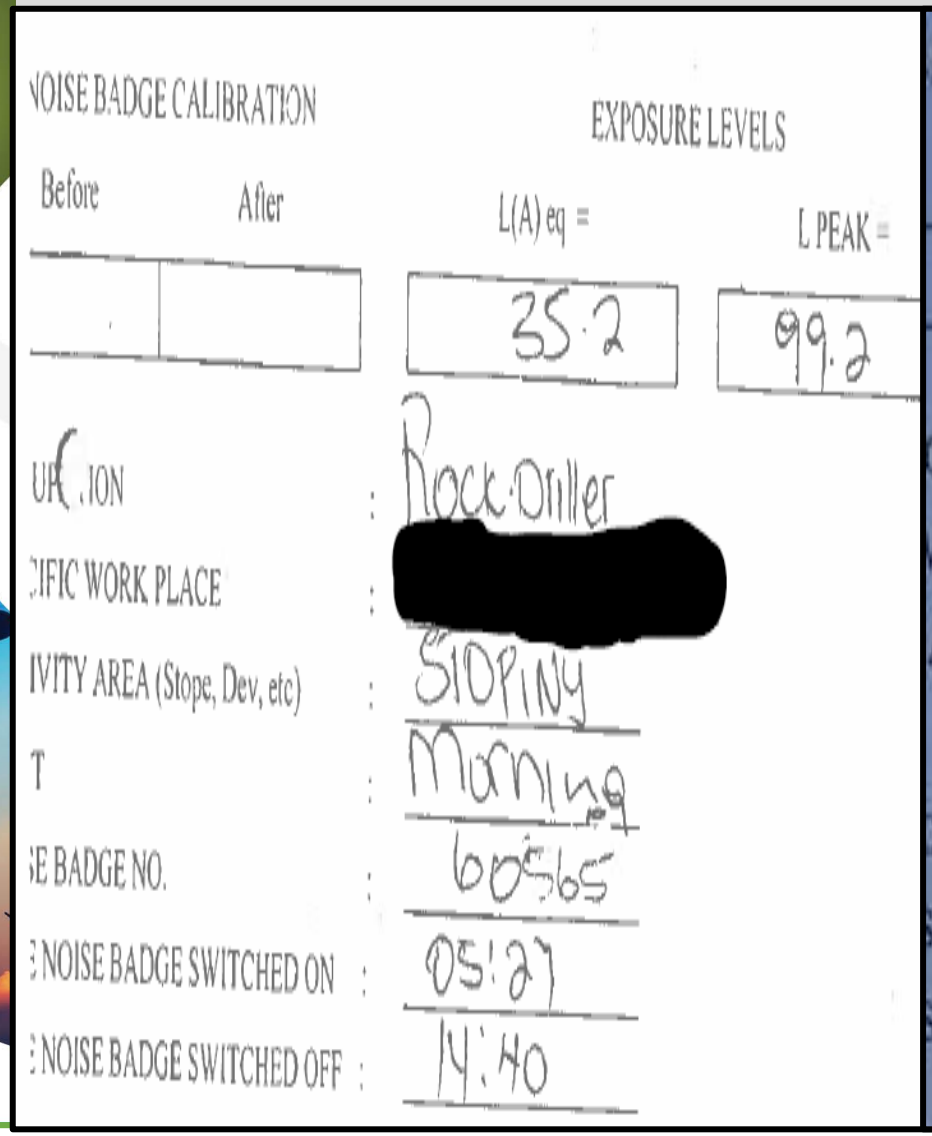
# NIHL cases by race and workplace



# Section 11.5(aA): Investigation commencement



# CHALLENGES



NOISE BADGE CALIBRATION

| Before | After | EXPOSURE LEVELS L(A) eq = | L PEAK = |
|---|---|---|---|
| | | 35.2 | 99.2 |

UPATION : Rock Driller

SPECIFIC WORK PLACE : [redacted]

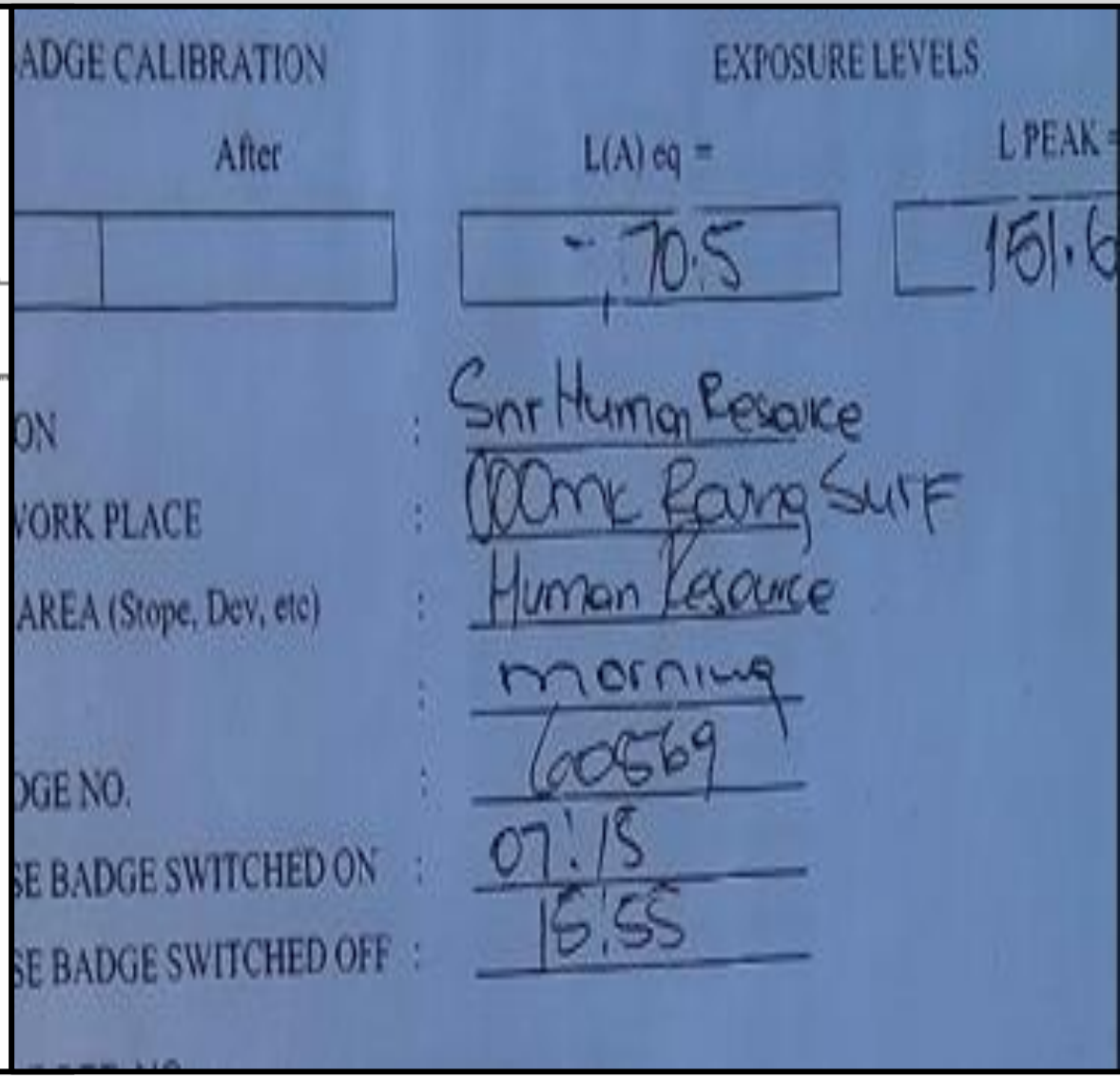
ACTIVITY AREA (Stope, Dev, etc) : STOPING

SHIFT : Morning

NOISE BADGE NO. : 60565

NOISE BADGE SWITCHED ON : 05:27

NOISE BADGE SWITCHED OFF : 14:40



BADGE CALIBRATION EXPOSURE LEVELS

| After | L(A) eq = | L PEAK = |
|---|---|---|
| | 70.5 | 151.6 |

ON : Snr Human Resource

WORK PLACE : 000mL Rand Surf

AREA (Stope, Dev, etc) : Human Resource

: morning

: 60569

DGE NO. : 07:18

SE BADGE SWITCHED ON : 15:55

SE BADGE SWITCHED OFF :

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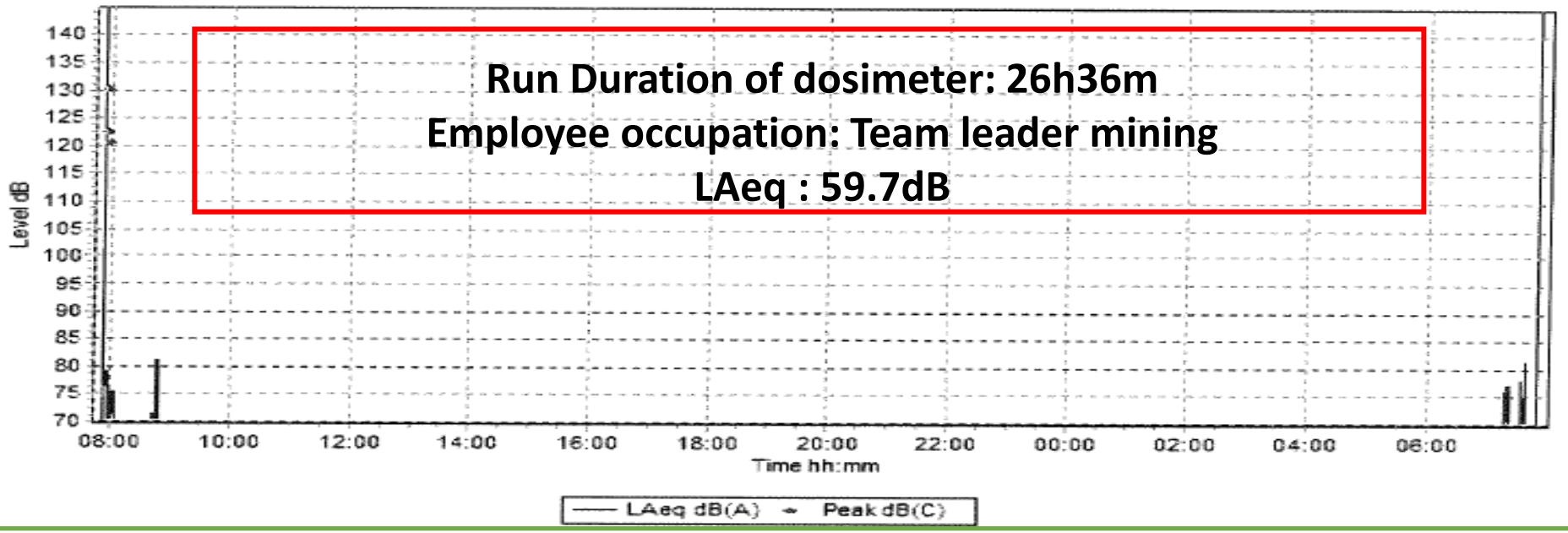
# CHALLENGES

| | |
|---|---|
| Read Order | 5 |
| doseBadge | PB142 |
| Meas.Date | 2022/03/30 |
| Meas.Time | 07:54:00 |
| Run Duration | 26:36:20 |
| LAeq dB | 59.7 |
| Lex dB | 64.9 |
| Dose % (from Leq) | 1 |
| Est.Dose % (from Leq) | 0 |

[redacted]




**Run Duration of dosimeter: 26h36m**
**Employee occupation: Team leader mining**
**LAeq : 59.7dB**

# CHALLENGES

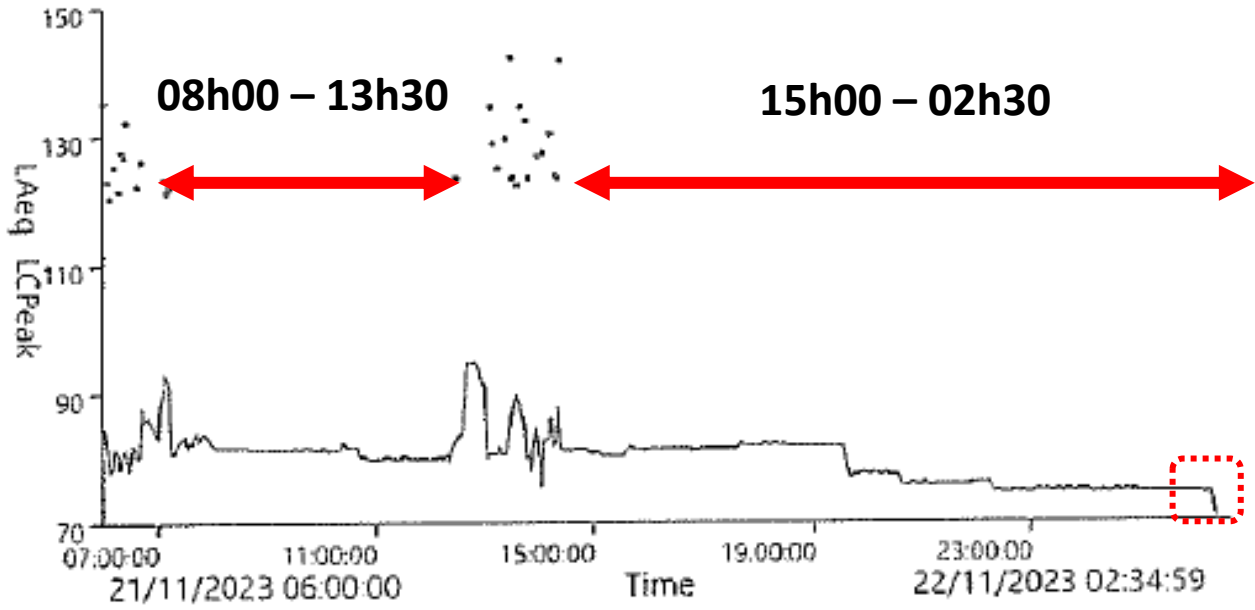
| # | Filter Identificatic | Quartz (mg) | Comments |
|---|---|---|---|
| 1 | K23 341 | < 0.010 | |
| 2 | K23 342 | 0.013 | |
| 3 | K23 343 | < 0.010 | |
| 4 | K23 344 | 0.062 | |
| 5 | K23 345 | 0.036 | |
| 6 | K23 346 | < 0.010 | |
| 7 | K23 347 | < 0.010 | |
| 8 | K23 348 | < 0.010 | |
| 9 | K23 349 | < 0.010 | |
| 10 | K23 350 | < 0.010 | |
| 11 | K23 351 | 0.042 | |
| 12 | K23 352 | < 0.010 | |
| 13 | K23 353 | < 0.010 | |
| 14 | K23 354 | < 0.010 | |
| 15 | K23 355 | < 0.010 | |

**BDL <0.010**

| Peak & Max Values | |
|---|---|
| LCPeak | 142.1 dB |

| ISO LAeq | |
|---|---|
| LAeq | 82.0 dB |
| LEPd | 86.1 dB |
| Dose | 128.0 % |
| LAE | 130.5 dB |

**Occupation: RDO**

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# THANK YOU

# MCSA & MOSH NIHL SYMPOSIUM

## Emperors Palace, Kempton Park, Gauteng

## 25 April 2024

# Department of Mineral Resources and Energy

## Overview of NIHL (Occupational Medicine)

Presented By: **Ms D Mahlaba**

**Director Occupational Medicine**

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# PRESENTATION OUTLINE

1) Noise as a Hazard
2) Noise induced hearing loss (NIHL) and Hearing loss (HL)
3) Health effects of noise as a hazard
4) Ototoxicants and hearing loss
5) NCDs: Ear, nose and throat (ENT) prevalence cases reported: 2022 AMRs
6) Challenges
7) Noise prevention strategy
8) Conclusion

# Noise as a Hazard

Noise is one of the most common physical hazards present in the occupational setting.

What is the risk associated with noise?

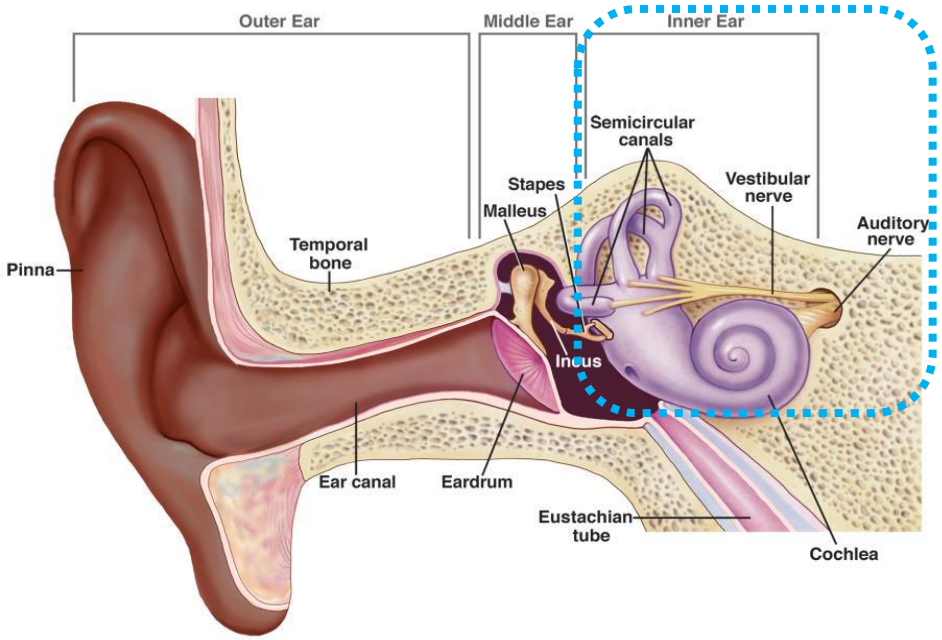
Noise can damage hearing if it's too loud. Both sudden, loud noises, like an *explosion*, and constant, loud noise, like working near *industrial machinery*, can damage hearing. Hearing damage includes *permanent or temporary hearing* loss and tinnitus (ringing in the ears).

What are engineering controls for hearing?

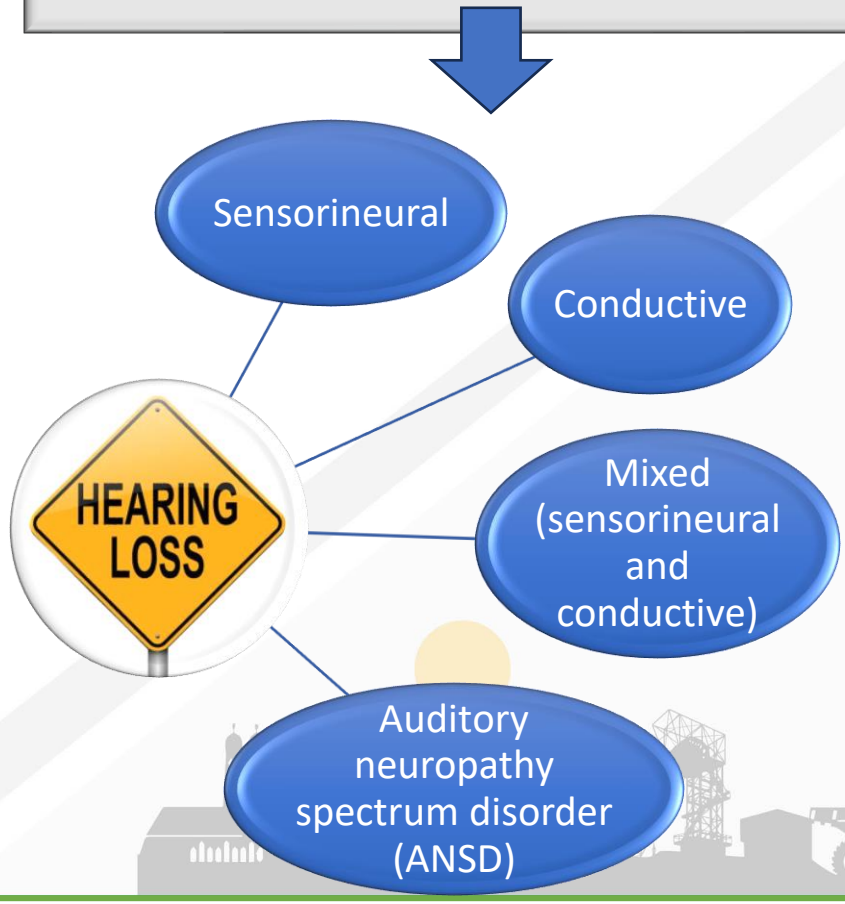
Engineering controls involve *modifying or replacing equipment*, or making related *physical changes at the noise source or along the transmission path* to reduce the noise level at the worker's ear.

# Hearing Loss and Noise induced hearing loss

Noise-induced hearing loss (NIHL) occurs when structures in the inner ear become damaged due to loud noises, and cannot be medically or surgically corrected.




Hearing loss affects people of all ages and can be caused by many different factors. The four types of hearing loss are:

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# HEALTH EFFECTS OF NOISE AS A HAZARD

Noise exposure can be linked to a variety of health risks, including:

- Hearing loss
- Tinnitus
- Stress
- Cardiovascular problems (statistics from the year 2022 AMRs showed: *99.92% hypertension, 0.04% ischaemic heart diseases and 0.04% cardiomyopathy prevalence cases in SAMI.*)
- Sleep disturbance
- Anxiety and depression

# Total employees by commodity: 2021-2022 AMRs

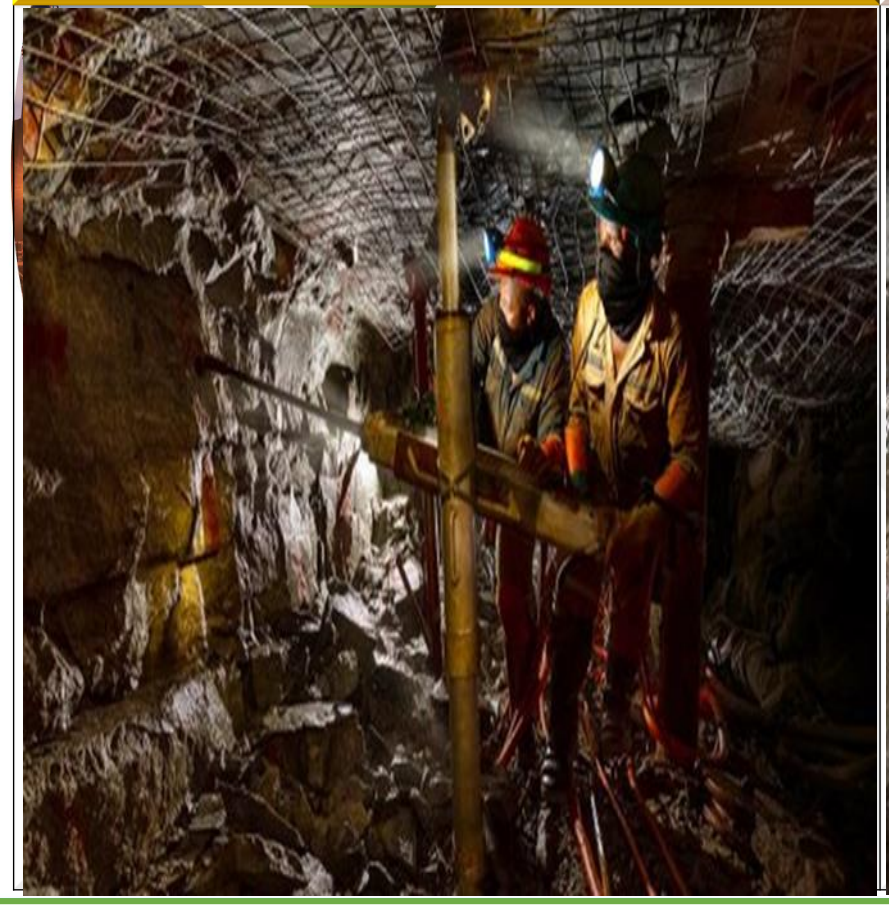
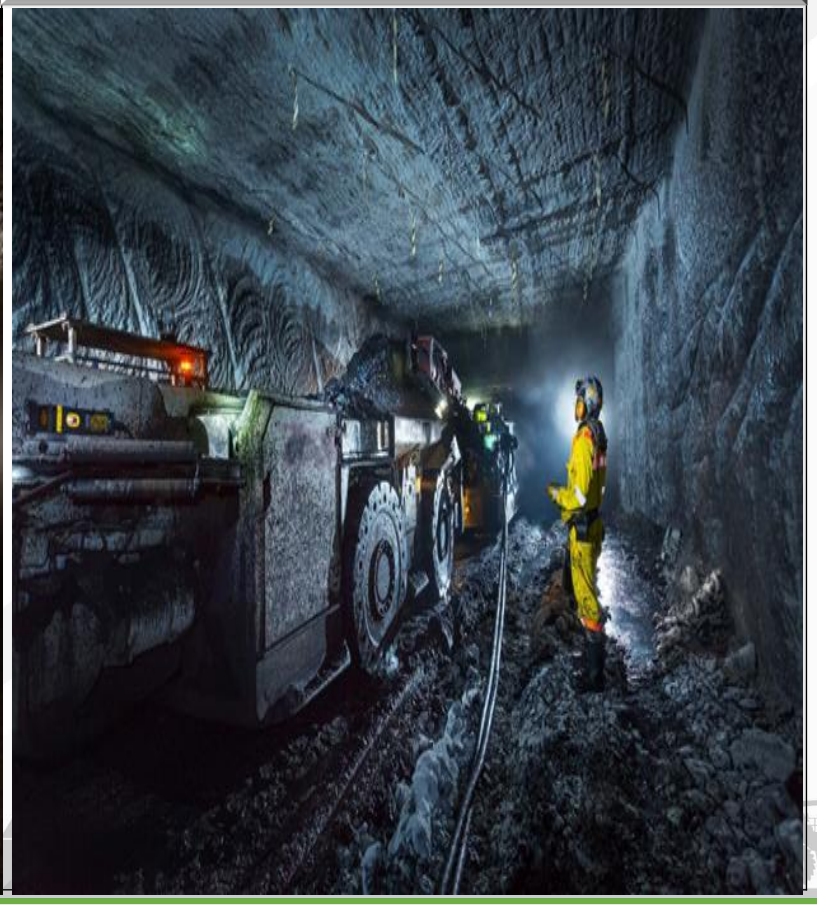
| | Gold | Platinum | Coal | Diamond | Copper | Chrome | Iron ore | Manganese | Other Mines | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| 2021 | 100 774 | 182 177 | 113 161 | 17 207 | 6 603 | 27 409 | 23 787 | 17 501 | 45 190 | **533 809** |
| 2022 | 101 970 | 190 973 | 110 200 | 23 542 | 5 376 | 32 203 | 24 667 | 1 6276 | 47 391 | **552 598** |

# Gold, Platinum and Coal geological rock structure in South Africa

| What is the geology of gold? | What is the geology of platinum? | What is the geology of coal? |
|---|---|---|
| Gold is usually found in a type of rock called ore. Gold can also occur as a rock in its pure form. This is called native gold. | Platinum in the Earth's crust originates from ultra-mafic igneous rocks. It can therefore be associated with rocks like chromite and olivine. In nature, pure platinum is unknown and well formed crystals are very rare. Platinum is typically found as nuggets and grains. | What is the texture of coal rock?<br>It is often crumbly, relatively moist and powdery. SUB-BITUMINOUS - is still poorly indurated and brownish in color, but more like bituminous than lignite. BITUMINOUS - is the coal most people are used to. The black, soft, slick rock is the most common coal used around the world. |
| **Gold mining methods** | **Platinum mining methods** | **Coal mining methods** |
| In South Africa, mining for gold typically involves methods like panning, sluicing, dredging, hard rock mining and by-product mining. The most effective method used is hard rock mining, since reserves are typically encased in deep underground rock. | **How is platinum extracted in South Africa?**<br>Most of the mining for platinum ore occurs deep underground. To extract the mineral-rich materials, miners pack explosives into holes drilled in the rock and blast it into smaller pieces. The broken rock is then collected and transported to the surface for processing. | **What are the 4 steps of coal mining?**<br>The oldest form of room and pillar mining--conventional mining--uses a 4-step process where the coal seam is cut, drilled, blasted and then loaded into cars. The more prevalent form of underground mining today is continuous mining. |

**Source: [Online]**

# Gold, Platinum and Coal common mining methods in South Africa

| Underground gold mining, South Africa | Underground platinum mining, South Africa | Underground coal mining, South Africa |
| --- | --- | --- |
|  |  |  |

# Ototoxicants and hearing loss

Ototoxicity (“ear poisoning”) caused by drugs or chemicals target auditory or hearing functions, and they are called ototoxicants. Based on the part of the auditory system they damage, ototoxicants are grouped as follows:


- Cochleotoxicants mainly affect the cochlear hair cells, which are the sensory receptors, and can impair the ability to hear
- Vestibulotoxicants affect the hair cells on the spatial orientation and balance organs
- Neurotoxicants damage the nerve fibres that interfere with hearing and balance

# Ototoxicants and hearing loss

The following table includes examples of ototoxic chemicals grouped by substance class:

| Substance Class | Chemicals |
|---|---|
| Pharmaceuticals | Aminoglycosidic antibiotics (e.g., streptomycin) and some other antibiotics such as tetracyclines, loo diuretics (e.g., furosemide), certain analgesics and antipyretics (e.g., salicylates such as aspirin), certain antineoplastic agents such as cisplatin. |
| **Ototoxicity at therapeutic doses is limited* | Loop diuretics* (e.g. furosemide, ethacrynic acid) |
| Organic Solvents | Carbon disulfide, trichloroethylene, n-hexane, toluene, p-xylene, ethylbenzene, n-propylbenzene, chlorobenzene, styrene, carbon disulphide, solvent mixtures and methylstyrene. |
| Asphyxiants | Carbon monoxide, hydrogen cyanide and its salts, tobacco smoke. |
| Nitriles | 3-Butenenitrile, cis-2-pentenenitrile, acrylonitrile, cis-crotononitrile, 3,3'-iminodipropionitrile. |
| Metals and Compounds | Lead, mercury, organotins, germanium dioxide, organic tin compounds. |

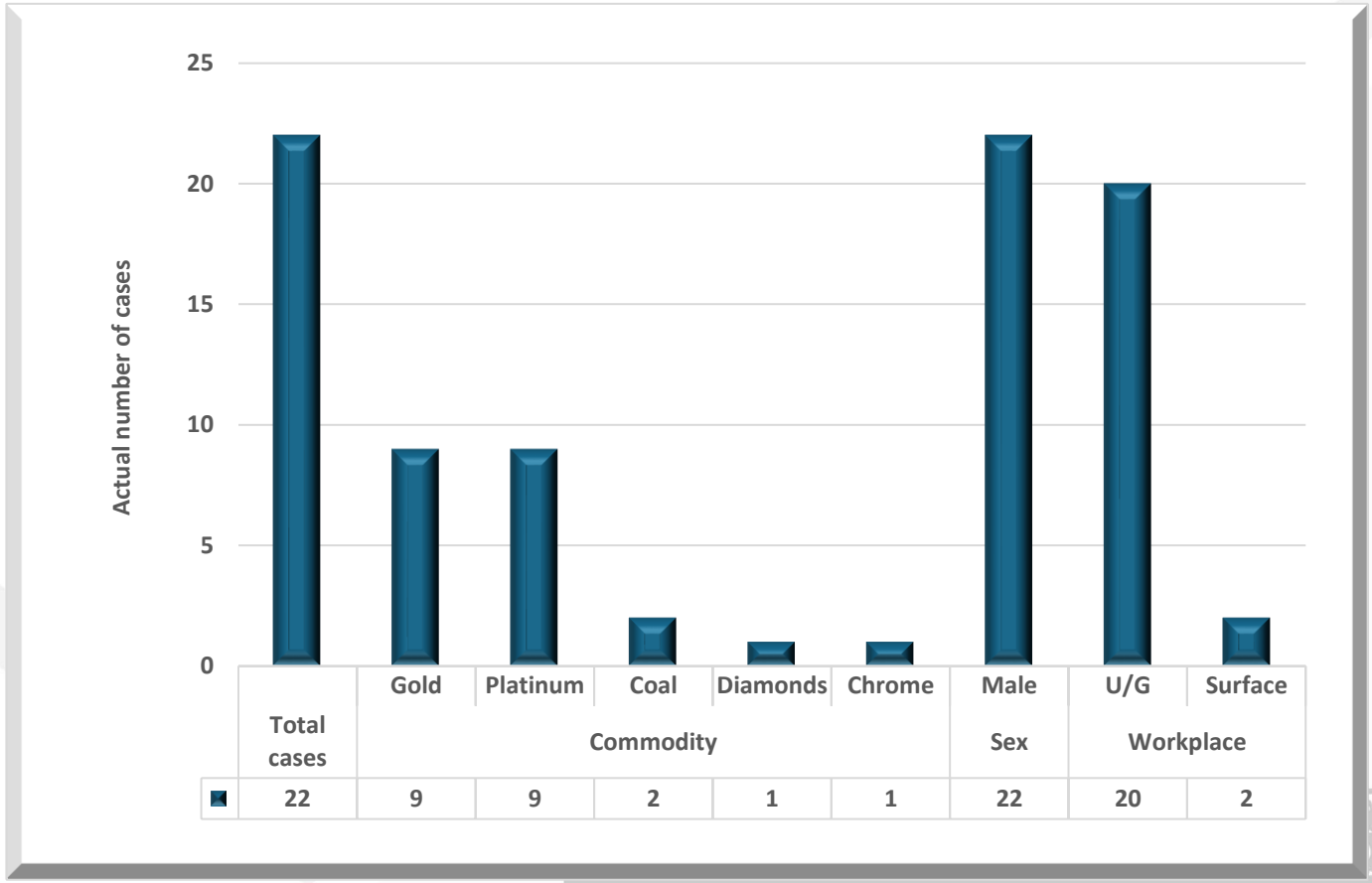
# Ototoxicants and hearing loss

*TB-related Hearing Loss:*

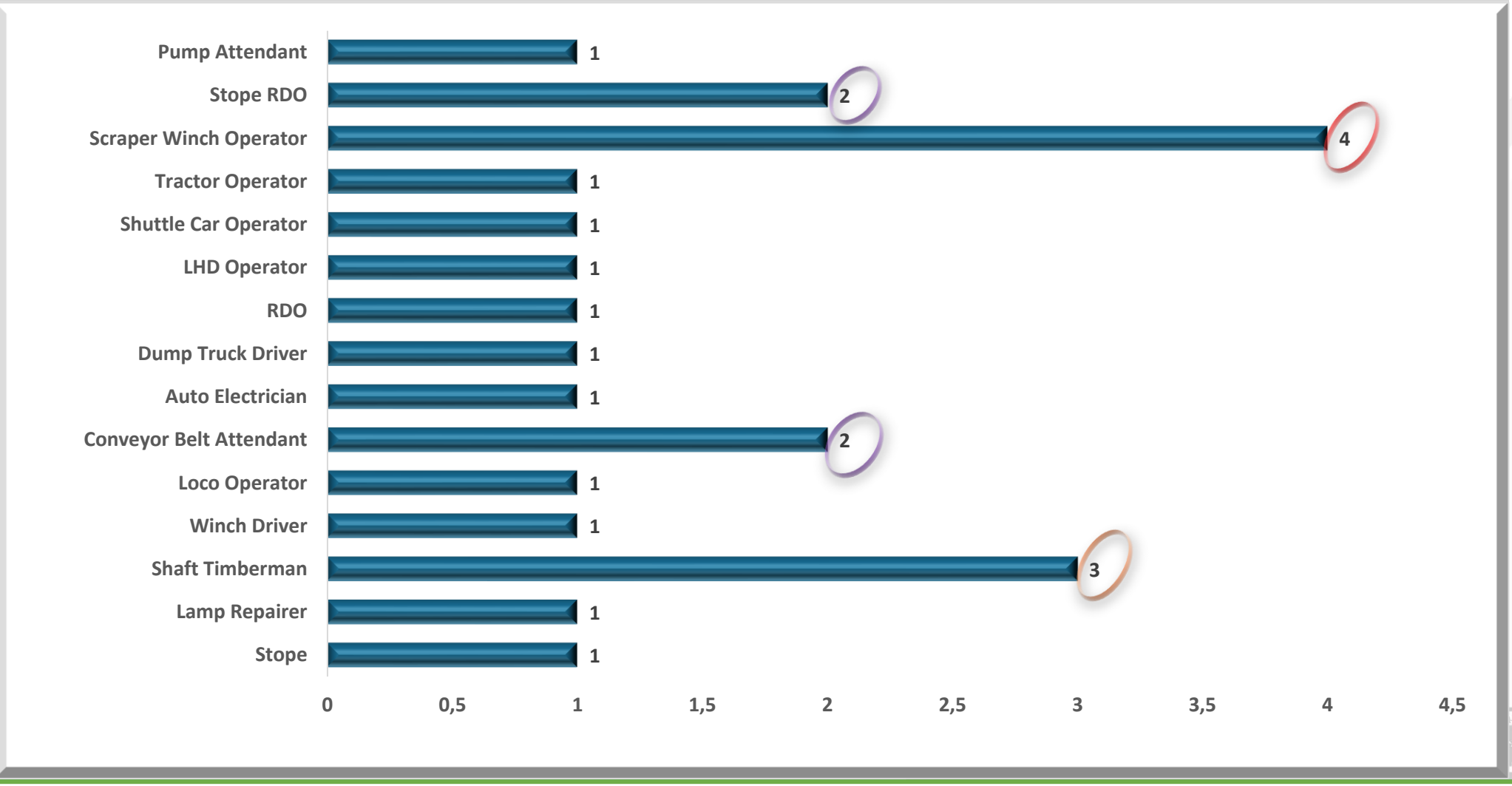
Aminoglycosides used in MDR-TB are arguably the principal cause of TB-related hearing loss. The graph below shows cases of MDR-TB reported from HIRs.

During April 2023 and March 2024, the mines reported 22 cases of MDR-TB.

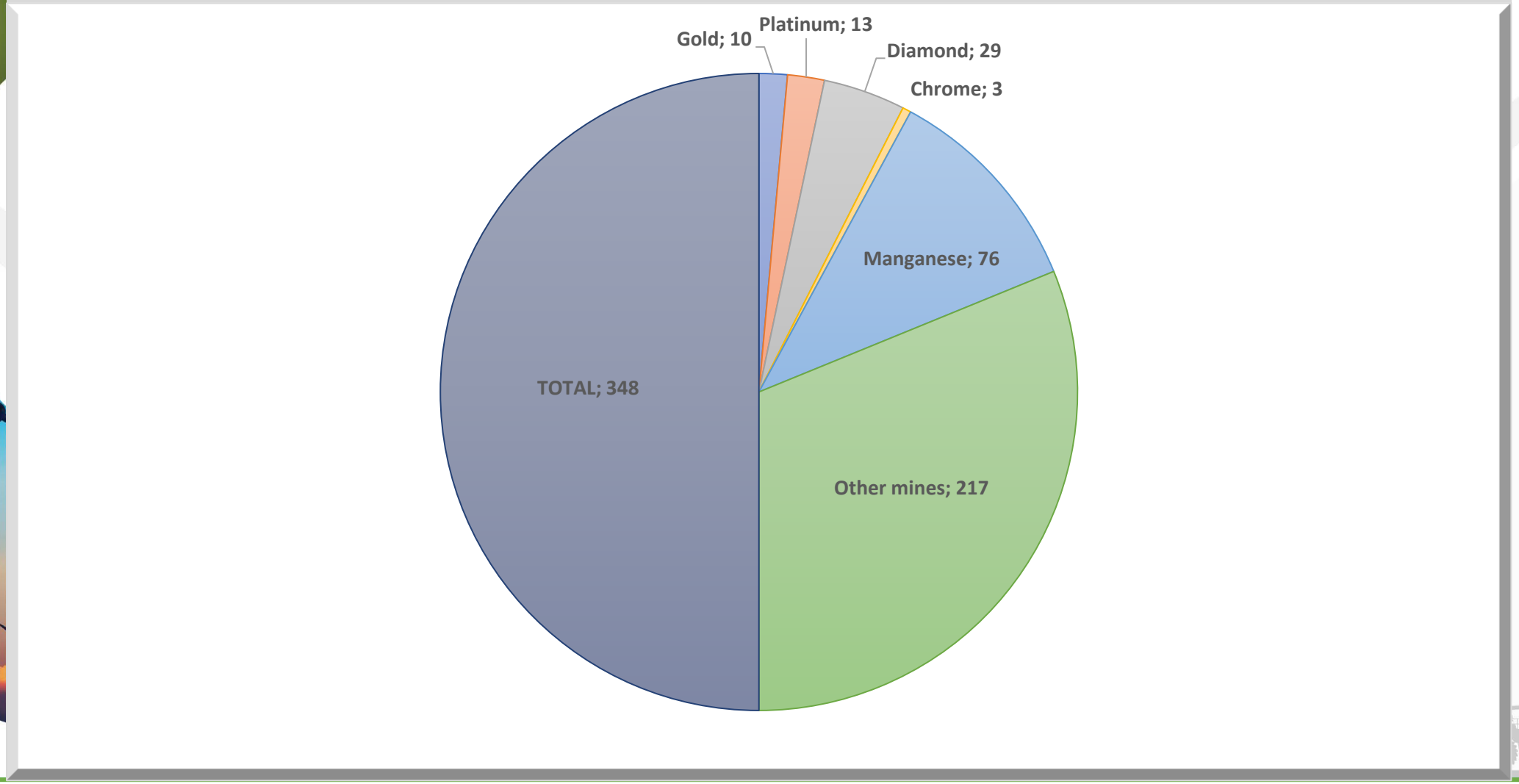
How many cases did the mines follow up to monitor affected employees' pre and post treatment audiometry results to determine the consequence of medication in relation to workplace noise exposure and possible hearing deterioration?



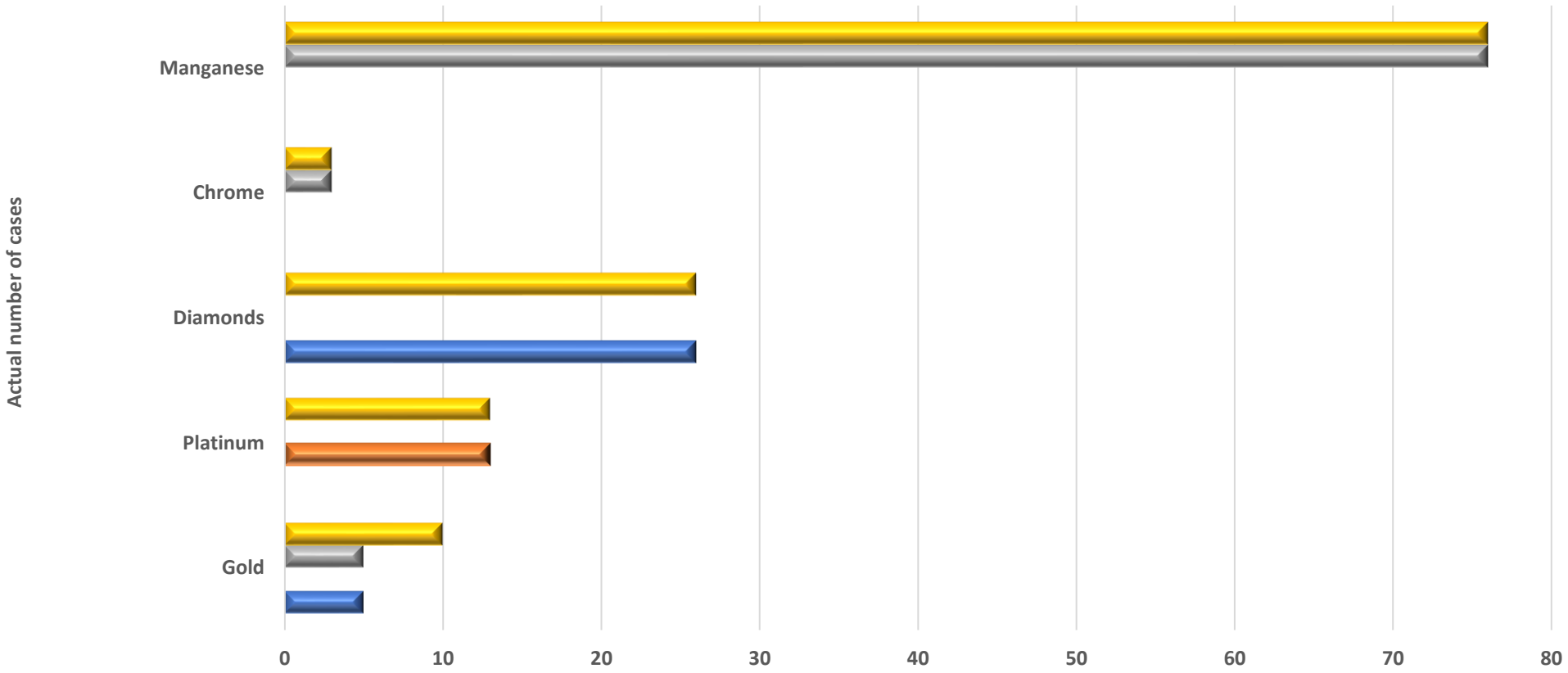
# Occupations for MDR-TB cases reported from HIRs: April 2023-March 2024



# ENT prevalence cases reported on NCDs by commodity: 2022 AMRs

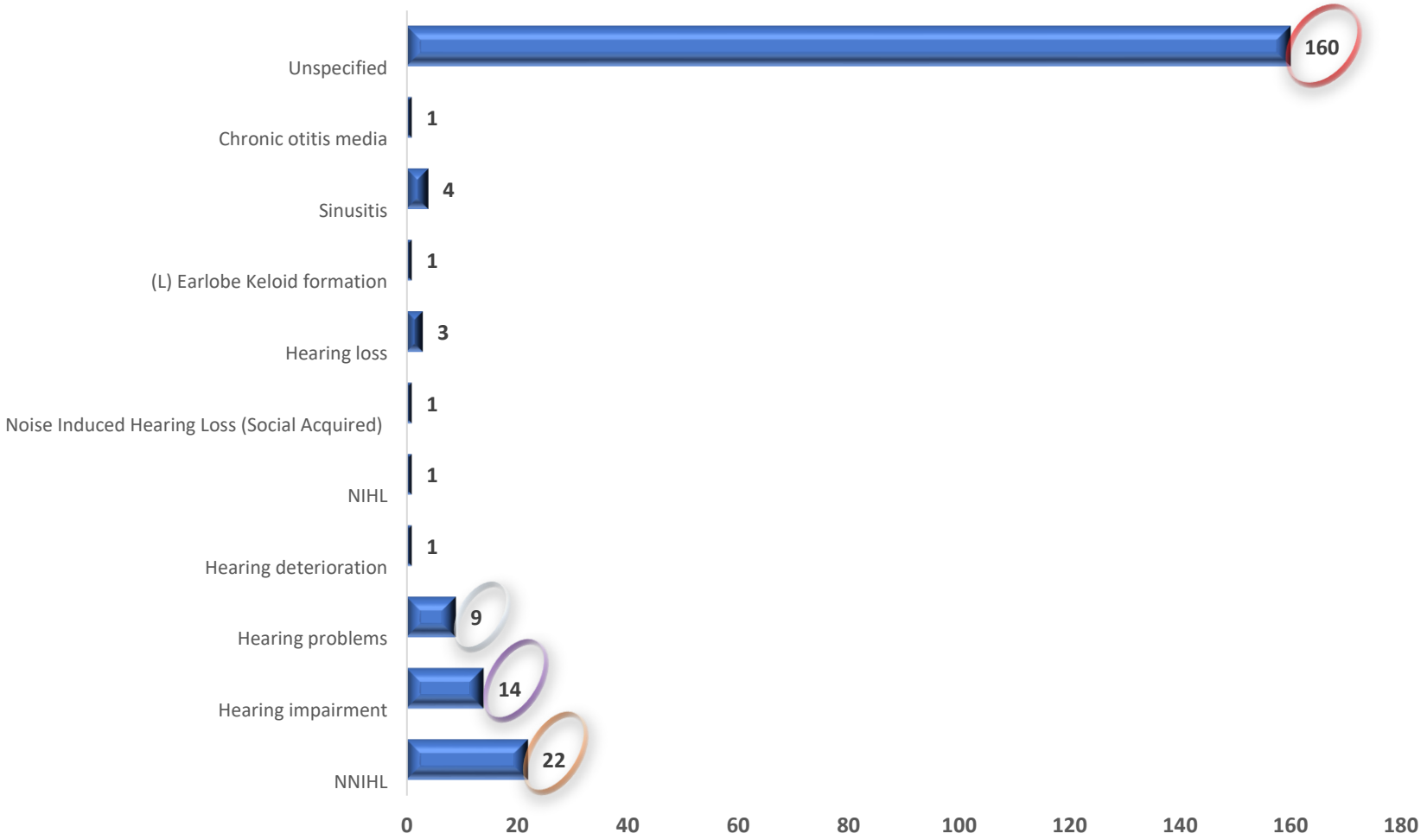


# Specified ENT cases by commodity: 2022 AMRs




| | Gold | Platinum | Diamonds | Chrome | Manganese |
|---|---|---|---|---|---|
| Total | 10 | 13 | 26 | 3 | 76 |
| ENT unspecified | 5 | 0 | 0 | 3 | 76 |
| Otitis media | 0 | 13 | 0 | 0 | 0 |
| NNIHL | 5 | 0 | 26 | 0 | 0 |

# Specified ENT cases from Other mines: 2022 AMRs



# CHALLENGES ON REGULATORY MECHANISMS (INVESTIGATIONS & MEDICAL SURVEILLANCE)

- Section 11.5 investigations focused on the hearing protection devices (HPDs) instead of engineering controls (Hierarchy of Control).
- Employees' records of medical surveillance not stored safely (section 15, MHSA). Records rooms not Fire-proof and Waterproof.
- Inadequate sound-proofing of Audiometry booths at some mines, particularly those installed in prefabricated partitioned rooms.
- Some COPs are not mine specific.
- Baseline audiometry not conducted at some mines, and some NIHL cases reported with PLH ≤10% from the baseline.

# CHALLENGES ON REGULATORY MECHANISMS (STATUTORY REPORTING)

Late reporting: non-adherence to the 30-day period stipulated in the for reporting occupational diseases/serious illness and health-threatening occurrence (CIoM Instruction OM-01-2023).

Incomplete information on the Health Incident Reports (HIRs), DMRE 231 Form: no details on section 11.5 investigation commenced/and or completed.

Reporting of unconfirmed NIHL cases (Compensable hearing loss (intervals of PLH ≥10 from the baseline audiometry); should be referred for diagnostic audiology or ENT specialist (8.2.2.3 (iv) Noise Guideline).

Reporting of cases with PLH <10 from the baseline audiometry.

Most ear, nose and throat (ENT) cases reported on ***Diseases of the Nervous*** System and Sensory Organs of non-communicable diseases (NCDs) group are not specified.

Some mines report NIHL cases at Mining House level, and this impacts on the trends analysis to identify priority mines.

# CHALLENGES: SNIPPETS OF STATUTORY REPORTING

**January 2024 Health Incident Report (HIR)**

| Commodity | Occupation | Baseline Audiogram | PLH | PLH% deterioration |
|---|---|---|---|---|
| Platinum | Driver EHDV | 7.6 | 10.50% | **2.9** |

**January 2024 Health Incident Reports (HIRs)**

| Main commodity | Occupation | Workplace | Baseline audiogram | PLH | Date of diagnosis | Date HIRs submitted | Date setion 11.5 investigation commenced | Section 11.5 investigation completed (Yes/No) | Occupational disease/s submitted for compensation (Yes / No) |
|---|---|---|---|---|---|---|---|---|---|
| Gold | Rock Driller Operator | U/G | 1.2 | 11.7% | 10/01/2024 | 2/2/2024 | N/A | No | Yes |
| Gold | Stope team leader | U/G | 6.9 | 26.80% | 19/01/2024 | 14/02/2024 | Not done | No | Yes |
| Gold | Shaft plater boilermaker M/S | U/G | 1.6 | 19.90% | 12/01/2024 | 14/02/2024 | Not done | No | Yes |

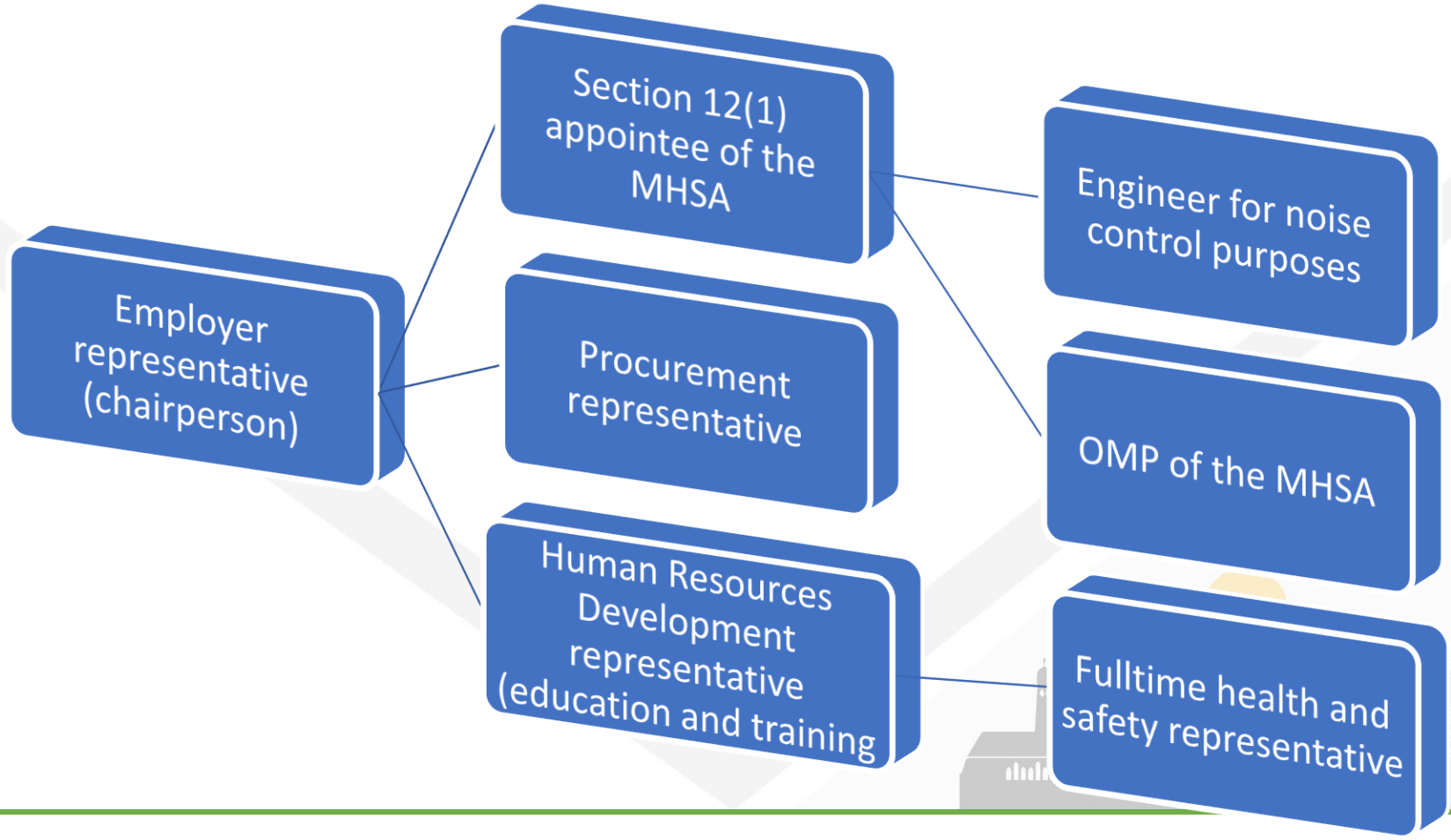
# CHALLENGES: SNIPPETS OF STATUTORY REPORTING (Cont.)

**Year 2023 annual medical report (AMRS)**

| Main commodity | Other commodities mined | NIHL | | | AMRs verification remarks |
|---|---|---|---|---|---|
| | | Diagnosed | Submitted | Certified | |
| Chrome | None | 6 | 0 | 0 | x6 diagnosed NIHL and zero cases submitted for compensation. Amended AMR submitted on 11/04/2024 with zero cases. |
| Sand | Stone | 3 | 0 | 0 | x3 diagnosed NIHL not submitted for compensation. Amended AMR submitted on 11/04/2024 with zero cases (not confirmed yet) |

# NOISE PREVENTION STRATEGY

Mines' Noise COPs: should put measures in place for the development and implementation of a functional structure with clearly defined roles and responsibilities based on the need to coordinate critical activities within the hearing conversation programme.



# Hierarchy of Controls

Most effective

Least effective

**Elimination** — Physically remove the hazard

**Substitution** — Replace the hazard

**Engineering Controls** — Isolate people from the hazard

**Administrative Controls** — Change the way people work

**PPE** — Protect the worker with Personal Protective Equipment

*Image by NIOSH*
*https://www.cdc.gov/niosh/topics/hierarchy/default.html*


WARNING
Loud noise area.
Risk of hearing loss.
Ear protection required beyond this point.


WARNING
Ototoxic Chemicals
Hearing loss is possible.

# Reflection: Leon Commission of Inquiry Report and MHSA

| Leon Commission of Inquiry Report (Chapter four) Volume 1, 1995 | MHSA |
|---|---|
| ***Intervention to control the working environment and disease*** Noise induced hearing loss is recognised as a major problem in the mining industry. Evidence was led which persuades the Commission that: | Occupational hygiene trends: Results show percentages of employees at risk to exposure to noise above the legal occupational limit. |
| •Far too much reliance has been placed on the supply of personal protective equipment to workers exposed to damaging noise levels. | Trends of NIHL analysis from AMRs show an increase. |
| •Insufficient attention has been paid to the need to engineer lower noise levels. | Poor compliance with: |
| •Action has been largely confined to audiometry to measure hearing loss, whereas more effort should be placed on the other components of a well-planned hearing conservation programme, on engineering changes to diminish noise levels, on informing exposed workers adequately and on ensuring compliance. | ▪ the implementation of section 9 (Codes of practice) in relation to audiometry.<br>▪ medical surveillance (baseline, monitoring and diagnostic audiometry)<br>▪ the reporting of serious illness and health-threatening occurrence in relation to noise (section 11(5B).<br>▪ section 11.5 investigations. |
| •In this matter, as in many others, the problem has been seen as one of disease detection rather than as the identification of index cases to enable intervention in the risk areas. | |

2021: Noise Guideline reviewed (Tripartite Committee)

2022: Industry-wide revised Noise Guideline dissemination workshops held (Tripartite Committee)

Regional Tripartite Forums & Health Working Groups

MHSI Branch Exco meetings with SA Mining Industry Executives

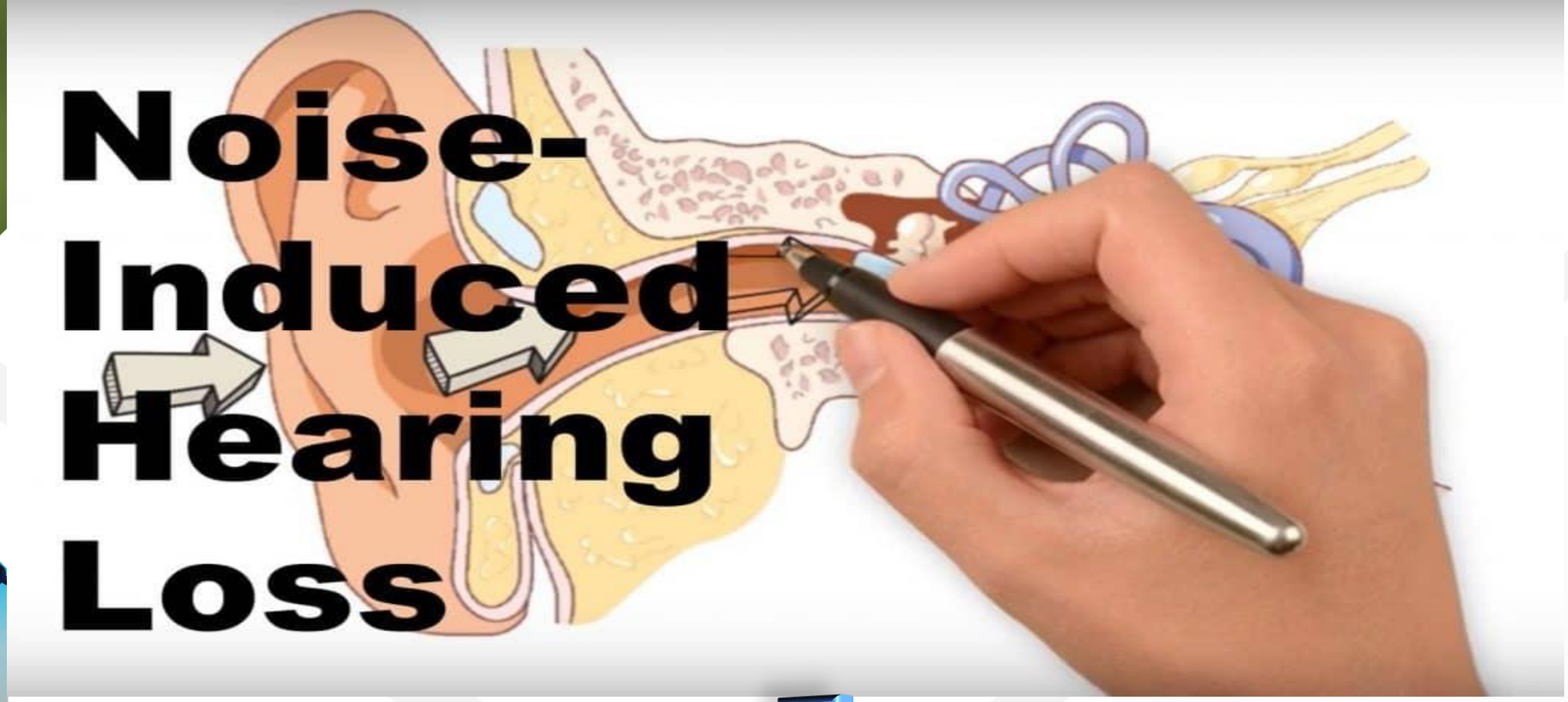
Engagements at Stakeholder Committees (MVS; SAIOH, MMPA)

MHSI activities (focused audits and inspections)

**Where is the Problem ?**

And…

# Noise-Induced Hearing Loss



**IS PREVENTABLE.**

The World Health Organisation (WHO) works worldwide to promote health, keep the world safe, and serve the vulnerable.

# OCCUPATIONAL MEDICINE STATUTORY REPORTING TEMPLATES

1) Health Incident Report, DMRE 231 Form

https://depdmr-my.sharepoint.com/personal/duduzile_mahlaba_dmre_gov_za/Documents/Desktop/H%20Drive/I%20AM%20Office-01-08-2011/Health%20Incident%20Reports/Docs/2023/DMRE%20231%20MHS%20Health%20Incident%20Report%20revised%202023%20-%2024%20October%202023.docx

# OCCUPATIONAL MEDICINE STATUTORY REPORTING TEMPLATES

1) Instruction OM-01-2023 on the revised Health Incident Report

https://depdmr-my.sharepoint.com/personal/duduzile_mahlaba_dmre_gov_za/Documents/Desktop/H%20Drive/I%20AM%20Office-01-08-2011/CIoM/Instructions%20on%20HIRs/2023/Instruction%20OM-01-2023%20on%20the%20revised%20Health%20Incident%20Report%20-%2027%20October%202023.pdf

# OCCUPATIONAL MEDICINE STATUTORY REPORTING TEMPLATES

1) Annual Medical Report, DMRE 165 Form

https://depdmr-my.sharepoint.com/personal/duduzile_mahlaba_dmre_gov_za/Documents/Desktop/H%20Drive/I%20AM%20Office-01-08-2011/Annual%20Medical%20Reports/Docs/2022/DMRE%20165%20MHS%20Annual%20Medical%20Report%20updated%202022.docx

# THANK YOU

# INDUSTRY NOISE MILESTONE PERFORMANCE

Noise Symposium

25 April 2024

MINERALS COUNCIL
SOUTH AFRICA

# INDUSTRY EQUIPMENT NOISE MILESTONE PERFORMANCE



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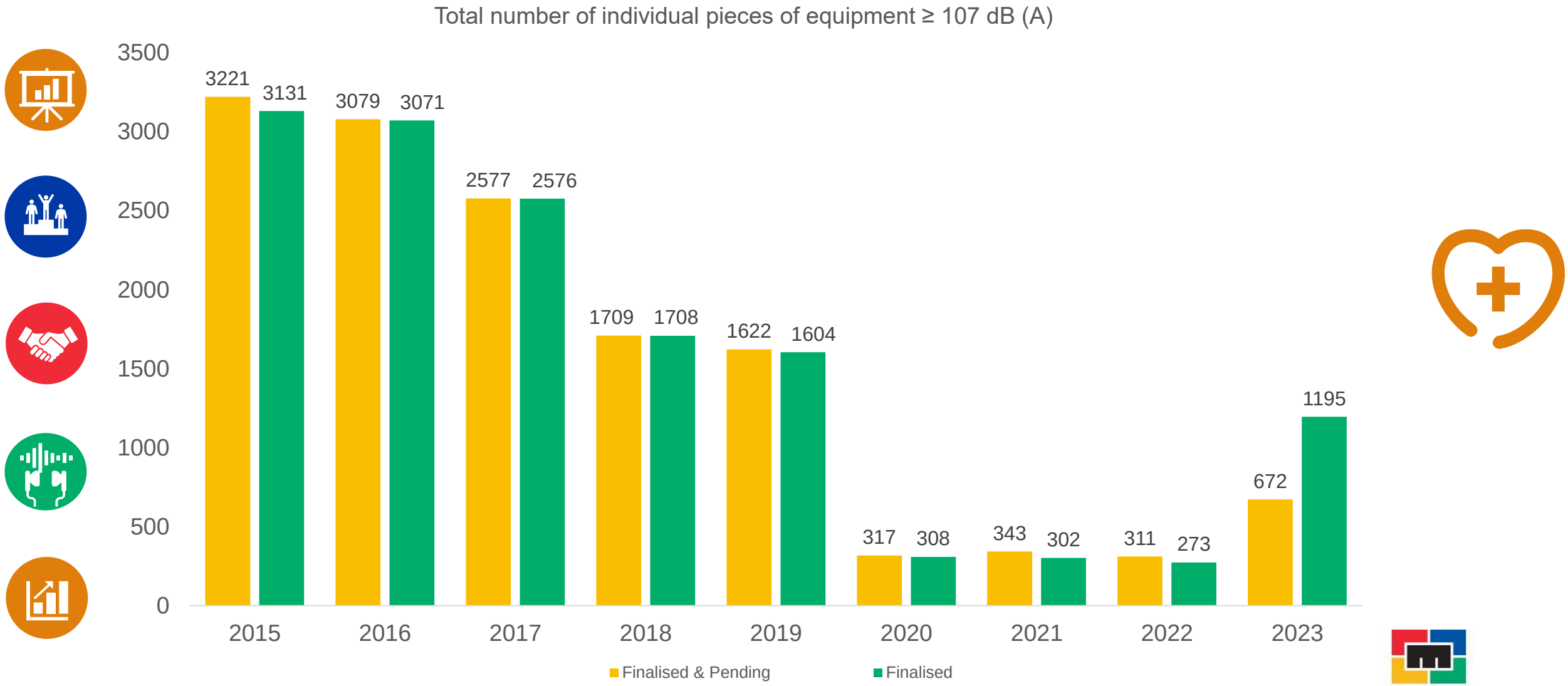
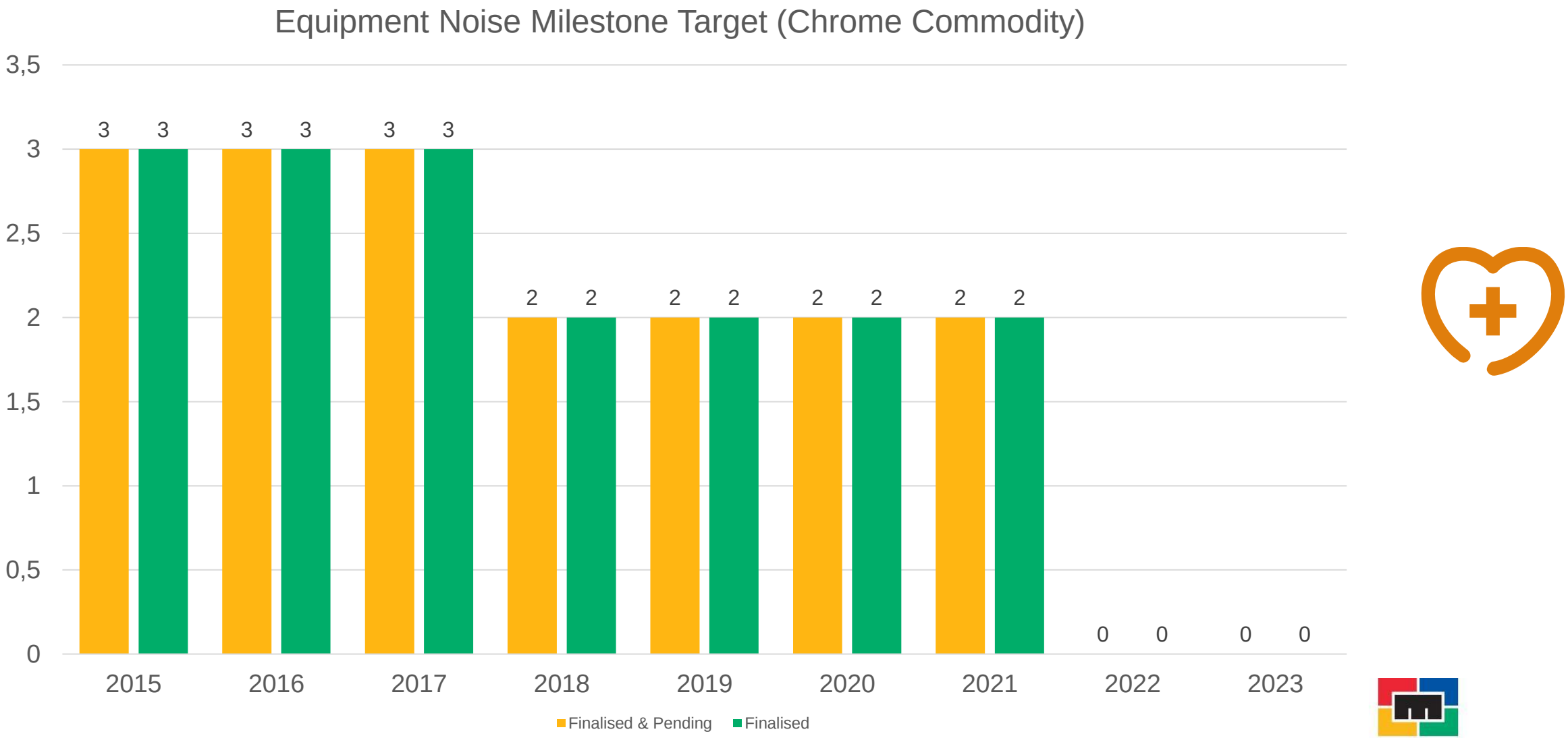
# INDUSTRY EQUIPMENT NOISE MILESTONE PERFORMANCE

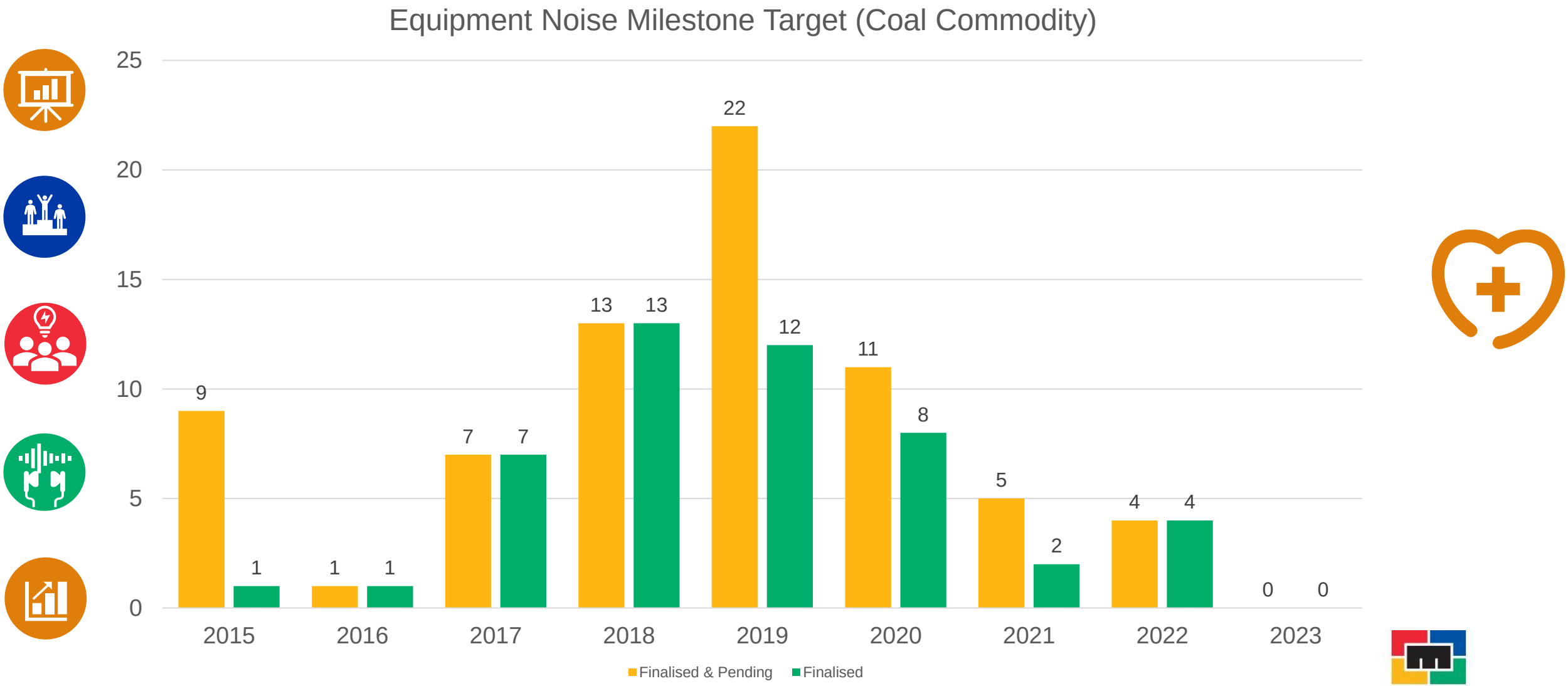


# EQUIPMENT NOISE MILESTONE PERFORMANCE PER COMMODITY

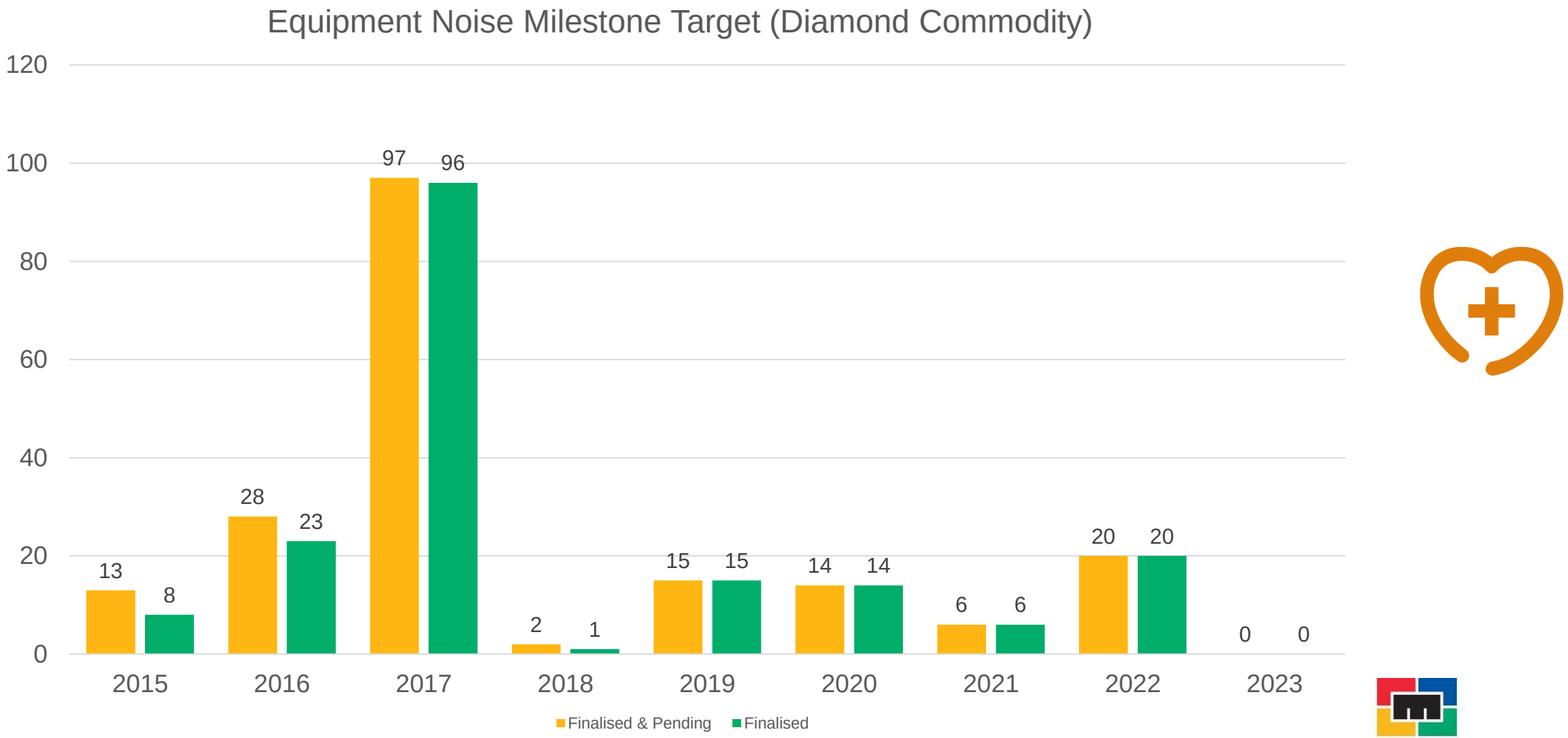
# CHROME COMMODITY EQUIPMENT NOISE MILESTONE PERFORMANCE



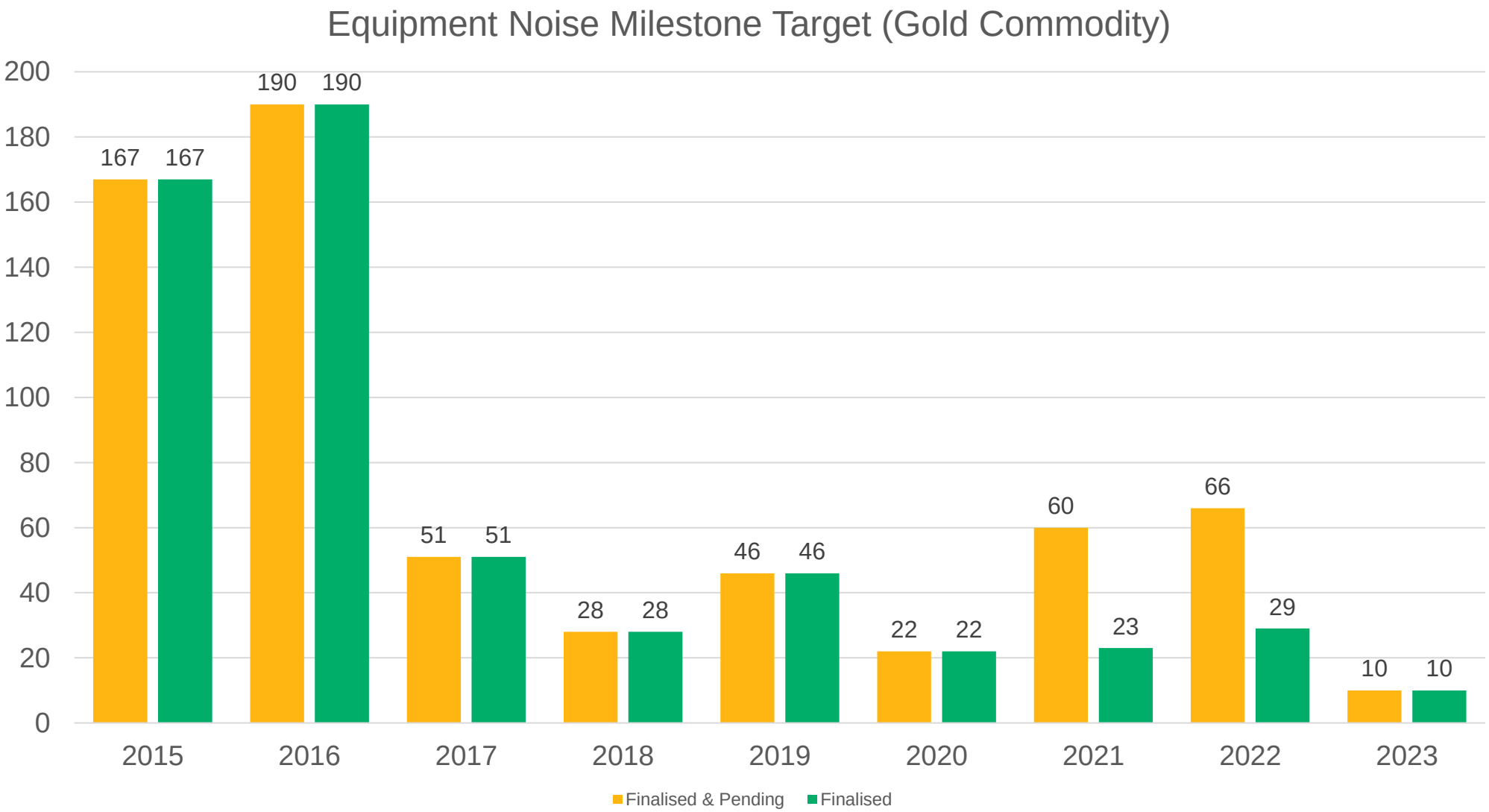
# COAL COMMODITY EQUIPMENT NOISE MILESTONE PERFORMANCE



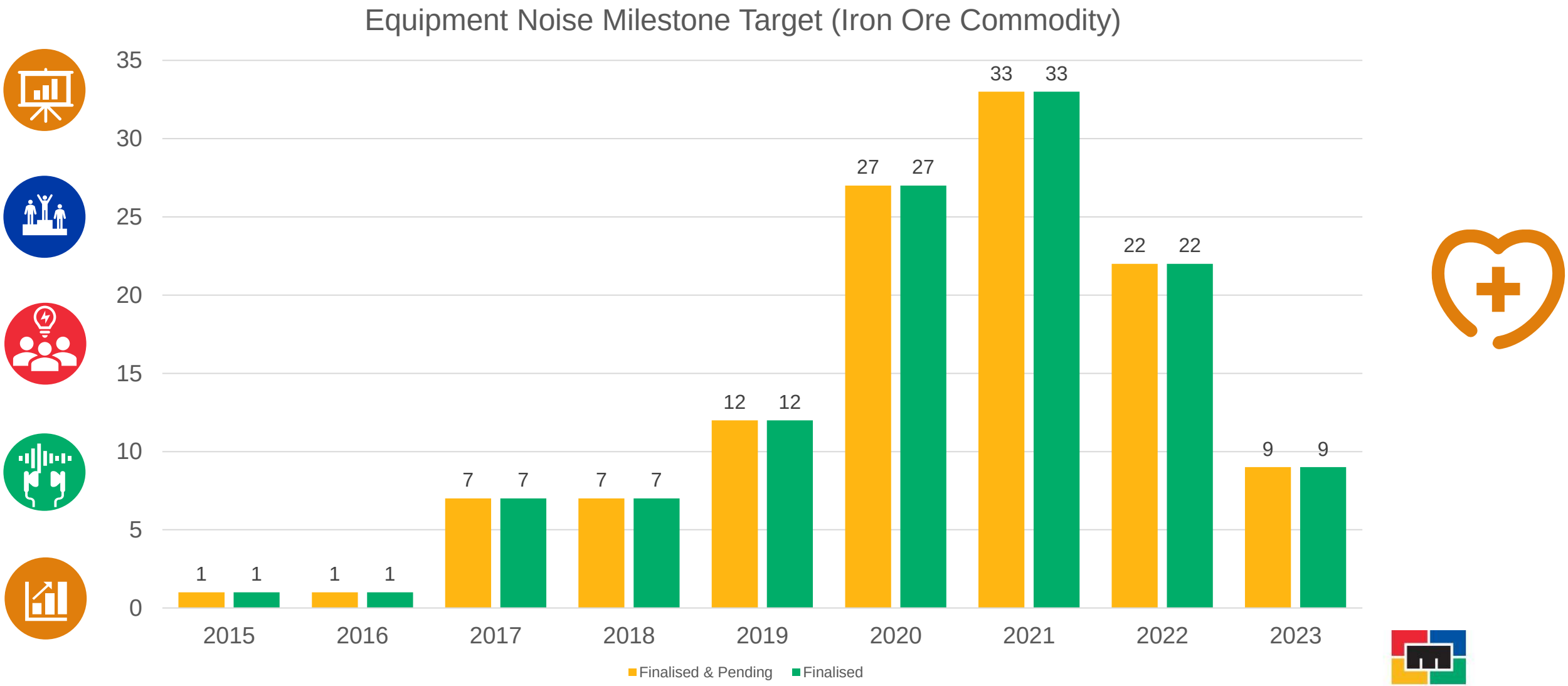
# DIAMOND COMMODITY EQUIPMENT NOISE MILESTONE PERFORMANCE



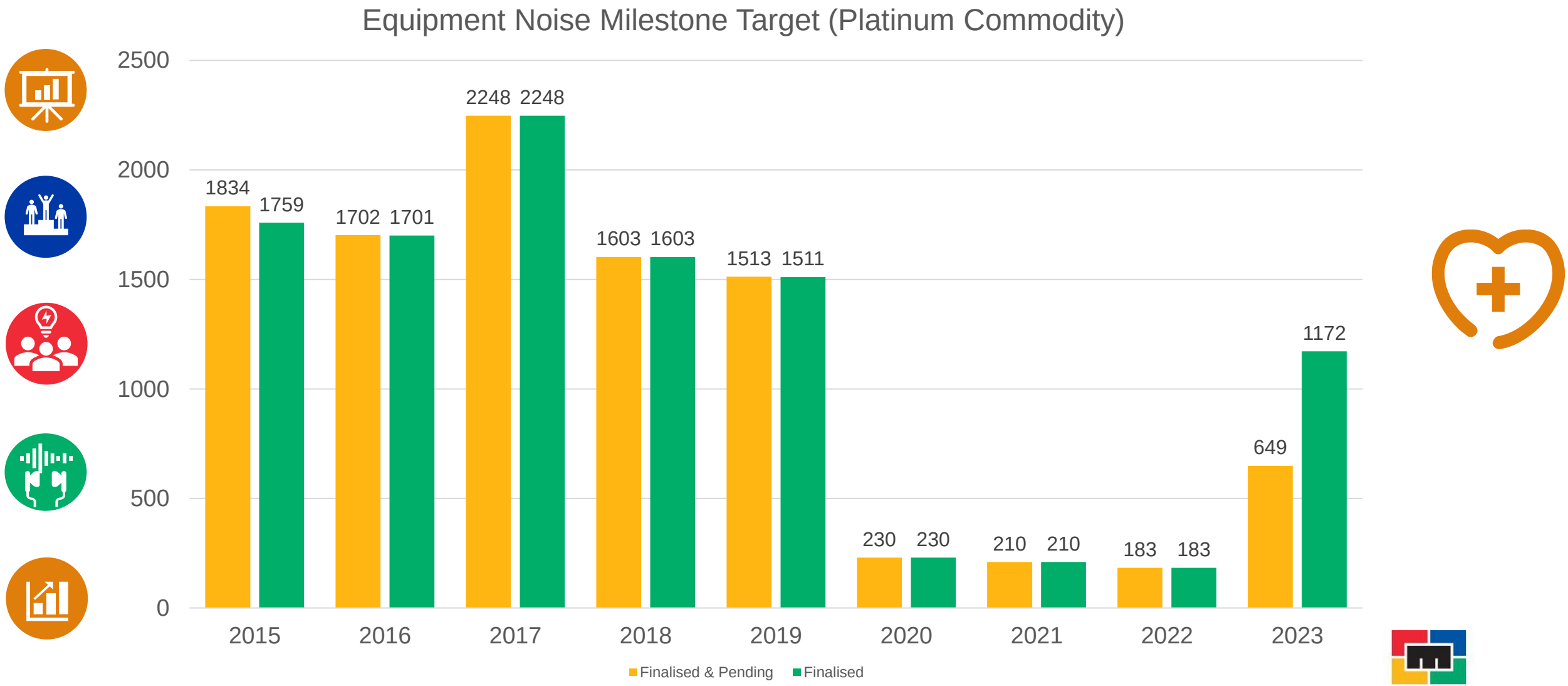
# GOLD COMMODITY EQUIPMENT NOISE MILESTONE PERFORMANCE



# IRON ORE COMMODITY EQUIPMENT NOISE MILESTONE PERFORMANCE

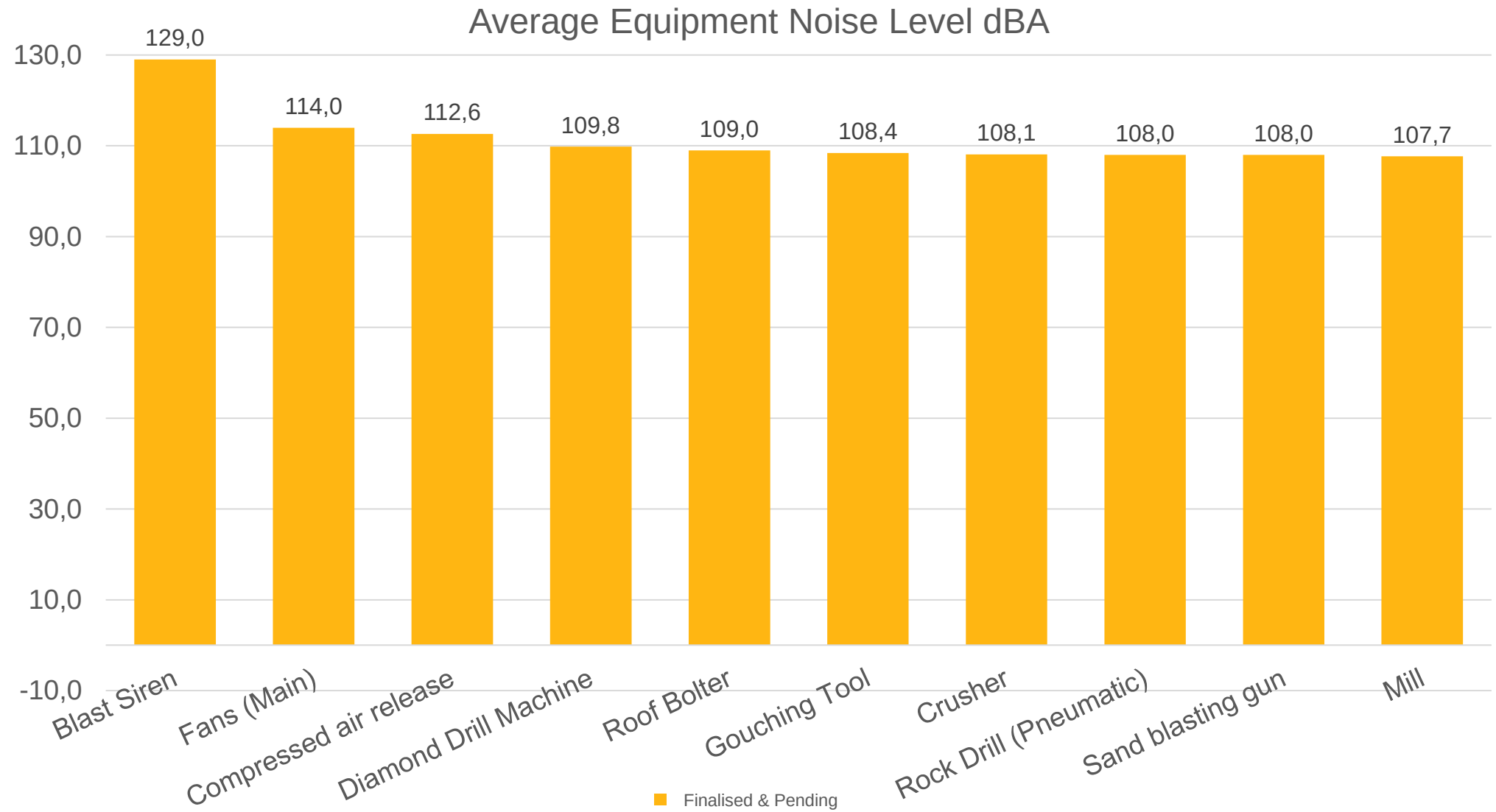


# PLATINUM COMMODITY EQUIPMENT NOISE MILESTONE PERFORMANCE

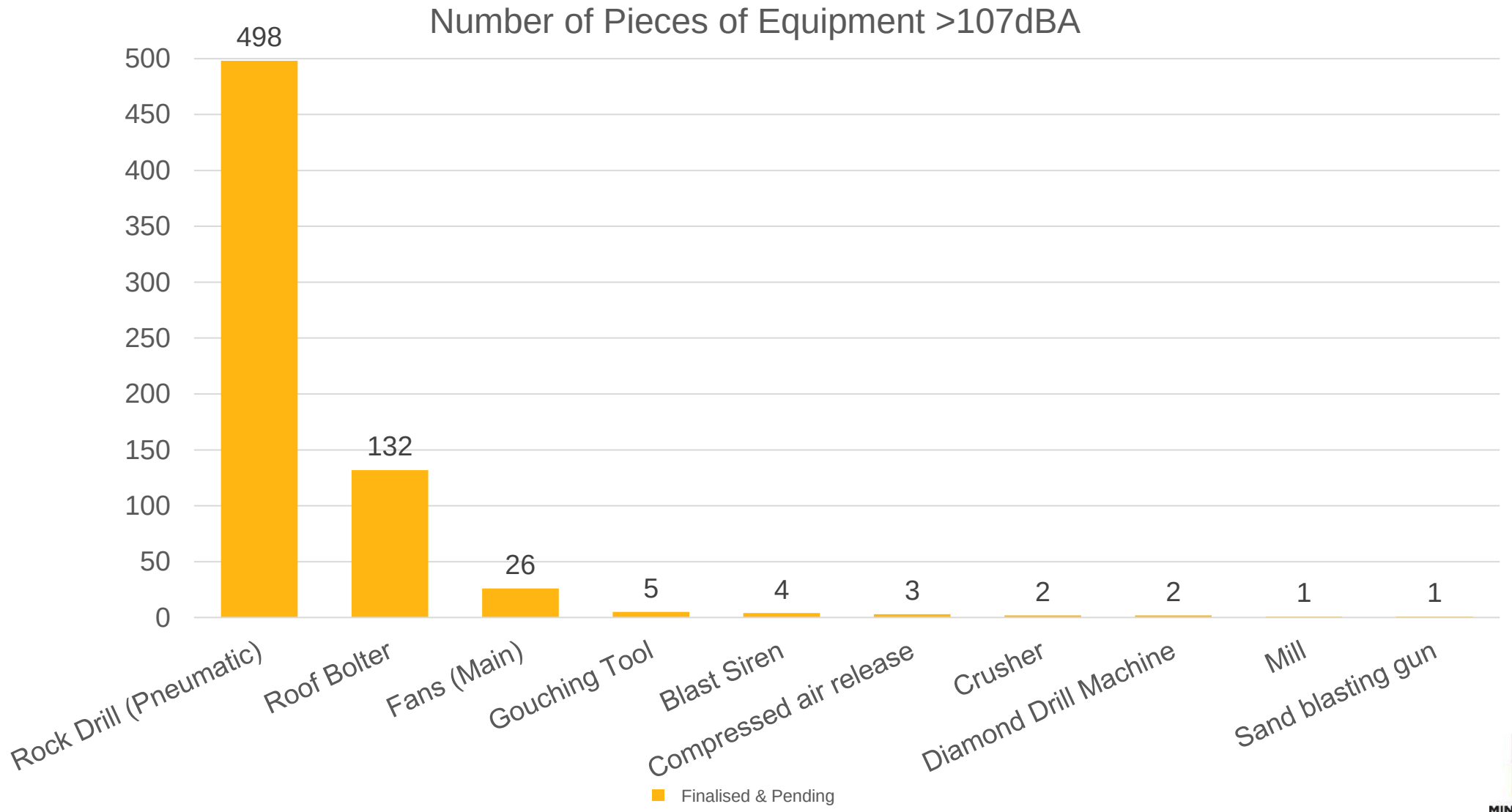


# NOISE PER EQUIPMENT TYPE

# AVERAGE EQUIPMENT NOISE LEVEL PER EQUIPMENT TYPE >107dBA



# NUMBER OF INDIVIDUAL PIECES OF EQUIPMENT PER TYPE >107dBA



# CONCLUSION

- Significant improvements have been made by the SAMI in the silencing of equipment towards meeting the Industry Equipment Noise Milestone.
- Little progress has been made at an Industry level since 2018 and increased efforts are required to meet the achieve the Industry Equipment Noise Milestone of 107dB(A) by December 2024.
- Some Commodities have been able to meet the Industry Equipment Noise Milestone.
- The most recent data indicates that the number of equipment exceeding the noise milestone have increased in the Platinum Commodity, a development attributed to maintenance issues and damage to rock drill mufflers.
- Pneumatic Rockdrills and Roofbolters are currently the most significant pieces of equipment exceeding the Equipment Noise Milestone.
- The GEE recently engaged the CM&EE to improve collaboration, buy-in and support in order to progress toward meeting the noise milestone.



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# INDUSTRY NOISE MILESTONE PERFORMANCE

**NOISE SYMPOSIUM**

**EMPEROR'S PALACE**

**25 April 2024**

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# INDUSTRY NOISE INDUCED HEARING LOSS MILESTONE PERFORMANCE



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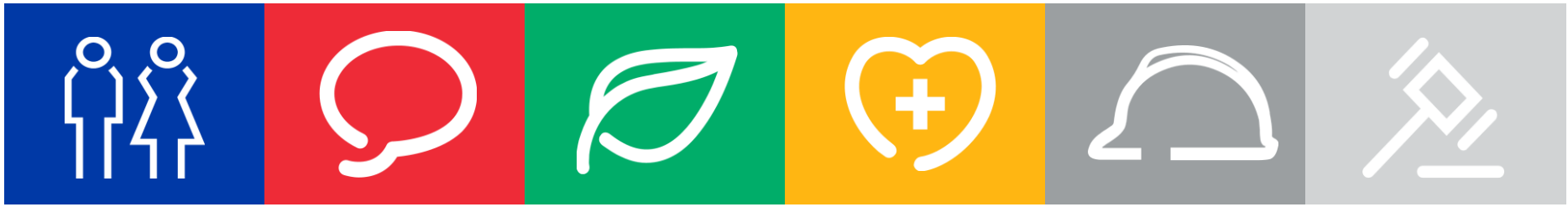
# NOISE INDUCED HEARING LOSS MILESTONE

- During the Mine Health and Safety Summit held in 2013, the industry agreed to stretch targets as Milestones to facilitate an improvement of Occupational Health performance and included the following:

- **Elimination of Noise Induced Hearing Loss (NIHL)**

  No individual miner's standard hearing threshold shift (STS) should exceed 25 dB from baseline, in both ears,

  and that the total operational or process noise emitted by any equipment must not exceed 107 dBA, by the December 2024





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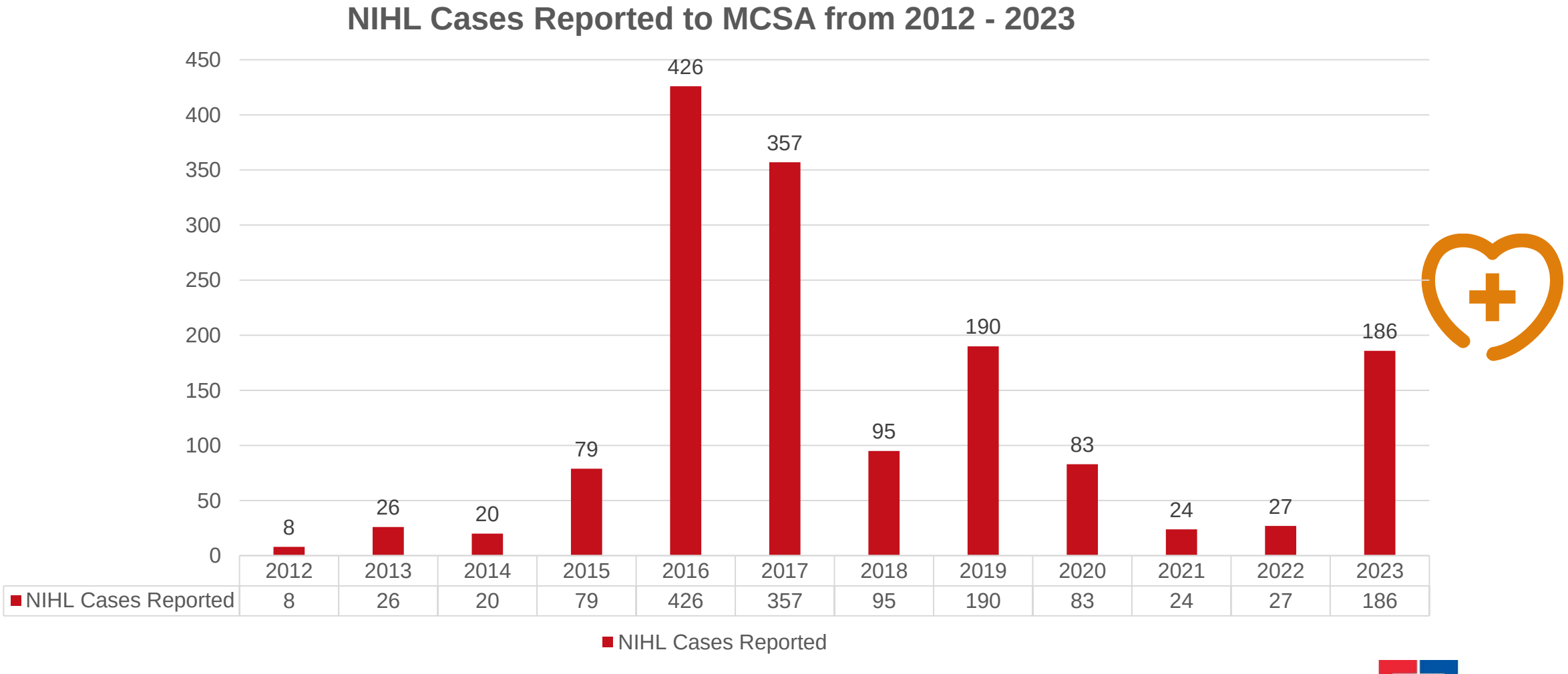
# OCCUPATIONAL NIHL CASES REPORTED TO MCSA 2012-2022



# INDUSTRY NOISE INDUCED HEARING LOSS PERFORMANCE PER COMMODITY



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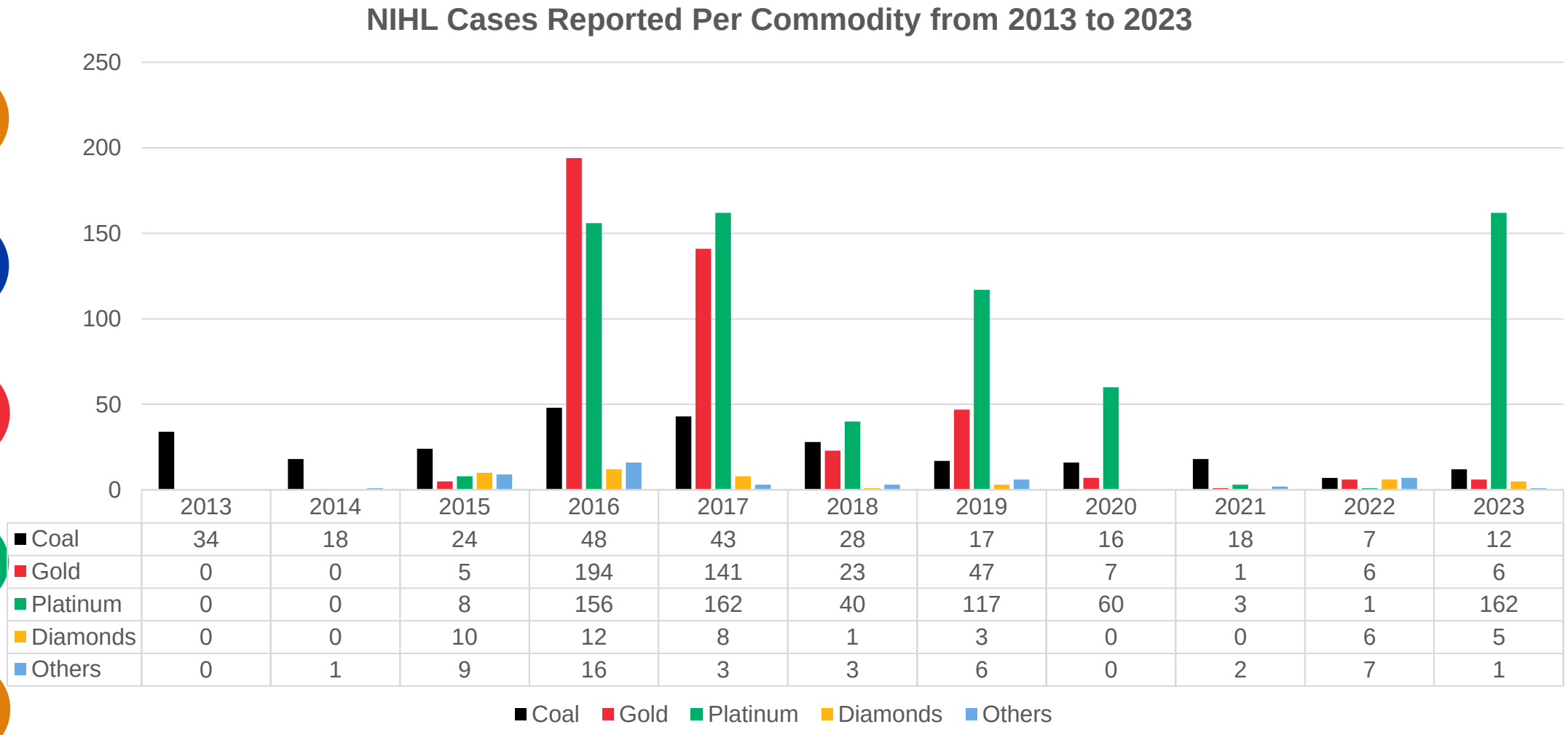
# STS CASES REPORTED TO MCSA FROM 2013 - 2023




| | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Coal | 34 | 18 | 24 | 48 | 43 | 28 | 17 | 16 | 18 | 7 | 12 |
| Gold | 0 | 0 | 5 | 194 | 141 | 23 | 47 | 7 | 1 | 6 | 6 |
| Platinum | 0 | 0 | 8 | 156 | 162 | 40 | 117 | 60 | 3 | 1 | 162 |
| Diamonds | 0 | 0 | 10 | 12 | 8 | 1 | 3 | 0 | 0 | 6 | 5 |
| Others | 0 | 1 | 9 | 16 | 3 | 3 | 6 | 0 | 2 | 7 | 1 |



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# INDUSTRY STANDARD THRESHOLD SHIFT MILESTONE PERFORMANCE



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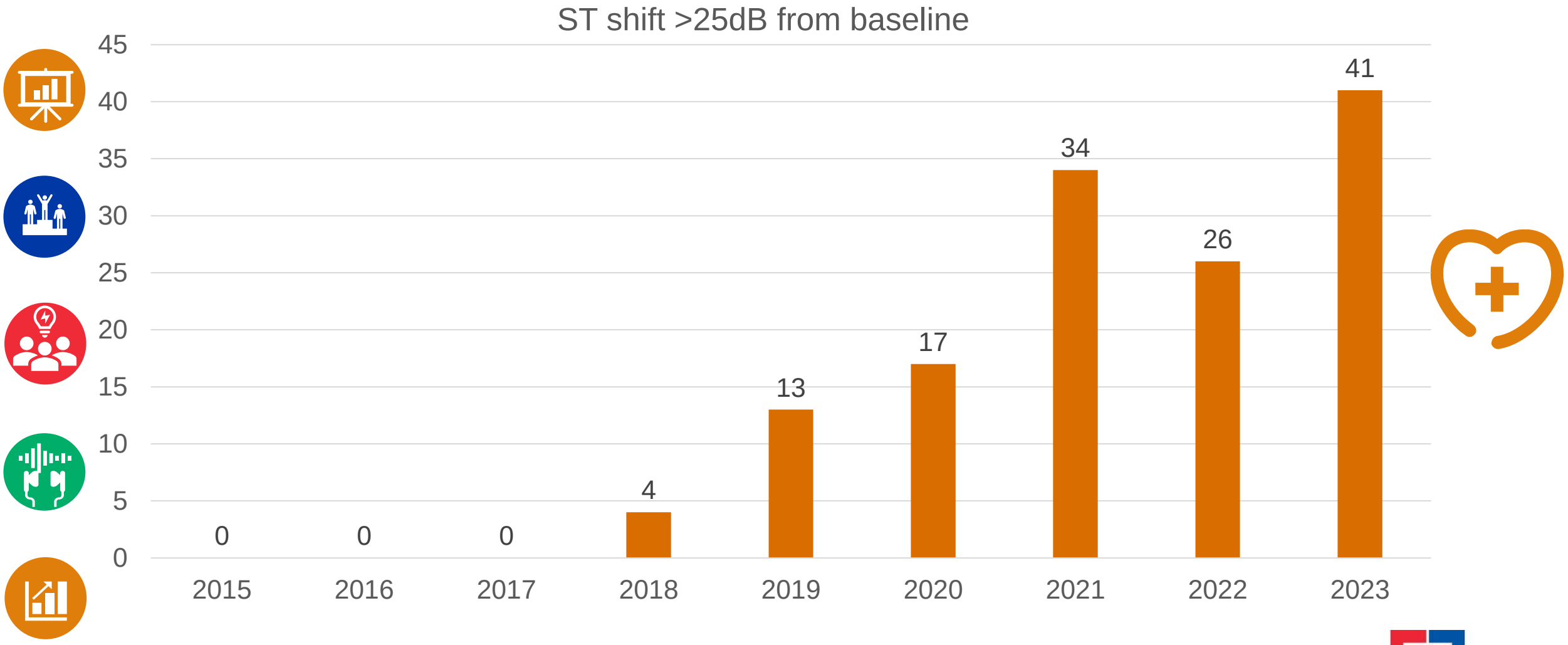
# STS CASES REPORTED TO MCSA FROM 2015 - 2023



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# INDUSTRY STANDARD THRESHOLD SHIFT MILESTONE PERFORMANCE PER COMMODITY



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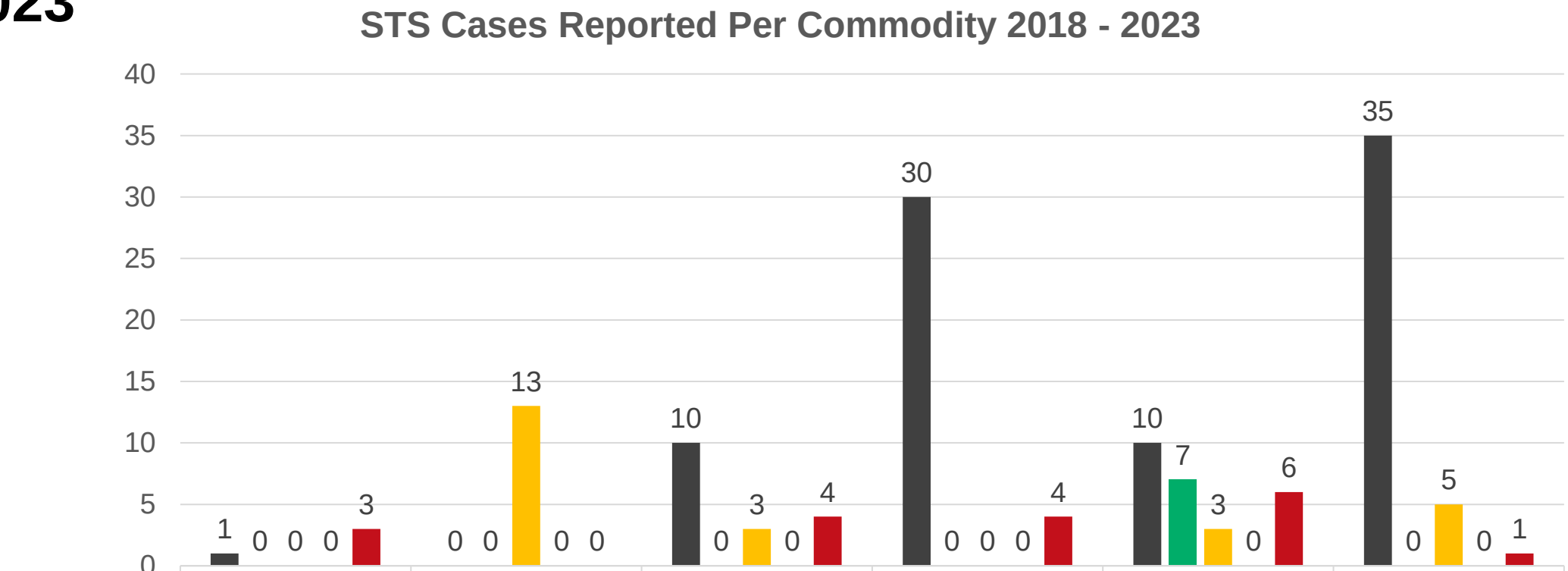
# STS CASES REPORTED TO MCSA PER COMMODITY 2018 - 2023




| | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|
| Coal | 1 | 0 | 10 | 30 | 10 | 35 |
| Platinum | 0 | 0 | 0 | 0 | 7 | 0 |
| Gold | 0 | 13 | 3 | 0 | 3 | 5 |
| Diamonds | 0 | 0 | 0 | 0 | 0 | 0 |
| Others | 3 | 0 | 4 | 4 | 6 | 1 |



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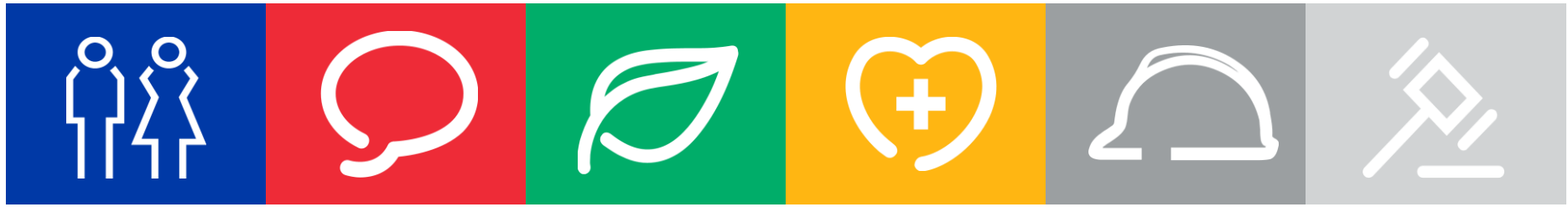
# WAS THE NOISE INDUCED HEARING LOSS MILESTONE MET?

- **The STS Milestone set out in 2014 has not been met.**
- **The Minerals Council conducted an STS Verification Study, and it showed the following reasons why the milestone was not met:**

- There is a need to properly define a milestone for ONIHL
- Poor understanding and implementation of the STS Guidance note issues in 2016.
- Poor monitoring and evaluation of ONIHL on the mines due to there being no useful early lag indicator.
- Lack of noise database to compare audiograms of employees as they move from industry to industry and company to company.





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# CONCLUSION

- There is a significant gap in the reporting of Noise Induced Hearing Loss.
- A robust early lag indicator for ONIHL should be developed and implemented for the monitoring and evaluation of mine Hearing Conservation Programs, as well as MHSC targets for ONIHL.
- An early lag indicator for ONIHL must be:
  - Easy to understand
  - Result in a maximum of true positive and minimum of false positive detections of early ONIHL
- There is a need to establish an Audiogram Repository to enable the easy identification and management of employees' ONIHL as they move from company to company.
- A Noise Induced Hearing Loss Prevalence Study should be done to establish the status of Occupational NIHL in the SAMI. This should include a cohort selected to understand the effectiveness of milestone equipment silencing efforts on early ONIHL.



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# Compensation Perspective:
# Have HCPs for Regulatory Compliance made an Impact?

**MCSA: NIHL SYMPOSIUM**

Dr Luvuyo Dzingwa

25 April 2024

# Outline

01

Introduction

02

Legal Framework

03

What we know about ONIHL?

04

ONIHL Claims Data Analysis

05

What needs to be done differently?

06

Q & A

# Introduction

- Occupational noise-induced hearing loss (ONIHL) is theoretically entirely preventable, but it still occurs.
- NIHL can be divided into temporary threshold shift (TTS) and permanent threshold shift (PTS).
  - TTS is defined as a threshold shift that recovers to baseline levels in hours, days, or weeks following exposure
  - PTS is defined as a noise-induced threshold shift that persists after a period of recovery
- ONIHL does not progress once exposure to noise is discontinued[1]
- Compensation provides a guide to the assessment of ONIHL and sets hearing loss thresholds
- The three accepted methods for assessing ONIHL worker compensation claims
  - HL thresholds
  - Age or time restriction stipulates that a claim can be lodged during the worker's working life
  - Age correction -involves a specific amount of decibels being extracted from the average HL over various frequencies.

*1. Kirchner,D.B., (2012) :Radi, et al., (2015)*

# Legal Framework

Specific laws that address control of the risk of exposure to noise in the workplace

Baseline audiometry must be conducted within three months of commencing employment to provide a control measure. Audiometry is then required at least yearly

01

OHSA s24* & 25; (prevention) – (1993)

- Action based on the diagnosis of (or suspicion of an occupational disease
- Report to Chief Inspector - details spelled out in GAR (8)(4).

02

MHSA (prevention) - (1996)

Action based on PLH shift of ≥ 10%
- Action based on Standard Threshold Shifts (STS) (2,3 & 4kHz) against audiometric zero milestone baseline

03

COIDA Instruction 171; (compensation) – (Nov 2001)

- The presence of "disablement" (determined by PLH,
- Action based on PLH shift ≥10% from baseline

04

**SANS 10083:2013 (Prevention & compensation) (2013)**

- Actions based on the contributions of the hearing thresholds at 2, 3 and 4kHz to the PLH value (not on a PLH shift)
- Action based on PLH shift values of 3.2, 6.4 and 10%.

# What we know about ONIHL

| Characteristic | Description |
|---|---|
| **Exposure** | The risk of ONIHL is directly related to cumulative exposure to noise exceeding 85 dB.<br>The higher the dose (exposure), the higher the risk of disease. |
| **Timing** | Onset ONIHL begins in 4-10 years of initial continued noise exposure, often regardless of the use of hearing protective |
| **Progression** | NIHL is a disease that develops gradually in response to cumulative exposure to excessive noise levels associated with significant, irreversible hearing damage. |
| **Susceptibility** | All individuals exposed to certain levels and types of noise are susceptible to ONIHL, but only some of those exposed develop the disease |
| **Relationship** | Noise exposure and ARHL have either independently or synergistically effect on development of ONIHL[1] |
| **Diagnosis** | ONIHL is primarily assessed using PTA<br>PTA is still considered to be the 'gold standard' of audiometry for determining the type and degree of HL[2] |

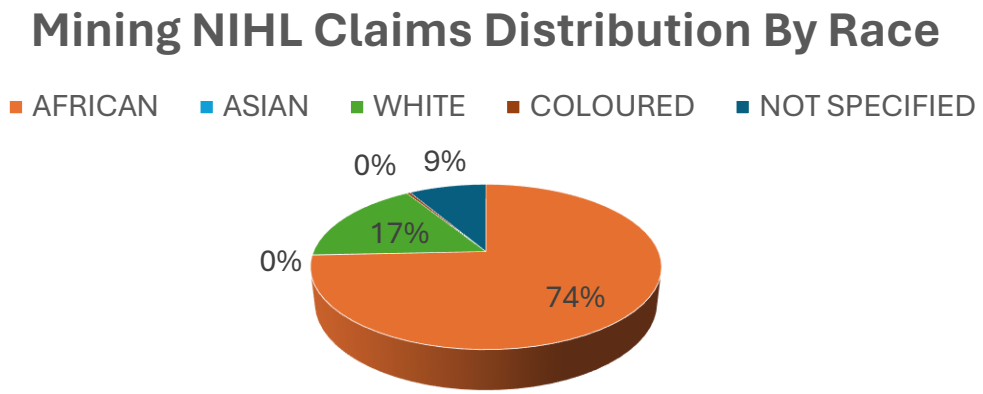
*Adapted: Craner, J., (2022)*

1. *Fetoni, A.R., et al., (2022)*
2. *Chau et al., 2012; Dillion et al., (2016); Fredriksson et al.,( 2016)*

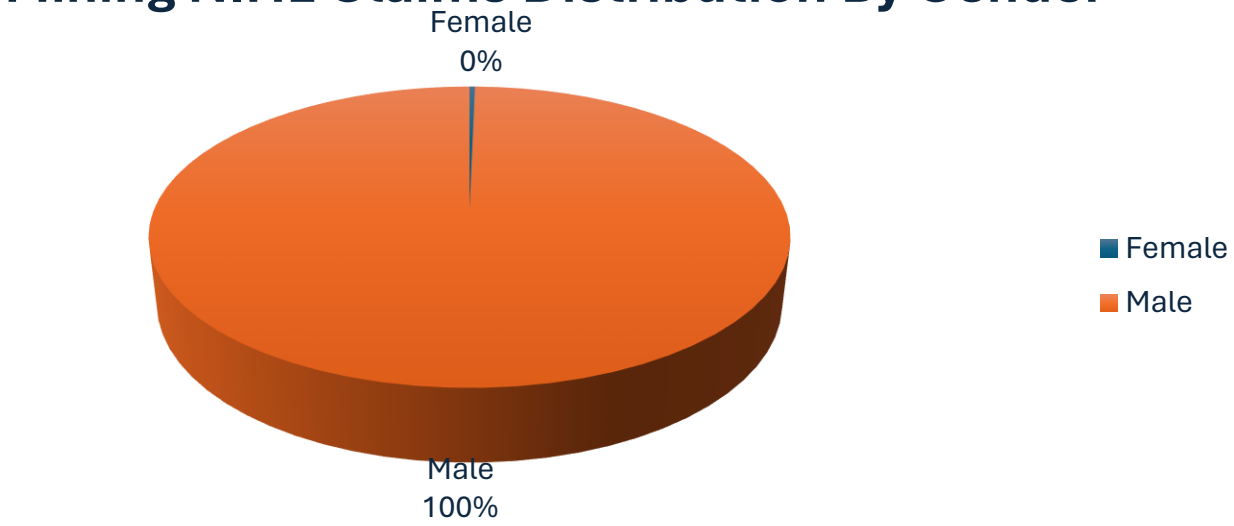
# ONIHL Claims Data Analysis

- 20-year analysis (2003-2023)
  - Volume of claims received
  - Liability distribution
  - Incident Rates
  - Payments
  - Top ten most impacted occupations
- Data Limitations
  - Assumptions
  - Proxy data

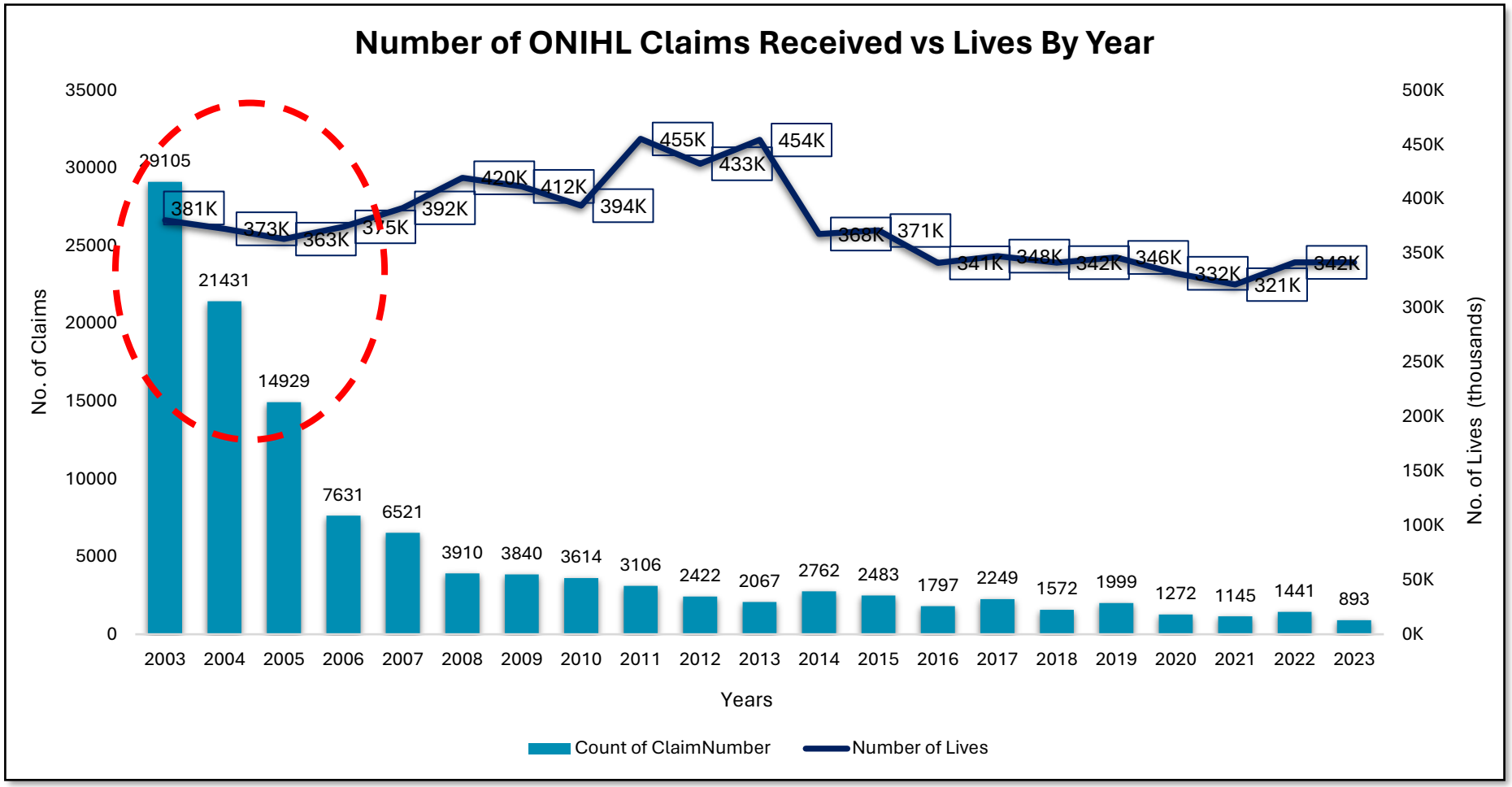
# ONIHL claims distribution by race and gender over the 20 years (2003 – 2023)




- This slide is a distribution of NIHL cases by race and gender over the past 20-year period.
- This gives insights of percentage of NIHL claims by race and by gender.



# Volume of claims Received vs Lives by year (2003-2023)



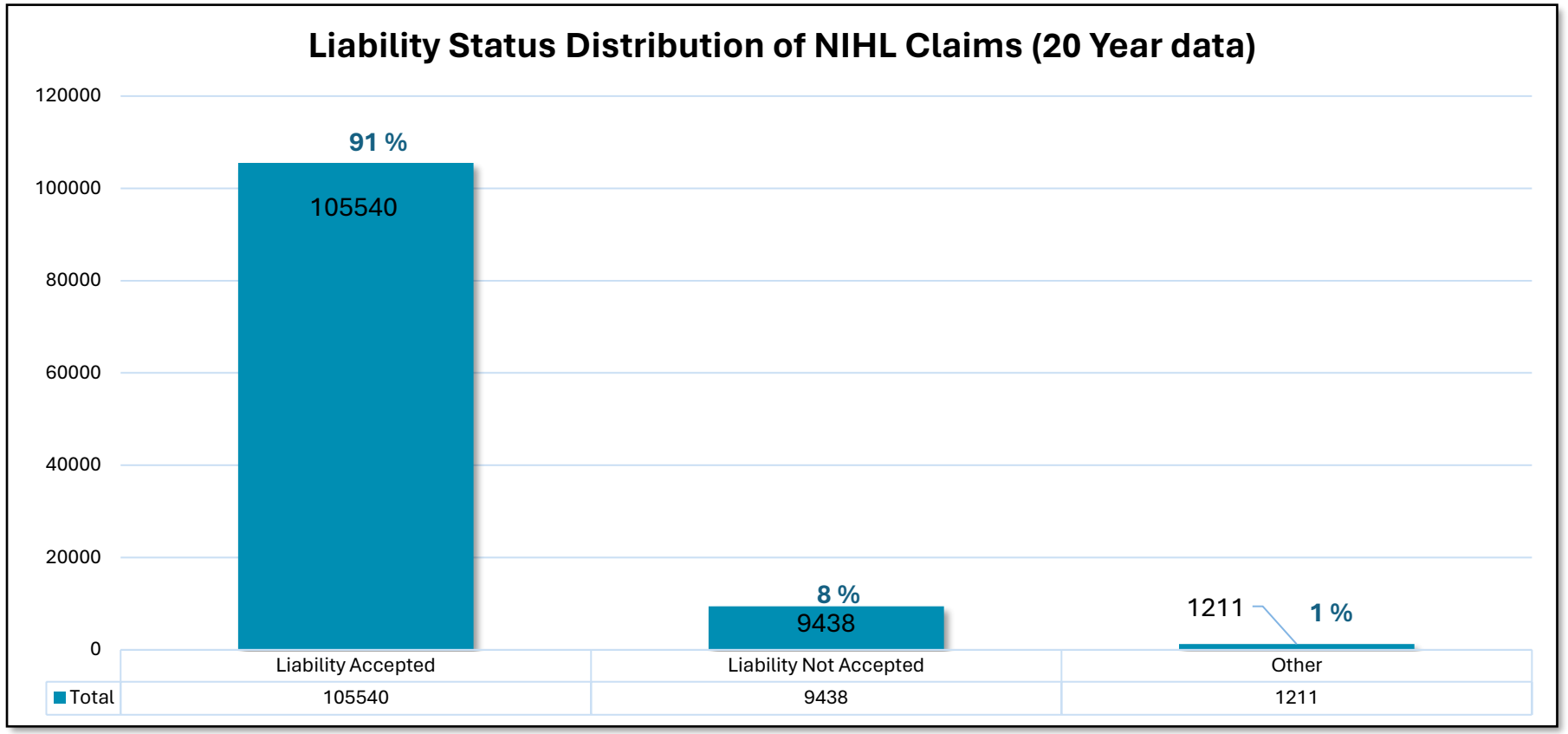

Overall Number of NIHL Claims Received

**116 189**

- The number of lives covered per year is also included for the abovementioned period.
- We have an average number of lives:

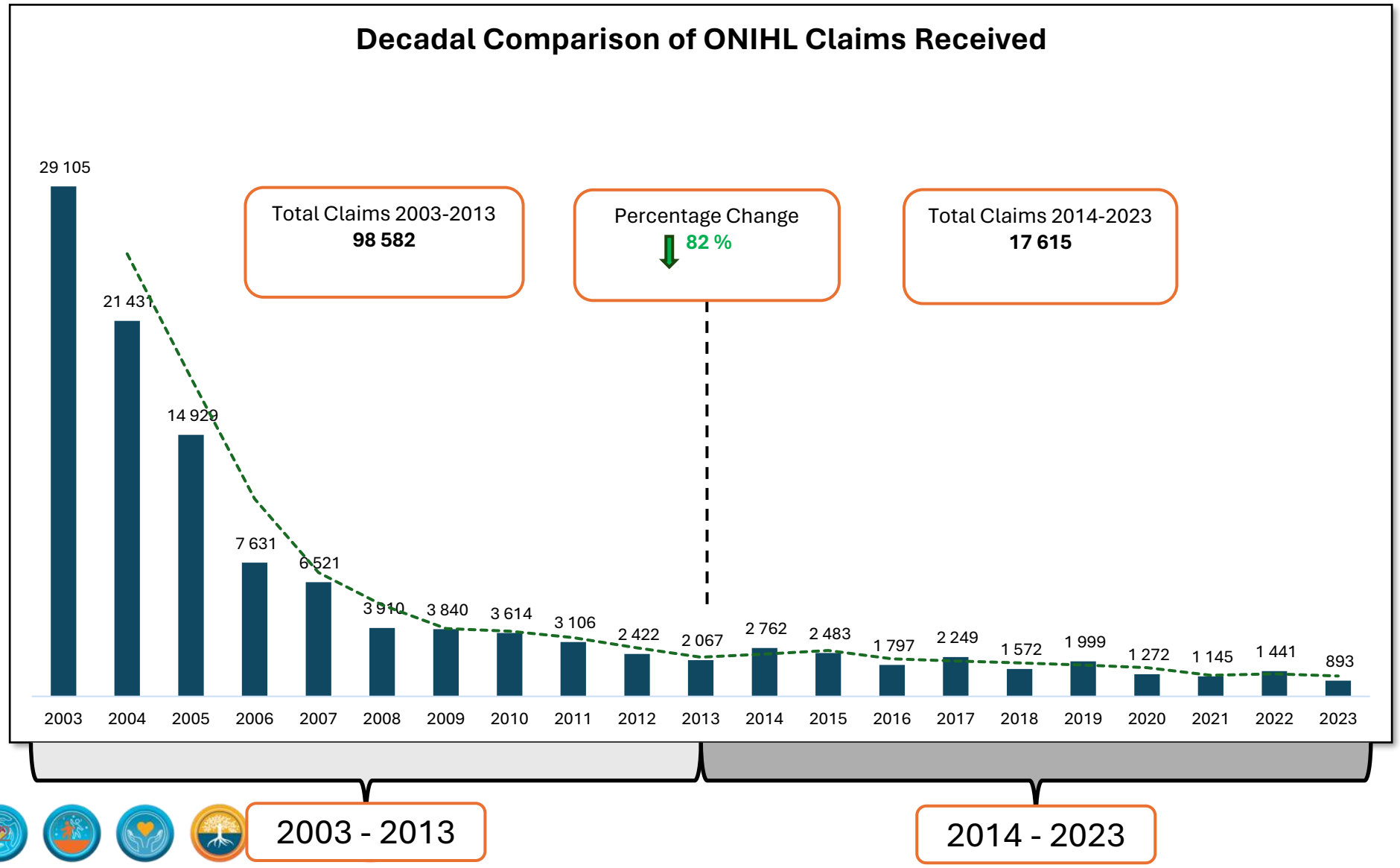
  Avg = **376 329**
- **High number**

# Liability status distribution of ONIHL  claims (2003-2023)



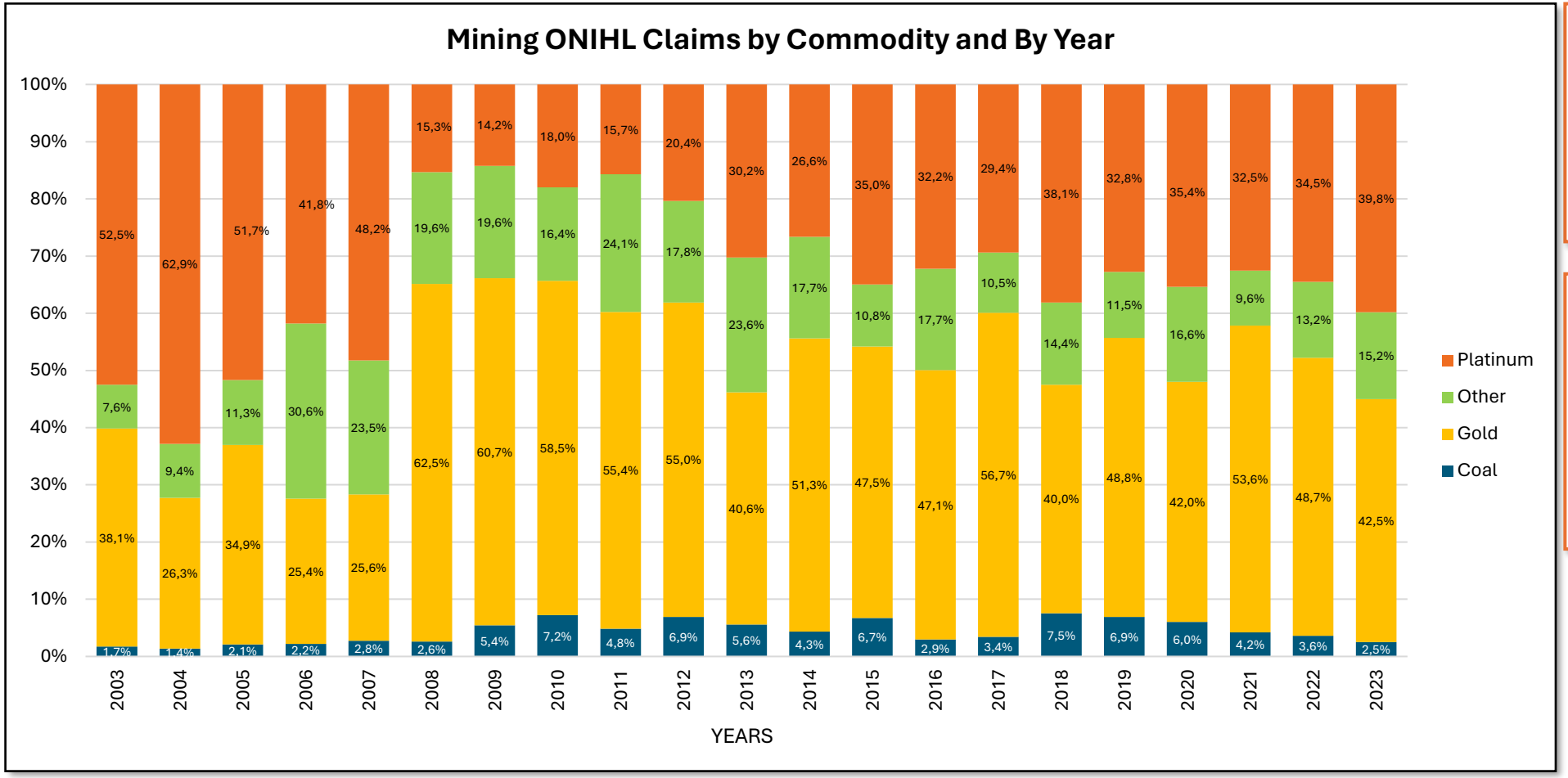

- Liability statuses of the Total population of **116 189** NIHL claims submitted over the 20 years,
- The category 'Other' constitutes claims under investigation, pending liability and those with outstanding documents.

# Decadal comparison of ONIHL claims received




- This chart illustrates the distribution of NIHL claim volumes by decade, along with the percentage difference between the two decades: 2003-2013 and 2014-2023.
- The volume of NIHL claims has decreased by **82 % (more than 80 thousand decrease in volume of NIHL claims)** over the past two decades.

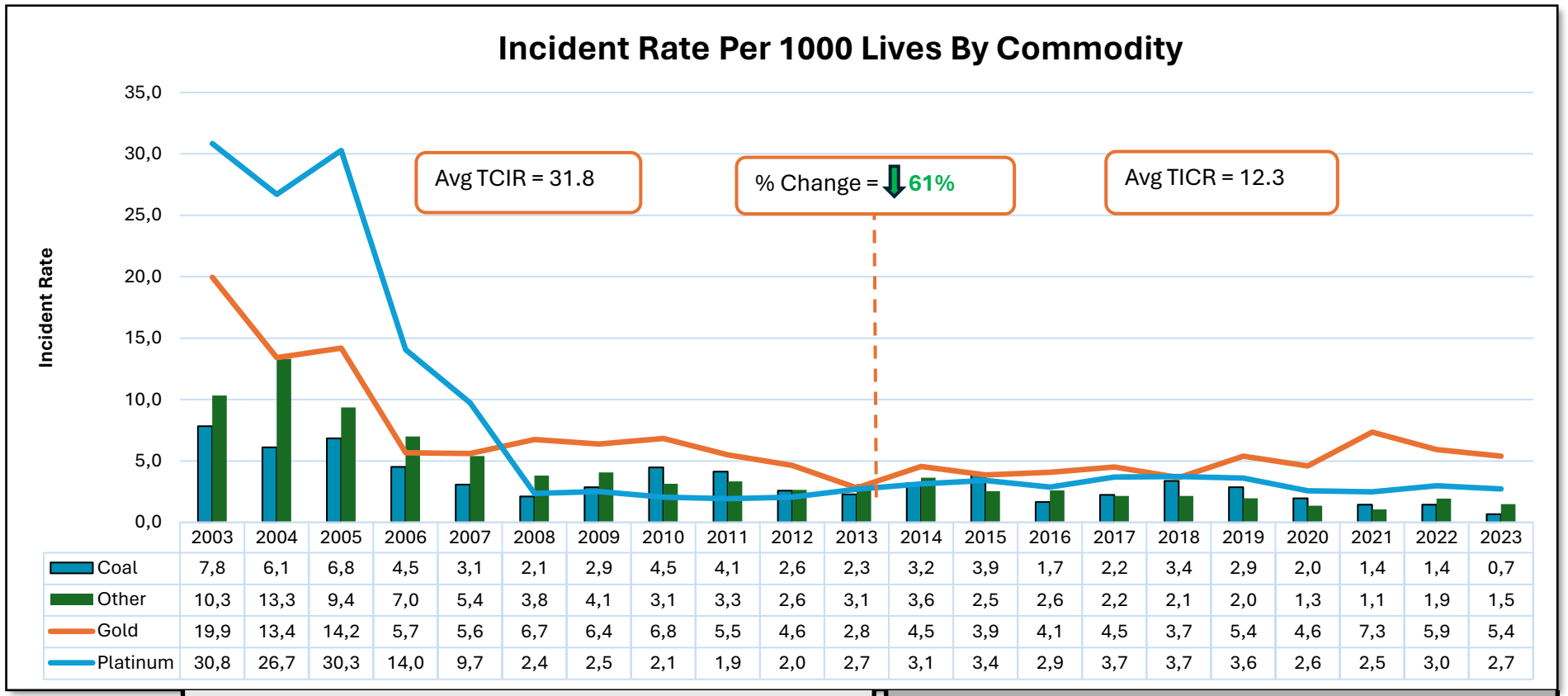
# ONIHL claims distributed by commodity and by year (2003 – 2023)




- This slide shows ONIHL's number of claims distributed by mining commodities over the 20 years.

- Over the past decade, gold has accounted for an average of 47% of ONIHL claims, followed by platinum at 33%.

# Incident rate per 1000 lives comparison: 2003-2013 vs 2014-2023



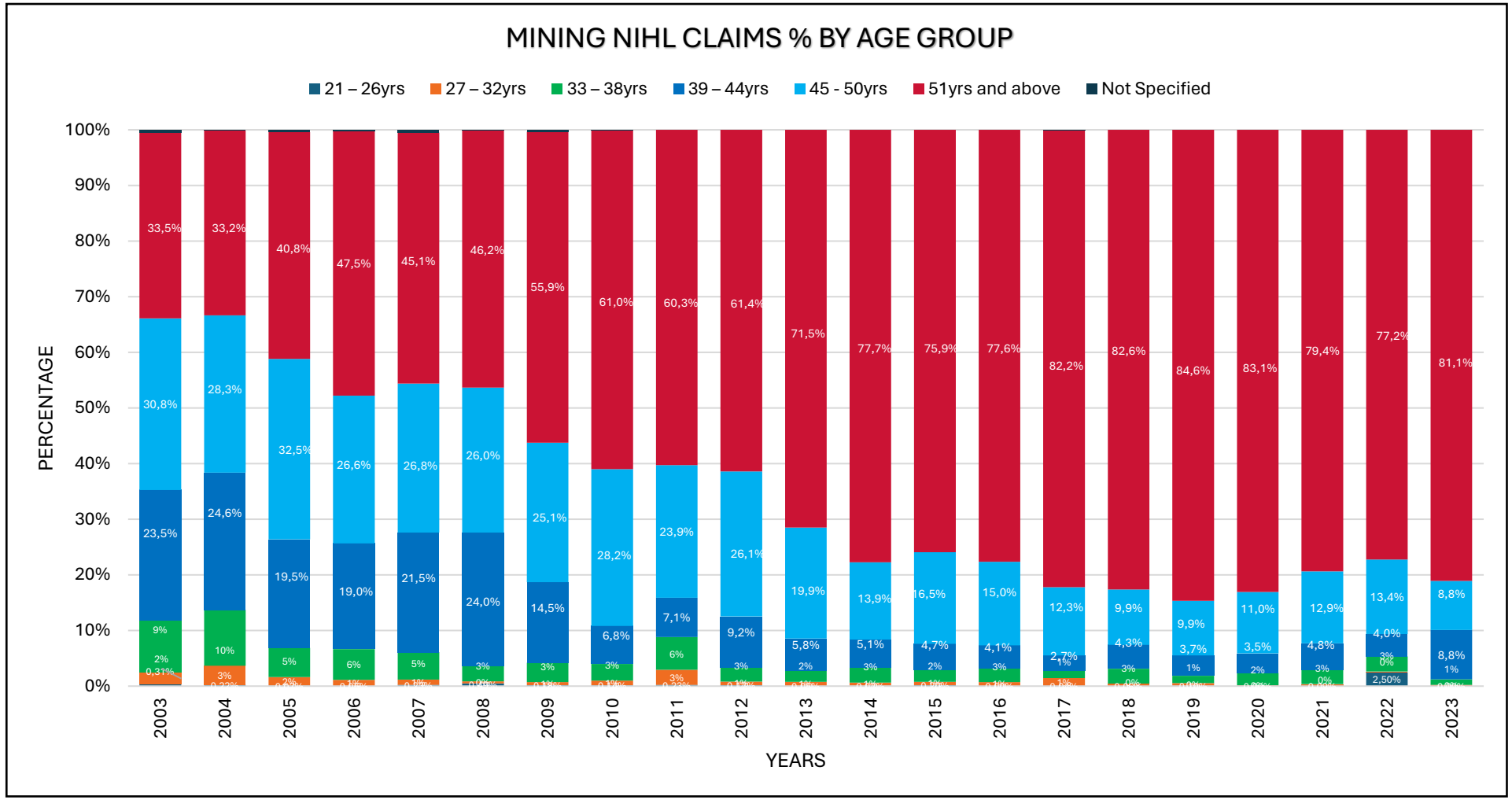

| | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Coal | 7,8 | 6,1 | 6,8 | 4,5 | 3,1 | 2,1 | 2,9 | 4,5 | 4,1 | 2,6 | 2,3 | 3,2 | 3,9 | 1,7 | 2,2 | 3,4 | 2,9 | 2,0 | 1,4 | 1,4 | 0,7 |
| Other | 10,3 | 13,3 | 9,4 | 7,0 | 5,4 | 3,8 | 4,1 | 3,1 | 3,3 | 2,6 | 3,1 | 3,6 | 2,5 | 2,6 | 2,2 | 2,1 | 2,0 | 1,3 | 1,1 | 1,9 | 1,5 |
| Gold | 19,9 | 13,4 | 14,2 | 5,7 | 5,6 | 6,7 | 6,4 | 6,8 | 5,5 | 4,6 | 2,8 | 4,5 | 3,9 | 4,1 | 4,5 | 3,7 | 5,4 | 4,6 | 7,3 | 5,9 | 5,4 |
| Platinum | 30,8 | 26,7 | 30,3 | 14,0 | 9,7 | 2,4 | 2,5 | 2,1 | 1,9 | 2,0 | 2,7 | 3,1 | 3,4 | 2,9 | 3,7 | 3,7 | 3,6 | 2,6 | 2,5 | 3,0 | 2,7 |

2003 - 2013

2014 - 2023

- This chart also illustrates the comparison between the two decades.
- A comparison of the Incident rate per 1000 Lives between the two-time frames will ultimately result in a 61% drop in the average Incident rate per 1000 Lives.

# ONIHL Claims Received by Age Group (2003 – 2023)

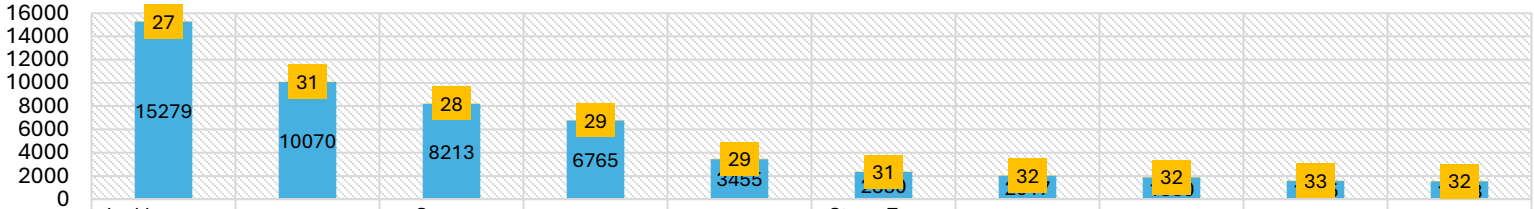



- The chart depicts the age group distribution of NIHL claims received throughout 20 years.

- Despite a decrease in NIHL claims in the recent decade, the susceptibility to hearing loss increases with the miners' age.
- Consequently, individuals aged 50 and above constitute over 80% of hearing loss cases, which may also be attributed to the natural aging process of hearing.

# Top 10 most impacted occupations and est. time to develop ONIHL in each (years)

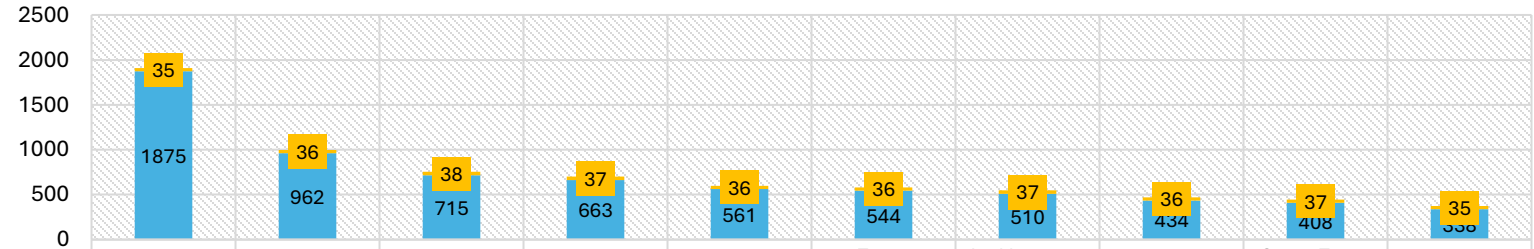
## TOP 10 Occupations By NIHL Claims Vs Est. Years to Develop NIHL (2003-2013)




| | Jackhammer Handle/Worker | Driller/Drill Operator | Scraper Winch Operator | Stope Team | Loco Driver (Underground) | Stope Team Leader/Supervisor | Shift Boss | Boilermaker | Miner | Shaft Worker |
|---|---|---|---|---|---|---|---|---|---|---|
| Time taken to develop NIHL (Years) | 27 | 31 | 28 | 29 | 29 | 31 | 32 | 32 | 33 | 32 |
| Count of ClaimNumber | 15279 | 10070 | 8213 | 6765 | 3455 | 2350 | 2017 | 1880 | 1575 | 1543 |

- This slide shows the top 10 occupations most impacted by ONIHL by the volume of claims received.
- There has been a significant decrease in ONIHL claims across various occupations in the last decade.

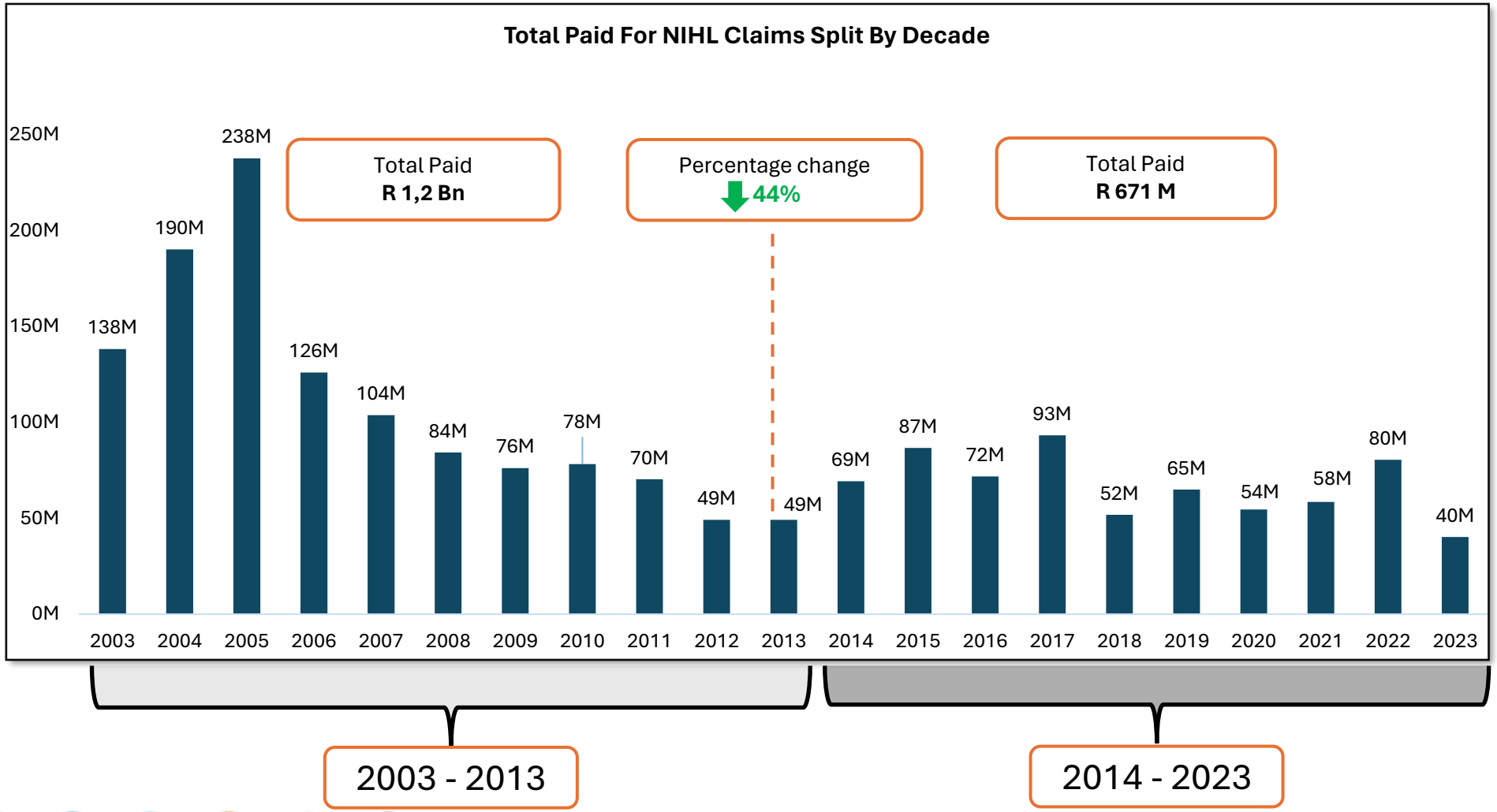
## TOP 10 Occupations By NIHL Claims Vs Est. Years to Develop NIHL (2014-2023)




| | Driller/Drill Operator | Boilermaker | Shift Boss | Scraper Winch Operator | Loco Driver (Underground) | Team Leader/Supervisor (Other | Jackhammer Handle/Worker | Fitter | Stope Team Leader/Supervisor | Miner |
|---|---|---|---|---|---|---|---|---|---|---|
| Time taken to develop NIHL (Years) | 35 | 36 | 38 | 37 | 36 | 36 | 37 | 36 | 37 | 35 |
| Count of ClaimNumber | 1875 | 962 | 715 | 663 | 561 | 544 | 510 | 434 | 408 | 338 |

- Furthermore, during the first decade (2003-2013), ONIHL took about 30 years on average. In contrast, the average time increased to 37 years in the last decade.
- This suggests that the measures implemented to prevent NIHL have been effective, resulting in a longer duration for a compensable ONHIL.

# Comparative analysis of ONIHL claim payments:2003-2013 vs 2014-2023




- This chart compares the aggregate payments for ONIHL Claims across the two decades, highlighting their percentage variation.
- Payments for NIHL claims have decreased by **44 % (paid less than just over R500 million in NIHL claim payments)** over the last decade.

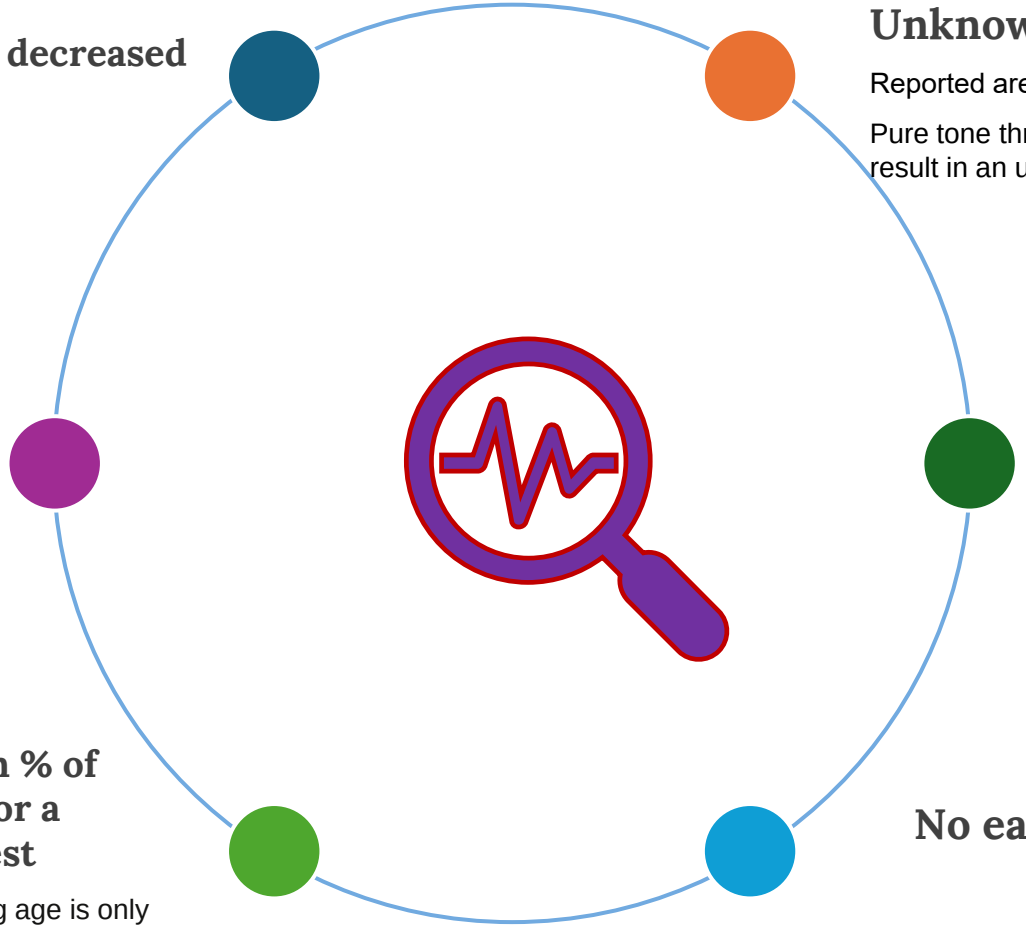
# Summary of Key Insights

**Claims volumes & Incident Rates sharply decreased over time**

**Significant reduction of ONIHL payments**

**The older group constitutes a high % of claims & it takes much longer for a compensable ONIHL to manifest**

The increase in the number of claims with increasing age is only partially consistent with the disease pattern



**Unknown extent and burden of ONIHL**

Reported are those that have ≥ compensation threshold

Pure tone thresholds solely relied upon to determine the extent of ONIHL result in an underestimation of NIHL prevalence and functional impact[4]

**High Compensation Threshold**

Reduction in the number of reported claims

**No early diagnosis of subclinical HL**

Screening

*4. Meng, Z.L., et al, 2022*

# What needs to be done differently?

The primary focus should be on early detection of sub-clinical hearing loss as a secondary preventive measure

**Screening: Audiometry test battery**

- **Early detection of ONIHL**
  - Otoacoustic emissions tests (OAEs)- [screening for sub-clinical hearing loss]
  - OAEs are sensitive to minor pathologies, rendering them an indicator of damage compared to CA
  - OAEs- an early indicator of minor hearing pathologies in subclinical diseases so that further hearing loss can be prevented

**Standard Threshold Shift**

**Regulatory-defined STS is considered to be an "early indicator of permanent hearing loss"**

- "However, no scientific evidence has been published to demonstrate how this regulatorily defined calculation is an effective preventive metric"[5]
- The characteristic notch pattern of NIHL with a peak loss in either the 3, 4, and/ or 6 kHz range and recovery at 8 kHz is often present in early stages, but as the disease advances to the point where an STS occurs
- The pattern sometimes cannot be differentiated readily from common diseases such as presbycusis or other less prevalent diseases associated with high-frequency hearing loss.
- it is a nonspecific, lagging indicator that has uncertain value as a disease prevention metric[6]

**Audiometric Data Interpretation**

- Audiometric data are mathematically unique compared to other medical surveillance metrics
- At the individual worker's hearing test level, an enormous number of permutations of audiometric results and their clinical interpretation are possible.
- Leverage the raw audiometric data already available and turn it into actionable data for effective secondary prevention to manage and reduce occupational hearing loss risk strategically[6]
- Statistical methods and information management tools are necessary to transform audiometry from a compliance-driven, individual screening test with limited preventive capability into a medical surveillance process directly linked to aggregate corrective and prevention actions[6]

*5. McBride, D., et al., 2003; Craner, J., 2022*
*6. Craner, J., 2022*

# Thank you

Q & A

MHSC
Mine Health and Safety Council

# MHSC Noise Research: Outcomes and Way Forward

*Noise Induced Hearing Loss Symposium 2024*

**Dr. Nonhlanhla Tlotleng**

**25 April 2024**

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

# Presentation Outline

**Introduction**

**Noise and NIHL Projects completed by MHSC Over the years**

- Impact of ARV's and HIV on the Auditory system
- Reviewed the Noise exposure limits and OEL vibration in the SAMI

**Planned research on noise (MHSC 2024/2025)**

**Future research on noise (MHSC 2025/2026)**

**Industry Milestones on Noise**

**Key recommendations on Prevention of NIHL from the 6th OH Dialogue**

# MHSC Research Thrust areas on Noise

**Thrust Area 7** **And** **Thrust Area 8**

***Physical Hazards*** ***Occupational Diseases***

- Include **noise**, vibration, temperature, ergonomics, illumination and radiation.
- Exposure that pose a significant risk of injury or diseases to exposed mine workers.
- Research projects are aimed at *identification of sources of these hazards in the mines/ occupation and measuring exposure levels* for *implementing control measures* that will lead to *over exposure* of mine workers.
- *Thrust 8 focuses on prevention and management of occupational diseases including NIHL.*

# Noise Induced Hearing Loss

- Occupational noise is the most common cause of NIHL in adults.
- Population exposed to intermittent or continuous noise levels (>85 dB) at their work are at risk of NIHL.
- Studies have shown that in addition to occupational noise exposure, other risk factors (e.g. non-occupational noise exposure, taking ototoxic drugs) were significantly associated with hearing status of workers.
- Effective noise exposure prevention programs such as identification of sources and implementation of control measures and regulations in the work environments.
- Performing periodic audiologic evaluation for those who are working at noisy environments.

# Noise Induced Hearing Loss

- In 1995, authors reported a high incidence of audiological changes in HIV-positive patients[1].
- Evidence points to the fact that between 21-49% of HIV positive individuals present with hearing loss.
- No clear findings of this association, direct action of the virus on the hearing pathways or a consequence of the ototoxicity induced by the medication used by these patients.
- Inception of this study from the lack of understanding of the relationship between risk factors related to hearing loss in the South African Mining Industry.

# MHSC Research On Noise and NIHL over the years

**Year: 1999**

**GEN 420 : An Examination of methods whereby noise levels in current and new equipment may be reduced**

**Year:2001**

**COL 714 Quantification of noise sources in**

**mechanical board and pillar coal**

**Year: 2005**

**Practical guide to noise and vibration control in the SAMI**

**Year: 2006**

**SIM 050501 Project Scope for Low-Noise Drilling'**

**Year: 2011**

**SIM 110501 Improvement of noise-induced hearing loss awareness to target audiences in the SAMI**

**Year: 2014**

**SIM 120501 Noise controls for mining equipment**

**Year: 2018**

**What is the impact of ARV Drugs and HIV on the auditory system**

**Year: 2020**

**Seed funded project: Acoustic Camera**

**Year 2021:**

**CoE 180701 Review the current SAMI noise exposure limit and conduct a study on vibration OEL in relation to the SAMI**

# NIHL Projects completed by MHSC- SIM 140802

| | |
|---|---|
| **Project Title:** | **What is the Impact of Anti-Retro Viral (ARV) Drugs and Human Immunodeficiency Virus (HIV) on the Auditory System?** |
| **Project No:** | **SIM 140802** |
| **Author/s:** | **Author/s: M.S. Mothemela, N.S. Ntuli, V. Hlayisi, and K. Sono *(Limpopo Department of Health)*** |
| **Report Date:** | **September 2018** |
| **Type of Research:** | **Applied Research** |

**Full report available on MHSC website:**
**https://mhsc.org.za/research-document/sim-140802-impact-of-hiv-and-arvs-on-auditory-system/**

# Aims and Objectives – SIM 140802

**Aim and objectives of the study**

- To determine the impact of HIV infection, ARV therapy on the auditory system of South African mineworkers.
- Determine the association between hearing loss and HIV status combined with ARV treatment;
- Determine risk factors that predispose miners to hearing loss i.e. age, noise exposure, ARV drug combination type, HIV stage, opportunistic infections and occupational environment characteristics.

# Research Outcome–SIM 140802

- No association between hearing loss and HIV infection/ ARV therapy.
- Prevalence of hearing loss amongst HIV-positive group was 47.5% vs prevalence of 51.4% in HIV positive individuals.
- HIV-negative mineworker have severe outcome from noise than HIV-positive individual.

# Research Recommendations–SIM 140802

1. **The SAMI need to continue to prioritise** strategies towards HIV / PTB awareness and prevention

3. **Guidelines** should be **adjusted** to incorporate high frequency audiometry at least three-monthly for the first year in those miners who are on ARV therapy.

2. **Prompt initiation** of treatment in those who are diagnosed with HIV-positive infection should be encouraged.

4. HIV-positive patients should be **educated** on symptoms of adverse auditory effects so that they report these as soon as possible.
Mine managements **could enforce six-monthly** high-frequency audiometry as part of medical surveillance for all HIV-positive mineworkers.

# NIHL Project completed by MHSC 2021- CoE 180701

| | |
|---|---|
| **PROJECT TITLE:** | **REVIEW THE CURRENT SAMI NOISE EXPOSURE LIMIT AND CONDUCT A STUDY ON VIBRATION OEL IN RELATION TO THE SAMI** |
| **Project no:** | **COE 180701** |
| **Research agency:** | **Enterprises at the University of Pretoria** |
| **Authors:** | **Prof Stephan Heyns, Kobus Dekker, Jason Ker-Fox, Dr Abrie Oberholster, Dr Nico Claassen, Dr Johan Schoeman, Sibonelo Dube, Jennifer van der Walt, Marguerite Pullen, Eugene Preis** |
| **Date:** | **February 2021** |

**Full report available on MHSC website:**
**https://mhsc.org.za/wp-content/uploads/2024/02/CoE-180701-COE-180701-REVIEW-THE-CURRENT-SAMI-NOISE-.pdf**

# Aims and Objectives –CoE 180701

**Aim and objectives of the study**

- Review occupational exposure limit (OEL) of noise in South Africa.
- Determine the impact of the current noise OELs on employees' hearing capability.
- Determine the impact of vibrations on employees, based on current mining operations.
- Review the relevance and applicability of the current noise and vibration OELs.
- Develop proposed noise and vibration OELs with associated guidance notes.

# Research outcome–CoE 180701

- Draft Guidance note on proposed potential OELs for Noise and Vibration in the SAMI
- Proposals on Noise Exposure Limits and Classification bands
- Proposals on vibration Exposure Limits
- Recommendations to update legislation on Noise

# Planned projects 2024/2025

## COE 210701 :Development of Engineering Noise Control Principles For Application on Mining Equipment

- Engineering noise control methodologies of equipment and a review of the outcomes of the IBMQI research consolidation report.
- Develop a list of potential engineering control measures for mining equipment listed in the IBMQI and these must be implementable in the SAMI.
- Findings in all regional tripartite forums (RTFs) hosted by the MHSC.

# Planned projects 2024/2025

## COE 190701 :Develop a Noise Prediction Tool/Model For Noise Emission For Equipment Used in Underground Mines, taking into Account the Outcomes of Project SIM 120501

- *Noise emission levels of equipment reported by original equipment manufacturers (OEMs) are assessed in a surface environment, impact in underground operations not considered*.
- Research will assist in refining the accuracy of the underground equipment noise prediction model developed in SIM 120501.
- Automation of the various algorithms required for the underground noise emission predictive tool/model (with an accuracy of less than 1dB variation).
- A step-by-step user guide/manual of the tool/model.

# Research Indaba 2024/2025 Topics

**What impact does the use of in-ear headphones connected to technology devices have on the development of Noise Induced Hearing Loss?**

- *There is no evidence-based research on the impact of prolonged utilization of headphones (including in-ear headphones/ air pods, etc.) and the development of Hearing Loss for mine employees.*

- Establish if there is an associated with increased/prolonged utilization of headphones and the development of Hearing Loss.

# Research Indaba 2024/2025 Topics

**What are the reasons behind the increased incidence of NIHL within the 45 years and above age group within the SAMI?**

*Analysis of the NIHL data for the SAMI revealed that the percentage of NIHL cases diagnosed within the 45 year and above age group has demonstrated an increasing trend and during 2022 accounted for above 80% of NIHL claims submitted.*

Expected outcome:

- Understanding of the reasons to the increasing NIHL trend within the 45 year and above age group, for improved NIHL Management.

# 2014 OHS Milestones

**Elimination of occupational diseases- By December 2024 95% of all exposure measurement results must be below the following limits for the respective respirable dust:**

- 0.05 mg/m3 for silica dust
- 1.5 mg/m3 for platinum dust
- 1.5 mg/m3 for coal dust
- No new cases should occur amongst previously unexposed individuals

**Elimination NIHL**

- By December 2024, noise emitted by equipment should not exceed 107 dB(A).
- By December 2016, no employee Standard Threshold Shift limit will exceed 25 dB from the baseline .

**Integrate and simplify compensation systems**

**Reduction and prevention of TB, HIV & AIDS**

- By December 2024, the TB incidence rate should be at or below the National TB incident rate.
- 100% of employees offered HIV Counseling and Testing (HCT) annually & all eligible employees linked to an Anti Retroviral Treatment (ART) programme.

# Proposals on achieving Noise Milestones and Preventing NIHL -from the 6th OH Dialogue

## On Equipment Emitting Noise:

- Develop an implementation plan to phase out old equipment emitting excessive noise
- Develop interventions to curb financial constraints related to Buying and Maintaining Quiet
- Adopt and internalise IBMQ  initiatives and other noise leading practices
- Silence equipment and link it with medical reports
- Proper change management and training of employees on noise controls and any changes made to equipment.
- Ensure that silenced equipment is properly maintained
- All equipment above 107 DB needs to be issued a stop notice.  This will encourage the sector to meet the milestones.

**On Noise Measurements and Reporting:**

- Ensure correct measuring and reporting
- Provide quarterly reports on employee exposure to equipment.
- Develop a National Database of industry pieces of equipment.

# Proposals on achieving Noise Milestones and Preventing NIHL -from the 6th OH Dialogue

**On the role of OEMs:**

- OEMs to be held accountable for their duties related to Section 21 of MHSA
- Tripartite approach to OEM engagement

**On research and development:**

- Design predictive models to analyse the impact of milestones on employee exposure

**On policy:**

- Continue using STS and review the existing STS guidance note

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

MHSC
Mine Health and Safety Council

# NOISE EXPOSURE IMPACT & DETECTION

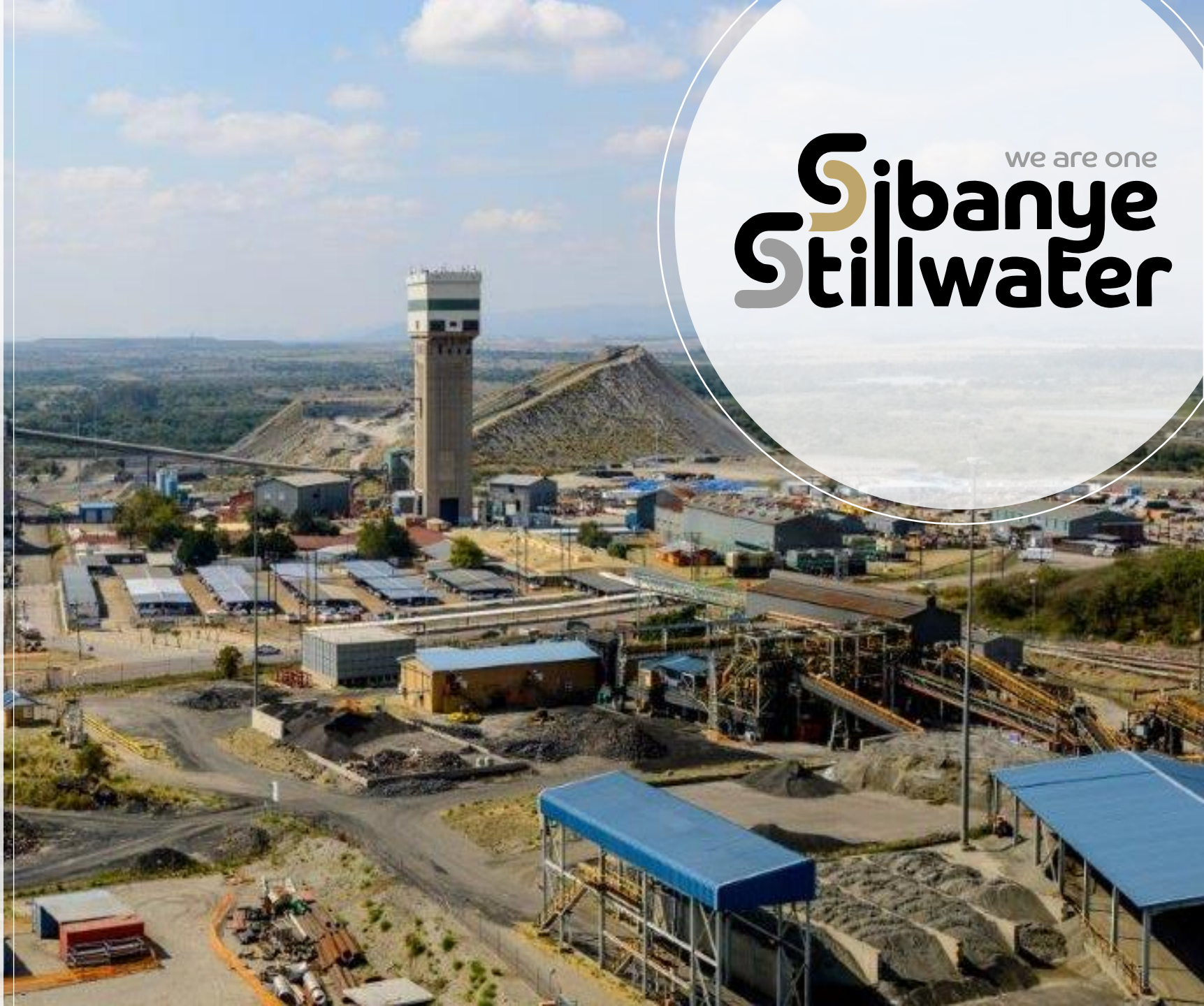


MINERALS COUNCIL
SOUTH AFRICA

Sibanye Stillwater

# Noise Risk Exposure Analysis A Mining Perspective

25 April 2024



# Agenda

- Risk exposure: Equipment noise exposure summary as per MOSH screening tool
- Current and proposed Controls
- Issue based risk assessment
- Equipment silencing
- Rock drill testing booths
- Buy quiet policy
- Real time monitoring
- Demarcation and signage
- Custom-made hearing protection
- Training and awareness

# The Mining Noise Exposure Challenge.

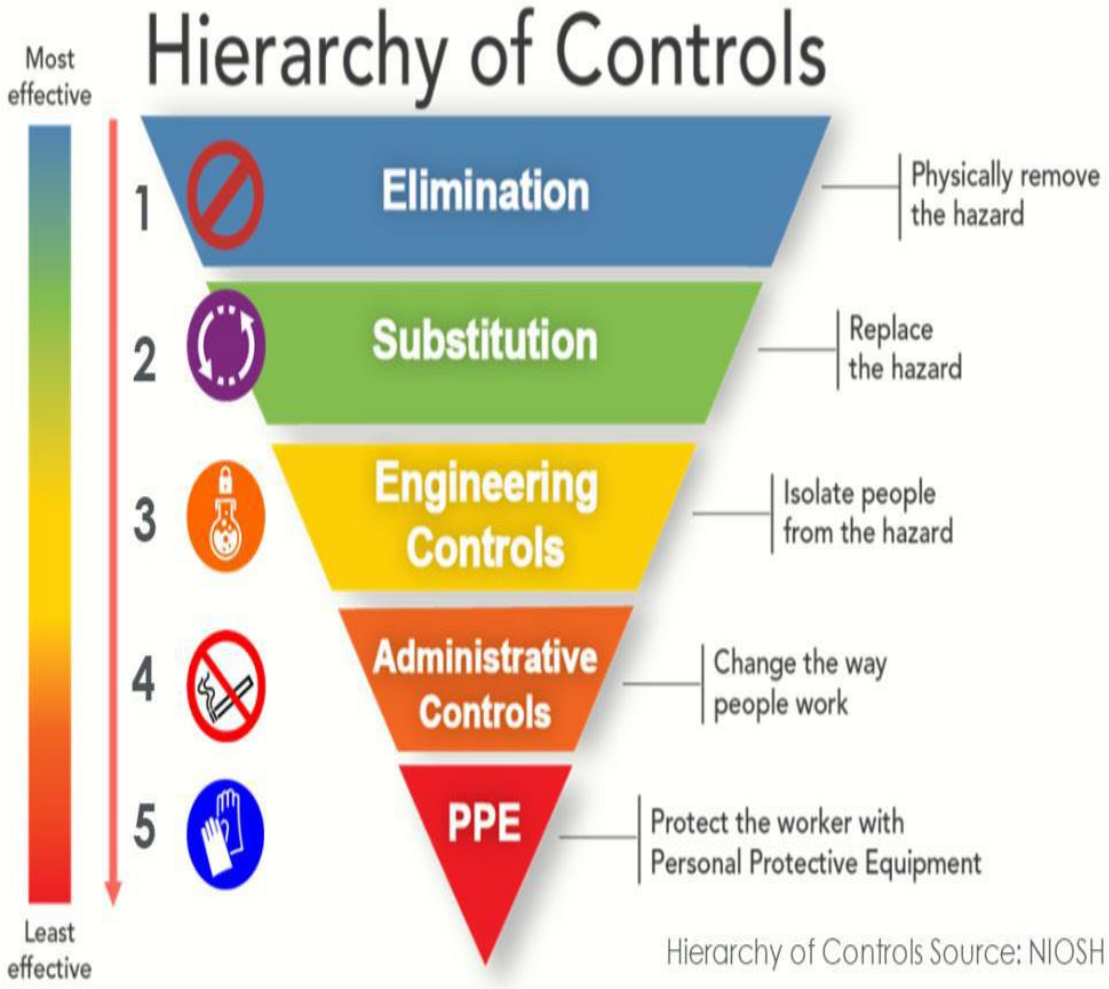
## SA Underground Operations – Top 5 Risk Shift – EXAMPLE


13 Initial Residual Risk Ranking in 2022

13 Final Residual Risk Ranking in 2024

| | |
|---|---|
| 1 | Rock mass management |
| 2 | Underground track-bound mobile equipment |
| 3 | Trackless mobile machinery |
| 4 | Scraping and rigging |
| 13 | Equipment Noise Levels |

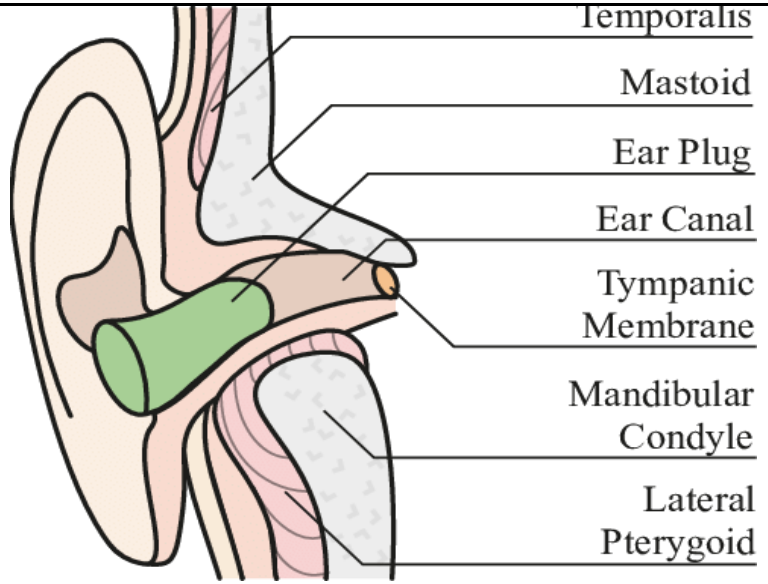
19




**Risk Assessment / Engineering out the Risk and PPE.**

## Prevention of Noise Induced Hearing Loss - Philosophy

The ambient noise levels where an employee works is a combination of all noise sources in the surrounding work environment, termed “process noise” in the MHSC milestones. The milestone relies on reducing the ambient noise and using hearing protection simultaneously in high noise areas, as defined in the mine’s Codes of Practice.




Graphic indicating the ear with an earplug (hearing protection), inserted in the ear canal.

The inner ear hair cells, cochlea and timpanic membrane will experience a noise level less than the Statutory exposure limit for noise of 85 dB(A) when the process noise is controlled to below 107dB(A) and the hearing protection is used correctly and for the full duration of the noise exposure, e.g. 107 – 25 = 82 dB (A).

# Risk exposure: Equipment noise exposure summary as per MOSH screening tool

# Equipment noise exposure summary (MOSH screening tool)

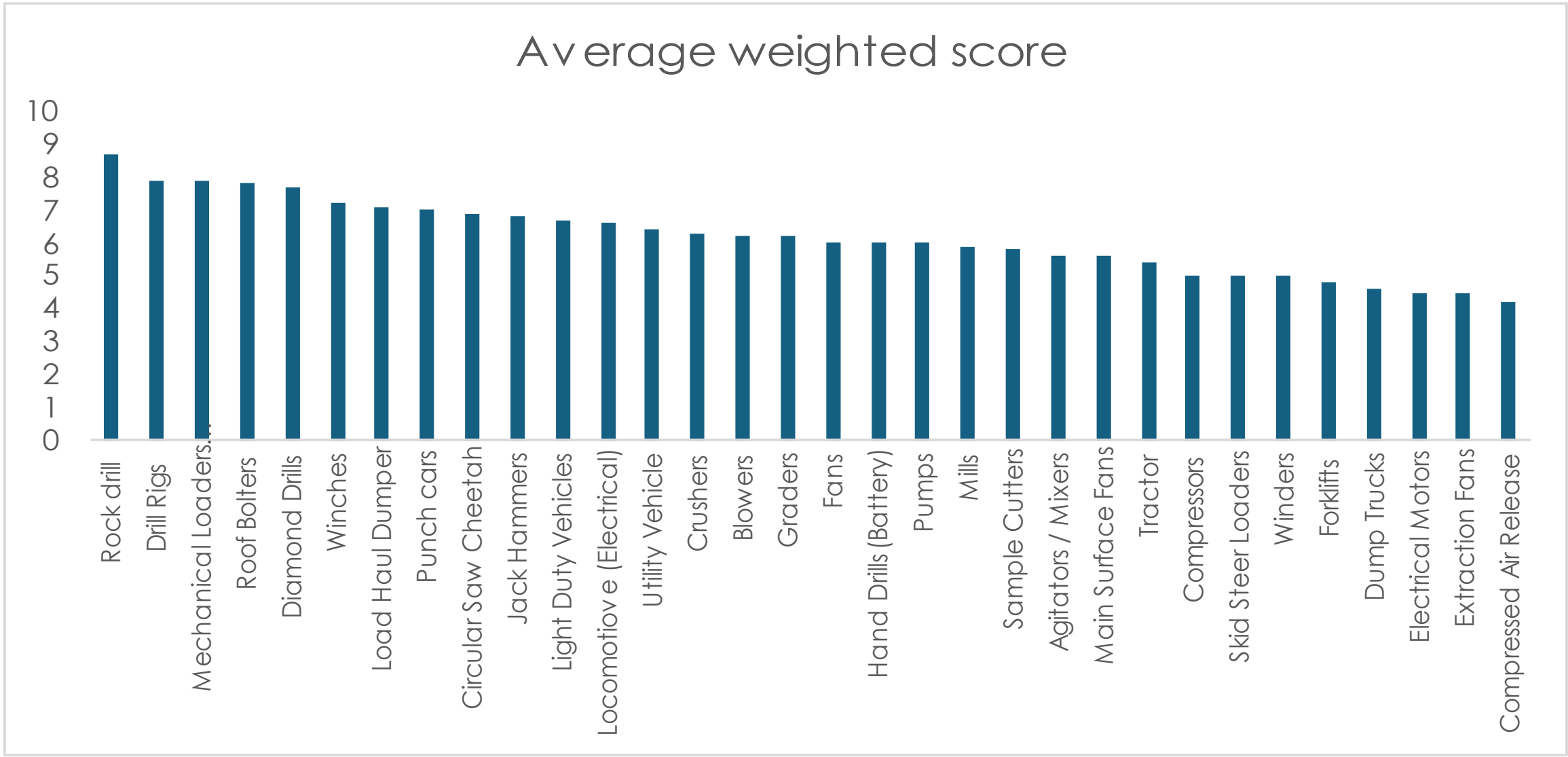
**Question key**

| | | | | |
|---|---|---|---|---|
| Q1 Noise measurement result in dBA | Q2 No. of Persons exposed | Q3 No. of machines | Q4 Time of exposure | Q5 Confined work space |
| Q6 Machine vibration | Q7 Maintenance | Q8 Equipment improvements & solutions | Q9 Hearing protection | Q10 Critical Frequency Range |


This Tool incorporates the key factors identified within the IBMQI, which influences the noise exposure risk of employees to noisy equipment, which includes the following:

- Noise Measurement Result in dBA
- Number of Persons Exposed
- Number of Machines within the Work Environment
- The Duration of Exposure
- The Acoustical Environment / Confined Workspace
- Machine Vibration
- Equipment Maintenance
- Equipment Improvements and Solutions
- Hearing Protection Devices
- Critical Noise Frequency Range

# Risk exposure: Equipment noise exposure summary as per MOSH screening tool



# Issue based risk assessments

# Issue based risk assessment

Issue based risk assessment includes critical controls, critical control owners and monitoring of controls.

## Issue based risk assessment - Noise exposure

| | |
|---|---|
| Reference: | SS-ZA-PGM's-SUP-MTS-OH RA Siphumelele 2022 |
| Date: | Sep-22 |
| Version: | 2 |

| HEG | DESIGNATION: | DESIGNATION CODE: | EMPLOYEES PER DESIGNATION: | HAZARD | SIGNIFICANT EXPOSURE TIME PER DAY | EXPOSURE PATTERN | DESIGNATION: | DESIGNATION CODE: | EMPLOYEES PER DESIGNATION: | HAZARD | SIGNIFICANT EXPOSURE TIME PER DAY | EXPOSURE PATTERN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HEG 13-01/01-Trackless 1E# | TM3 Cheesa | 20504 | 78 | Noise | >8 hrs/day | Intermittent | | | | | | |
| | TM3 Drill Rig Operator | 20401 | 36 | | | | | | | | | |
| | TM3 Roofbolt Operator UG | 20807 | 117 | | | | | | | | | |
| | TM3 Stoper | 20304 | 41 | | | | | | | | | |
| | TM3 Sweeper | 29903 | 10 | | | | | | | | | |
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| WORKPLACE OPERATION AND ACTIVITIES: | HEALTH EFFECTS: | HAZARDS: ACTUAL MEASURED VALUES, OCCUPATIONAL EXPOSURE LIMITS & MOST SIGNIFICANT NOISE SOURCES: | | | | DMRE CLASSIFICATION BAND: | RISK RATING: | |
|---|---|---|---|---|---|---|---|---|
| | | MEASURED VALUES ( PERSONAL NOISE): | | PERSONAL NOISE OEL | | | Inherent Risk Rating | Residual Risk Rating |
| These occupations visit the the TMM stoping working face for minimum of 8 hours per day for face preparation, washing, marking, drilling, inspections, supervision and maintenance, supporting and job observations. The majority of their time is spent underground. | Noise induced hearing loss due to exposure to prolonged or excessive noise levels exceeding 85 dBA over a 8 hour period | 91,6 | Log Average (LAeq-dB(A)) | 85,0 | Log Average ($LA_{eq}$ - dB(A)) | B | 9 | 6 |

| MOST SIGNIFICANT NOISE SOURCES ABOVE 105dB(A)(INTERNAL LIMIT) BASED ON PREVIOUS YEAR'S DATA | | | |
|---|---|---|---|
| MEASURED VALUES dB(A) | NOISE SOURCE | MEASURED VALUES dB(A) | NOISE SOURCE |
| | No noise sources above 105dB(A)- refer to equipment noise register. | | |
| | | | |
| | | | |

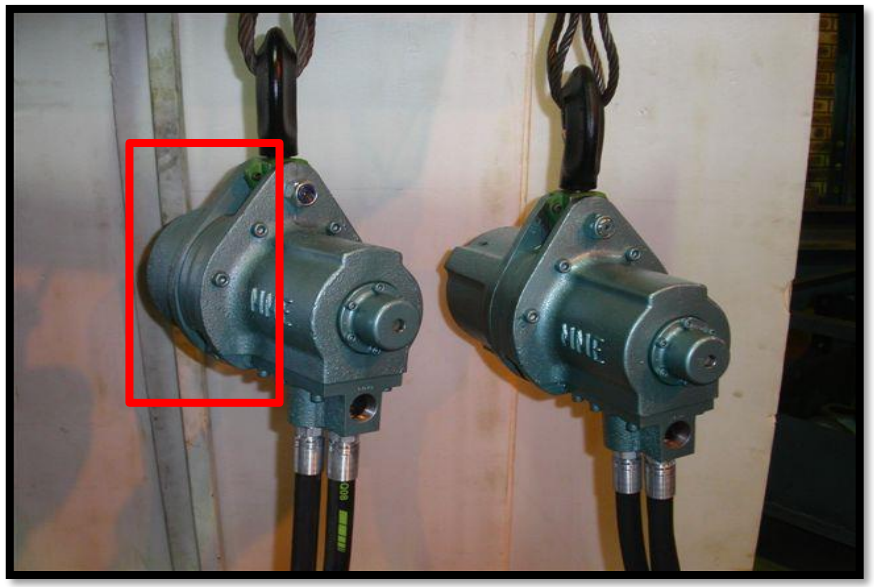
# Issue based risk assessment

| SOURCES OF EXPOSURE | CONTROL | CONTROL MEASURE | RESPONSIBLE CONTROL OWNER | DESIGN CRITERIA | MONITORING OF CONTROL EFFICIENCY (SYSTEM) | MONITORING FREQUENCY | COMPLIANCE TO DESIGN CRITERIA EFFICIENCY (%) | ADDITIONAL MITIGATION OF RISK |
|---|---|---|---|---|---|---|---|---|
| Mobile Machinery Ventilation Fans Pumps | Elimination | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | Substitution | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | Engineering | Maintenance of Trackless mobile machinery | 2.13.1 | Planned Maintenance/ service schedule in place | All maintenance are scheduled through SAP system as per TMM MCOP and missed services are managed in accordance with our missed service procedure- **SS-ZA-PGMs-MCOP-ENG-ALL-0088** | Daily/weekly/ monthly | 100% | N/A |
| | | Installation of sound attenuated fans | 2.13.1 | Fan installation done as per mine technical services platinum operations procedure trackless ventilation **SS-ZA-PGM's-PRO-MTS-VEN-1008**. | Fan installation layout to be issued by Ventilation personnel- **SS-ZA-PGM's-PRO-MTS-VEN-1008** | As requested | 100% | N/A |
| | | Maintenance of pumps | 2.13.1 | Planned Maintenance/ service schedule in place | All maintenance are scheduled through SAP system as per Pump maintenance procedure and missed services are managed in accordance with our missed service procedure- **SS-ZA-PGMs-MCOP-ENG-ALL-0088** | Daily/weekly/ monthly | 100% | N/A |
| | | • Hearing conservation procedures<br>• MANDATORY CODE OF PRACTICE<br>for an Occupational Health Programme for Noise | 12,1 | Compliance with the DMRE guideline - **16/3/2/4-B7** | Internal audits are used to verify compliance with this document and action any non-compliance accordingly. | Audits Annual | 100% | N/A |
| | | | 12.1 | Periodic audiometry - as per MANDATORY CODE OF PRACTICE<br>for an Occupational Health Programme for Noise (SS-ZA-PGM's-MCOP-HEA-OCH-0011) and MANDATORY CODE OF | Time & Attendance and biometric access interlinked to block employee according to the Human Resources OREP (Occupational Risk Exposure Profile) - exception report available | Yearly | 100% | N/A |

# Equipment silencing

# Equipment silencing

The various types of top noise producing equipment were identified and silenced to reduce the noise levels to below 105 dB(A). Below are examples of the most significant noise producing equipment which was silenced.



Air hoist Silencers

Pneumatic water pumps are fitted with silencers in order to reduce noise exposure. Some operations are replacing the pneumatic "Quimby" water pumps with two stage water pumps which, due to their low noise levels, do not require any silencing.

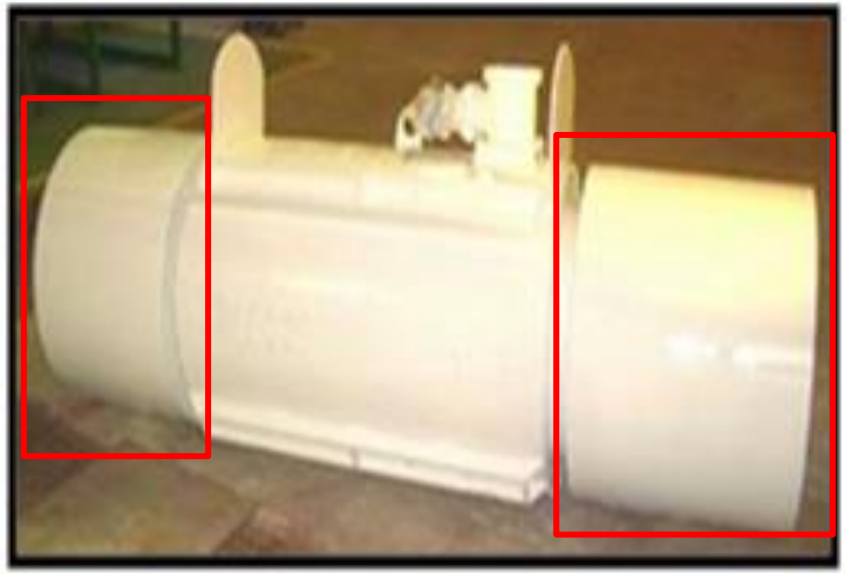
# Equipment silencing

Mechanical loader silencers

Diamond drill silencers

MechCal energy efficient fan

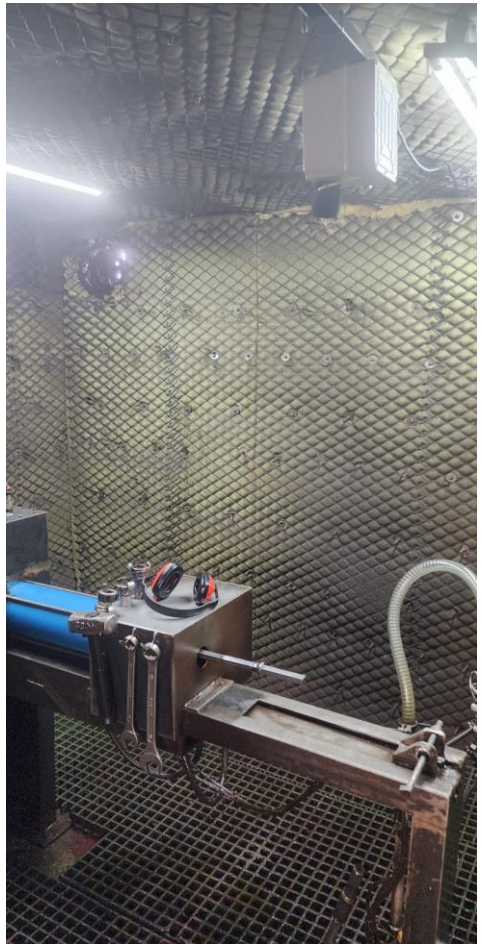
Rock Drill muffler



Silenced Fan (all standard axial flow fans equipped with two silencers)

# Rock drill testing booths

Noise included in the pass/ fail criteria (105 dB(A)).



Rockdrill test bench

Noise sensor

Rockdrill test bench

# Buy quiet policy

# Buy quiet policy

**Aim:**
Incorporating noise as a parameter when procuring and maintaining any equipment used at the SA operations.

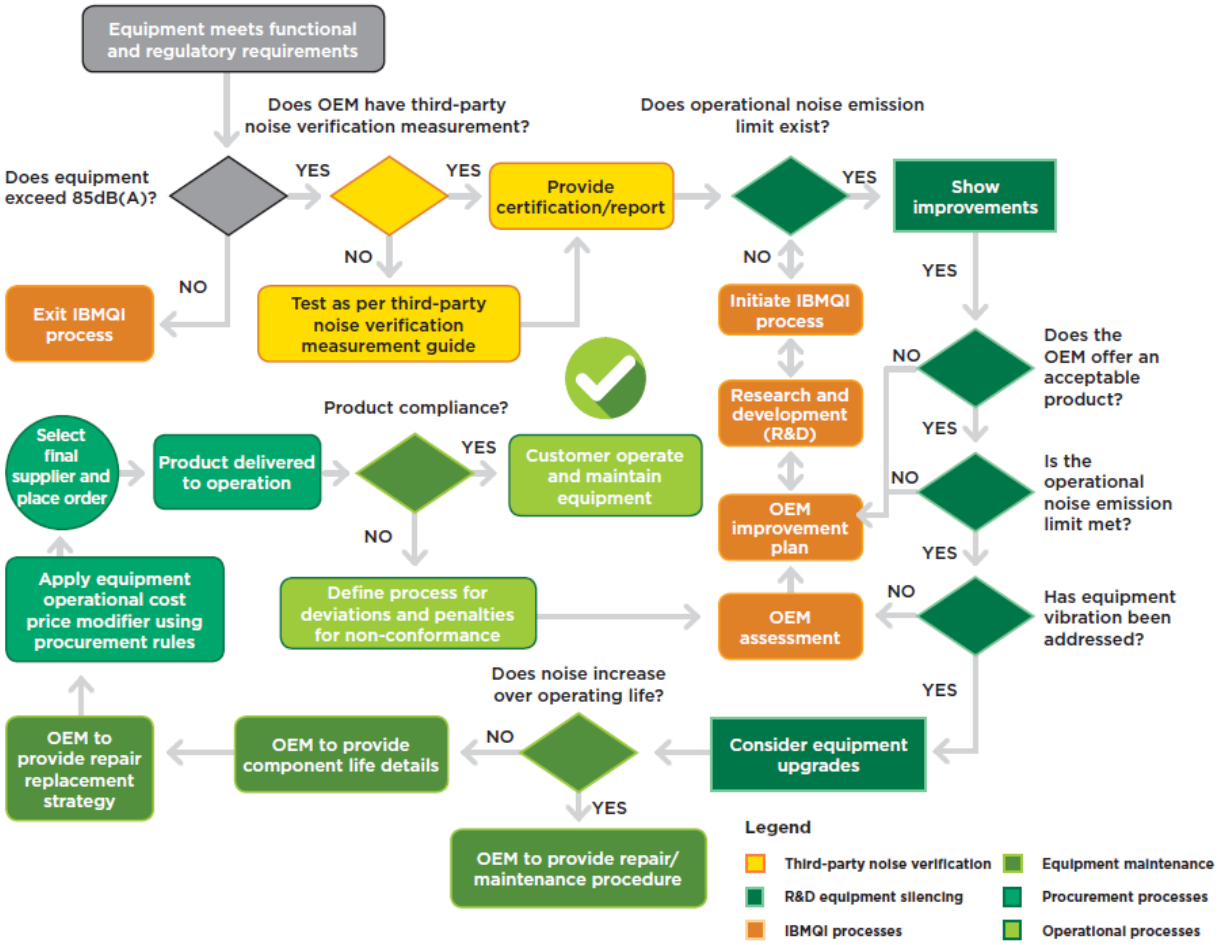
**Key policy principals:**

1. **New equipment:**
   - Noise levels included as a determining factor in the procurement calculation when selecting the recommended supplier.
   - The responsible end user include the correct specifications of the required equipment and sign off the scope of work with the relevant requirements for procurement purposes
   - Where the noise level emitted by the equipment exceeds 85dB(A), a noise certificate should be supplied by a certified service provider for every type of equipment (make and model).
   - The following is applied for any new equipment exceeding the internal Sibanye Stillwater limit 105 dB (A).
     - Alternative OEM or equipment to be sourced;
     - If all parties agree that no alternative supplier or equipment can be sourced, the OEM should be engaged, and a noise reduction process initiated.

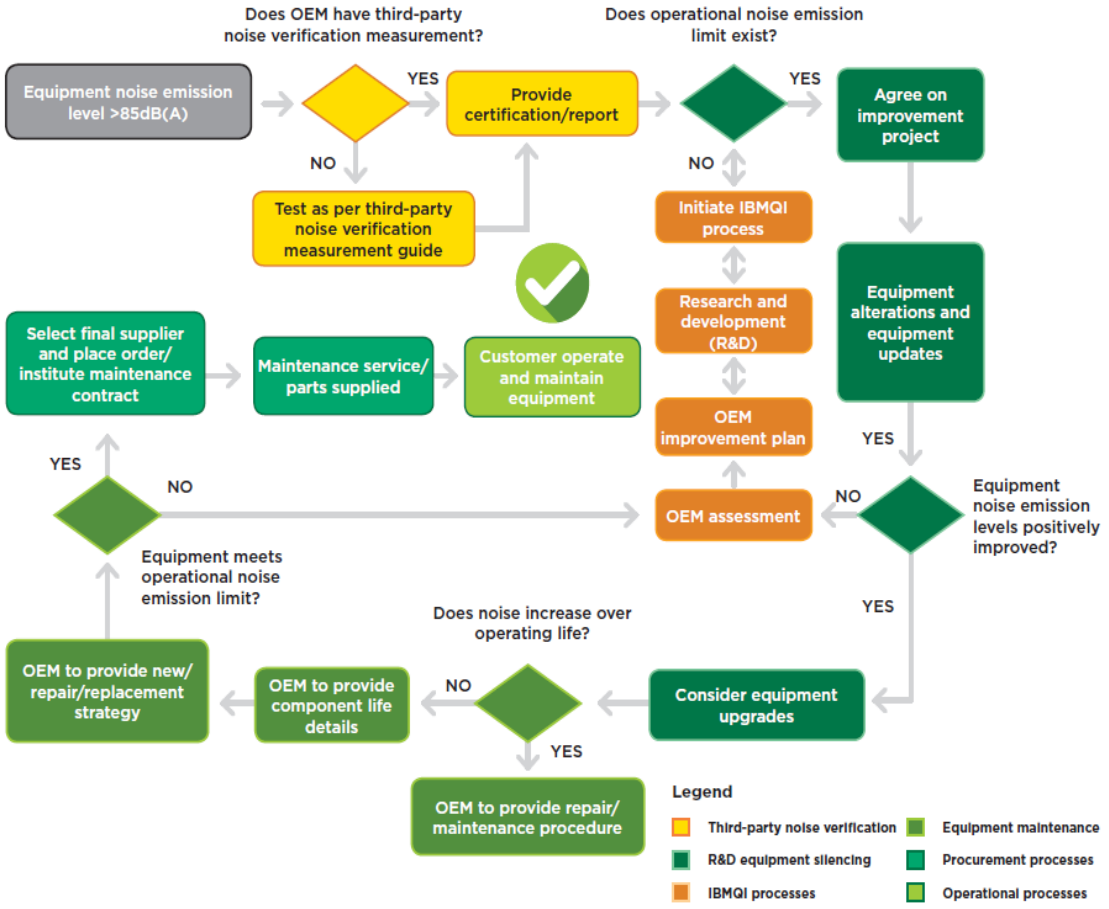
2. **Current equipment:**
   - Current equipment – noise certificates and specifications
   - As part of the buy quiet policy any existing equipment exceeding 105 dB (A) will be identified and risk assessed. The risk assessment process entails the quantification of noise and employee exposure levels to establish whether a hazard exists and, if so, to assess and prioritize sources of employee exposure and risk. Based on the risk assessment outcome a noise reduction process will initiated

# Buy quiet policy – MOSH process

## CONSIDERING NOISE DURING THE PROCUREMENT PROCESS




## CONSIDERING NOISE DURING THE REPAIR/MAINTENANCE OF EXISTING EQUIPMENT PROCESS



# Real time monitoring

# Real time monitoring

Real-time noise monitor installed at the Concentrator crushers.  The monitor is linked to Scada.
If equipment noise emitted is above 105 dBA, the Scada alarm sounds and the control room operator creates a SAP job card will be triggered for an engineering inspection and maintenance investigation to be completed and root cause determined and rectified.

# Demarcation

we are one
Sibanye Stillwater

# Noise demarcation

DIFFERENT NOISE SIGNAGE

| Underground working places or workshops noise zone demarcation | Surface or underground noise zone demarcation | Surface or underground workshops noise zone demarcation | Noise source identification |
|---|---|---|---|
|  |  |  |  |

# Custom made hearing protection

we are one
Sibanye Stillwater

# Custom made hearing protection

**Issuing:**

- Occupations with a logarithmic mean average 8-hour exposure level equal to or exceeding 90 dB(A).
- Employees with a shift in hearing as per recommendation by the occupational health center.

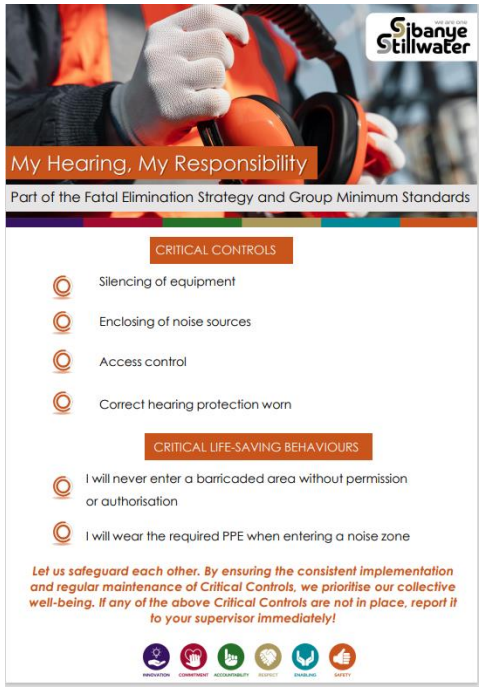
# Training and awareness

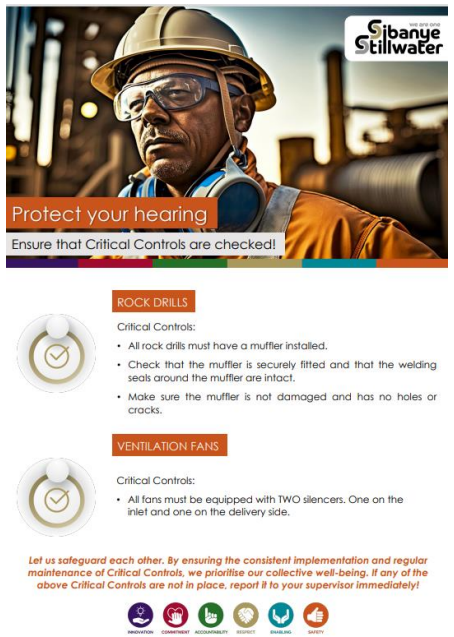
# Training and awareness

**Sibanye wide noise awareness campaign including:**

- Podcast videos
- Posters
- SMS's
- Desktop background
- E mail signatures
- Animation video
- Industrial theater
- Social Media:
- Facebook
- Twitter/X
- LinkedIn



# Questions

# NIHL IMPACT: A SHORT VIDEO

https://www.youtube.com/watch?v=65aeVI5nwRo

Minerals Council South Africa – MOSH Noise Day of Learning

# Competency-based training for prevention of Noise Induced Hearing Loss

*25 April 2024*

*Riaan Bergh – rbergh@csir.co.za*

science & innovation
Department:
Science and Innovation
REPUBLIC OF SOUTH AFRICA

CSIR
Touching lives through innovation

# The problem with “old school” training approaches

**Shortcomings:**

1. Training presented in a **classroom lecture** format has been shown to achieve low learner engagement and subsequent **poor retention and recall** of the learning content.
2. Recall and application of learning material training in real-life scenarios are not always tested.

**Example – Airline emergency procedure**

(Courtesy of M. Biffi)





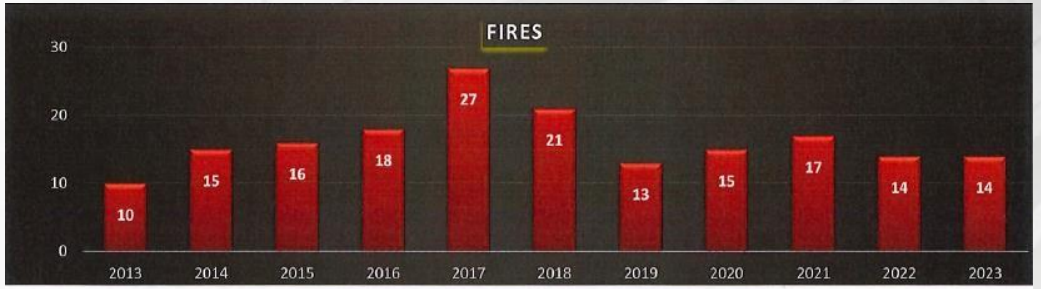
CSIR
Touching lives through innovation

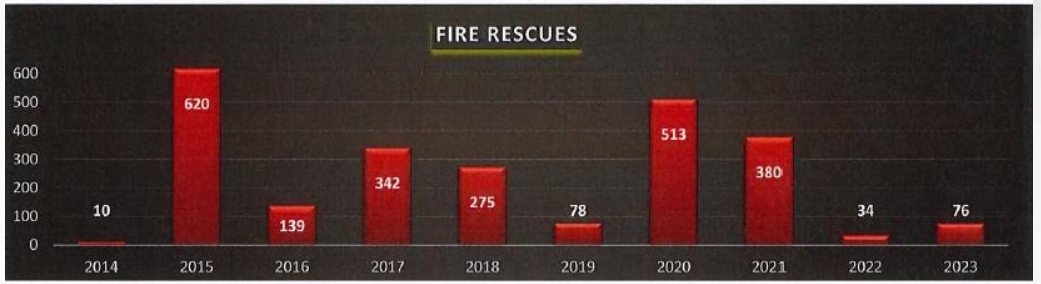
# Example scenario: *Training of mine workers for emergency response*

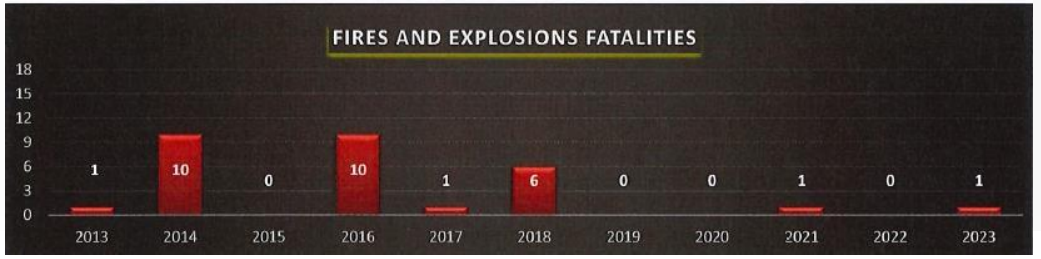
Fire and explosions in underground mines can result in catastrophic damage and loss of life

Prevention is the best mitigation but fires, gas ignitions and explosions still occur

Rapid, appropriate worker response saves lives




Source: https://minesrescue.co.za/

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# Saving lives: *From awareness to competency*

## Training framework

1. **Immersive, experiential training** interventions achieve **high learner engagement** and **improved retention and recall**
   - Engage five senses
   - Interactive eLearning training modules
   - Learn what to expect
   - Practice the motor skills
   - Demonstrate competency
2. **Virtual Reality** simulated emergency scenario training for **induced psychological stress**
   - Recall appropriate response procedure
   - Practice the required response actions
   - Demonstrate competency



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Touching lives through innovation

# Changing people's minds: *From apathy to action*

## Training framework


**Immersive, experiential training** interventions achieve **high learner engagement** and **improved retention and recall**

- Engage five senses (or as many as possible)
- Interactive training modules – knowledge transfer
- Engage the learner – VR tour of the inner ear
- Learn what to expect – what will it be like to suffer hearing loss? Immersive, virtual reality experience of healthy vs compromised hearing

# Changing people's minds: *From apathy to action*

## Training framework

At this point, the learner is primed to really **absorb and internalize** the training that will help to **protect their hearing**.

- Learn to identify / recognize noise hazards – VR simulation of the workplace: interactive identification and application of noise hazard mitigations

- Interactive assessments to demonstrate competency

# In summary: *Effective training preserves hearing*

## Technology enabled training approach

1. Create **awareness**
2. Establish **urgency**: why should I care?
3. Transfer knowledge and skill: **high engagement**
   - Identify noise hazards
   - Mitigate
   - Protect hearing
4. Demonstrate competency through **application of knowledge and skills** acquired



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# Thank you


# OTOTOXICITY

Nolwazi Letsoalo
B.Communication Pathology
Ms. Audiology

# AGENDA


- Background
- Types of ototoxicity
- Impact of ototoxic agents/chemicals
- Prevention and monitoring of ototoxicity
- Intervention of Ototoxicity & Hearing loss
- Impact on the current problem NIHL

# OTOTOXICITY

- Refers to damage to the hearing and / or balance organs that occurs after exposure to medications or chemicals that affect the inner ear.
- The pharmacological adverse reaction affecting the **inner ear** or **auditory nerve,** characterized by **cochlear or vestibular** dysfunction


# TYPES OF OTOTOXICANTS

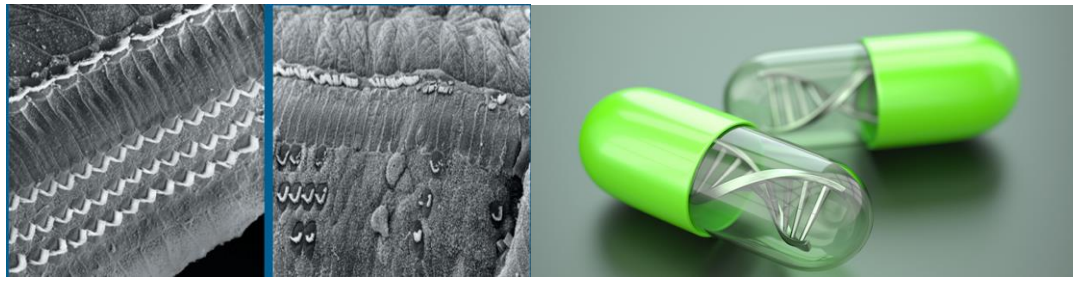
- MEDICATION /PHARMACEUTICALS
- CHEMICALS/ AGENTS
- NOISE / ACOUSTIC TRUAMA

# EXPOSURE TO OTOTOXICANTS

**Workers can be exposed to these chemicals in different ways:**

- Breathing them in.
- Consuming food, DRUGS or drinks that have been contaminated.
- Absorbing chemicals through the skin by touching them.

Once exposed, these chemicals can travel through the blood stream and injure the inner ear and damage the nerves that transmit information to the brain.



1. **Examples of chemicals that damage hearing**

- Solvents (e.g., toluene, styrene, xylene, ethylbenzene, and trichloroethylene)
- Metals and compounds (e.g., mercury compounds, lead, and organic tin compounds)
- Asphyxiants (e.g., carbon monoxide, hydrogen cyanide and its salts, and tobacco smoke)
- Nitriles (e.g., 3-butenenitrile, cis-2-pentenenitrile, and acrylonitrile)
- Pharmaceuticals (e.g., certain antineoplastic drugs
- Pesticides

# Ototoxic chemicals in the workplace

## Common Industries & Manufacturing Applications

- Manufacturing of metal, fibreglass, leather, and petroleum products
- Machinery
- Leather and allied product
- Textile and apparel
- Paper / Printing
- Chemicals (including paints)
- Plastics
- Mining
- Utilities
- Construction
- Agriculture
- Furniture and related products
- Transportation equipment (e.g., ship and boat building)
- Electrical equipment, appliances, and components (e.g., batteries)
- Solar cell
- Aircraft maintenance
- Assay laboratories
- Firefighting
- Pesticide spraying
- Fueling aircraft and motor vehicles

*Source: Canadian Centre for Occupational Health and Safety (CCOHS) Website*

# IMPACT TO THE AUDITORY SYSTEM MAY CAUSE:

Tinnitus,

Hearing loss,

Hyperacusis,

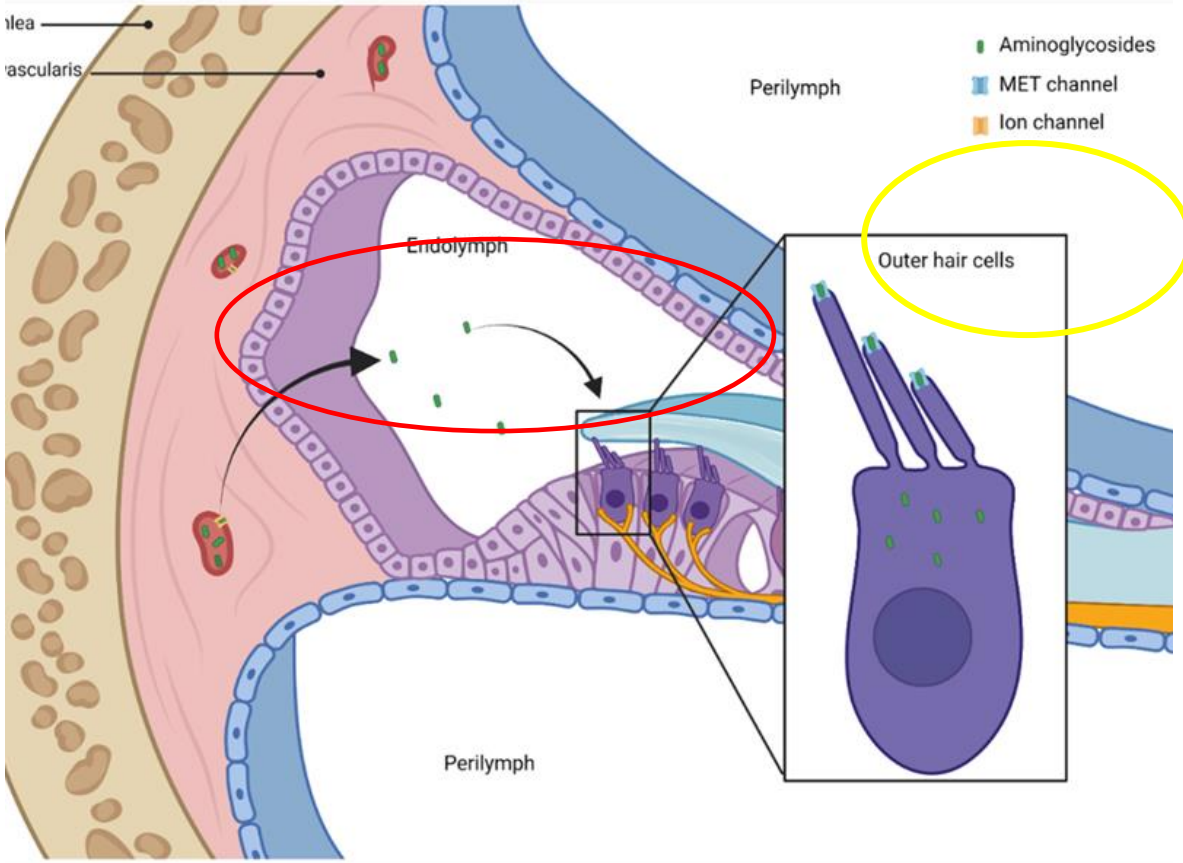
Aural fullness,

Dizziness,

and Vertigo

Perceiving stationary objects around you as moving (oscillopsia).

Exposure to chemicals can make ears even more sensitive to the harmful effects of noise.




Noise exposure at work is responsible for an estimated 16% of disabling hearing loss in adults worldwide **(Nelson , 2005).**

# AUDITORY SIGNS AND SYMPTOMS OF OTOTOXICITY

Difficulty following conversations.

You have difficulty following group conversations (especially when background noise is present)

Phone conversations are unclear. ...

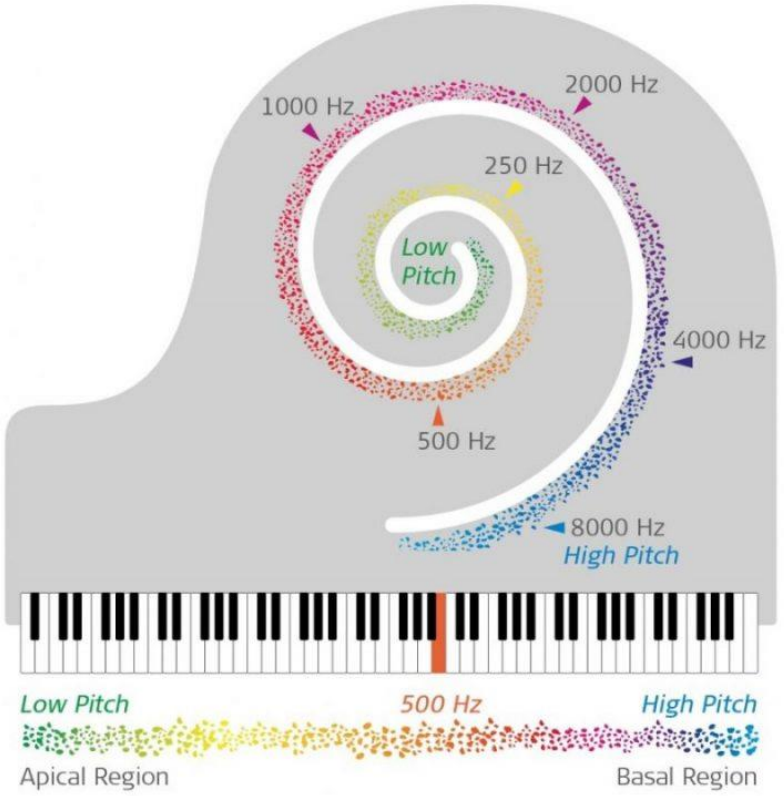
People seem to be mumbling. ...

Difficulty locating sounds. ...

Signs of tinnitus. ...

Turning up the TV too loud.

# PROCESS OF OTOTOXICITY




After aminoglycoside exposure, the main cochlear pathology underlying drug-induced hearing loss is sensory hair cell loss.

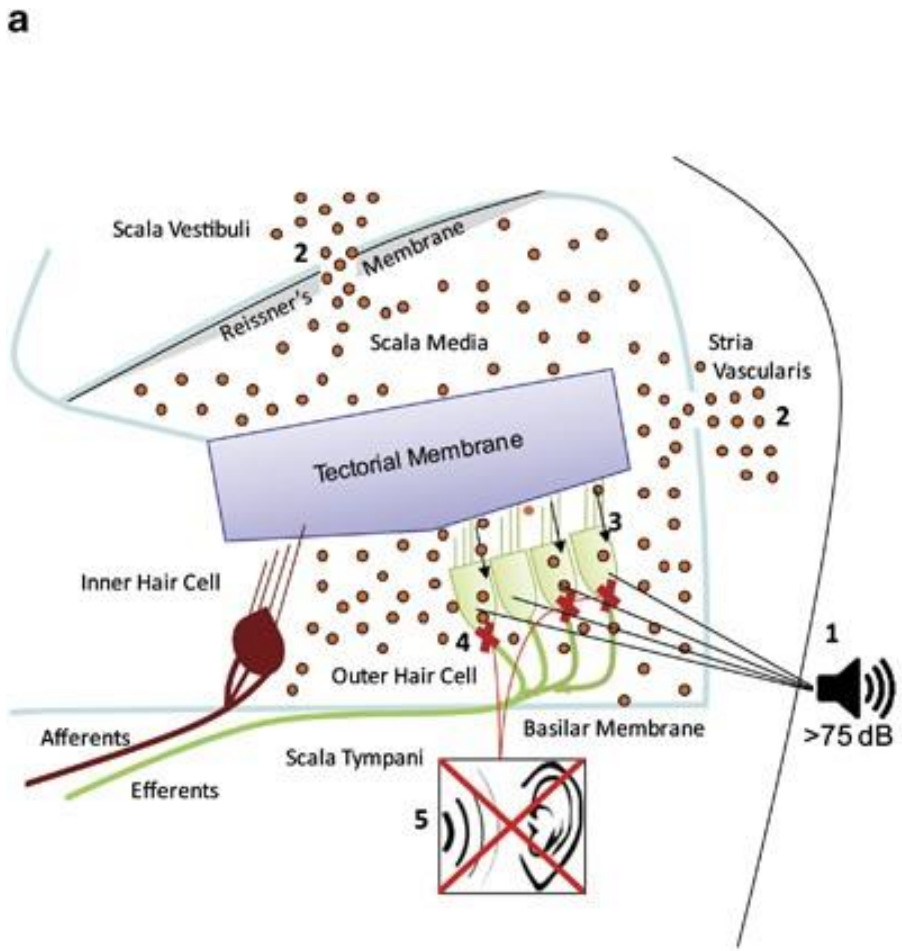
Sensory hair cells are mechanoreceptors required for hearing and balance functions, they are tonotopically arranged such that high frequency sounds stimulate hair cells in the basal region and low frequency in the apical region.

Early in the disease process when hearing loss typically begins in the high frequency, hair cell loss is found in the basal region (Fausti et al., 1992).

However, hearing loss can progress into the mid- and low frequency ranges with corresponding hair cell loss in those regions in the cochlea.

# OTOTOXICITY

Several mitochondrial DNA mutations are known to have been associated with aminoglycoside-induced hearing loss.




b

1. Loud noise increases the amount of hair cells stimulated

2. Aminoglycosides (orange circle) enter the Scala Media via the Reissner's Membrane and the Stria Vascularis [25,26]

3. Loud noise increases the open probability of the MET channels and the current through these channels (black arrow) [38]

4. Loud noise exposure increases the hair cell uptake of Aminoglycosides—which can block the rapid depolarizing transduction current (red cross) [48,49]

5. By entering and damaging the hair cells, aminoglycosides can cause hair cell death resulting in hearing loss [51]

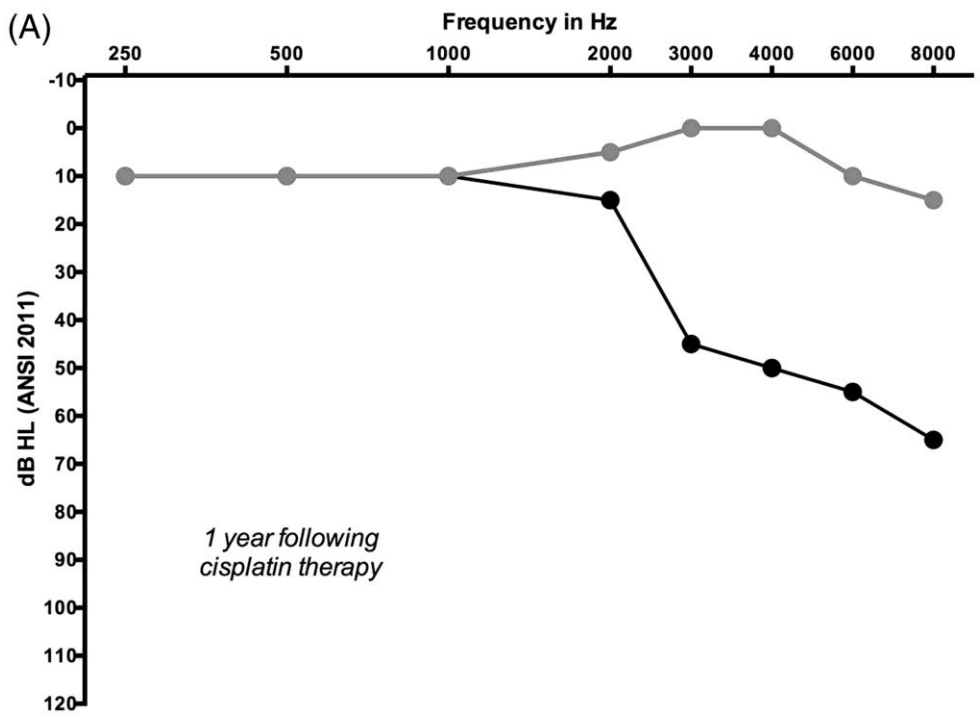
# PREVALENCE OF OTOTOXICITY WITH AMINOGLYCOSIDES

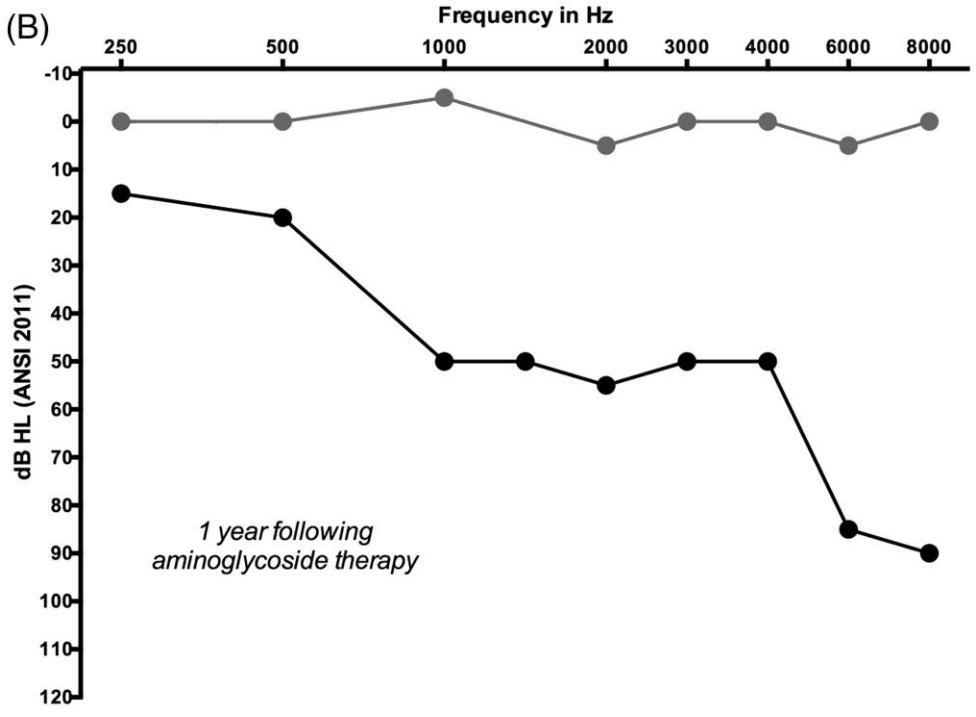
Estimates of the prevalence of ototoxicity in patients vary widely across the literature, ranging between 2%–25% for hearing deficits and 1%–10% for vestibular dysfunction (Ariano et al., 2008; Huth et al., 2015).

For patients who require multiple courses of intravenous aminoglycoside antibiotics (e.g., treatment of tuberculosis and cystic fibrosis patients) estimates are higher and may exceed 50% (Duggal and Sarkar, 2007; Waters et al., 2015)

# IMPACT OF OTOTOXICITY TO THE AUDITORY SYSTEM

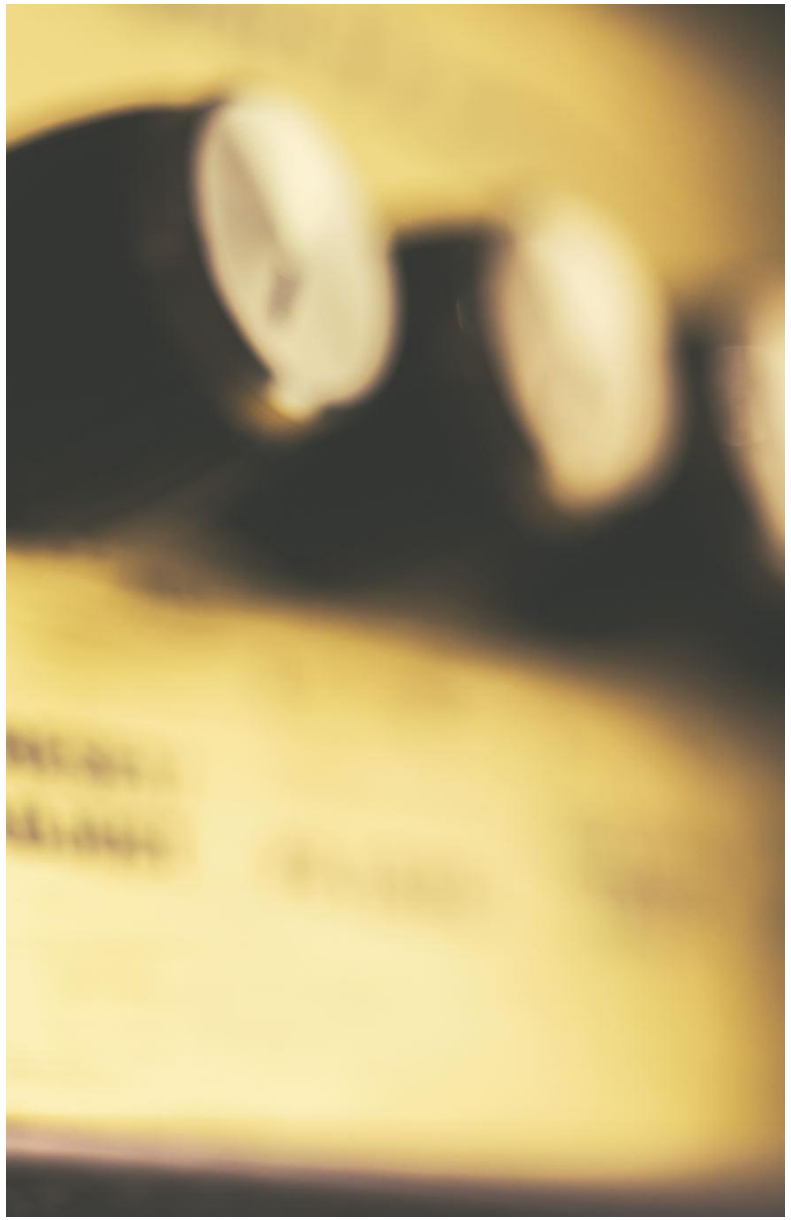
- 10–15 dB decline in hearing at 6 and 8 kHz bilaterally
- 20 dB decline in hearing at any single test frequency



# AMINOGLYCOSIDES

- Aminoglycoside ototoxicity represents one of the most common, preventable forms of drug-related hearing loss worldwide.
- The BLB is strongly influenced by physiological factors such as active and passive membrane functions, ion channels, blood flow, inflammation, free radicals and possibly noise exposure (Abbott and Blakley, 2007; Shi, 2016).
- This structure can affect the pharmacokinetics of aminoglycosides in the inner ear, supported by evidence that endotoxin-mediated inflammation enhances aminoglycoside trafficking across the BLB and potentiates cochlear uptake of aminoglycosides and permanent hearing loss in mice (Koo et al., 2015)
- BLB- Blood Labyrinth Barrier



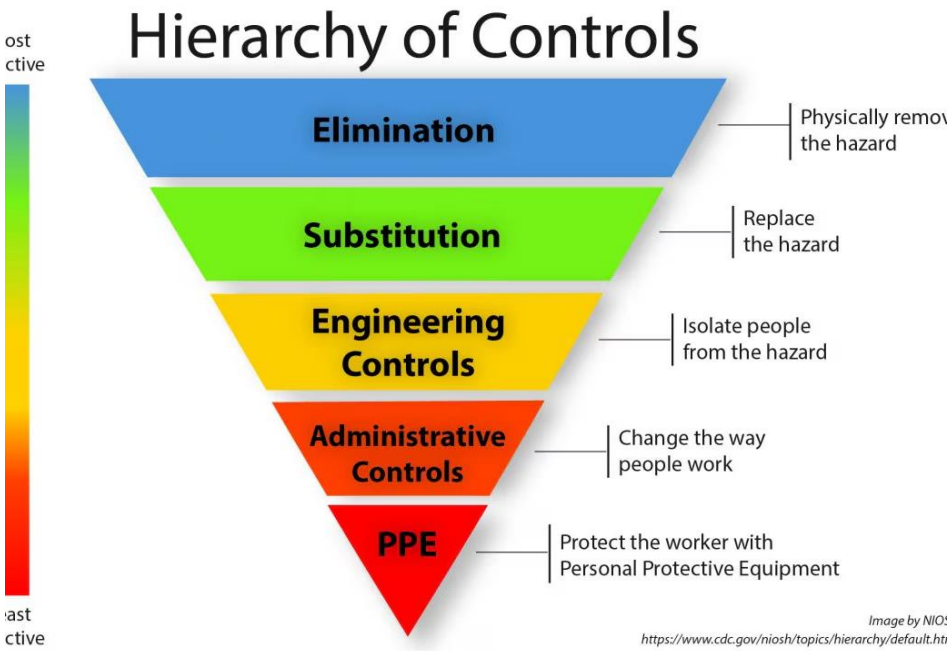
# A LONGITUDINAL COMMUNITY-BASED OTOTOXICITY MONITORING PROGRAMME AND TREATMENT EFFECTS FOR DRUG-RESISTANT TUBERCULOSIS TREATMENT, WESTERN CAPE

LUCIA J STEVENSON[1], LEIGH BIAGIO-DE JAGER, MARIEN A GRAHAM, DE WET SWANEPOEL

- **Objectives:** A longitudinal study was conducted to describe the service delivery characteristics of a community-based OMP for DRTB patients facilitated by CHWs as well as observed ototoxic hearing loss in this population.
- Deterioration in hearing thresholds was bilateral and most pronounced at high frequencies (4 kHz - 8 kHz).
- The presence of pre-existing hearing loss, human immunodeficiency virus co-infection and a history of noise exposure were significant predictors of ototoxicity in patients.


THE POWER OF PREVENTION DEPENDS ON:

- Timing
- Identification of impact/ risk
- Prevention programs




Prevention of aminoglycoside-induced ototoxicity requires effective therapeutic drug monitoring, as well as hearing evaluation before, during and after drug treatment.

Ototoxicity isn't always preventable, but identifying symptoms early allows the healthcare provider to help manage symptoms.

# PREVENTION

# PREVENTION OF CHEMICAL INDUCED HEARING LOSS

## MEASURES TO TAKE/ PPE:

- Wear gloves resistant to the chemical(s) of concern,
- Long sleeves,
- Eye protection, and other protective equipment as needed.
- Wear a properly selected respirator, as appropriate.

**Manage the administration of certain drugs**

1. Chemotherapy drugs
2. Loop Diuretics
3. Aminoglycosides antibiotics
4. Quinine (malaria)
5. Salicylate

# HEARING HEALTH & SAFETY MATTERS

1. **Like with noise, hearing loss caused by ototoxic chemicals varies based on**
- How often you are exposed (exposure frequency).
- How much you are exposed (chemical strength/potency).
- How long you are exposed (duration).

- Exposure to other workplace hazards (such as noise) and other individual factors (such as age and smoking status) also influence the effect of chemicals that damage hearing.
- Increased chances of Noise Induced Hearing Loss

# PREVENTION & MONITORING

- It is preventable
- Often reversable
- Treatment can be challenging
- Prevention is the most advocated approach
- Avoidance where possible
- Awareness of potential risk for clinicians and employees

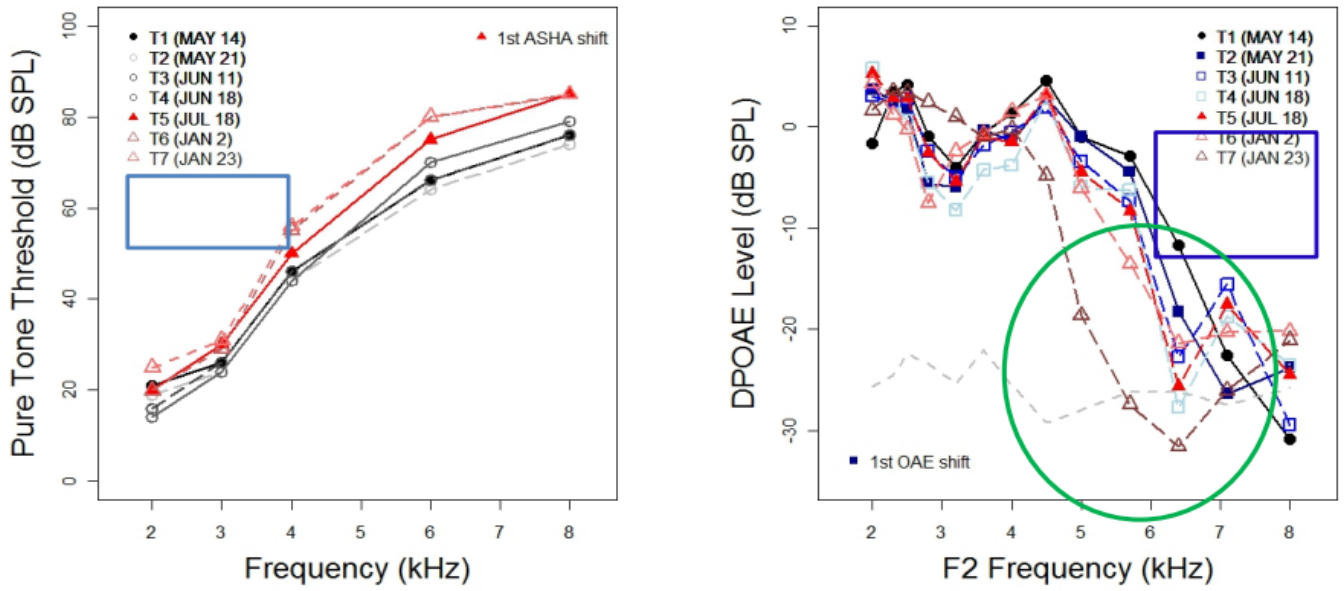
# MONITORING AUDITORY TEST BATTERY

**Diagnostic tests (or tests to check your hearing before you start any ototoxic medicine) may include:**

- ✓ Audiograms
- ✓ **Extended frequency testing -16kHz**
- ✓ Tympanometry
- ✓ Oto Acoustic emissions
- ✓ Speech audiometry
- ✓ Auditory Brain stem Response (ABR)
- ✓ Vestibular testing
- ✓ **Electrophysiological testing**

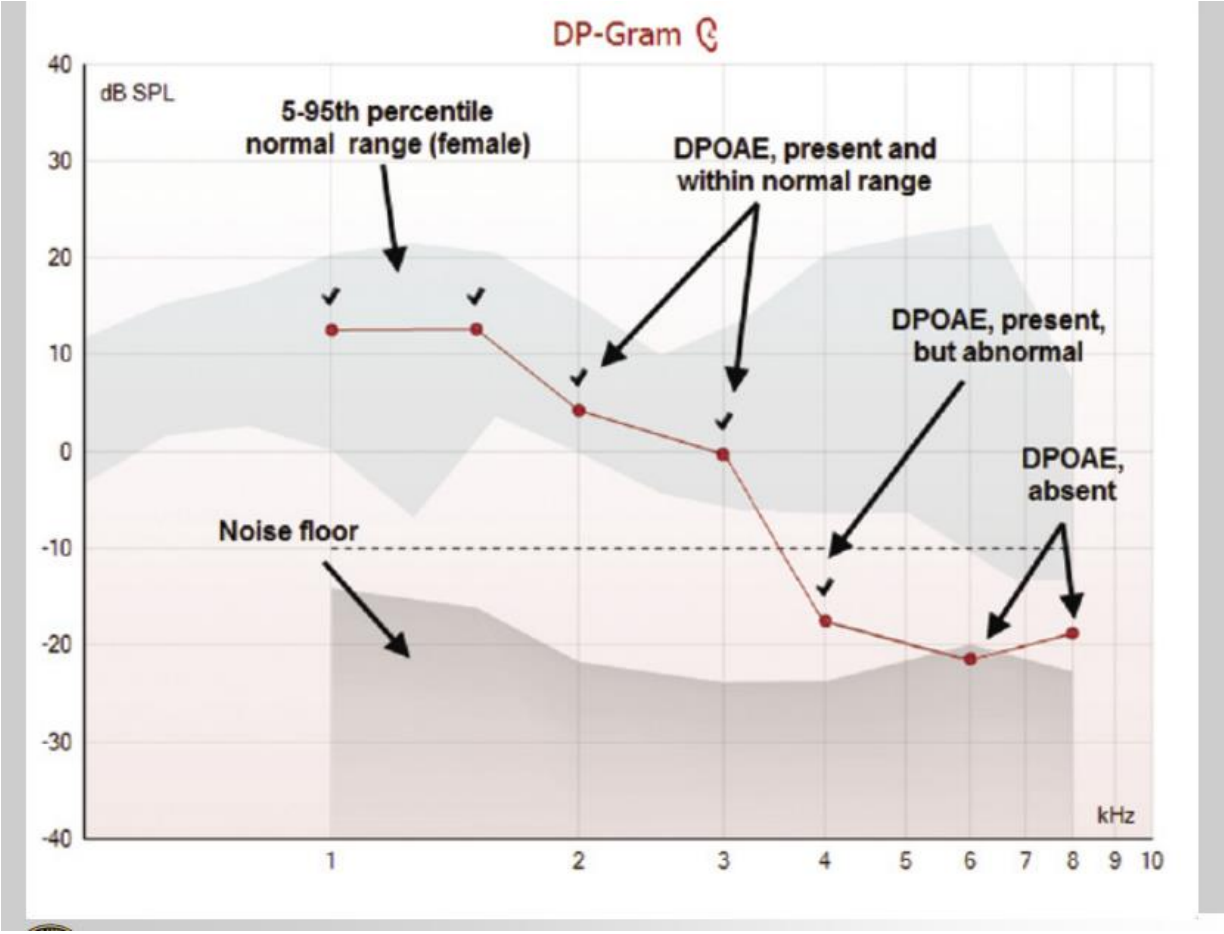
## Case Study: Sensitive/Early Index

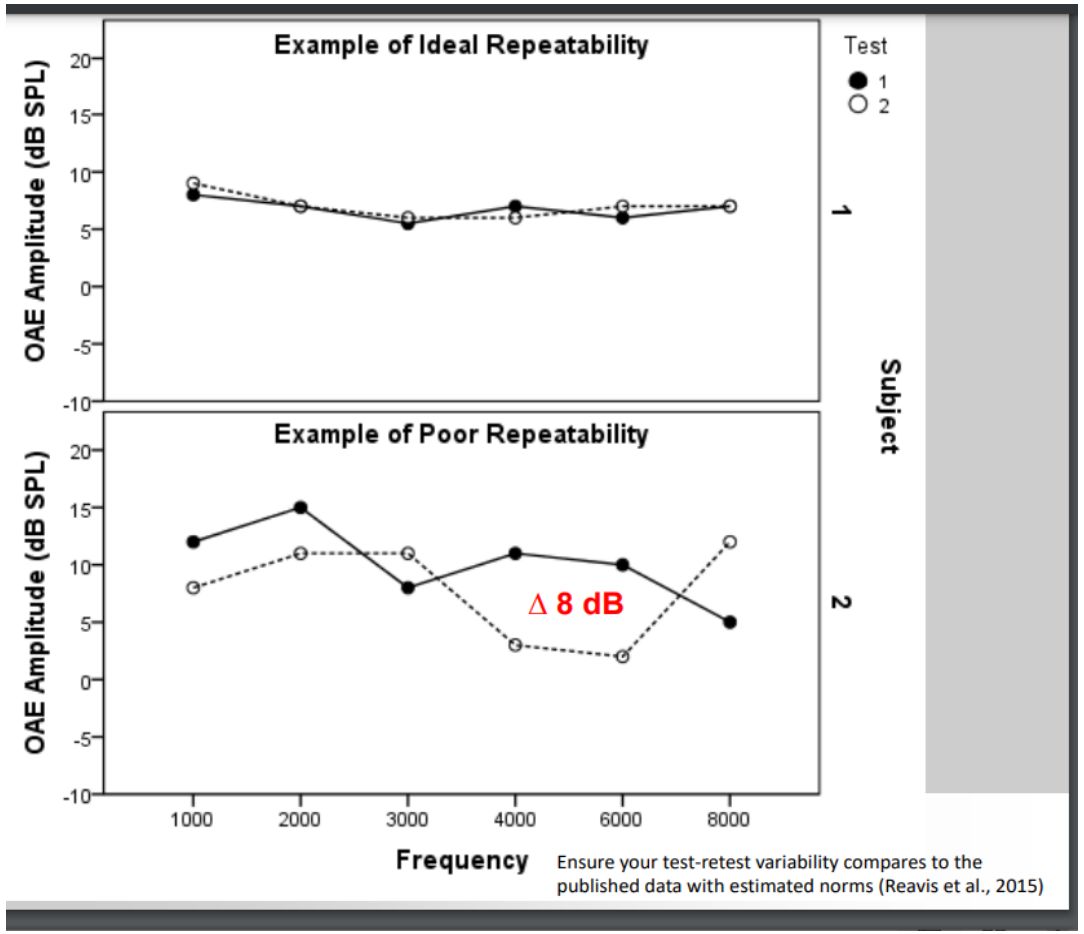
*OAE change appears to have earlier time course than HL from cisplatin*




Case illustration of serial measurements obtained in a 68-year-old patient receiving Cisplatin treatment with A, behavioral hearing thresholds as a function of frequency and B, DPOAE level as a function of f2 frequency. Different lines/symbols represent data from eight trials, with the filled circle indicating Trial 1 (baseline).

# DPOAE FOR MONITORING OTOTOXICITY



# MALE 51 YEARS OLD

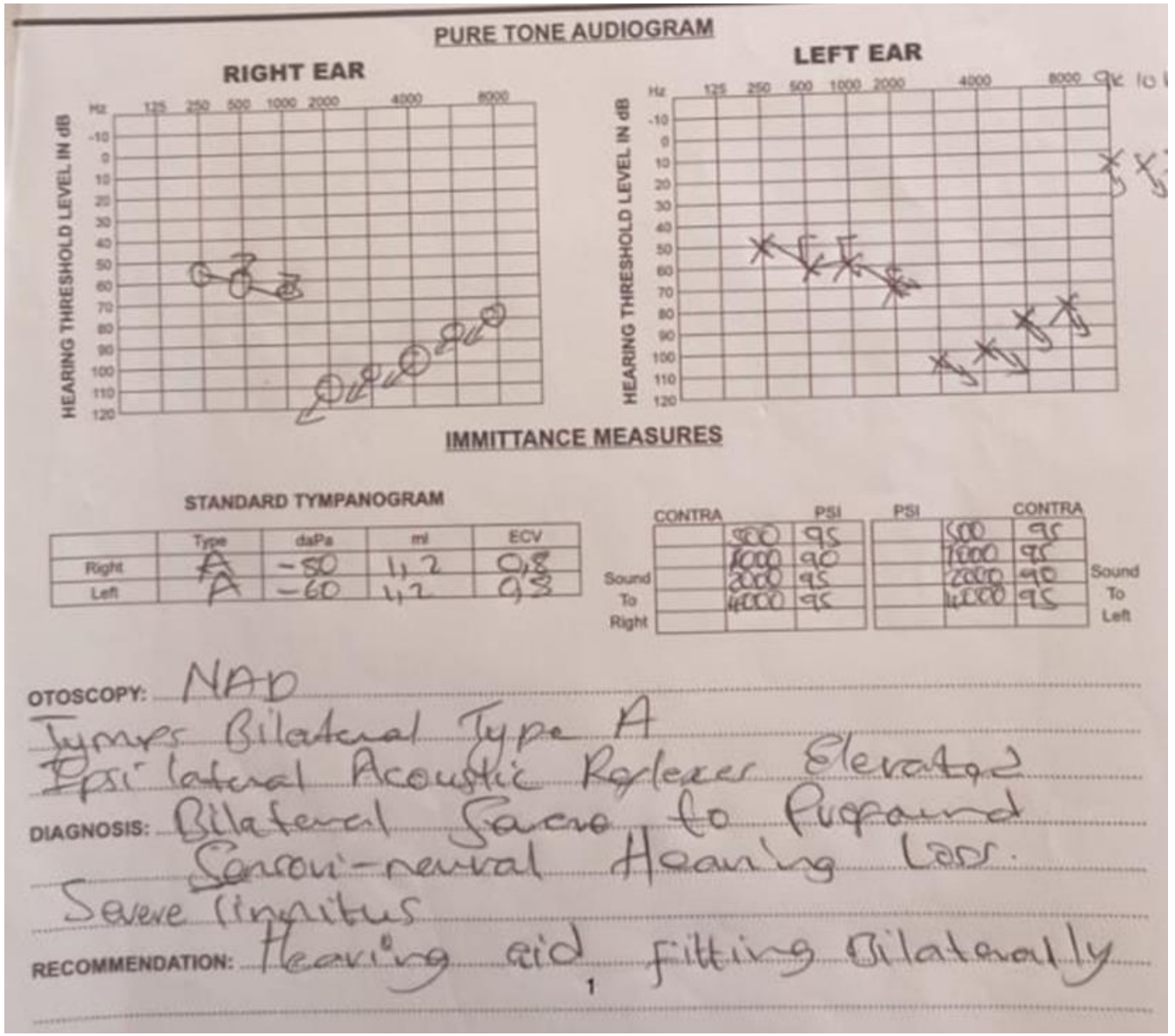
Normal Tympanometry

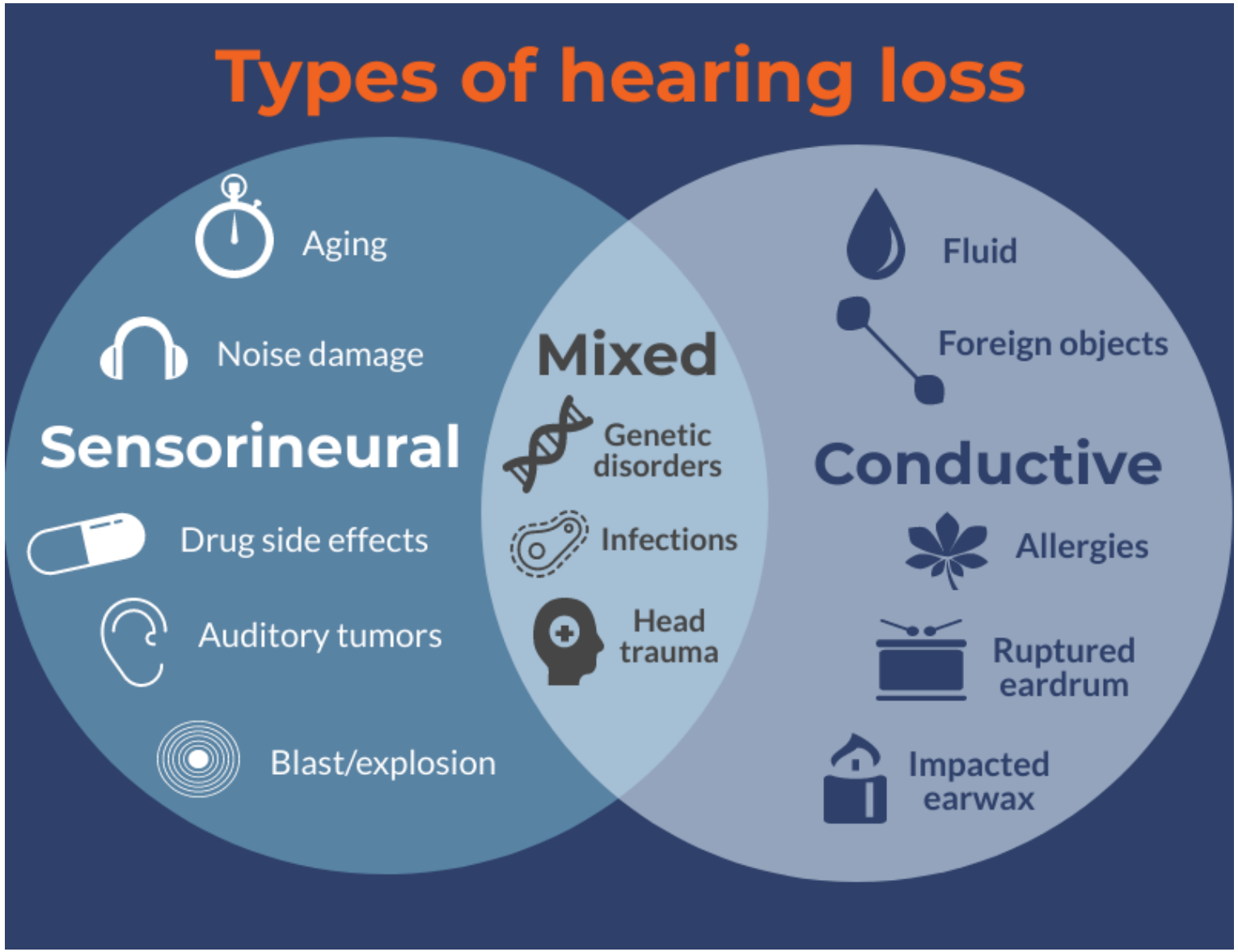
Present but elevated reflexes

Severe bilateral tinnitus

SNHL- Profound thresholds

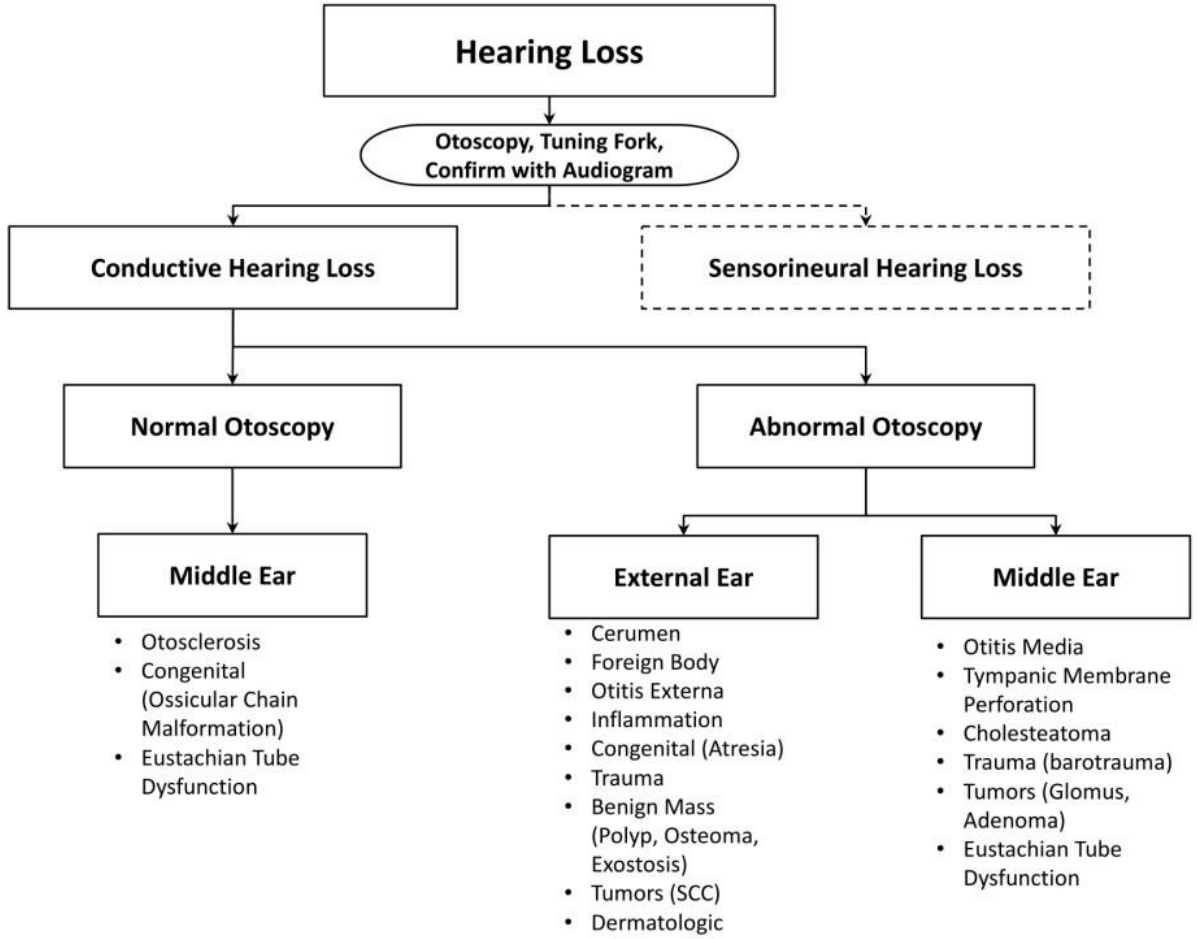
Case history is very important




Types of hearing loss
Aging
Noise damage
Sensorineural
Drug side effects
Auditory tumors
Blast/explosion
Mixed
Genetic disorders
Infections
Head trauma
Fluid
Foreign objects
Conductive
Allergies
Ruptured eardrum
Impacted earwax

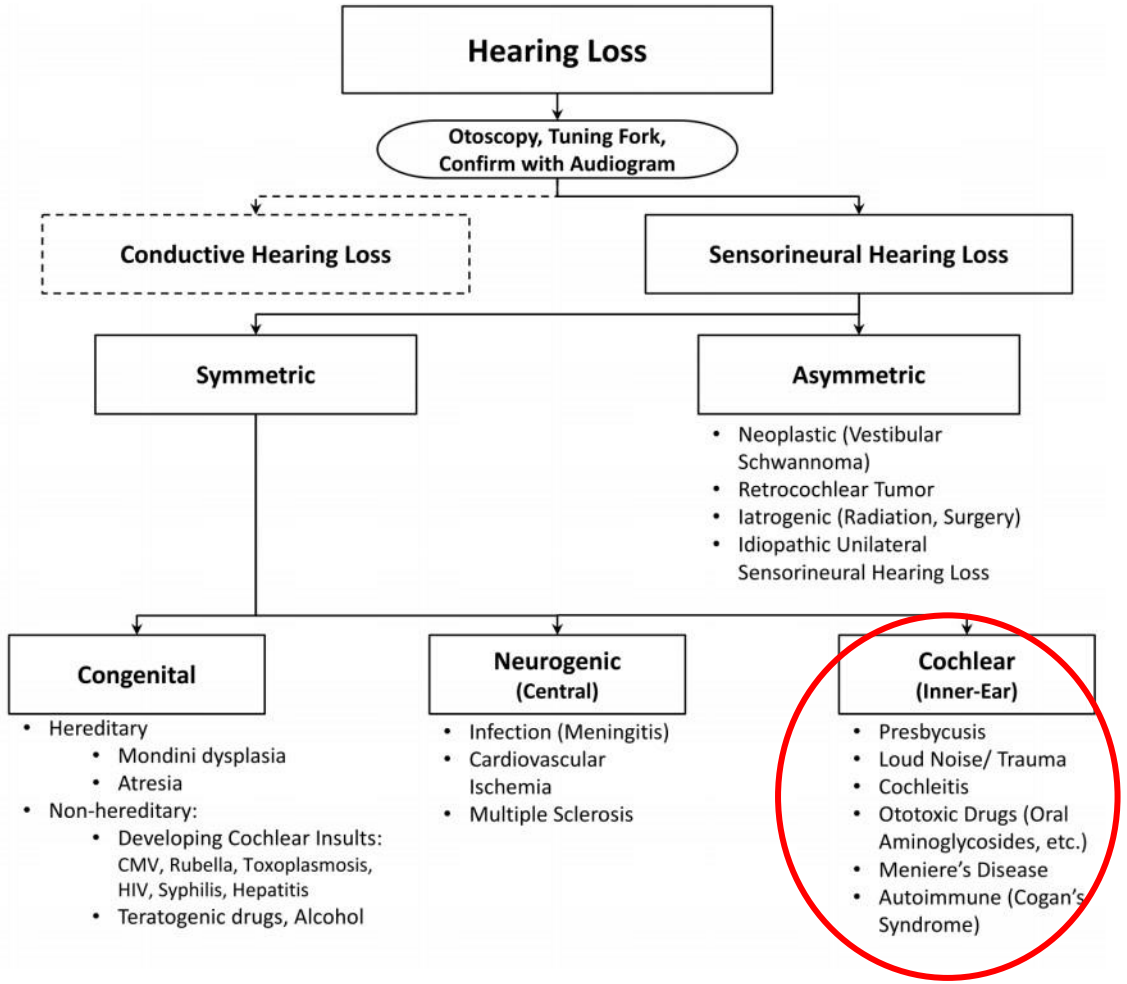
# Hearing Loss

Conductive



# Hearing Loss

## Sensorineural




Otolaryngologic

# NB: MONITORING PROTOCOL

- **Chemotoxicity classification systems** can be divided into those which focus on hearing change from a baseline audiogram and those that focus on the functional impact of the hearing loss.
- **The primary aim** of an ototoxicity monitoring programme (OMP) is to ensure the **early identification of hearing loss** (Konrad-Martin et al. Citation2014; Brooks and Knight Citation2017).
- This information can, at times, prevent functional hearing loss by allowing for alternative therapies or by **influencing drug prescribing procedures**; specifically, smaller or less frequent doses, or interruption or suspension of treatment altogether.
- **Monitoring for ototoxicity** can also lead to the provision of **care and support for the patient** and the family (Konrad-Martin et al. Citation2014).
- Finally, monitoring takes place to **evaluate drug safety** and sometimes efficacy, particularly in the domain of clinical trials.

# SUMMARY

- South Africa has one of the **highest rates of MDR-TB in the world**, placing a strain on the healthcare system and highlighting the need for ototoxicity monitoring.[28]
- However, ototoxicity monitoring is not occurring because of a lack of **collaboration between relevant** healthcare providers.
- The audiologist, Ear, Nose and Throat (ENT) specialist and doctor should be in **communication regarding drug dosage**, the manner of the **drug's absorption** and excretion, risk factors and the **patient's audiologic status**.[3]
- It is also important to raise the awareness of doctors regarding ethical practice, including the need for disclosure to patients of the risks when prescribing ototoxic medication.[4]
- With the high **prevalence of HIV infection** and likely increase in incidence of hearing loss, information on possible hearing loss should be included as part of the process of **obtaining informed consent** for the initiation of **aminoglycoside therapy**.[9]

# CONCLUSION

- Ototoxicity monitoring aims to detect hearing loss before speech frequencies are affected and communication problems develop.[9]
- Even in the well-resourced provinces, patients were not enrolled in an ototoxicity-monitoring programme.[35]
- It is important to assess hearing thresholds beyond the 250 Hz to 8000 Hz frequency range when monitoring ototoxicity, with clinics investing in audiometers that have a high-frequency test capability and additional headphones to test at higher frequencies.[34]
- These are measures and otoprotective strategies that can be put in place without any additional need for resources.

# CITATIONS


- Konrad-Martin, D; Hawe, L; Poling, G; Hulswit, J; Nofstker, K. (2020). "Ototoxicity Monitoring using Otoacoustic Emissions" VA RR&D National Center for Rehabilitative Auditory Research (NCRAR)
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UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

# NIHL SUMMIT

## Date: 25 April 2024

## Venue: Emperors Palace

**TITLE:** OAE and STS Application in Noise Risk Management

**By**

**Dr Liepollo Ntlhakana**

# Introduction

**Background…**

Definitions

- Oto-acoustic emissions (OAE)
- Standard threshold shifts (STS)

Rationale

- Understand risk factors associated with NIHL
- Identify early signs of hearing deterioration

Tests in audiometry surveillance

- Objective audiometry measures
- Subjective audiometry measures

Interventions for NIHL risk management

- Intergrated reporting of audiometry results

# DEFINITIONS

- **Oto-acoustic emissions** *are sound energy produced from the outer hair cells, this is transmitted through the fluids in the cochlea back to the middle ear and tympanic membrane to create a sound wave* ***made sense*** *in the external ear canal.*

- **Hearing threshold** *is the soft sound that's perceived by the ear during testing (for example, pure tone) to determine hearing sensitivity (as a function of frequency/intensity). Hearing within normal limits < 25dBHL (12 years and older).*

- **Standard threshold shift (STS),** *is defined by OSHA as a change in hearing threshold, relative to the baseline audiogram for that employee, of an average of 10 decibels (dB) or more at 2000, 3000, and 4000 hertz (Hz) in one or both ears* (OSHA 1904.7).

# RATIONALE

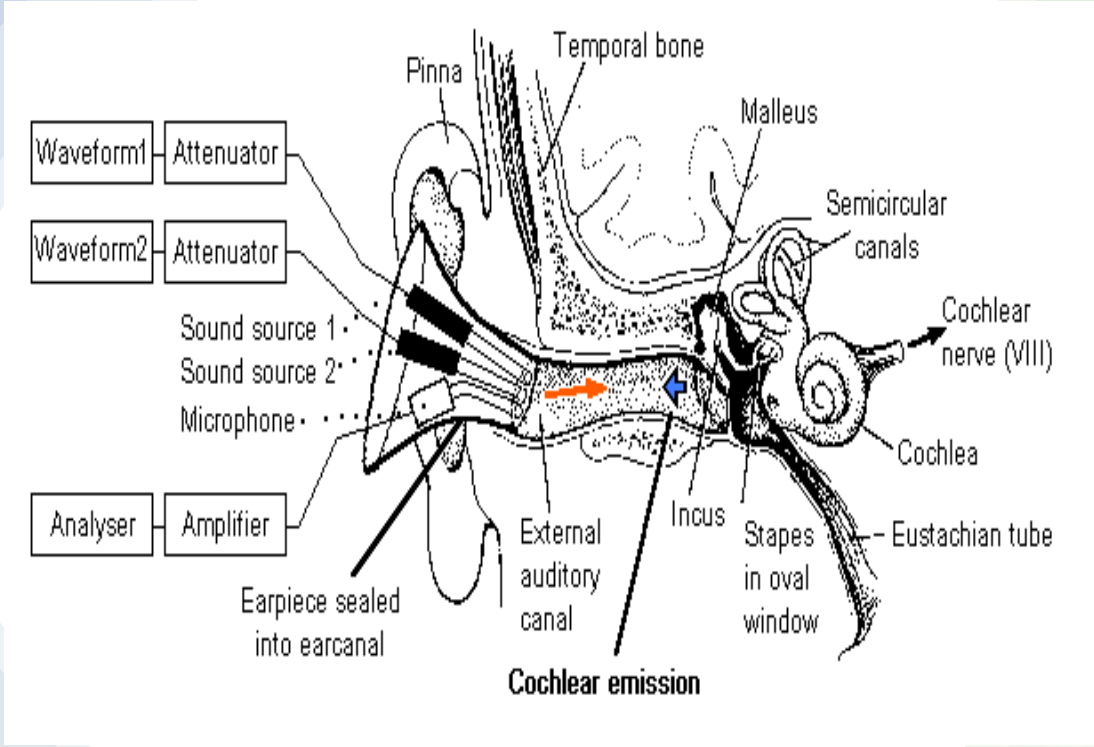
- **Oto-acoustic emissions**
  - *Outer hair cells (OHCs) are vulnerable to diseases and damage.*
  - *Noise exposure, other occupational exposures, medical conditions and ototoxic factors.*

- **Hearing threshold**
  - *To track hearing function.*
  - *Audiometry medical surveillance*

- **Standard threshold shift (STS),**
  - *Measures as a minute change in hearing threshold*
  - *Ability to identify and track minute changes in hearing deterioration*

# TESTS: AUDIOMETRY SURVEILLANCE

- **Oto-acoustic emissions**
  - *Non-invasive objective test that measures cochlea functioning.*
  - *Detects OHCs damage due to noise exposure, other occupational exposures, medical conditions and ototoxic factors.*
  - *Different types of OAE are used clinically but will focus on distortion-product OAE (DPOAE).*
  - *DPOAEs: measured as a response of two tones, analysed as an output of a distortion product.*
  - *Benefits: frequency-specific responses; quick; reliable; replicable; HF; clear outer and middle ear structures*



# TESTS: AUDIOMETRY SURVEILLANCE

- **Basic audiometry**
  - *Non-invasive subjective test that measures hearing sensitivity.*
  - *Air-conduction testing: manual vs automated audiometry.*
  - *Clear instructions and language considerations are essential.*
  - *Testing environment matter in audiometry*

# RECOMMENDATIONS: Case History

## Basic Patient Information

- Patient demographic information
- Referral source
  - Physician or other provider
  - Self-referral
- Primary complaint
- Hearing loss
  - Ear specificity
  - Previous hearing evaluation
    - Changes in hearing over time
  - Onset of hearing loss
    - Congenital or acquired
    - Onset relative to speech and language development
    - Gradual or sudden
  - Stability of hearing loss
    - Factors that the patient notices relevant to fluctuation or progression
  - Impact of hearing loss on the patient's life
  - Previous experience with hearing instruments and/or assistive listening devices
    - Current and past hearing instrument use
    - Interest in hearing instrument use
- Family history of hearing loss
- Exposure to loud noise
  - Type of noise
  - Duration of exposure
  - Time since last exposure to noise
- Pain, fullness, or pressure in the ears
  - Ear specificity
  - Current presence of symptom
  - Occurrence and duration of last episode of symptom
  - Related reduction in hearing sensitivity
- Experience with otitis media or otitis externa
  - Dates of occurrence
  - Previous treatment
  - Drainage
- History of previous ear surgeries
  - Ear specificity
  - Type of surgery
  - Date of surgery
- Tinnitus
  - Ear specificity
  - Description of sensation
  - Impact on the patient
- Dizziness
  - Description of sensation
  - Nausea/vomiting
  - Activities that precipitate dizziness
  - Occurrence and duration of dizziness
  - Factors that cause a reduction of symptoms
  - Other symptoms observed with the dizziness
- Current medications (prescription and over the counter)
  - Use of other substances (other drugs, alcohol, caffeine, etc.)
- Other medical problems

**FIGURE 1**
The normal ear canal and tympanic membrane

# Percentage Loss of Hearing (PLH%)  Standard Threshold Shift (STS)

## DPOAE Preventive

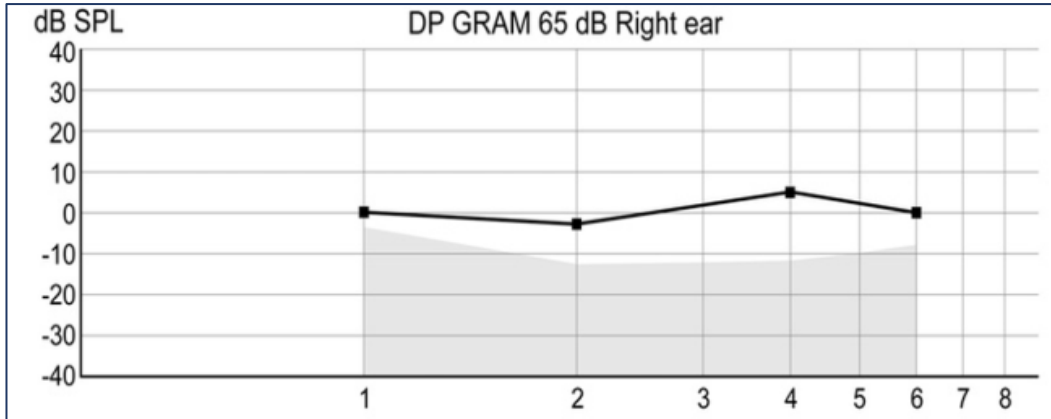
- SANS10083
- 2f1-f2 DPOAEs @ constant stimulus levels of L1=65 dB SPL and L2=55 dB SPL.
- Frequency range from 750 to 8000 Hz, the focus is at **2002, 3174, 4004, 6348 and 7996** Hz to compare with pure tone audiometry. DPOAEs are considered present when the average DPOAE response amplitude is ≥6 dB SPL above the noise floor level.
- Considerations: Testing is done in a sound-treated room. Monitor ambient noise levels.
- DP-Gram: Pass or refer screening result. Present (normal/abnormal) or absent OAE for diagnostic – **not a test of hearing – complement to pure-tone audiometry**

## STS Preventive

- NIHL Regulation 839
- High-frequency average for 2000, 3000 and 4000Hz for each ear.
- Baseline mandated from 2014 to December 2016. No employee's STS should exceed 10 dBHL from baseline in one or both ears.
- A shift in the hearing threshold of ≥ 25 dBHL, for one or both ears, indicates hearing loss.
- STS success will be reviewed in 2024

# Percentage Loss of Hearing (PLH%)  Standard Threshold Shift (STS)

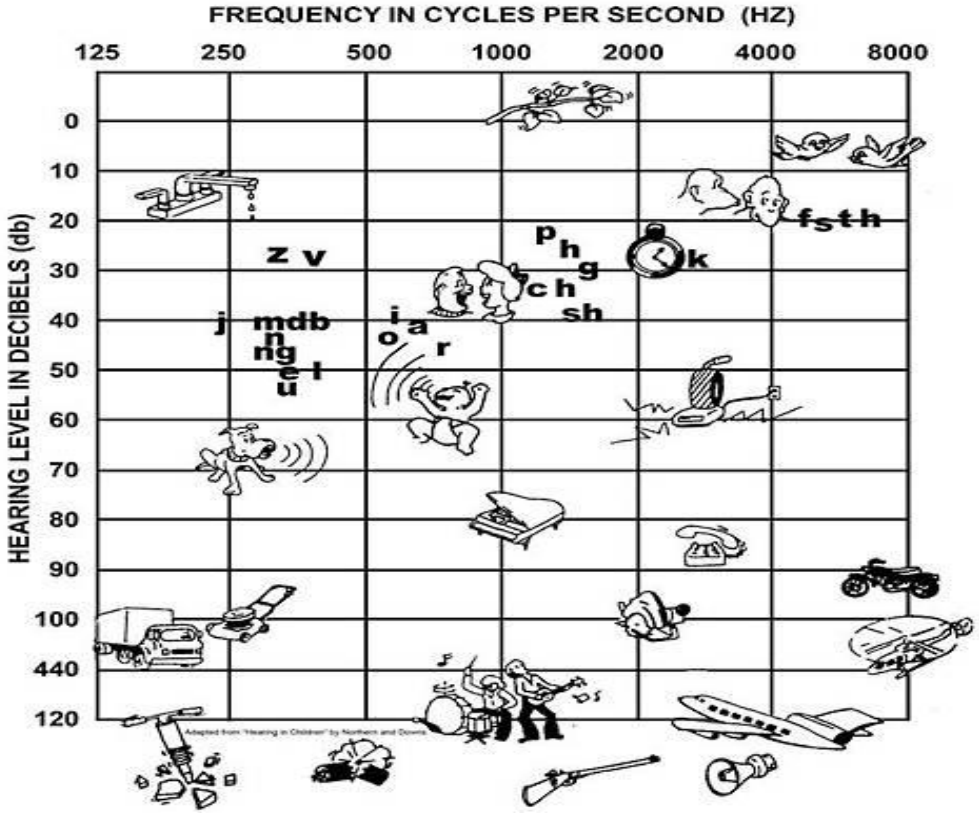
## DPOAE: DP GRAM



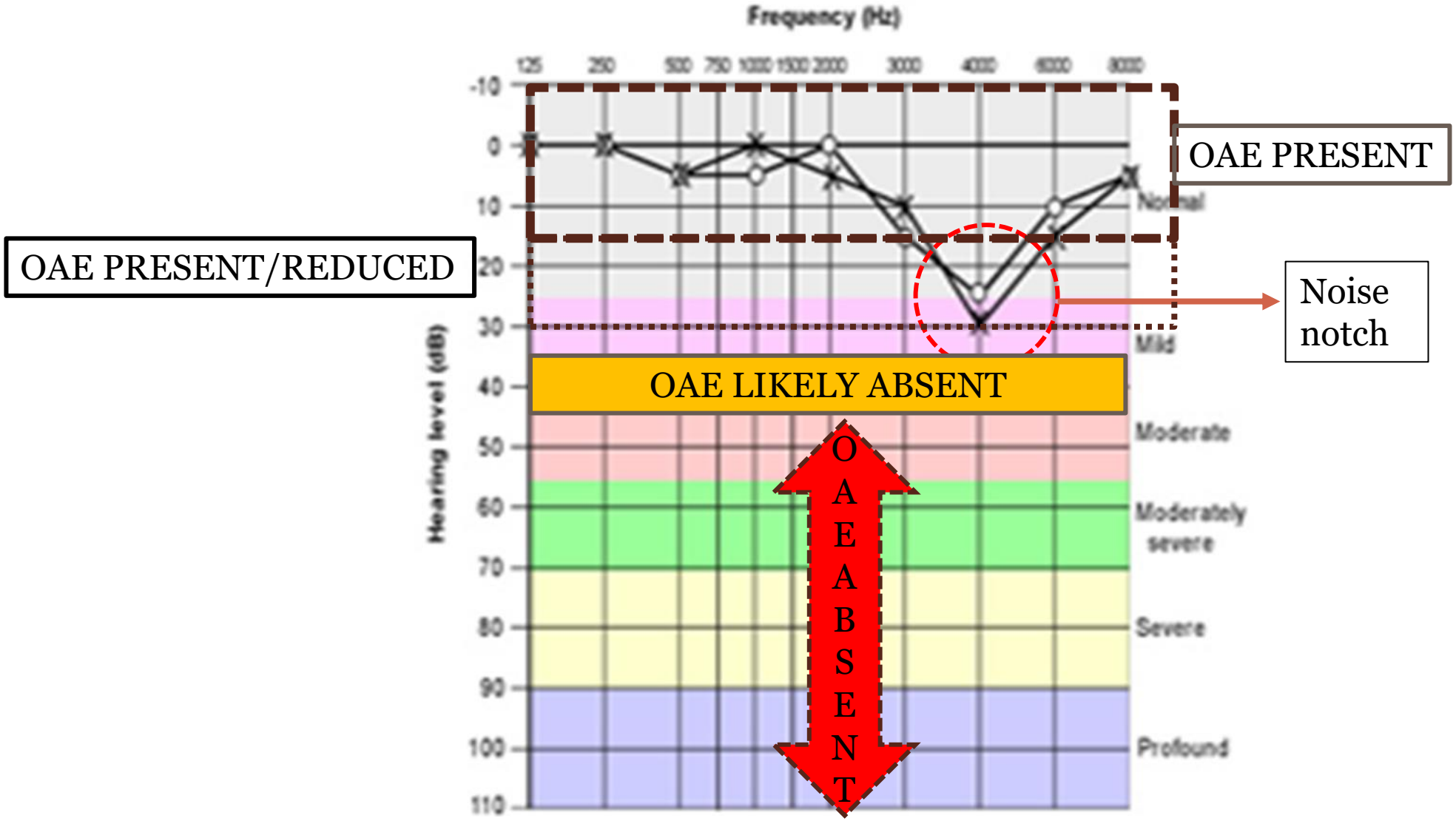

| f2 | DP | L1 | L2 | DP level | Noise level | S/N level | Measured | Rejected |
|---|---|---|---|---|---|---|---|---|
| 1000 Hz | 638 Hz | 65 dB | 55 dB | 0.3 dB | -4.9 dB | 5.2 dB | 74 | 17% |
| 2000 Hz | 1278 Hz | 65 dB | 55 dB | -3.2 dB | -13.2 dB | 10.0 dB | 70 | 19% |
| 4000 Hz | 2556 Hz | 65 dB | 55 dB | 5.0 dB | -12.0 dB | 17.0 dB | 28 | 0% |
| 6000 Hz | 3836 Hz | 65 dB | 55 dB | 0.4 dB | -8.5 dB | 8.9 dB | 55 | 2% |

| S/N stop criteria | Rejection level | Stimulus tolerance | Test time |
|---|---|---|---|
| 7 dB | 20 dB | ± 5 dB | 0 min. 48 sec. |

## STS: AUDIOGRAM



# LIKELIHOOD OF OAE/HEARING THRESHOLD LEVEL



# Interventions for NIHL risk management

- **Oto-acoustic emissions**
  - *presence indicates good hair cell function = cochlear function*
  - *provides an indication that hearing thresholds should be better than 40 dB*
  - *Other considerations:*
    - *the absence may mean outer and middle ear pathology.*
    - *The presence doesn't always indicate normal hearing, there could be auditory nerve problems, lower brainstem lesions, or synaptopathy (hidden hearing loss).*
    - *Cross-check measure – should be used with other tests*
    - *Testing (repeated measures) should be done more quieter settings – very sensitive to noise*

- **Standard threshold shift (STS)**
  - *Indication of a change in hearing thresholds, relative to the baseline audiogram of the employee*
  - *Auditory system from the outer to the inner ear*
  - *Considerations:*
    - *Subject elements*
    - *Testing environment*
    - *Limited high-frequency coverage*

- **Benefit**
  - **Machine learning systems can be used to predict early signs of NIHL**

- ***NOTE: complex relationship between the two when interpreting results***

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# THANK YOU

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# THEME 3: NOISE RISK MANAGEMENT



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MC Mining - Vele

# MOSH NOISE INITIATIVES

## POTENTIAL LEADING PRACTICES

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# IDENTIFICATION OF POTENTIAL LEADING PRACTICES


Potential Leading Practices identified through Noise Working Group Committee


Site Verification by Noise Team


Day of Learning:

Industry Show and Tell


GEE Ratification


Practice Documentation


Publish a compendium of Leading Practices



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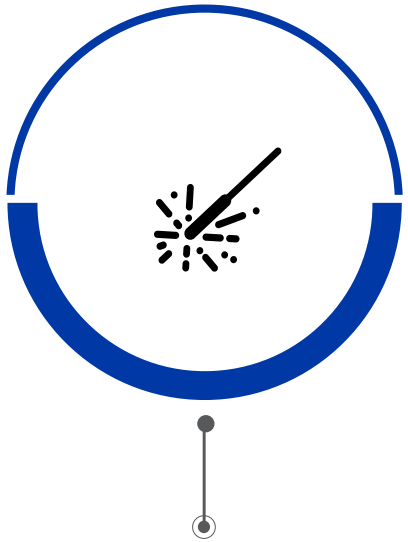
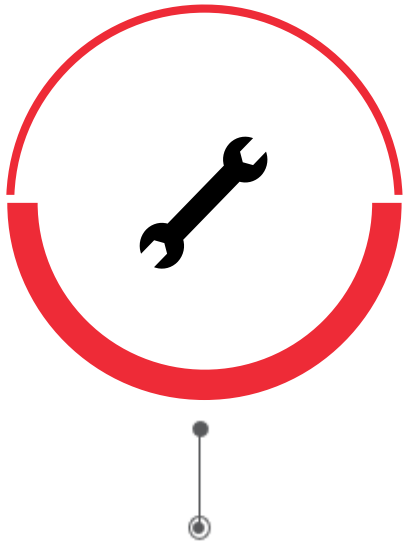
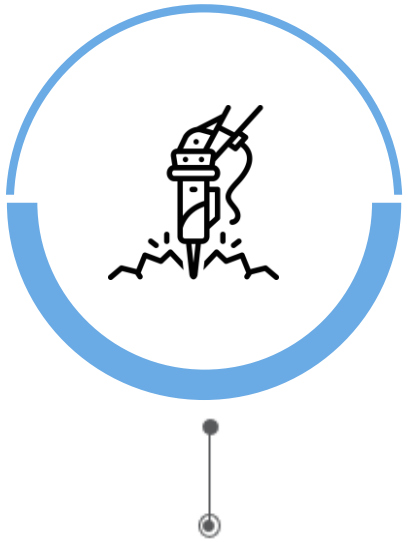
# POTENTIAL LEADING PRACTICES



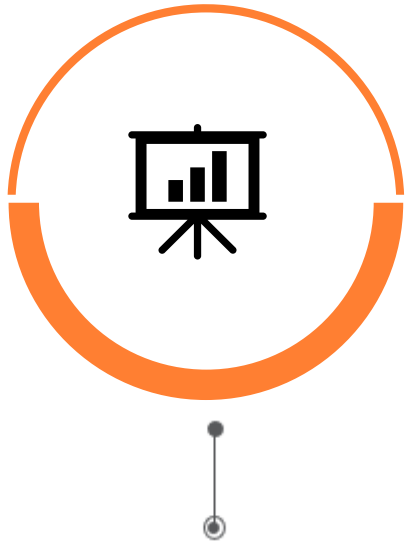
**Gouging Noise Reduction**



**Mobile Impact Wrench**



**Remote Operated Impact Breaker**



**Continuous Real-Time Monitoring**

**Oto Acoustic Emission Testing**



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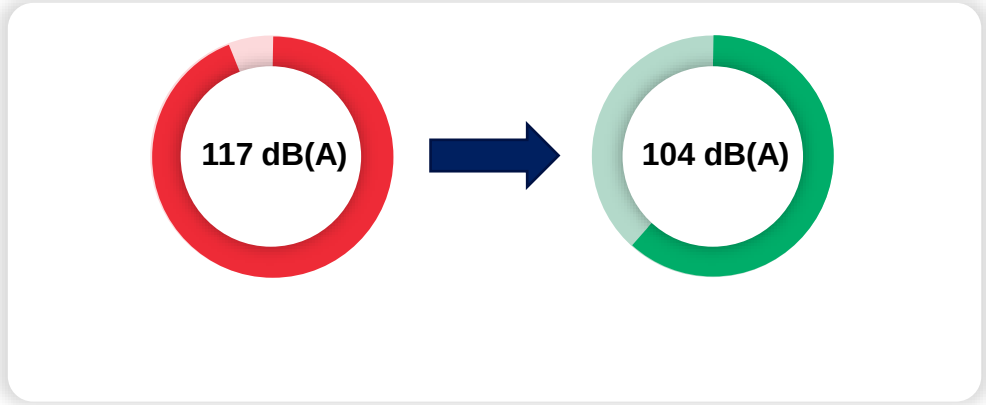
# GOUGING NOISE REDUCTION

## Summary

*Implementing an alternative power source, by transitioning from Constant Current to Constant Voltage in air-arc gouging, with controlled air pressure.*




**SOURCE MINE**

Sishen Kumba

Irone Ore

**EQUIPMENT/PROCESS**

Gouging

**CONTROL TYPE**

Engineering: Substitution



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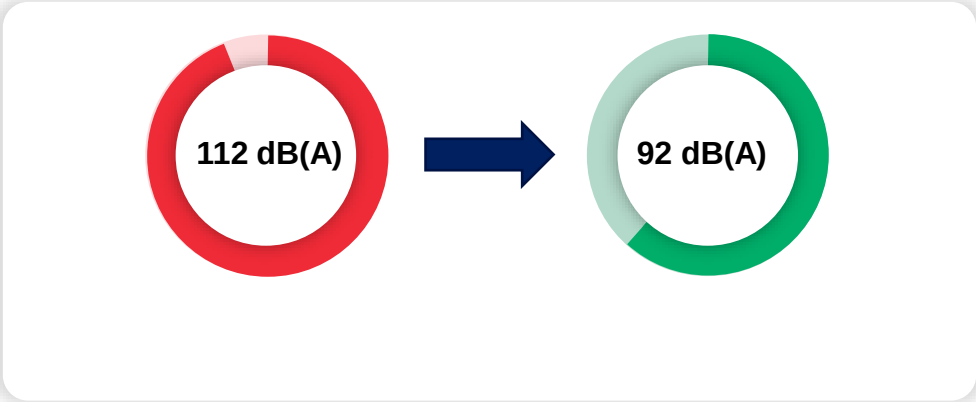
# MOBILE IMPACT WRENCH

## Summary

*Direct fitment of muffler on the impact wrench's compressed air, with controlled pressure.*




**SOURCE MINE**

Sishen Kumba

Irone Ore

**EQUIPMENT/PROCESS**

Wrenching

**CONTROL TYPE**

Engineering:
Silencing/Muffling



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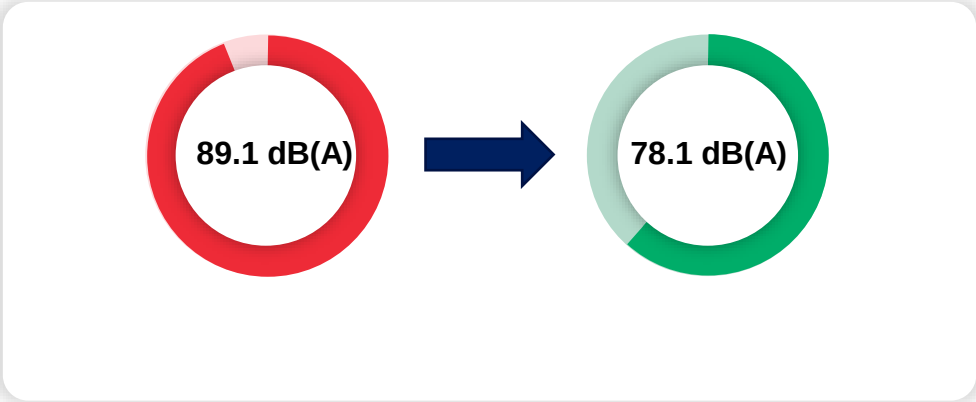
# REMOTE OPERATED IMPACT BREAKER

## Summary

*Automating rock breaking processes by relocating personnel from underground to operate the rock breaker remotely from a surface-based control room.*




**SOURCE MINE**

Gold Fields:
South Deep

**EQUIPMENT/PROCESS**

Rock Breaking

**CONTROL TYPE**

Engineering: Automation



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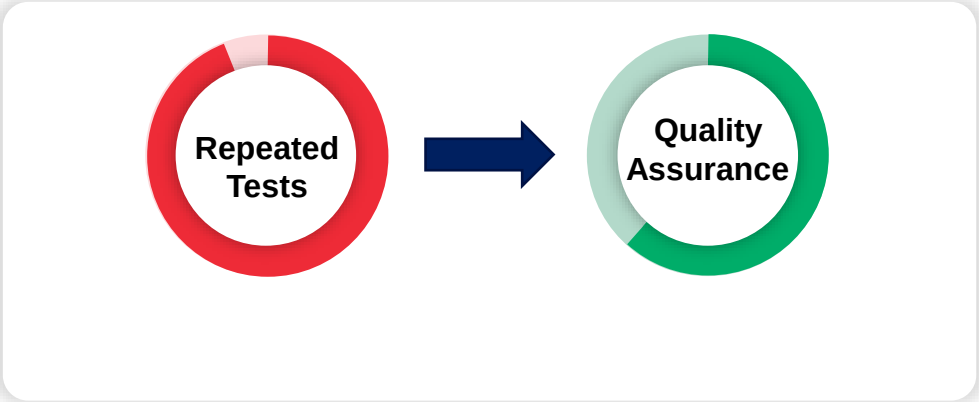
# CONTINUOUS REAL-TIME MONITORING

## Summary

*Implementation of CRTM within audiometric testing facilities to guarantee accurate outcomes during hearing assessments.*




**SOURCE MINE**

Glencore Alloys

**EQUIPMENT/PROCESS**

Audiometric Testing

**CONTROL TYPE**

Administrative:

Critical Control Management



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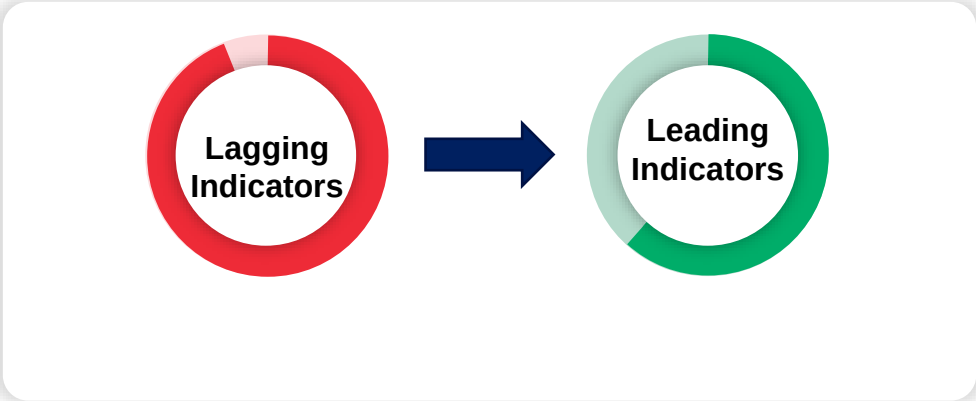
# OTO ACOUSTIC EMISSION TESTING

## Summary

*Application of Oto Acoustic Emission Testing in Noise Risk Management for Early NIHL detection and Hearing Protection Devices compliance.*




**SOURCE MINE**

Harmony Gold

**EQUIPMENT/PROCESS**

In Ear Monitoring

**CONTROL TYPE**

Administrative:

Medical Surveillance

Glencore Coal - Tweefontein

# Thank you

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UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

1922 2022

# MINERALS COUNCIL MOSH NOISE DAY OF LEARNING

# NOISE INDUCED HEARING LOSS SYMPOSIUM 2024

## RECENT ADVANCES IN HEARING CONSERVATION PROGRAMMES

**Prof Nomfundo Moroe**

**Occupational Audiologist**

**Certified Hearing Conservationist**

INTRODUCTION

# Advances in Hearing Conservation

- We live in an era of unprecedented technological advancement that impacts every aspect of our lives, from the way we shop and travel to the way we communicate with friends and family.

- These trends are resulting in new methods and tools that change the way **safety professionals and industrial hygienists prevent hearing loss** (p. 1).

- Occupational noise-induced hearing loss is the most common **occupational health** condition and the most commonly reported occupational disease **globally**[1].

# TRUTH ABOUT HEARING CONSERVATION PROGRAMMES

- Hearing conservation programs require **multiple layers** of protection due to **imperfections** in individual elements.
- Many organizations focus on **superficial checkboxes** rather than implementing comprehensive noise control measures.
- **Incorrect or inconsistent** use of hearing protection can render the entire program ineffective.
- This can lead to a **false sense of security** while actual risks of exposure remain high.
- Without fail-safe layers of protection, efforts to mitigate noise hazards may not result in meaningful risk reduction over time.

# SMART HEARING PROTECTION

- Utilises **integrated microphones** and **data transfer to monitor and provide alerts** related to **wear rates** and **noise exposure**.
- a hearing health professional can take action years before permanent harm is caused.
- This may involve **educating** and **informing** a person about their known sound exposures and taking steps to prevent exposures from occurring.
- Provides the missing link between **applying a process of continuous improvement** with **the hierarchy of risk controls**
-

# SMART HEARING PROTECTION

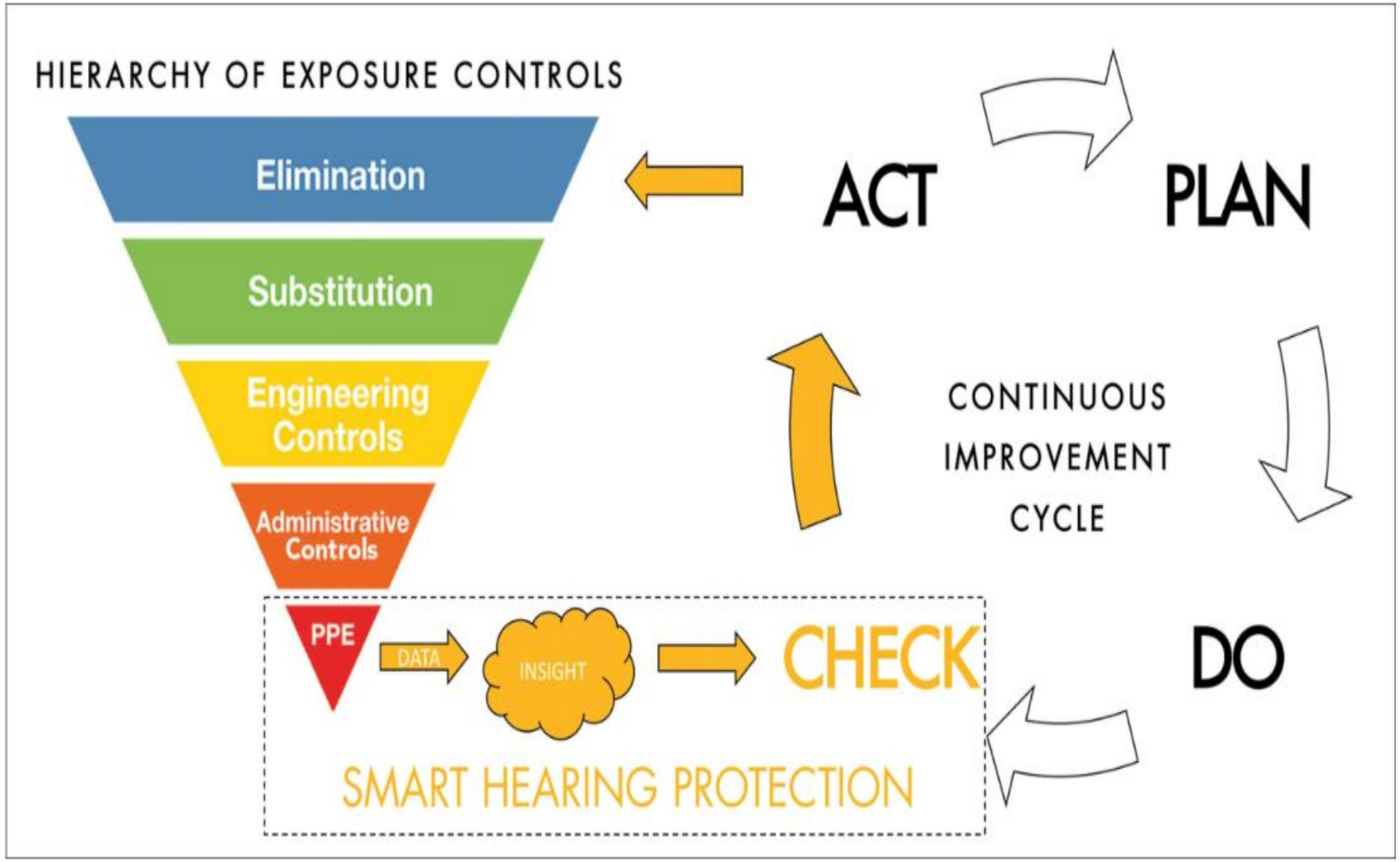



Figure 1. Data and insights from smart hearing protection provide the missing link between applying a process of continuous improvement to the effective use of the hierarchy of risk controls.

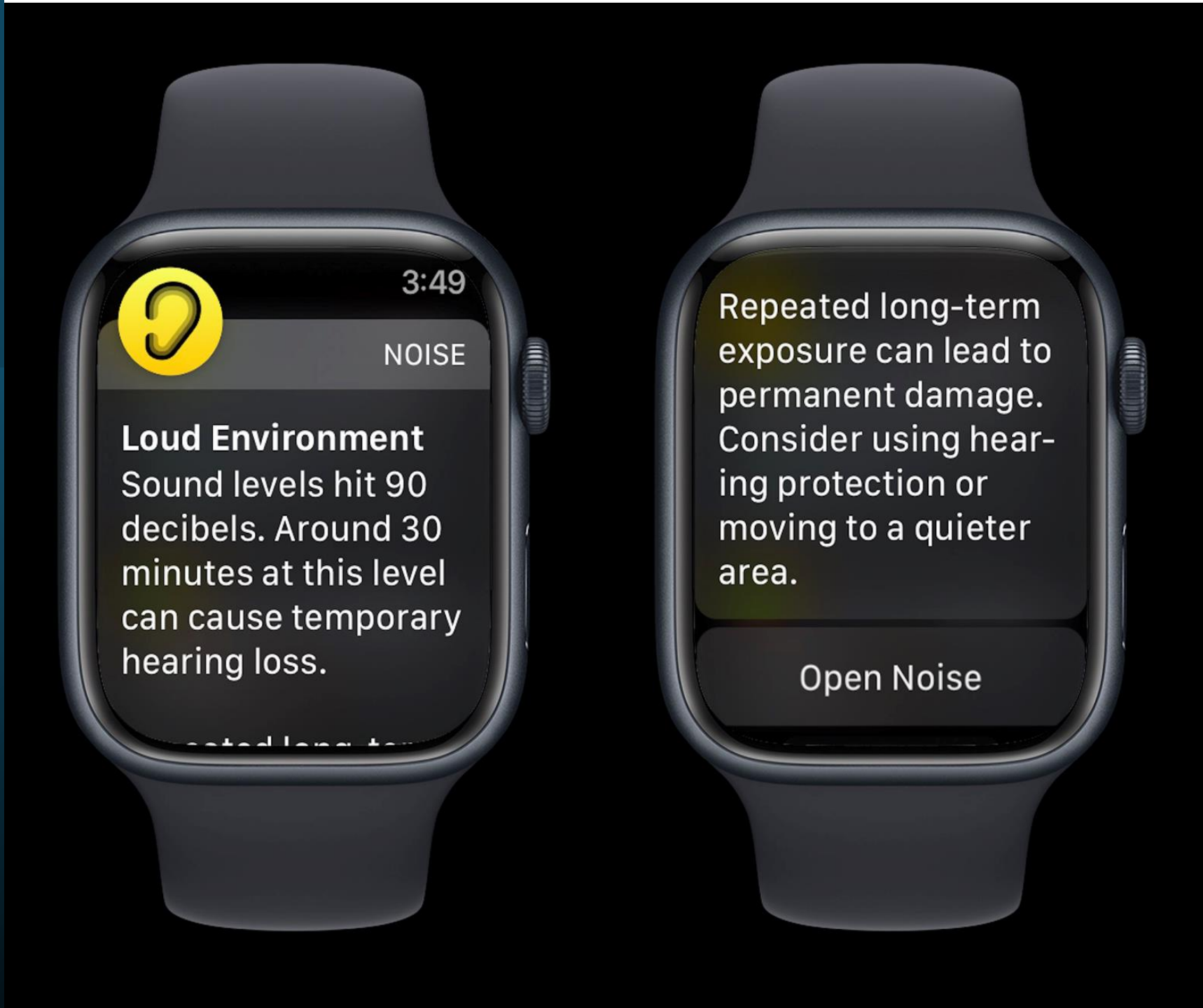
# SMART HEARING PROTECTION – BENEFITS

- **Hear-Through Function**: Allows workers to hear critical conversations and alarms while protecting them from unwanted noise.
- **Visual and Audible Alerts**: Notify workers when they approach or exceed their daily dose limits, enhancing awareness of noise exposure.
- **Fit Testing**: Alerts users or safety managers if the headset is not properly fitted or worn correctly, ensuring optimal protection.
- **Data Generation**: Provides a wealth of data that can be used by safety managers to improve hearing conservation programs, leading to personalized safety approaches and better-fitting hearing protection for workers.

# SMART HEARING PROTECTION – BENEFITS

- **Tracking** hearing protection wear rates and improving them.
- **Guaranteeing the effectiveness** of the hearing protection provided by keeping track of worker's personal exposure to noise and enabling intervention where required before permanent harm occurs.
- Improving **site safety** by replacing the 'blindfold' effect of traditional hearing protection with improved situational awareness.
- **Removing hazards** at source by using the data from the smart hearing protection to uncover and control unexpected noise hazards.
- Accurately **assessing noise risks** using a complete and continuous data source, removing the need to rely on assumptions and snapshots of risk.

# Wearable Real-Time Noise Alerts



# Individual Fit Testing

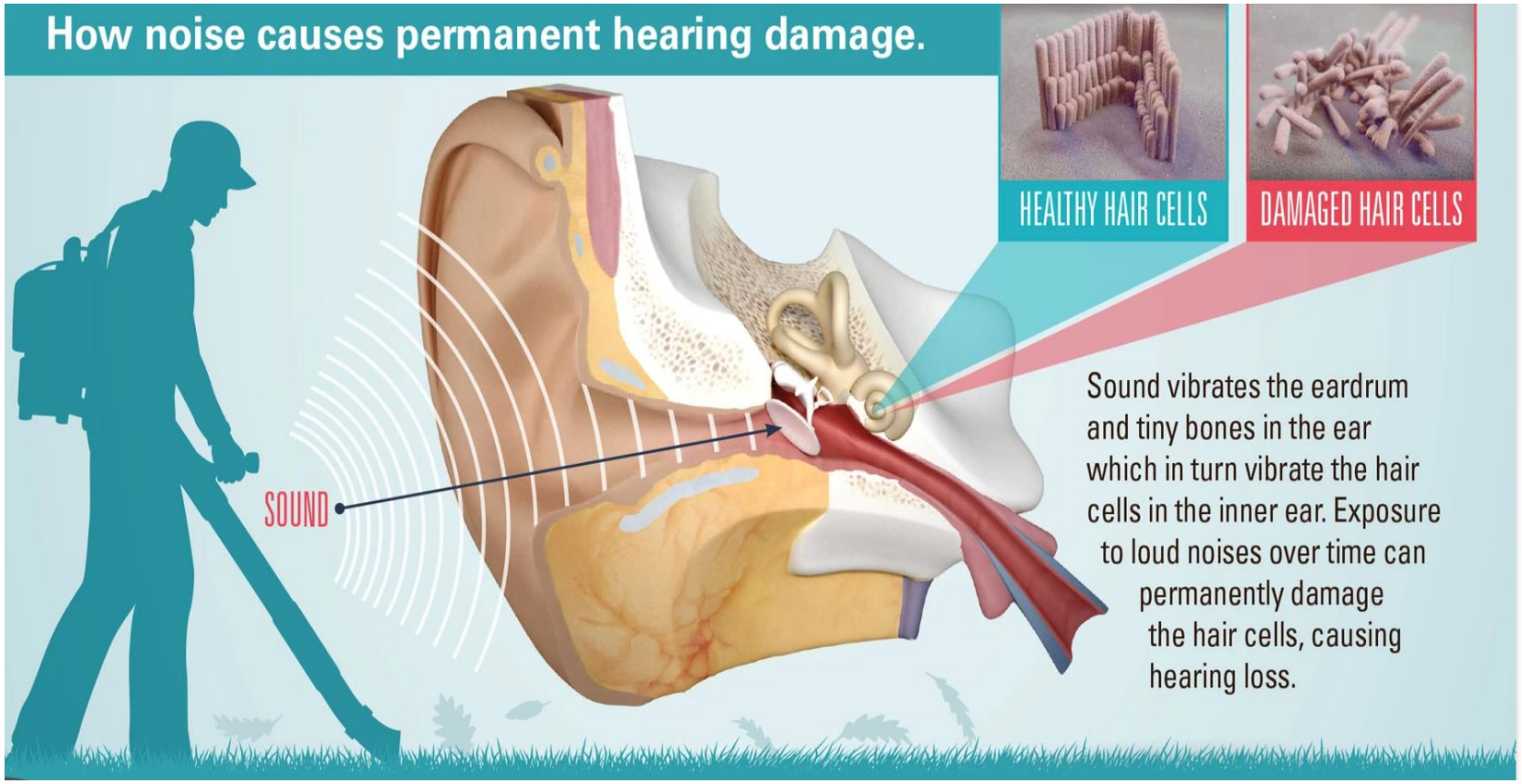
- https://www.youtube.com/watch?v=SYzR740rD8I

- Acts as a valuable training and train-the-trainer tool.
- Assists in OSHA-required audiometric testing follow-up procedures.
- Provides documentation on hearing protector adequacy and training.
- Evaluates the overall effectiveness of an employer's hearing conservation program.
- Matches hearing protector attenuation to noise exposure levels, especially beneficial for hearing-critical jobs or individuals with hearing impairment.
- Aids in selecting appropriate hearing protection for new hires by testing various protectors and selecting the best model for optimal protection.

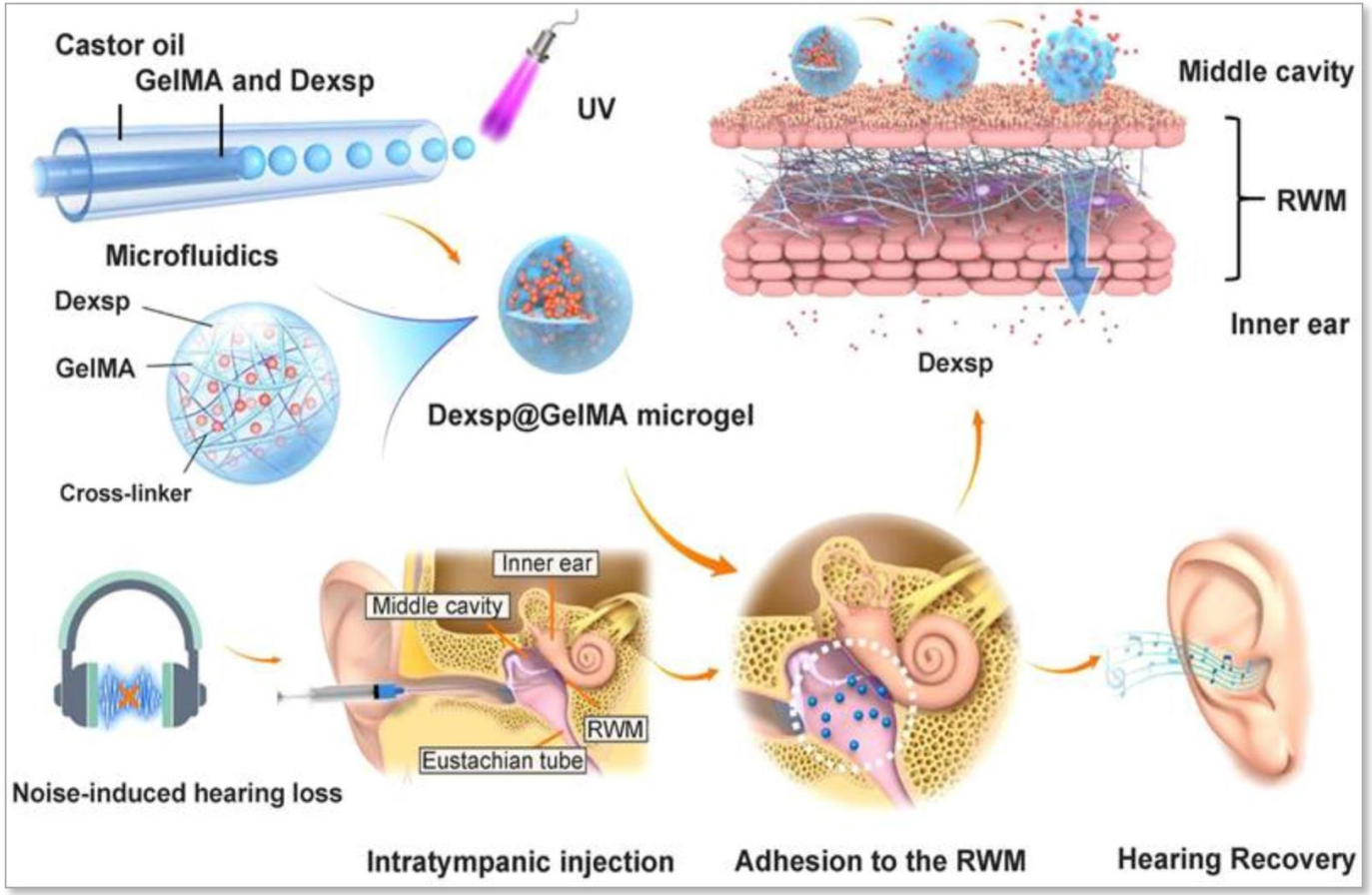
# Smartphones measurement

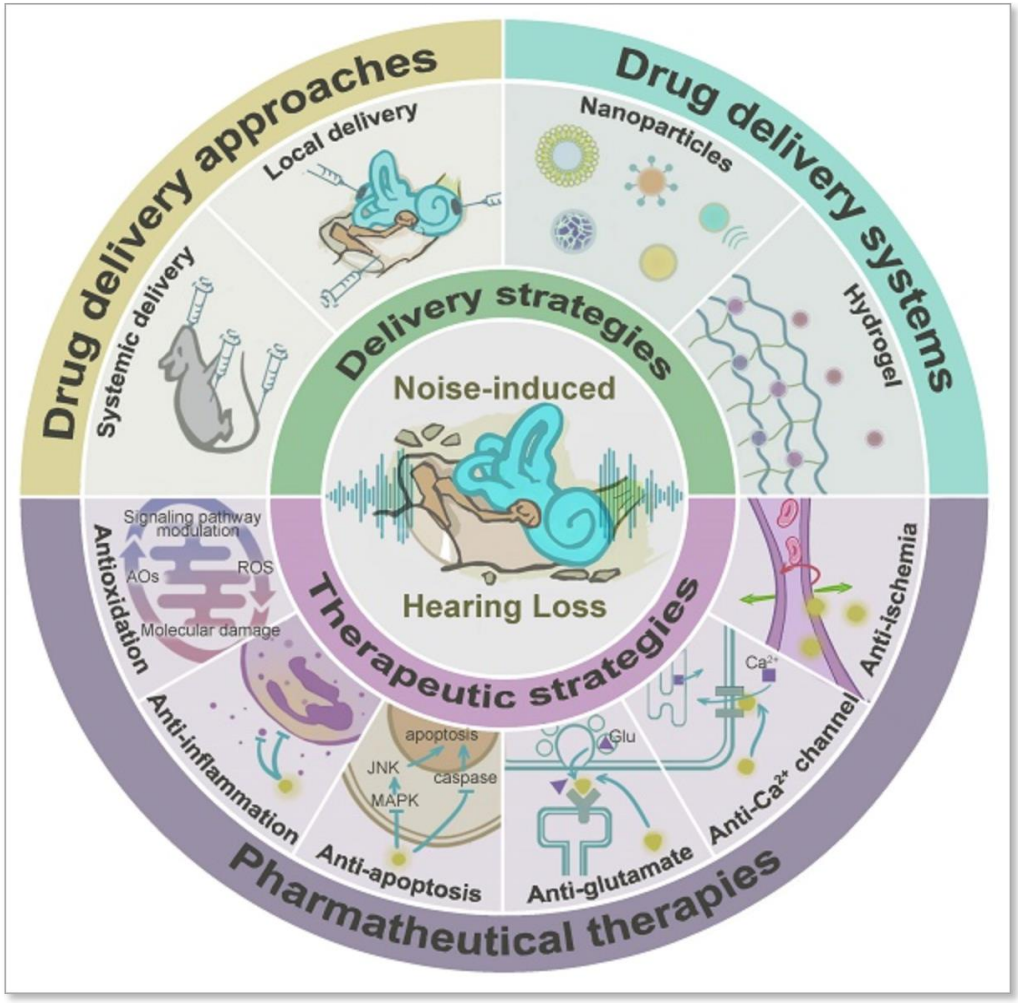
- Application of booth-less and wireless technology for industrial hearing assessments
- Performing pure-tone audiometry outside a sound booth utilising automation, earphone attenuation and integrated noise monitoring
- Diagnostic pure-tone audiometry without a sound-treated environment
- Utilisation of mobile technology for booth-less audiometry.

# Otoprotective therapeutic interventions

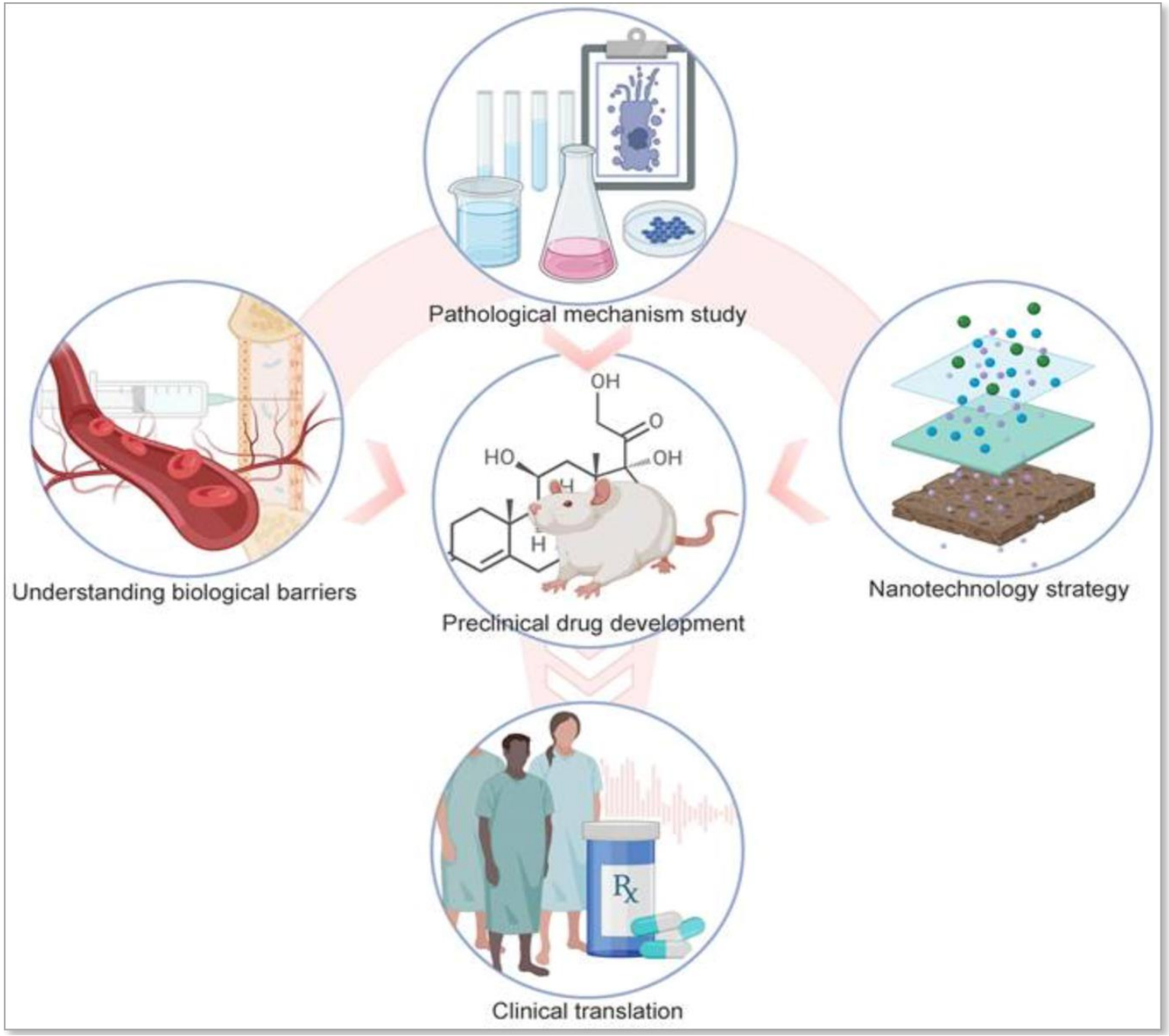


# Delivery Mode



# Where we are now



# Hearing conservation and Behaviour Change Intervention

# Proposed Behaviour change intervention

Table 1. Determinants, intervention functions, and needs included in the intervention.

| COM-B Component | Needs Addressed by the Intervention | Intervention Functions |
|---|---|---|
| Psychological capability | Providing knowledge related to hearing protection devices | Education |
| Physical capability | Developing the skills required to use and maintain hearing protection devices | Education |
| Social opportunity | Generating a positive culture among mineworkers for consistent use of hearing protection devices | Enablement, Social influence |
| Physical opportunity | Providing mineworkers with the means to access and use hearing protection devices effectively | Environmental restructuring |
| Reflective motivation | Assessing the benefits of using hearing protection devices and promoting their consistent use among mineworkers | Education, Persuasion, Incentivization |
| Automatic motivation | Increasing mineworkers' confidence in using hearing protection devices and fostering a sense of safety | Persuasion |

# Behaviour Change Intervention

Fig 4: Summary of behaviour change techniques included in the intervention.

| | |
|---|---|
| **Group education session** | • Information on health and hearing loss consequences<br>• NIOSH Hearing loss simulator demonstration<br>• Fit-testing problem-solving hearing protection insertion |
| **Activity monitor and diary** | • Information on health and hearing loss consequences<br>• NIOSH Hearing loss simulator demonstration<br>• Fit-testing problem-solving hearing protection insertion |
| **Coaching visits** | • Social support from coach who is a credible source<br>• Setting and reviewing behaviour goals<br>• Action planning |

# OCCUPATIONAL NOISE:

## ASSESSING THE BURDEN OF DISEASE (NIHL) AT NATIONAL OR INDUSTRY LEVEL

## MONITORING THE EFFECTIVENESS OF HEARING CONSERVATION PROGRAMMES AT INDUSTRY AND SITE LEVEL

Prepared by Dr Charles Mbekeni – supported by Dr Bongani Nene (for NIHL Symposium)

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# WHAT QUESTIONS DO WE WANT TO ANSWER?

Of the X million workers exposure to noise at the various workplaces in SA – what X% is in mining; X% in construction; X% in the military and X% in transportation?

Of the ~ 500,000 workers in the mining sub-sector – what % of workers are in underground convention mining, % in mechanised opencast mining; % in process operations?

What is the proportion of workers exposed to < 85 dB (A); (85-90) dB(A) and > 90 dB (A) in the various mining and processing categories?

The number of workers (and %) in the mining sub-sector at highest risk of exposure are e.g.;

- Rock drillers – X thousand employees
- Engineering workshops – x thousand

In total – the mining subsector has:

- X thousand workers exposed to noise levels (85-90 dB (A)
- X thousand workers exposed to > 90 dB(A)

What are the key focus areas contained in our noise reduction strategies and mitigation plans? Monitor execution of plans



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# WHAT QUESTIONS DO WE WANT TO ANSWER?

On average, at what age level or after how many years of exposure does a rock driller reach 41 dB threshold (WHO) or >25 dB threshold (NIOSH)?

Of the employees that were compensation by RMA in 2023 – what is the average dB threshold of the various age categories (35-40); (41-45 years)……

Over the years, have we observed an increase in the average age or duration of exposure – of the workers who reach a specific dB threshold (using compensation data)?

Based on our current exposed population or occupation numbers - how many exposed employees are likely to reach a certain level of hearing impairment (e.g. 25 dB) by 2030?

What is the average Baseline dB threshold of novices/new graduates (19-20 years of age) – with no previous employment both in and outside of mining?



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# WHAT IS STOPPING US FROM ANSWERING SOME OF THESE QUESTIONS?

- A binary perspective on leading versus lagging indicators
- Unavailability of specific data points
- Test-retest variability – e.g.; pure tone screening audiometry
- Focus on mainly quantitative data – and undervaluing qualitative data.
- A limited view on relevant data sources

# WHO ARE WE INFORMING AND FOR WHAT PURPOSE?

All quantitative and qualitative data is important if used for the right purpose (understanding its limitations)

It is important to have clear reporting narrative and objectives for collecting and collating noise exposure and noise induced hearing loss data.

Policymakers

Enforcement agency

Tripartite Leaders

SHE Committees

# GETTING THE DATA IS NOT IMPOSSIBLE IF WE KNOW WHAT WE WANT AND WHERE TO LOOK?

| Required Data | Data Source | Question |
|---|---|---|
| Employment per relevant economic sub-sector | STATS SA; DOEL; ILO; sub-sector associations | How many employees work in the economic sub-sectors that have exposed to noise? |
| Employment per mining and processing method and risk categories of at-risk occupations | DMRE, Workers Compensation Bodies; Mining survey and reports | What is the proportion of employees in each mining category (+ occupations) at risk? |
| Data on hearing impairment among workers exposed to Noise | Workers Compensation Bodies | How many workers were compensated for NIHL – (incl. age categorisation and levels of noise impairment? |
| Hearing Conservation Programme | Noise reduction plans and mitigation measures, incident investigations, VFLs; reports | Where is the leading practice and how do we share it? |
| Data Gaps/Hypothesis | Noise related - research agenda/programme | |



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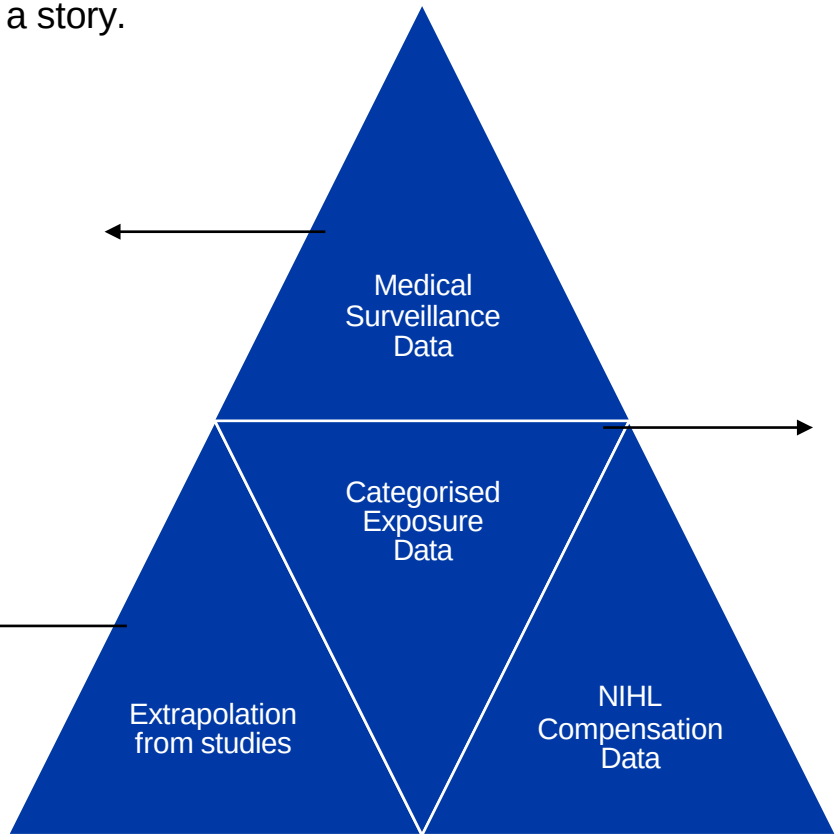
# DATA TRIANGULATION

Instead of have a reporting framework that relies on one or two data points – data triangulation uses multiple data sources to tell a story.

Report on PLH shifts, Temporal Threshold Shifts and observed or reported use of hearing protection devices (HPDs)




Exposure profiles, risk registers; list of noise emitting equipment or processes; and critical control monitoring

Prevalence studies and other surveys

Report on hearing impairment (using WHO impairment levels)



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# BURDEN OF DISEASE AND/ OR PROGRAMME EFFECTIVENESS

## 1 Estimating the burden of occupational exposure to noise and NIHL

- Data triangulation – routine national data and extrapolation from studies
- Adopt an appropriate M&E Framework
- Attributable burden: incidence of NIHL or disability-adjusted life years (DALY).

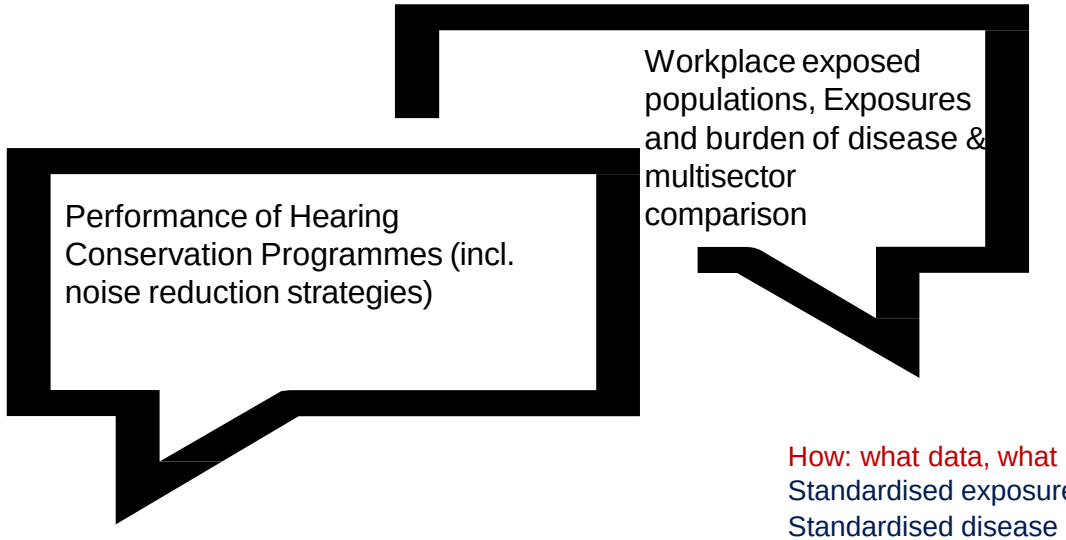
## 2 Effectiveness of Hearing Conservation Programmes

- Integration of hearing conservation programmes into the overall hazard prevention and control programme
- Specific noise-prevention and control strategies – the work processes and machinery; the workplace; the worker.

# DATA REPORTING: EXPOSURE AND NIHL

**Monitor programme performance**

**Standardise the national and sector specific exposure and disease profiles**




How: what data, what sources and what tool/template

How: what data, what sources and what tool/template
Standardised exposure profiles
Standardised disease profiles

**Workplace equipment and processes:** Risk register; List of noise emitting equipment, maintenance schedule

**Work areas:** exposure data; noise reduction plans – with a focus on engineering controls

**Worker:** hearing protection devices, %PLH shift old and new; auto acoustic emissions



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# RECOMMENDATION

Let us move away from occupational health milestones that focus on a few data points – and rather design a reporting narrative – plus a monitoring and evaluation framework that provides a national, sector-specific, mining method-specific and occupation-specific situation analysis and programme performance.

# THANK YOU

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# THANK YOU
## for your participation!

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# NOISE INDUCED HEARING LOSS SYMPOSIUM 2024




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