The development of a simplified SOP for the analysis and identification of asbestos and the use thereof to analyse samples collected at the Potchefstroom campus of the North-West university

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Statement:

Three separate documents were compiled for this project, namely:

- Project Report
- Asbestos Report and Register and,
- Student Asbestos Analysis Guide

This presentation is only about the project report. Hard copies of the **Asbestos Report and Register** and **Student Asbestos Analysis Guide** are available to view.

Problem Statement:

- A gap was identified in the Chemical Stressors 1(BHIG 321) module relating to the analysis and identification of asbestos.
- Students are trained to count fibres, but not how to use a stereomicroscope to determine the presence of asbestos and polarising light microscopy to determine the type of asbestos.
- No simplified methodology exists to guide students on how to analyse samples that may contain asbestos and how to identify the type of asbestos, should it be present.

Introduction:

- Asbestos - thin fibres with a high tensile strength.
- Classified into two distinct families: serpentine and amphibole.
- Due to its unique properties, asbestos became a popular material with various uses.
- Asbestos causes severe health effects (asbestosis and mesothelioma) with a latency period between 14-72 years.
- Mining was outlawed in 2002 and by 2008 all asbestos products were banned.
- Many buildings still contain asbestos and a SOP using stereo microscopy and polarising light microscopy will simplify identification of asbestos.

Aim and Hypothesis:

Aim:

The aim of this study is to develop a simplified SOP for asbestos identification and analysis, by means of polarising light microscopy techniques and the use of a stereomicroscope.

Hypothesis:

It is expected that the simplified SOP will be a successful alternate asbestos analysis guide for future student use. Students will become confident in their ability to use the stereomicroscope and polarizing microscopy techniques. The student analysis results will match the reference samples from the accredited laboratory with an 80% accuracy. Out of the ten samples that will be analysed, it is expected that at least 6 out of the 10 will contain asbestos.

Methodology:

SOP Development:

- Literature study was conducted on the techniques used to identify and analyse asbestos, chemicals used during analysis and sample preparation. The HSG248 Asbestos: The Analysts' Guide was the main source of this literature study.
- Practical experience was also gained by observing accredited asbestos AIA's analysing asbestos during WIL 2022. Knowledge on how to identify, extract and mount fibres onto a prepared slide was gained form this experience.
- Experience was also gained through trial and error, while additionally improving the practise of operating the microscopes, during the attempt to analyse asbestos in the laboratory.

- By using all the knowledge and experience gained, a comprehensive asbestos analysis guide for student use was compiled.

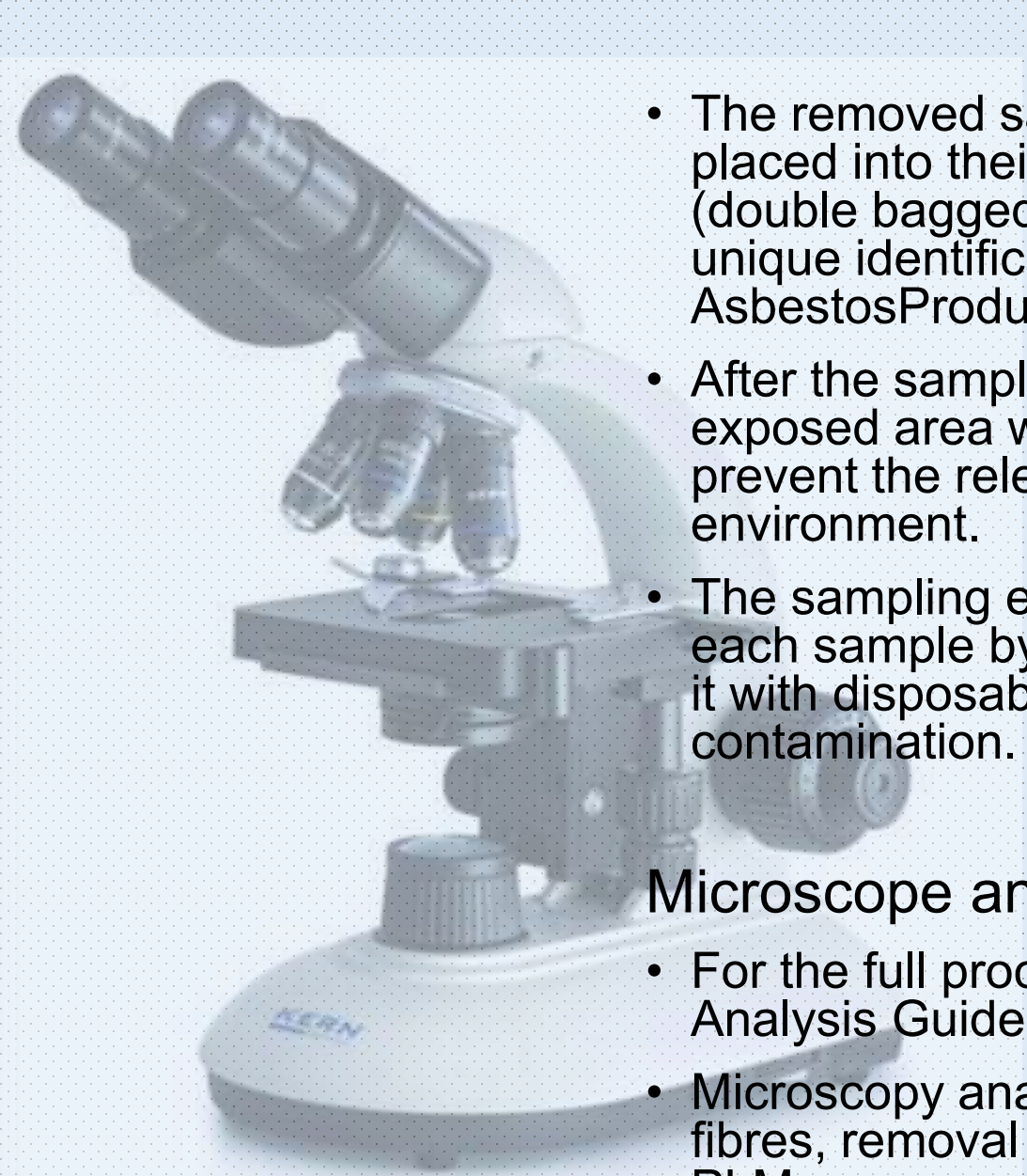
Bulk sampling of material suspected of containing asbestos:

- Permission was given by the infrastructure department to collect samples on campus, where it was suspected that asbestos may be present.
- Asbestos rope or tape, raw asbestos insulation and lagging (insulation material) were categorised as higher risk materials. Asbestos cement products were classified as lower risk.
- A map of the campus was used and the southernmost building was identified. Working systematically in a northern direction, each building was surveyed for the presence of building material, suspected of containing asbestos. This process was followed until ten bulk samples of building material, suspected of containing asbestos, were identified.

- The A, B and C blocks of campus were surveyed (starting at A, moving towards B and then C). Buildings and rooms likely to contain higher risk asbestos were prioritised, whilst lower risk asbestos was noted. No higher risk asbestos such as, raw asbestos insulation, rope or lagging were found.
- The sites where samples would be taken were visited again. This was done to gather information regarding the quantity, the state of the material, the type of material and the location. Photos of the different materials identified were also taken. All this would be used to compile the asbestos report and register.

Sampling Process:

- Where the material allowed, one or two samples were broken off from the main piece of material using pliers. If a piece could not be broken off, a battery powered hand-drill with a core cutter was used to remove a single core, which was then later split into two



- The removed samples samples were then placed into their respective zip-lock bags (double bagged) that were labelled with a unique identification code (BuildingNumber-AsbestosProduct) prior to the survey.
- After the sample had been removed, the newly exposed area was sealed with varnish to prevent the release of fibres into the environment.
- The sampling equipment was cleaned between each sample by rinsing it with water and drying it with disposable paper towel to prevent cross contamination.

Microscope analysis:

- For the full procedure refer back to the Student Analysis Guide: Methodology
- Microscopy analysis entails: Identification of fibres, removal of fibres and inspection under PLM.

Personal Protection and Safety:

Prior to sampling being performed, it had been decided that only one member of the group would perform the actual sampling. This was decided, to minimise the risk of exposure. The member performing the sampling wore the following PPE:

- 3M half-face respirator with FFP3 cartridge filters.
- Disposable latex gloves.
- 3M disposable overalls, and
- Safety goggles

Working at the fume cabinet

- 3M half-face respirator with FFP3 cartridge filters.

Results:

	Student Analysis	Accredited Lab Analysis
Sample	A1-Ceiling boards	
Positive/Negative	Positive	Positive
Type(s) of asbestos	Crocidolite & Amosite	Crocidolite
Sample	A1-Decorative panel	
Positive/Negative	Positive	Positive
Type(s) of asbestos	Amosite & Crocidolite	Chrysotile & Crocidolite
Sample	A1-Wall panel	
Positive/Negative	Negative	Negative
Type(s) of asbestos	N/A	N/A
Sample	B6-Pot plant	
Positive/Negative	Positive	Positive
Type(s) of asbestos	Chrysotile	Chrysotile
Sample	B8-Roof	
Positive/Negative	Positive	Positive
Type(s) of asbestos	Chrysotile	Chrysotile
Sample	B14b-Kitchen floor	
Positive/Negative	Negative	Negative
Type(s) of asbestos	N/A	N/A
Sample	B15(G11)-Tiles	
Positive/Negative	Negative	Negative
Type(s) of asbestos	N/A	N/A
Sample	B15-Ceiling/Walls	
Positive/Negative	Negative	Negative
Type(s) of asbestos	N/A	N/A
Sample	C2-Pot plant	
Positive/Negative	Positive	Positive
Type(s) of asbestos	Amosite & Crocidolite	Chrysotile & Crocidolite
Sample	C3a-Roof	
Positive/Negative	Positive	Positive
Type(s) of asbestos	Chrysotile & Crocidolite	Chrysotile

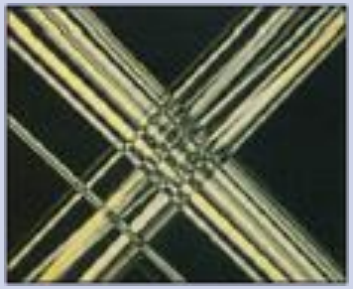
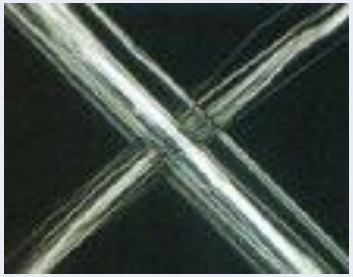
Discussion:

- 100% accuracy when determining if the samples were positive for containing asbestos
- Both sets of results indicated that six out the ten samples were positive for asbestos.
- 71% accuracy when identifying the types of asbestos present.

- No established library of control fibres available at the NWU to compare results during the analysis procedure.
- A **complete control library of asbestos fibres**, as well as non-asbestos fibres should be bought, to compare samples.

- The accredited laboratory identified only chrysotile in sample C3a-Roof, while this study's results indicated that crocidolite was also present. This was likely due to cross-contamination between samples.
- **Better housekeeping**, such as the cleaning of all equipment used, surfaces and hands between the preparation of each sample, should be implemented.

- Only crossed polars were used to distinguish between amosite & chrysotile
- Using only crossed polars, a chrysotile fibre will have a daylight white colour and an amosite fibre will have a warm white (almost yellow) colour. There was incorrectly distinguished between these two colours
- A **central stop dispersion staining objective** would be ideal to better distinguish between chrysotile and amosite,

Asbestos type	Crossed Polars	Crossed Polars with 530nm filter
Amosite		
Chrysotile		

Conclusion:

- A SOP for the identification and analysis of asbestos as a simplified and alternative procedure for students to follow, could be successfully developed
- The PLM techniques and the correct use of a stereomicroscope in the SOP is easier to understand than other published procedures
- Ideal for training purposes when recommendations are implemented
- 100% accuracy when determining if the samples were positive for containing asbestos The anticipated 80% accuracy from the hypothesis was correct and is accepted.
- 71% accuracy when identifying the types of asbestos present. The 80% anticipated in the hypothesis was incorrect and rejected.
- Both sets of results indicated that six out the ten samples were positive for asbestos. Correct and accepted hypothesis