Annual Pathology Asbestos Analysis Report

Bulk material and air filter data for 2003 – 2017

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GLOSSARY

Asbestos	A group of fibrous silicate minerals that include chrysotile (white asbestos), crocidolite (blue asbestos) and Amosite (brown asbestos) and others that were not mined in South Africa.
Samples	All materials received and analysed for asbestos.
Type of sample	The sample that was received, be it an air filter, piece of floor tile or roof grouped into either the air filter or bulk sample category.
Bulk samples	All samples that do not include air filters e.g. pieces of floor tiles, roofs, soil, ceiling, cement etc. This information is obtained from the description of the material that was sampled and submitted with the sample.
Air filters	Gold coated filters that were used in pumps to sample the air.
Province	The province where the sample was taken
Industry	The industry where the samples were taken was grouped into categories according the Standard Industrial Classification of all economic activities (7th Edition).
Activity	The activity that resulted in sending the sample to analyse for asbestos e.g. inventory purposes or identifying asbestos prior to demolition work

REPORT SUMMARY

A total of 2990 samples were received and analysed from 2003 to 2017. Of these, 1094 (36.6%) contained asbestos. Most of the samples (n=2849, 96.8%) were received from provinces in South Africa and 91 (3.0%) samples originated from other African countries such as Botswana and Lesotho. There were five (0.2%) samples for which the origin could not be classified.

The largest number of samples were received from Gauteng (n=792, 27.4%) followed by Western Cape (n=587, 20.3%), with Mpumalanga (n=539, 18.6%) being the third largest contributor. Only 56 (1.9%) of the samples were received from the Eastern Cape.

The majority of samples received were bulk samples (n=1581, 52.9%). The most common types of bulk samples were cement materials (n=287, 18.2%) which excluded roofs, floor tiles (n=267, 16.9%), soil samples (n=178, 11.3%) and cement roofs (n=175, 11.1%). On analysis, 867 (54.8%) bulk samples contained asbestos. Most of these samples contained amphibole asbestos (n=469, 54.1%) and of these 340 (72.5%) were amphibole/serpentine mixtures. The activities resulting in sending the samples were mostly due to renovations (n=458, 29.0%) and risk assessment (n=381, 24.1%).

Air filters made up 1409 (47.1%) of the total number of samples received and on analysis 227 (16.1%) contained asbestos. The majority (n=204, 89.9%) of these contained amphibole asbestos with 22 (10.8%) being amphibole/serpentine mixtures.

The most common industries from which samples were received are electricity, gas, steam and air conditioning supply (n=501, 16.8%), mining and quarrying (n=386, 12.9%) and transportation and storage (n=298, 10.0%).

Samples received from Mpumalanga that were mostly from electricity generating power stations are declining drastically. There was an increased number of samples received from the Western Cape Province, most of which were from the education sector which includes schools.

Cement roofs had a high number of samples that contained asbestos 146 (83.4%). Of these, the most common asbestos type(s) identified was mixtures of chrysotile and crocidolite (n= 76, 52.1%). Of the air filters, 229 (16.3%) were received from asbestos landfill sites. Of these, the majority (n=216 94.3%) did not contain asbestos.

BACKGROUND

In terms of the 2002 Asbestos Regulations, the first step when working with asbestos should be its identification. The regulations specify all precautions that need to be considered when conducting any work on any structure containing asbestos. Draft Asbestos Abatement Regulations have been gazetted by the Department of Labour and will replace the Asbestos Regulations of 2002. However, the draft suggests that the identification of asbestos in materials and air will continue to remain an integral part of the regulations.

Regulations to prohibit the use, manufacture, import and export of asbestos and asbestos containing materials were promulgated in 2008. Despite this prohibition, the legacy of asbestos remains and this legacy include environmental contamination due to activities such as mining, milling and transportation of asbestos as well as the presence of a large number of asbestos containing materials in the environment. Environmental contamination poses potential health risks to surrounding communities. These risks include the potential development of asbestos related diseases namely pleural plaques, asbestosis, lung cancer and malignant pleural mesothelioma. While occupational exposure through the mining and milling and manufacturing of asbestos has ceased, workers in other industries may be exposed. The incorrect removal of asbestos containing materials can result in the liberation of fibres, exposing workers in the construction and demolition industries as well as to the community.

The National Institute for Occupational Health (NIOH) analyses samples for the presence of asbestos using scanning electron microscopy combined with electron dispersive spectrometry (SEM/EDS). This technique enables the identification of the type(s) and size of asbestos fibres present in the sample. All samples received are analysed and reported. The Electron Microscopy Unit participates in the Asbestos in Materials Schemes from Health and Safety Laboratories in the United Kingdom. This external quality assurance scheme ensures that the unit produces reliable results.

In 2003 the NIOH was able to offer a service to meet the demand by contractors to identify asbestos in materials and to enumerate asbestos fibres in air. In addition to recording the results for samples that are submitted for analysis, the NIOH also captures the information that accompanies the samples in a database. The database was created using Epi Info and contains various fields including the origin of the sample, the industry as well as the activity taking place before, at or after sample collection e.g. demolition/renovation etc. The NIOH, being a national research institute, undertakes to study various aspects of occupational and environmental health in terms of asbestos exposure. Data from these studies are also captured in the database and are included in the results presented in this report.

While the legacy of asbestos is recognised as a national problem, detail of its extent and magnitude remain largely unknown. This database provides information about the location and type of asbestos that remains in the environment.

This report summarises the asbestos database. Data from the asbestos database are exported into, and analysed, using SAS enterprise guide v7.1.

SECTION 1 – SAMPLES RECEIVED AND TYPE OF ASBESTOS IDENTIFIED

The number of samples received in the period 2003 to 2017 is displayed in Figure 1.1. A total number of 2990 samples were received. The highest number of samples (454, 15.2%) was received in 2013. The two types of samples received were bulk samples (n=1581, 52.9%) and air filters (n=1409, 47.1%). The types of bulk samples are displayed in Table 1.1.

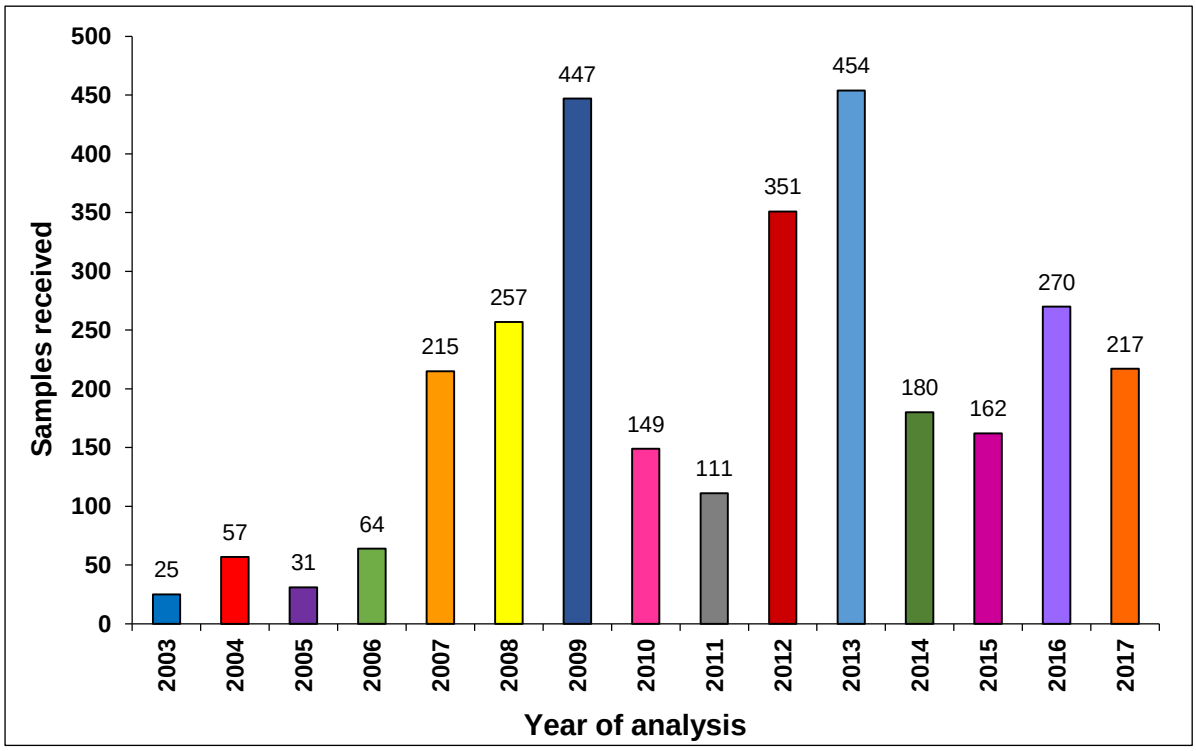

FIGURE 1.1: TOTAL NUMBER OF SAMPLES RECEIVED (2003-2017)

TABLE 1.1: THE TYPES OF BULK SAMPLES RECEIVED

Bulk type	N	%
Cement	287	9.6
Floor tile	267	8.9
Soil	178	6.0
Cement roof/ sheet	175	5.9
Fibrous material	108	3.6
Insulation material	85	2.8
Dust	83	2.8
Ceiling	80	2.7
Unknown	46	1.5
*Other	1681	56.2
Total	2990	

*Other includes: fascia board, fibrous material, Marley tile, wall section, artificial coal, bird proofing, board, brake lining, brick, cladding, clay material, flower pot, foam, gasket, gutter, heater, insulation material, jewellers sheet, lagging, manhole cover, millboard, ore, panel, pedestals, pipe, plaster, powder, pressure cleaning, rock, rope, seal, ship gear, ship wall panel, sludge, sponge material, string, sweepings, textile, vermiculite, water, waterproofing material, window putty, windowsill, woven material

The number of samples that contained asbestos is displayed in Figure 1.2. Asbestos was identified in more than half of the bulk samples (n=867, 54.8%) and in 227 (16.1%) air filters. The type(s) of asbestos identified per sample type are displayed in Table 1.2.

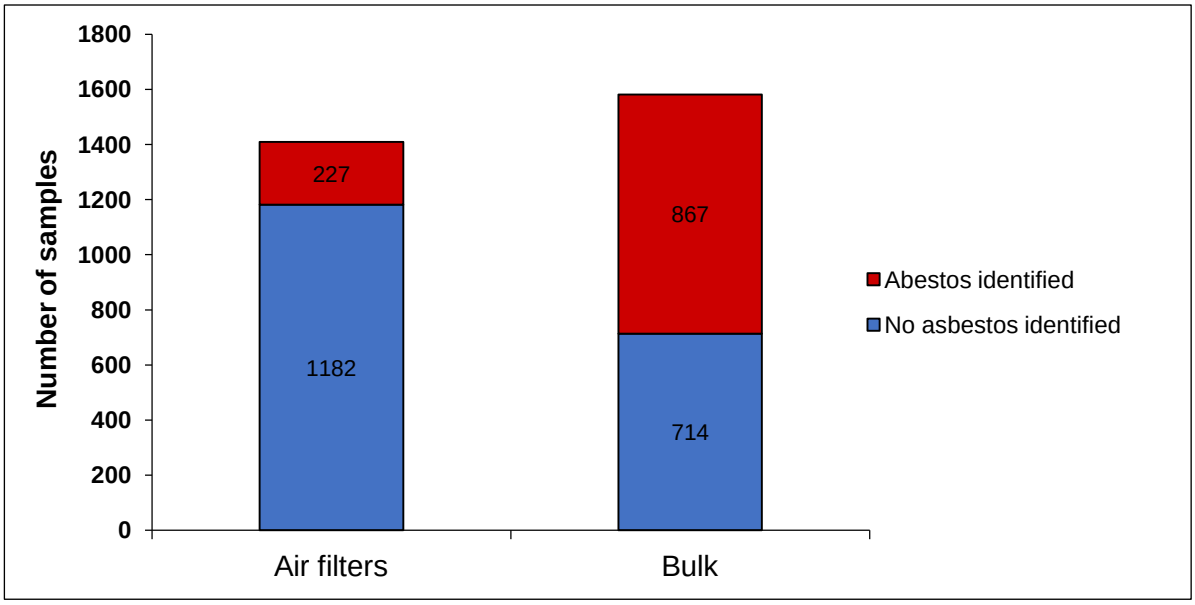

FIGURE 1.2: THE NUMBER OF SAMPLES THAT CONTAINED ASBESTOS PER SAMPLE TYPE (2003-2017)

TABLE 1.2: THE TYPES OF ASBESTOS IDENTIFIED PER SAMPLE TYPE (2003-2017)

Asbestos type	Air filters	Bulk
Chrysotile only	23	398
Chrysotile, crocidolite mixture	6	231
Chrysotile, Amosite mixture	12	86
Amosite only	131	79
Crocidolite only	33	38
Chrysotile, crocidolite and Amosite mixture	4	23
Crocidolite, Amosite mixture	12	9
Chrysotile, crocidolite, Amosite and tremolite mixture	5	3
Tremolite only	1	0
Total	227	867

SECTION 2 – SAMPLE ORIGIN

Each sample is received with accompanying information including the country or provincial origin of the sample. Information regarding the sample's origin was incomplete for five (0.2%) samples, and after unsuccessful efforts to obtain this the origin was then classified as unknown. The origins for the samples received in the period 2003-2017 are displayed in Table 2.1 and Figure 2.1 below.

TABLE 2.1: THE COUNTRY OF ORIGIN FOR SAMPLES RECEIVED (2003-2017)

Countries	Number of samples	%
RSA	2894	96.8
Botswana	73	2.4
Lesotho	12	0.4
Namibia	3	0.1
Other African countries	2	0.07
Mozambique	1	0.03
Unknown	5	0.2
Total	2990	

Most of the samples were received from Gauteng (n=792, 26.5%) followed by Western Cape (n=587, 19.6%) and Mpumalanga (n=539, 18.0%). The least number of samples were received from the Free State (n=58, 1.9%) and the Eastern Cape (n=56, 1.9%) provinces.

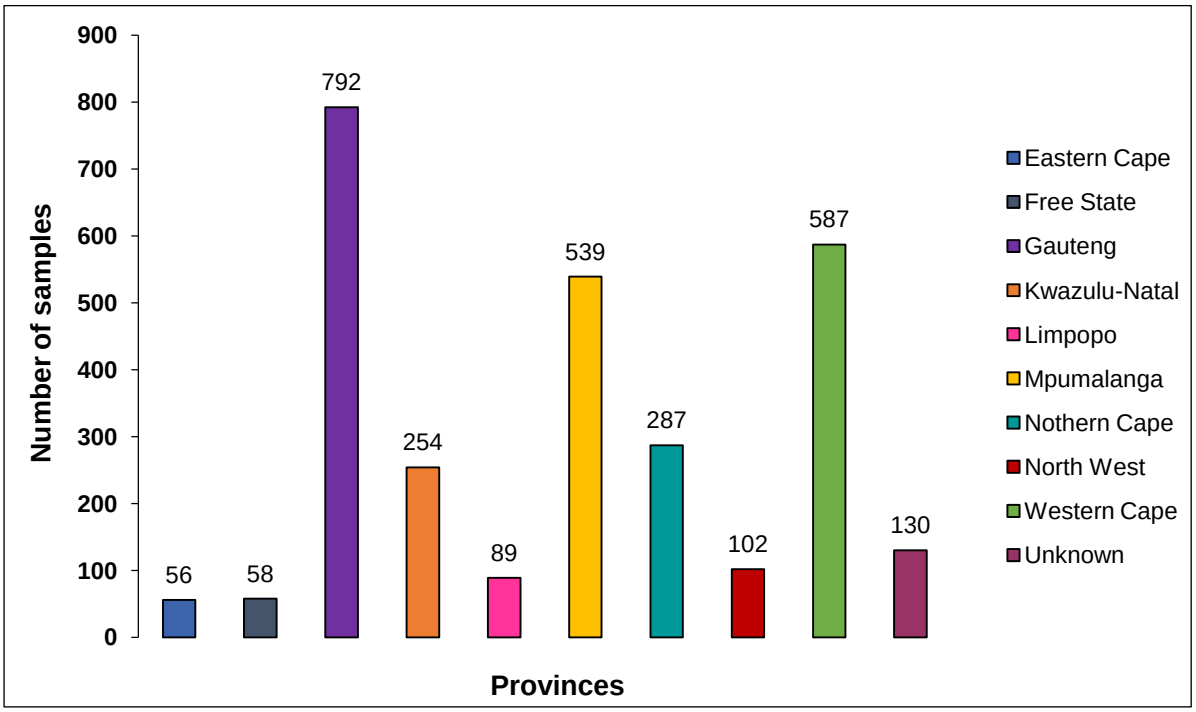

FIGURE 2.1: THE SOUTH AFRICAN PROVINCE FROM WHICH THE SAMPLES WERE RECEIVED (2003-2017)

SECTION 3 – INDUSTRY CLASSIFICATION OF SAMPLES

The industrial sector was assigned to each sample according to the Standard Industrial Classification of all Economic Activities. Where no information regarding the sample's industry was received, the sample was classified as unknown (n=300, 10.0%). The various industries are displayed in Table 3.1.

TABLE 3.1: THE INDUSTRY CLASSIFICATION FOR SAMPLES RECEIVED (2003-2017)

Industry classification	N	%
Electricity, gas, steam and air conditioning supply	501	16.8
Mining and quarrying	386	12.9
Unknown	300	10.0
Transportation and storage	298	10.0
Professional, scientific and technical activities	279	9.3
Water supply; sewerage, waste management and remediation activities	259	8.7
Education	203	6.8
Manufacturing	188	6.3
Real estate activities	188	6.3
Human health and social work activities	92	3.1
Public administration and defence; compulsory social security	81	2.7
Wholesale and retail trade; repair of motor vehicles and motorcycles	62	2.1
Financial and insurance activities	56	1.9
Administrative and support service activities	26	0.9
Arts, entertainment and recreation	23	0.8
Construction	18	0.6
Agriculture, forestry and fishery	17	0.6
Accommodation and food service activities	8	0.3
Information and communication	5	0.2
Total	2990	

SECTION 4 – ACTIVITIES BEFORE, AT OR AFTER SAMPLE COLLECTION

The activities taking place before, at or after sample collection were categorised and displayed in Table 4.1. Most of the air filter samples were sent for monitoring (n=845, 28.3%) and most of the bulk samples were sent because of renovations (n=458, 15.3%).

TABLE 4.1: ACTIVITIES BEFORE, AT OR AFTER SAMPLE COLLECTION (2003-2017)

Activity	Sample type			
	Air filters	%	Bulk	%
*Air monitoring	910	64.6	0	-
Demolition	58	4.1	221	14.0
High pressure cleaning	2	0.1	7	0.4
Inventory	0	-	360	22.8
Renovation	282	20.0	458	29.0
Risk assessment	111	7.9	381	24.1
Unknown	46	3.3	154	9.7
Total	1409		1581	

*Air monitoring includes, but is not limited to, the monitoring of asbestos landfill/waste sites, communities and clean ups.

SECTION 5 – WHAT THE ASBESTOS DATABASE IS INDICATING

Three provinces, Gauteng (n=792, 26.5%), Western Cape (n=587, 19.6%) and Mpumalanga (n=539, 18.0%) supplied the majority (64.1%) of all samples received from 2003 to 2017 and are displayed in Figure 5.1. The number of samples from Gauteng peaked in 2009 and has since decreased to 38 in 2017. There has been steady increase in samples from the Western Cape since 2012, peaking at 117 in 2016. In Mpumalanga there was a sharp increase of sample from between 2008 and 2013. Numbers have since shown a decline and no samples were received in 2017.

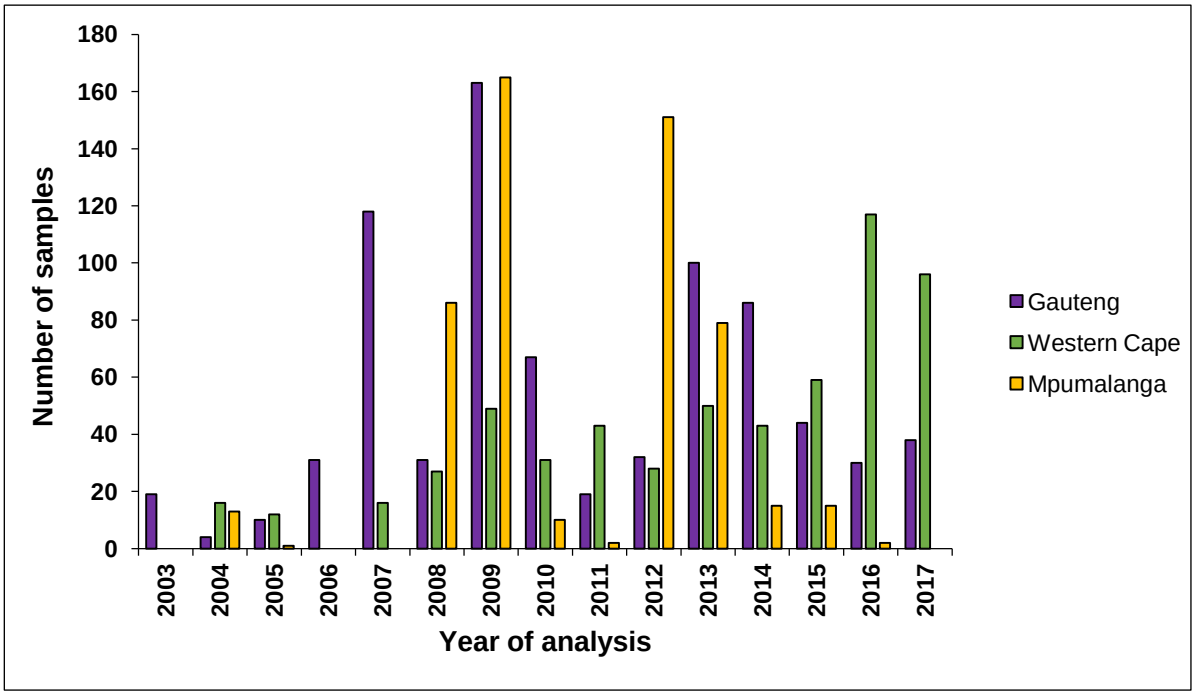

FIGURE 5.1: PROVINCES THAT SUPPLIED THE MAJORITY OF SAMPLES (2003-2017)

The distribution of samples received from education is shown in Figure 5.2. The numbers have increased from 1% of the total number of samples in 2007 to 18% in 2017. Most of these (n=162, 79.8%) samples originated from the Western Cape Province.

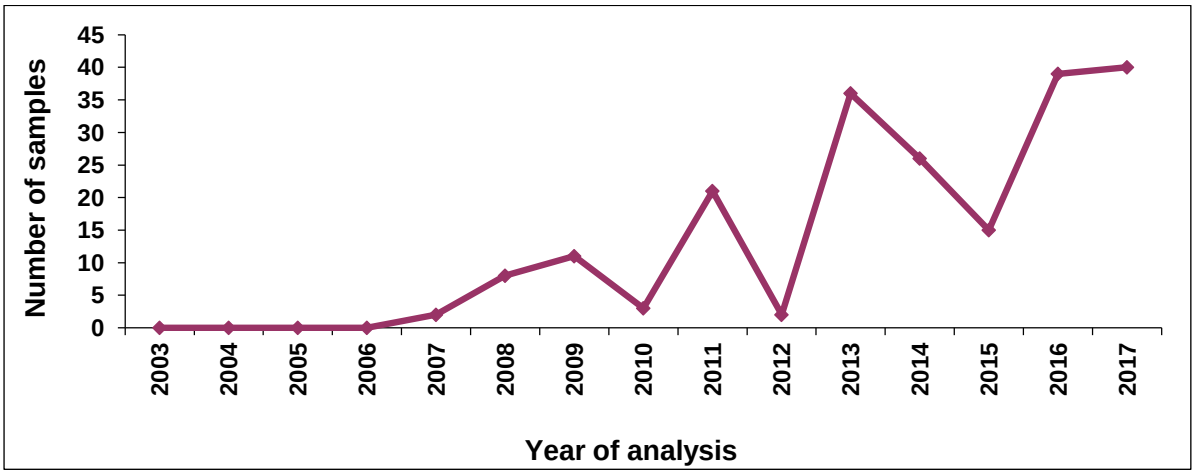

FIGURE 5.2: SAMPLES RECEIVED FROM THE EDUCATION SECTOR (2003-2017)

A total of 175 samples from cement roofs were received for asbestos analysis as presented in Figure 5.3. Of these, 146 (83.4%) contained asbestos. The asbestos type identified is displayed in Table 5.1. A mixture of chrysotile and crocidolite (n= 76, 52.1%) was the most common asbestos type in roofs followed by chrysotile (n=49, 33.6%).

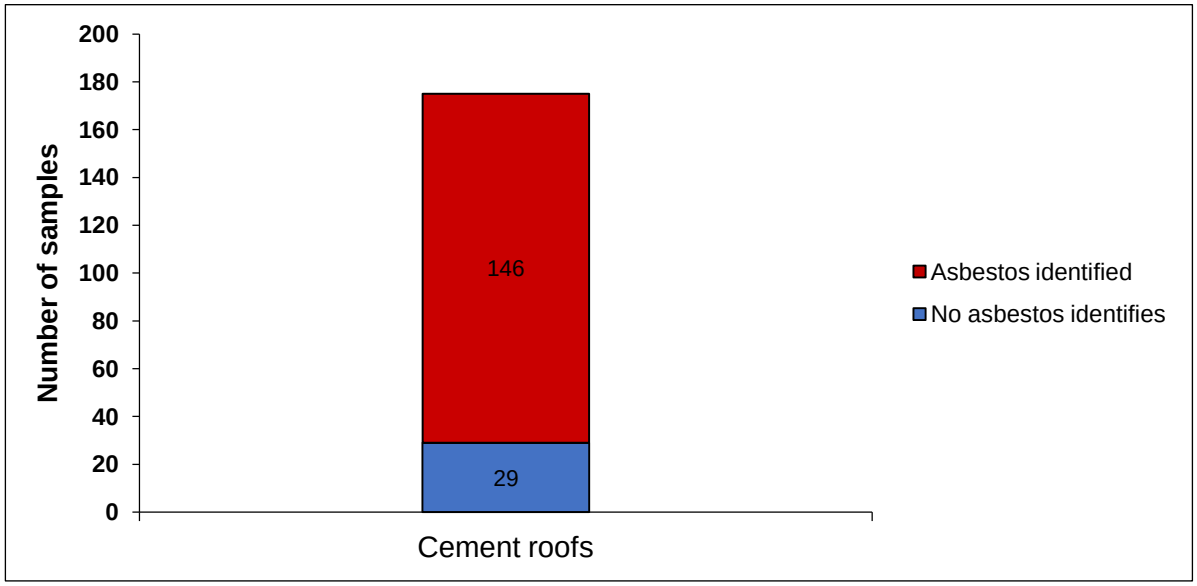

FIGURE 5.3: CEMENT ROOF SAMPLES RECEIVED FOR ANAYLSIS (2003-2017)

TABLE 5.1: TYPES OF ASBESTOS IDENTIFIED IN CEMENT ROOF SAMPLES (2003-2017)

Asbestos type	N	%
Chrysotile, crocidolite mixture	76	52.1
Chrysotile only	49	33.6
Chrysotile, Amosite mixture	11	7.5
Chrysotile, crocidolite and Amosite mixture	6	4.1
Chrysotile, crocidolite, Amosite and tremolite mixture	2	1.4
Crocidolite only	1	0.7
Amosite only	1	0.7
Crocidolite, Amosite mixture	-	-
Total	146	

Figure 5.4 displays air filters received from asbestos air monitoring at landfill sites. The majority of the samples did not contain asbestos fibres (n=216, 94.3%).

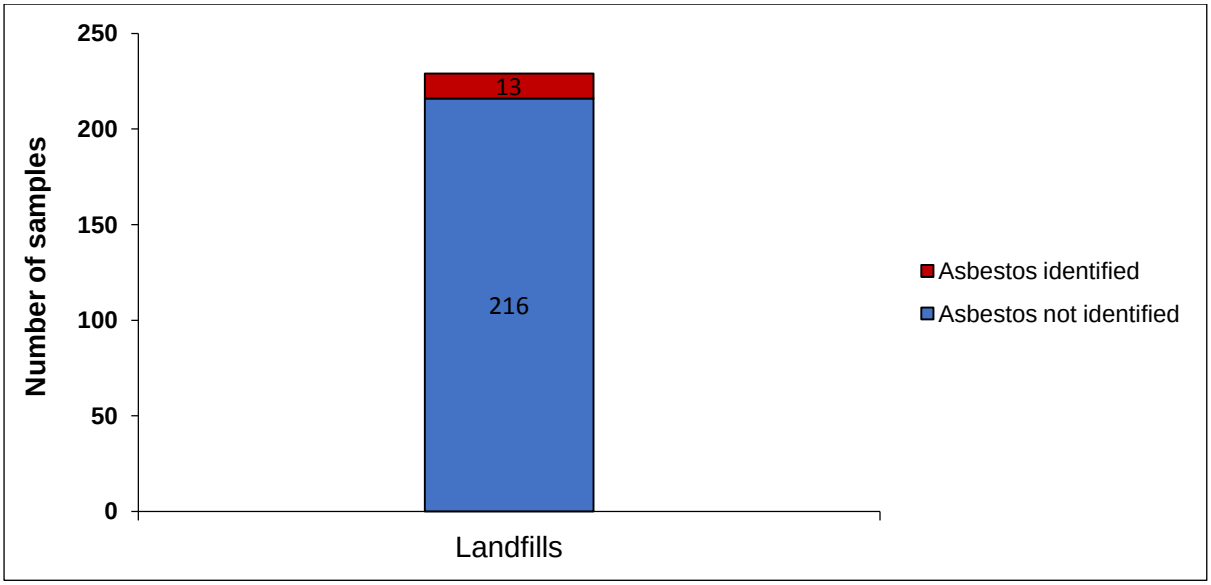

FIGURE 5.4: AIR FILTERS FROM ASBESTOS LANDFILL SITES (2003-2017)

ACKNOWLEDGEMENTS

We thank the following staff members for their contributions to this report:

Estelle Garton

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APPENDIX 1: PUBLICATIONS, PRESENTATIONS AND POSTERS UTILISING THE ASBESTOS DATABASE

Publications:

Rees D, Phillips JI. The legacy of in situ asbestos cement roofs in South Africa, *Occupational and Environmental Medicine*, 2017;74 (Suppl 1):A76-A77

Phillips JI, Norman G, and Renton K. Asbestos in soil around dwellings in Soweto. *Occupational Health Southern Africa*, 2009;15(2):24–27.

Phillips JI, Rent K, Murray J, Garton E, Tylee BE, and Rees D. Asbestos in and around Soweto dwellings with asbestos cement roofs. *Occupational Health Southern Africa*, 2007;13(6):3–7.

Milne SJ, Garton E, Nelson G, Murray J, Davies JCA, Phillips JI. A South African database of samples analysed for the presence of asbestos. *Occupational Health Southern Africa*, 2003;19(6):14–21.

Oral presentations:

Rees D, Phillips JI. *In situ* asbestos and the risk of exposure for workers. An International challenge. EPICOH conference; 28 – 31 August 2017. Edinburgh Scotland

Kgokong N, Vorster T, Kereeditse KR, Phillips JI. The NIOH asbestos database – What can it tell us? World day for Safety and Health at Work; 30 May 2017. NIOH Braamfontein

Vorster T, Kgokong N, Kereeditse KR, Phillips JI. The NIOH asbestos database – What can it tell us? Research Forum; 19 April 2017. NIOH Braamfontein

Poster presentations:

Vorster T, Kgokong N, Phillips JI. The possible health implications of the legacy of asbestos cement roofs in South Africa. Pathology Research and Development Congress; 23-24 June 2017. Emperor's Palace, Johannesburg, South Africa