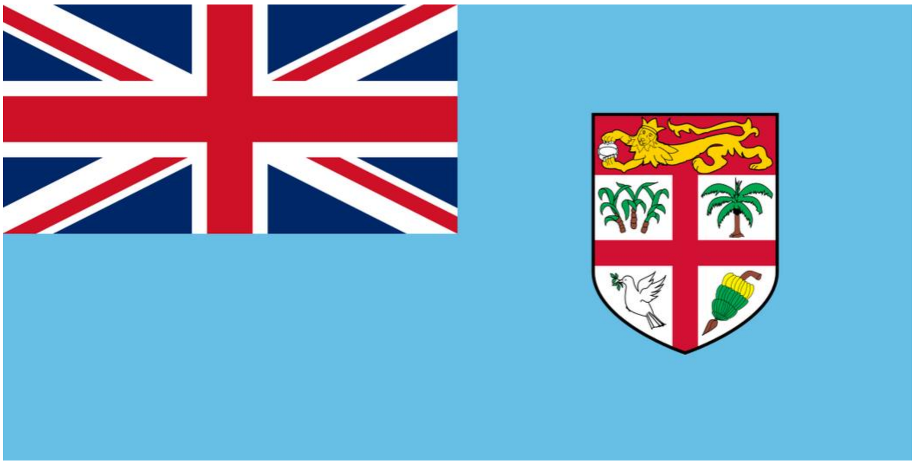
Survey of the Regional Distribution and Status of Asbestos-Contaminated Construction Material and Best Practice Options for its Management in Pacific Island Countries

Report for the Republic of Fiji



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Executive Summary

PacWaste (Pacific Hazardous Waste) is a four year (2013-2017), €7.85 million, project funded by the European Union and implemented by Secretariat of the Pacific Regional Environment Programme (SPREP) to improve regional hazardous waste management in 14 Pacific island countries, plus Timor Leste, targeting the priority areas of healthcare waste, asbestos, E-waste and integrated atoll solid waste management.

Asbestos-containing wastes and materials are a major issue for many Pacific Island countries with a history of use of asbestos-containing building materials in construction. All forms of asbestos are carcinogenic to humans and inhalation of asbestos fibres that have become airborne can cause serious lung disease or cancer.

SPREP's regional priorities for asbestos management include conducting an inventory of the distribution of asbestos-containing materials (ACMs) in thirteen Pacific island countries, assessing the risks posed to human health by asbestos, progressive stabilization of high-risk facilities such as schools and occupied dwellings, and final disposal of ACM wastes in suitable locations.

PacWaste has commenced with a series of baseline surveys that will collect and collate information about the current status of all three hazardous waste streams targeted (healthcare waste, asbestos, E-waste) and its management in the South Pacific region and will identify best practice options for interventions that are cost-effective, sustainable and appropriate for Pacific Island communities. These remedial interventions will be implemented in priority countries identified through the baseline survey.

This report aims to meet part of the objectives of SPREP'S Pacific Regional Solid Waste Management Strategy 2010–2015 and the regional hazardous waste strategies, 'An Asbestos Free Pacific: A Regional Strategy and Action Plan 2011'.

This report covers the Fiji component of a survey of the regional distribution and status of asbestos-containing material (ACM), and best practice options for its management, in selected Pacific Island communities. The objectives of the survey are summarised as follows:

- To assess the status of, and management options for, ACM throughout the Pacific region; and
- To develop recommendations for future management interventions, including a prioritised list of target locations.

The work was carried out by a consortium led by Contract Environmental Ltd and Geoscience Consulting (NZ) Ltd, under contract to the Secretariat of the Pacific Regional Environment Programme (SPREP), with funding provided by the European Union. The majority of information relating to the distribution of ACM in Fiji was obtained during two field visits undertaken by Gareth Oddy of Geoscience and John O'Grady of Contract Environmental between the 12th and 24th July and 31st July and 2nd August 2014. The field visits were conducted with assistance from the Fijian Government and in particular the Ministry of Labour Industrial Relations and Employment (Ministry of Labour) Occupational Health & Safety (OHS) team and the Department of Environment.

Survey Methodology

The survey work undertaken in Fiji included meetings with key government agencies, area-wide surveys of residential properties across the Islands of Viti Levu and Vanua Levu, and targeted investigations of public and commercial buildings.

A statistical method was adopted for the survey of residential properties. This involved calculating the minimum sample size required from the total population to give the required confidence level and margin of error.

The survey sample size was based upon a 95% confidence level and 3.5% margin of error. With 167,400 households across the nation the number of houses required to ensure a statistically representative number of households was 780. In fact, 3,400 houses were inspected in Viti Levu and Vanua Levu.

In addition to residential households, the survey sought to identify public buildings and government-owned industrial and commercial properties containing ACMs. The primary focus of this part of the survey was on public buildings that would potentially present the most prolonged and thus significant risks for public exposure. Commercial and industrial buildings were included if they were observed in close proximity to residential housing or public areas.

The basic approach taken for all property types was an initial visual assessment, usually from the roadside or property boundary, followed by closer inspection if the buildings appeared to contain potential ACMs, such as fibreboard cladding, roofing materials, or pipes. The information collected in the close-up inspections was recorded on the spot using a tablet-based application designed specifically for this project. In addition, samples of any suspect materials were collected for testing.

The collected samples were sent by courier to EMS Laboratories Incorporated in California, USA. Analysis was by Polarised Light Microscopy, which is a semi-quantitative procedure for identifying asbestos fibres, with a detection limit in the range of 0.1 to 1% on a surface area basis.

Risk Assessment

A systematic risk assessment approach was adopted in order to assess the relative risks of each building identified as containing ACMs. The method used was that given in the UK HSE guidance document '*Methods for the Determination of Hazardous Substances (MDHS100) Surveying, sampling and assessment of asbestos-containing materials (2001)*' and UK HSE guidance document '*A comprehensive guide to Managing Asbestos in premises (2002)*'. The method uses a simple scoring system to allow an assessment of the relative risks to health from ACMs. It takes into account not only the condition of the asbestos, but also the likelihood of people being exposed to the fibres.

The risk assessment approach adopted presents algorithms that allow a score to be calculated for each ACM item observed or confirmed by laboratory analysis. The sites with high scores may present a higher risk to human health than those with lower scores.

Survey Outcomes

Asbestos fibres were detected in building material samples with 16 of 29 sites testing positive. The percentages of fibres detected in the bulk samples ranged from 2 – 95%.

Otherwise apart from a few notable exceptions there appears to be little asbestos in Fiji. The exceptions include the following:

- There are stockpiles of water pipes and no doubt underground networks of pipes.
- The Suva Grammar School has asbestos panels which may now have been removed, as well as broken asbestos flooring in the classrooms.
- Labasa Hospital has many asbestos sunshades as well as old fibreglass boiler pipe lagging.
- There is also extensive old asbestos remaining at the Tamavua-Twomey Hospital Complex in Suva. For example asbestos-lined pipe ducting runs along ward corridors for a long distance, the old Ward 5 complex has asbestos cladding on the outside and asbestos lining and ceilings on the inside. There are also external pipes with deteriorating asbestos lagging in several parts of the ground.

Statistical Summary – Population and Households in Fiji

Town/ city	Suva		Lami		Nasinu		Nausori		Lautoka	
Locality	Town	Rural	Town	Rural	Town	Rural	Town	Rural	City	Rural
Population	424,846	74,481	11,210	10,752	9,777	76,064	11,382	24,919	22,685	43,473
	499,327		21,962		85,841		36,301		66,158	
No. Households	99,865		4,392		17,168		7,260		13,231	

Town/ city	Nadi		Ba		Sigatoka		Labasa		Savusavu	
Locality	Town	Rural	Town	Rural	Town	Rural	Town	Rural	Town	Rural
Population	11,685	30,599	6,826	11,700	1,634	7,988	7,706	20,243	3,285	3,749
	42,284		18,526		9,622		27,949		7,034	
No. Households	8,456		3,705		1,924		5,589		1,407	

Town/ city	Levuka		Tavua		Unincorporated Towns and Other Urban Areas					
Locality	Town	Rural	Town	Rural	Rakiraki	Vatukoula	Navua	Korovou	Deuba	Nabouwalu
Population	1,131	3,266	1,079	1,309	4,952	5,580	5,048	349	1,819	592
	4,397		2,388							
No. Households	879		478		990	1,116	1,010	70	364	118

Source: 2007 Population Census of Fiji, Fiji Islands, Bureau of Statistics.

The survey sample size was based upon a 95% confidence level and 3.5% margin of error. With 167,400 households across the nation the number of houses required to ensure a statistically representative number of households were included, and to allow estimates to be made, was 780.

Information on the population distribution of Fiji was provided by the 2007 population census produced by the Fijian Bureau of Statistics. Fiji had a population of 837,000 in 2007 across the Republic's 106 inhabited islands and total land area of 18,300 km^2. The population is estimated (based on 5 residents per household) to be housed in approximately 167,400 residential households, with the majority of those households on the island of Viti Levu.

Our survey of Fiji focused on Viti Levu and Vanua Levu and in particular the towns and cities presented in the table above, which provides a summary of the Fijian 2007 census data and the survey data collected during this assessment.

Based on the 3,600 properties surveyed, none of the residential buildings were suspected of containing ACM in the exterior material. The majority of the households surveyed were located in and around the towns of Suva, Nadi and Lautoka. Given the sample size and conclusion based upon it, if this estimate is extrapolated to include the remaining residential properties on Viti Levu and Vanua Levu, and also the outer islands, then based on a 95% confidence level the potential number of households in Fiji to contain ACM would be zero +/-1.7% (ie between 0 and 2846 houses). However, caution should be used with any extrapolation of data and especially in this project as the residential buildings encountered on Viti Levu and Vanua Levu are likely to differ significantly from those on the outer islands where building resources are limited.

Cost Estimates

Pacific-wide cost estimates have been calculated for several remediation scenarios, as shown in the table below:

Summary of Costs for Various Remediation Options (Costs rounded to nearest $US)

Remediation Method	Cost per m^2 (face area) $US
Encapsulation	
Roofs:	
Encapsulate roof where there is no ceiling present below the roof	50.00
Encapsulate roof where there is an existing ceiling below the roof that needs to be removed and replaced	91.00
Cladding:	
Encapsulate wall cladding where there is no internal wall sheeting	26.00
Encapsulate wall cladding where there is internal wall sheeting in good condition, which means only the exterior needs to be encapsulated	18.00
Encapsulate wall cladding where there is internal wall sheeting in poor condition, which must be treated as asbestos contaminated and removed and replaced: USD65.92/m2 (face area)	66.00
Removal and Replacement	
Roofs:	
Remove and replace roof	96.00
Cladding:	
Remove and replace cladding	76.00
Miscellaneous	
Remove and replace floor tiles*	80.00
Pick up debris, pipes	40.00

**$US80 is the lower end of the cost spectrum for removing and replacing vinyl floor tiles and the cost could easily double (or more) for difficult removal projects. To balance this out, the vinyl tile matrix is stable and there is little risk of asbestos exposure unless they are badly deteriorating. Vinyl floor asbestos projects could therefore be lower down on the priority list.*

The above removal and replacement rates assume asbestos waste disposal to a suitable nearby local landfill. If the waste needs to be exported or if sea disposal is being considered, then this will need to be costed as an extra.

A summary of the recommended actions, estimated time and materials and estimated costs are included in the table below.

Remedial Cost Estimates for Fiji

Site Name	ACM	Risk Score	Recommended Remedial Actions	ACM Area (m^2)/ Volume (m^3)	Estimated Cost Range ($ USD)
Tamavua Hospital	Rope lagging, beneath corridor slab	26	Remove and replace ACM	240m	21,000
	Ward 5 – outside pipe rope	24	Remove and replace ACM	180m	18,000
	Ward 5 – cladding north	23	Remove and replace ACM	1200m^2	85,200
	Ward 5 – cladding south	23			
	Contaminated soil	23	Remove	80 m^2	5,000
Suva Grammar School	Window panels – science classroom	25	Remove and replace ACM	30m^2	2,130
	Vinyl Tile – entrance corridor	24	Remove and replace ACM	100m^2	7,600
	Hall external panel	16	Remove and replace ACM	60m^2	4,560
Suvasuva Hospital	Entrance Vinyl Floor	23	Remove and replace ACM	200m^2	15,200
Fiji Sugar Corporation Labasa Mill	Compressor lagging	23	Remove and replace ACM	0.5m^3	2,500
Twomey Hospital	Boiler room, boiler lagging	22	Remove and replace ACM	0.5m^3	2,500
	Boiler room, pipe lagging	21	Remove and replace ACM		
Labasa Hospital	Boiler Rope	19	Remove and replace ACM	0.1m^3	2,500
	Sunshade	19	Remove and replace ACM	160m^2	7,840
Labasa College	Library Sunshade	17	Remove and replace ACM	40m^2	1,960
WAF Labasa	Compound vinyl floor	18	Remove and replace ACM	100m^2	8,000

Recommendations

The following recommendations are therefore made in relation to asbestos in Fiji:

A. It is recommended that the above higher priority asbestos work is carried out in Fiji and that consideration be given to removing other asbestos as per the table above. In particular the work at the Tamavua-Twomey Hospital should be completed.
B. No residential houses were identified as having asbestos in Fiji but it is still possible that houses may contain asbestos, so vigilance should still be maintained.
C. The Naboro Landfill is ideal for receiving asbestos wastes and should be used for all asbestos disposal.
D. Before asbestos remediation takes place (and after if all the asbestos is not removed) it would be appropriate to set in place suitable asbestos management practices and procedures to deal with the ongoing risk posed to human health by asbestos exposure. This should be accompanied by an appropriate education and training programme.

E. Consideration should be given to Fiji passing suitable legislation to prevent asbestos being imported into Fiji.

Contents

Definitions

ACM: "Asbestos Containing Material" – ie any material that contains asbestos.

Amosite: Brown or Grey Asbestos

Asbestos: The fibrous form of mineral silicates belonging to the Serpentine and Amphibole groups of rock-forming minerals, including amosite (brown asbestos), crocidolite (blue asbestos), chrysotile (white asbestos), actinolite, tremolite, anthophyllite or any mixture containing one or more of these

CEL: Contract Environmental Limited

Chrysotile: White Asbestos

Crocidolite: Blue Asbestos

EMS: EMS Laboratories Incorporated

External: Refers to the top or outside of roof sheeting or the outside of building/wall cladding

Friable: With respect to asbestos-containing material, means able to be crumbled, pulverised or reduced to powder by hand pressure when dry, and includes non-bonded asbestos fabric

GPS: Global Positioning System

Hazard: Is a potential to cause harm

IANZ: International Accreditation New Zealand

Internal: Refers to the underside of roof sheeting, or the inside of building/wall sheeting and structures therein

MDHS100: Methods for the determination of hazardous substances, surveying, sampling and assessment of asbestos-containing materials

Non-Friable: With respect to asbestos containing material means unable to be crumbled, pulverised or reduced to powder by hand pressure when dry

PACM: "Presumed Asbestos Containing Material" – ie any material presumed to contain asbestos, based on observation and knowledge of other relevant factors

PPE: Personal Protective Equipment

Practicable: Able to be done / put into practice having regard to:

- The severity of the hazard or risk in question
- The state of knowledge about the hazard or risk
- The availability and suitability of ways to remove or mitigate that hazard or risk
- The cost of removing or mitigating that hazard or risk

Risk: Is the likelihood of illness or disease arising from exposure to airborne asbestos fibres

SMF: Synthetic Mineral Fibres

SPREP: Secretariat of the Pacific Regional Environment Programme

1. Introduction

1.1 Purpose

This report covers the Fiji component of a survey of the regional distribution and status of asbestos-containing material (ACM), and best practice options for its management, in selected Pacific island communities. The objectives of the survey are summarised as follows:

- To assess the status of, and management options for, ACM throughout the Pacific region; and
- To develop recommendations for future management interventions, including a prioritised list of target locations.

The work was carried out by a consortium led by Contract Environmental Ltd and Geoscience Consulting (NZ) Ltd, under contract to the Secretariat of the Pacific Regional Environment Programme (SPREP), with funding provided by the European Union. The majority of information relating to the distribution of ACM in Fiji was obtained during two field visits undertaken by Gareth Oddy of Geoscience and John O'Grady of Contract Environmental between the 12th and 24th July and 31st July and 2nd August 2014. The field visits were conducted with assistance from the Fijian Government and in particular the Ministry of Labour Industrial Relations and Employment (Ministry of Labour) Occupational Health & Safety (OHS) team and the Department of Environment.

1.2 Scope of Work

A copy of the Terms of Reference for this work is given in Appendix 1. It lists the following tasks:

1. *Collect and collate data on the location (geographic coordinates), quantity and condition of asbestos-containing building materials (including asbestos-containing waste stockpiles) in each nominated Pacific Island country;*

2. *Review, and recommend a prioritised list of local best-practice options for stabilisation, handling and final disposal of asbestos-contaminated materials in each nominated Pacific Island country (including review of existing local institutional, policy and regulatory arrangements);*

3. *Recommend and prioritise actions necessary to minimise exposure (potential and actual) of the local population to asbestos fibres for each nominated Pacific Island country. An approximate itemised national cost should be presented for each option identified;*

4. *Identify any local contractors who have the expertise and capacity to potentially partner with regional or international experts in future asbestos management work; and*

5. *Develop a schedule of rates for local equipment hire, mobilisation, labour, etc., to guide the development of detailed cost-estimates for future in-country asbestos remediation work.*

1.3 Background to Fiji

Fiji, officially the Republic of Fiji, is an island country in Melanesia in the South Pacific Ocean about 2,000 km northeast of New Zealand. Fiji is an archipelago of more than 332 islands, of which 110 are permanently inhabited, and more than 500 islets, amounting to a total land area of about 18,300 square kilometres. The two major islands, Viti Levu and Vanua Levu, account for 87% of the population of almost 860,000 (837,000 in the 2007 Census). The capital and largest city, Suva, is on Viti Levu. About three-quarters of Fijians live on Viti Levu's coasts, either in Suva or in smaller urban centres like Nadi or Lautoka. Viti Levu's interior is sparsely inhabited due to its terrain.

The two most important islands are Viti Levu and Vanua Levu, which account for about three-quarters of the total land area of the country. The main towns on Vanua Levu are Labasa and Savusavu. The two main islands are mountainous, with peaks up to 1,324 metres, and covered with thick tropical forests. Other islands and island groups include Taveuni and Kadavu (the third and fourth largest islands, respectively), the Mamanuca Group (just off Nadi) and Yasawa Group, which are popular tourist destinations, the Lomaiviti Group, off Suva, and the remote Lau Group.

The climate in Fiji is tropical marine and warm year round with minimal extremes. The warm season is from November to April and the cooler season lasts from May to October. Temperature in the cool season still averages 22 °C (72 °F). Rainfall is variable, with the warm season experiencing heavier rainfall, especially inland. Winds are moderate, though cyclones occur about once a year (10–12 times per decade).

Figure 1 shows a Map of Fiji and Figure 2 shows a Map of the main island Viti Levu.

Figure 1 – Map of Fiji

Figure 2 – Map of Viti Levu

1.4 Report Content and Layout

Section 2 of this report gives details of the methodology used for the study including the approach used for determining the survey coverage, the identification of specific target sites, procedures for site inspections and data capture, and sample collection and analysis. In addition, the relative importance of different sites was assessed using a risk assessment methodology, which is described in section 3.

The asbestos survey is discussed in section 4 of the report, with the laboratory and residential results given in section 5, and the risk assessment results in section 6.

Section 7 provides a generic discussion of possible management options for ACMs, and this is followed in section 8 by a specific analysis of the most appropriate options for those ACMs identified in Fiji.

Section 9 provides a review and analysis of existing national policies and legal instruments relevant to ACM management, while costings including local contracting capabilities and costs are discussed in section 10.

Section 11 contains a review of Fiji Policies and Legal Instruments.

Section 12 of the report provides a final discussion and a list of recommended actions, including cost estimates for those sites identified as priority targets for remediation.

Additional supporting information is given in a series of appendices.

2.0 Survey Methodology

2.1 Pre-Survey Desk Study

The survey work undertaken during the visit to Fiji included meetings with key government agencies, area-wide surveys across the islands of Viti Levu and Vanua Levu and specific investigations of 77 individual sites.

Prior to conducting the surveys and visiting Fiji, the survey team completed a desk study to enable a more targeted assessment of buildings potentially containing ACM. The desk study included contacting relevant local Government agencies in advance of the trip to evaluate if the agencies were aware of any buildings where ACM was a concern. In addition, the consultation aimed to evaluate local regulations and practices with respect to ACM identification, removal and disposal practices.

Reports provided by the Government agencies and other parties on the distribution of asbestos or if available on specific sites, were reviewed by the survey team. Reports relevant to this project were reviewed, they included the following;

- Fiji Ministry of Labour, Occupational Health Safety Asbestos audit and risk Assessment Airports Fiji Limited (Nadi Airport)';
- "The Extent of Usage and Hazards Associated with Asbestos in Colonial Buildings in the Municipality of Suva City, Fiji". MOHS Treatise by Osea Carawu 1996.

A number of newspaper articles produced by Fiji Times Online on the presence of asbestos within buildings and urban areas in Fiji were also reviewed.

A second objective of the desk study was to evaluate the population distribution on the survey islands in order to prioritise which population centres and if possible which individual buildings should be included in the survey. The most recent census data was sought and reviewed in order to ensure a sufficient statistically representative number of residential buildings were included in the survey.

Where population centres were identified, existing aerial photographs and geographically positioned photographs (where available) provided on Google Earth were reviewed. The review of Google Earth photographs enabled the survey team to appreciate the typical types of building construction materials in the centres, an approximate age of the buildings and in certain cases possible asbestos containing material (PACM) was observed in photographs in Google Earth. Conclusions on any PACM observed in the photographs were to be verified during the surveys.

2.2 Survey Coverage

Due to the large population of Fiji spread over 110 inhabited islands, a survey of each island and residential household was not feasible in the timeframes and budget of the project. A statistical approach was therefore adopted to ensure a sufficient number of residential properties were included in the survey to allow a confident estimate of the number of houses with certain characteristics related to asbestos to be made.

The survey covered the islands of Vitu Levu and Vanua Levu. The Vanua Levu survey was restricted to Labasa and Savusavu due to the majority of historical development and population being located in these centres. The Vitu Levu survey concentrated on the main towns/cities including Suva, Nadi, Lautoka, Signatoka, Ba and Nausouri, although a circuit of the island was carried out.

According to the Fijian Bureau of Statistics, 2007 population census, Fiji had a population of approximately 837,000 in 2007. Table 1 summarises the most recent census data for Fiji.

Table 1: Fiji 2007 Census – Population by Town

Suva		**Lami**		**Nasinu**		**Nausori**		**Lautoka**	
City	Rural	Town	Rural	Town	Rural	Town	Rural	City	Rural
424,846	74,481	11,210	10,752	9,777	76,064	11,382	24,919	22,685	43,473
499,327		21,962		85,841		36,301		66,158	
Nadi		**Ba**		**Sigatoka**		**Labasa**		**Savusavu**	
Town	Rural	Town	Rural	Town	Rural	Town	Rural	Town	Rural
11,685	30,599	6,826	11,700	1,634	7,988	7,706	20,243	3,285	3,749
42,284		18,526		9,622		27,949		7,034	
Levuka		**Tavua**		**Unincorporated Towns and Other Urban Areas**					
Town	Rural	Town	Rural	**Rakiraki**	**Vatukoula**	**Navua**	**Korovou**	**Deuba**	**Nabouwalu**
1,131	3,266	1,079	1,309	4,952	5,580	5,048	349	1,819	592
4,397		2,388							

Source: 2007 Population Census of Fiji, Fiji Islands, Bureau of Statistics.

According to the Bureau of Statistics, the average household size in Fiji is five residents. The Fijian population is therefore housed in approximately 167,400 residential houses, with the majority (approximately 100,000 homes) in the Capital City Suva located on the island of Viti Levu.

The statistical approach adopted is a technique commonly used in household marketing surveys and political polls. For a specified total population size the required sample numbers can be calculated to give a target level of uncertainty.

The statistical approach adopted required that a random method was used for selecting residential buildings to be surveyed and included in the sample size. In practice this involved selecting a cluster of properties at random when viewed from the road. The surveyor then undertook a more detailed inspection of the properties. Where possible samples of the building material were collected and tested in the field for indications of asbestos fibres.

2.3 Identification of Target Sites

In addition to residential households, the surveyed sought to identify public buildings and government owned industrial and commercial properties containing ACM. The primary focus of the survey was on residential properties and public buildings that would potentially present the most prolonged and thus significant risks for public exposure. Commercial and industrial buildings were included in surveys where they were observed in close proximity to residential housing and public areas.

The asbestos surveys had three main objectives. Firstly, it was, as far as reasonably practicable within the time available, to locate and record the location, extent and product type of any presumed or known ACMs. Secondly, it was to inspect and record information on the accessibility, condition and surface treatment of any presumed or known ACMs at the worst case scenarios. Thirdly, the survey aimed to determine and record the asbestos type, either by collecting representative samples of suspect materials for laboratory identification, or by making a presumption based on the building age, product type and its appearance.

A list of the people and organisations contacted during the visit is given in Appendix 2, and the key points arising from the discussions are summarised in Appendix 3.

During the initial week of the survey, the surveyor attended meetings with representatives from the Fijian government department responsible for hazardous waste, Department of Environment and also the department responsible for occupational health, the Department of Labour. The representatives provided information regarding asbestos regulations and potential state assets containing asbestos.

Other government departments and agencies were also contacted regarding the potential for asbestos to be present in their assets, including the Ministry of Education, Water Authority Fiji (WAF), Fiji Electricity Authority (FEA) and the Fiji Sugar Corporation (FSC)

The remainder of the survey consisted of inspecting residential areas and government owned facilities including (but not limited to) schools, hospitals and healthcare centres, power stations, water treatment facilities, research centres and government administration buildings.

A total of 77 sites were surveyed in Fiji to assess for the presence of ACM. This included 50 sites in Vitu Levu and 27 sites in Vanua Levu.

2.4 Site Assessment Data Capture

Information was collected from each survey site using a tablet-based application designed specifically for this project. The software requires certain information to be recorded including location, type of facility, whether asbestos was identified, type, volumes, and most applicable remedial methodology. The software also allows for pictures to be taken of the sites and uses a Global Positioning System (GPS) to record where the pictures were taken. Information provided by owners/occupants of the building relating to its age, state of repairs, previous ACM knowledge was also recorded in the software.

The use of the application ensures that data is collected in a uniform manner across all of the surveyed countries regardless of the survey team members.

2.5 Sample Collection Methodology

77 individual facilities / properties were identified as requiring a detailed site assessment due to their age, use, sensitive location or observations of suspected ACM. In order to assess if suspected ACM contained asbestos, samples were collected and analysed by a professional accredited laboratory in accordance with international standards.

Samples of suspected ACM were only collected if the following conditions were met;

- Permission was granted by the property owner;
- The work would minimise the disruption to the owner's operations;
- The sampling would not put the health and safety of occupants at risk;
- The areas to be sampled inside buildings were as far as possible unoccupied;
- Entry of other people not wearing personal protective equipment (PPE) to the sampling area was restricted;
- Where the material to be sampled could be safely pre-wet (i.e. excludes items with a risk of electrocution or where permission to wet a surface was not received); and
- Collection of a sample would not significantly damage the building material.

Where the above conditions were met, sampling was conducted following standard Geoscience Procedure and in accordance with international guidance provided by the United Kingdom Health & Safety Executive (UK HSE) and New Zealand Demolition and Asbestos Association (NZDAA).

The samples were collected in accordance with the following procedure;

- Sampling personnel must wear adequate personal protective equipment (PPE), as determined by the risk assessment (disposable overalls, nitrile gloves, overshoes and a half face respirator with P3 filters);
- Airborne emissions were controlled by pre- wetting the material to be sampled, with a fine water mist.
- Damaged portions of suspected ACM were sought first where it will be easier to remove a small sample. The sample size collected was approximately 5 cm2
- Samples were obtained using pliers or a screwdriver blade to remove a small section from an edge or corner;
- A wet-wipe tissue was used between the pliers and the sample material to prevent fibre release during the sampling;
- All samples were individually sealed in their own sealable polythene bag which was then sealed in a second polythene bag.
- Water was sprayed onto the sample area to prevent fibre release;
- Sampling points were further sealed masking and PVC tape where necessary;
- Samples were labelled with a unique identifier and in the survey documentation;
- Each sample was noted on a laboratory provided chain of custody and secured in a sealable container.

As with any environmental assessment, sampling of a media, in this case building material, can vary both spatially and temporally. Due to the wide scope of the survey including all residential and public buildings on the island, a limited number of samples were collected. The collection of samples was based on the aforementioned considerations but also with the project scope in mind. Where similar building materials were encountered at numerous sites, a single sample was considered sufficient to be used to base conclusions on. Also, where a large amount of PACM was identified at a single site, one sample of each main material identified was considered sufficient for this stage of the assessment.

2.6 Sample Laboratory Analysis

The samples were sent by courier to EMS Laboratories Incorporated (EMS) located in California in the United States of America for analysis. Analysis of the samples was performed by EMS using 'Polarised Light Microscopy'. According to EMS the analysis method is a semi-quantitative procedure with the detection limit between 0.1-1% by area and dependent upon the size of the asbestos fibres, sampling method and sample matrix. The type of asbestos fibre present was also reported with the three most common fibres types being chrysotile (white asbestos), crocidolite (blue asbestos) and amosite (brown asbestos).

The results for these samples are discussed in Section 4, and copies of the laboratory report are given in Appendix 4 of this report.

3.0 Risk Assessment Methodology

A systematic risk assessment approach was adopted in order to assess the risk that identified asbestos containing material presented to site occupants and if applicable the public. The risk assessment adopted was that provided by the UK HSE guidance document 'Methods for the Determination of Hazardous Substances (MDHS100) Surveying, sampling and assessment of asbestos-containing materials (2001)' and UK HSE guidance document 'A comprehensive guide to Managing Asbestos in premises (2002)'.

The documents present a simple scoring systems to allow an assessment of the risks to health from ACMs. They take into account not only the condition of the asbestos, but the likelihood of people being exposed to the fibres.

The risk assessment approach adopted presents algorithms that allow a score for each ACM item observed or confirmed by laboratory analysis, to be calculated. The sites with high scores may present a higher risk to human health than those with lower scores.

The risk assessment approach has two elements, the first algorithm is an assessment of the type and condition of the ACMs or presumed ACMs, and their ability to release fibres if disturbed. The final score for each ACM or presumed ACM depends on the type of ACM i.e. concrete v's lagging, the condition of the ACM, if there is any surface treatment and the actual type of asbestos (i.e. chrysotile (white), amosite (brown), or crocidolite (blue).

The second algorithm considers the ACM setting, likelihood of the ACM actually being disturbed and exposure to a receptor or many. The setting assessment therefore considers the normal occupant activity in that area of the site and the likelihood of disturbance. Each ACM is again scored and these scores are added to those for the material assessment to produce a total score.

3.1 ACM Assessment

UK HSE (2001) MDHS100 recommends the use of an algorithm to carry out the material assessment. The algorithm is a numerical way of taking into account several influencing factors, giving each factor considered a score. The algorithm in MDHS100 considers four parameters that determine the risk from an ACM: that is the ability to release fibres if disturbed. These four parameters are:

- product type;
- extent of damage;
- surface treatment; and
- asbestos type.

Each of the parameters is scored and added to give a total score between 2 and 12:

- materials with scores of 10 or more should be regarded as high risk with a significant potential to release fibres if disturbed;
- those with a score between 7 and 9 are regarded as medium risk;
- materials with a score between 5 and 6 are low risk; and
- scores of 4 or less are very low risk.

The material assessment algorithm shown in MDHS100 is reproduced in Table 2.

Table 2: MDHS100 Material assessment algorithm

Sample variable	Score	Examples of scores
Product type (or debris product)	1	Asbestos reinforced composites (plastics, resins, mastics,roofing felts, vinyl floor tiles, semi-rigid paints or decorative finishes, asbestos cement etc)
	2	Asbestos insulating board, mill boards, other low density insulation boards, asbestos textiles, gaskets, ropes and woven textiles, asbestos paper and felt
	3	Thermal insulation (eg pipe and boiler lagging), sprayed asbestos, loose asbestos, asbestos mattresses and packing
Extent of damage/deterioration	0	Good condition: no visible damage
	1	Low damage: a few scratches or surface marks; broken edges on boards, tiles etc
	2	Medium damage: significant breakage of materials or several small areas where material has been damaged revealing loose asbestos fibres
	3	High damage or delamination of materials, sprays and thermal insulation. Visible asbestos debris
Surface treatment	0	Composite materials containing asbestos: reinforced plastics, resins, vinyl tiles
	1	Enclosed sprays and lagging, asbestos insulating board (with exposed face painted or encapsulated), asbestos cement sheets etc.
	2	Unsealed asbestos insulating board, or encapsulated lagging and sprays
	3	Unsealed laggings and sprays
Asbestos type	1	Chrysotile
	2	Amphibole asbestos excluding crocidolite
	3	Crocidolite
Total score		Out of 12

3.2 ACM Setting Assessment

The location of the ACM is equally important as the type and condition of the ACM when considering the potential risk to human health. There are four aspects presented in the HSE guidance, however this algorithm has been modified in this assessment with 'maintenance activity' not considered.

The removal of maintenance activity from the algorithm is due to the level of awareness of asbestos by the building management or owners at the majority of surveys was considered to be low. Therefore any maintenance undertaken is likely to be 'unplanned' with little or no controls around asbestos exposure. . In addition, the amount of maintenance was often extremely difficult to quantify through discussion with the building management contacts.

The three areas of the algorithm adopted when considered risk posed by the ACM;

- Occupant activity
- Likelihood of disturbance
- Human exposure potential

Each of the above parameters are summarised in the following sections.

Occupant activity

The activities carried out in an area will have an impact on the risk assessment. When carrying out a risk assessment the main type of use of an area and the activities taking place within it should be taken into account.

Likelihood of disturbance

The two factors that will determine the likelihood of disturbance are the extent or amount of the ACM and its accessibility/vulnerability. For example, asbestos soffits outdoors are generally inaccessible without the use of ladders or scaffolding, and on a day to day basis are unlikely to be disturbed. However if the same building had asbestos panels on the walls they would be much more likely to be disturbed by occupant movements/activities.

Human exposure potential

The human exposure potential depends on three factors:

- the number of occupants of an area,
- the frequency of use of the area, and
- the average time each area is in use.

For example, a hospital boiler which contains friable asbestos cladding in a room which is likely to be unoccupied is a lower risk than say in a school classroom lined with an exposed asbestos cement roof, which is occupied daily for six hours by 30 pupils and a teacher.

The algorithm adopted for ranking the ACMs setting is shown in Table 3.

Table 3: HSG227 (2002) Priority Assessment Algorithm

Assessment factor	Score	Examples of score variables
Normal occupant activity		
Main type of activity in area	0	Rare disturbance activity (eg little used store room)
	1	Low disturbance activities (eg office type activity)
	2	Periodic disturbance (eg industrial or vehicular activity which may contact ACMs)
	3	High levels of disturbance, (eg fire door with asbestos insulating board sheet in constant use)
Likelihood of disturbance		
Location	0	Outdoors
	1	Large rooms or well-ventilated areas
	2	Rooms up to 100 m2
	3	Confined spaces
Accessibility	0	Usually inaccessible or unlikely to be disturbed
	1	Occasionally likely to be disturbed
	2	Easily disturbed
	3	Routinely disturbed
Extent/amount	0	Small amounts or items (eg strings, gaskets)
	1	<10 m2 or <10 m pipe run.
	2	>10 m2 to ≤50 m2 or >10 m to ≤50 m pipe run
	3	>50 m2 or >50 m pipe run
Human exposure potential		
Number of occupants	0	None
	1	1 to 3
	2	4 to 10
	3	>10
Frequency of use of area	0	Infrequent
	1	Monthly
	2	Weekly
	3	Daily
Average time area is in use	0	<1 hour
	1	>1 to <3 hours
	2	>3 to <6 hours
	3	>6 hours
Total		Out of 21

Each of the parameters is scored and added together to give a total score between 0 and 21. The setting score is then added to the ACM score to provide an overall score and risk rating in order to rank the sites in order of priority for management and/or remedial action. The scoring system is detailed in Table 4.

Table 4: Risk Ranking Scoring

ACM Score	Setting Score	Total Score	Risk Rating
10 - 12	16 – 21	24 - 33	High risk – significant potential to release fibres if disturbed and significant risk to occupants
7 – 9	11 – 15	17 - 23	Moderate risk
5 – 6	8 – 10	12 - 16	Low risk
0 – 4	0 – 7	0 – 11	Very low risk

4.0 Asbestos Survey

4.1 Residential Survey Coverage

The majority of residential dwellings observed on both Vitu Levu and Vanua Levu were constructed of concrete blocks, bricks, weatherboard and corrugated iron.

Information on the population distribution of Fiji was provided by the 2007 population census produced by the Fijian Bureau of Statistics. Fiji had a population of 837,000 in 2007 across the Republic's 106 inhabited islands and total land area of 18,300 km^2. The population were have been calculated (based on 5 residents per household) to be housed in approximately 167,400 residential households with the majority of those households on the island of Vitu Levu. Our survey of Fiji focused on Vitu Levu and Vanua Levu and in particular the towns and cities presented in Table 1. Table 1 provides a summary of the Fijian 2007 census data and the survey data collected during this assessment.

The survey sample size was based upon a 95% confidence level and 3.5% margin of error. With 167,400 households across the nation the number of houses to be surveyed to ensure a statistically representative number of households were included and to allow estimates to be made was 780.

4.2 Targeted Survey Coverage

Initial research of the presence of buildings in Fiji that contained ACM indicated that several sites in the Suva region and Nadi had previously or still may contain ACM. According to several articles in the Fiji Times, the Department of Labour OHS team had identified several sites including the Nadi International Airport, Fiji School of Medicine, University of the South Pacific, Nausori Market and Suva Market . Also reported in the Fiji Times Newspaper were several schools including Queen Victoria School, Marist Brothers High School, Saint Johns College, Ratu Kadavulevu School and Suva Grammar School

Following consultation with the Department of Labour, Ministry for Education and Department of Environment in addition to the possible ACM sites from the desk study, a number of buildings were shortlisted for a more detailed assessment. These included buildings of sufficient age considered possible to have been constructed of ACM such as the former Twomy Hospital, War Memorial Hospital, Suva Grammar School and St Stephens Building.

It also became apparent in the initial days of the survey that ACM were not widely used in Fijian residential properties or commercial buildings. However, AC water pipes were reportedly widely used and their repair and disposal practices were not well managed. Therefore several Water Authority Fiji (WAF) sites were also visited and surveyed in order to assess this prevalence of AC pipe and risk to the public.

The remainder of the survey consisted of visits to government buildings, including those which were likely to be frequented by large numbers of individuals and that were built or likely to be built prior to 1990. The buildings included (but were not limited to) schools, hospitals and healthcare centres, libraries, research centres, government administration buildings, power stations and waste disposal facilities. Copies of all of the individual site assessment reports for Fiji are available from SPREP. The specific sites visited are listed in Table 5.

Table 5: Specific Sites Surveyed in Fiji.

Site Name	Date of Assessment	Suspected PACM?	Samples Collected of PACM?
1. Nadi College	13/07/2014	Yes	Yes
2. Nadi Hospital, Maternity Ward	13/07/2014	Yes	Yes
3. National Fire Assocation, Nadi	13/07/2014	No	No
4. Ratu Navula College, Nadi	13/07/2014	Yes	Yes
5. Namaka Public School	13/07/2014	Yes	Yes
6. Nadi Primary School	13/07/2014	Yes	Yes
7. Abandoned House – Police Accommodation, Nadi	13/07/2014	Yes	Yes
8. Tavakubu Rd, Lautoka	14/07/2014	Yes	Yes
9. Sugar City Mall, Lautoka	14/07/2014	Yes	Yes
10. Rogorogoivada House, Lautoka	14/07/2014	Yes	Yes
11. SP Distillery Lautoka	14/07/2014	Yes	Yes
12. Sigatoka Town	15/07/2014	No	No
13. FEA Sigatoka Power Station	15/07/2014	No	No
14. Sigatoka Hospital	15/07/2014	No	No
15. Water Authority Fiji (WAF), Sigatoka Waste water treatment plant	15/07/2014	No	No
16. Water Authority Fiji (WAF), Sigatoka Depot	15/07/2014	Yes	Yes
17. Saint Agnes Primary School	16/07/2014	No	No
18. FEA, Kinoya Power Station, Suva	16/07/2014	No	No
19. WAF Kinoya, waste water treatment plant and office	16/07/2014	No	No
20. Rishikul Nadera Primary School	16/07/2014	No	No
21. Suva Grammar School	16/07/2014	Yes	Yes
22. ANZ Stadium, Suva	16/07/2014	No	No
23. FMF Gymnasium, Suva	16/07/2014	Yes	Yes
24. Library Services, Suva	17/07/2014	No	No
25. University of the South Pacific, Suva Campus	17/07/2014	No	No
26. Waste by MacGregor Rd	17/07/2014	Yes	Yes
27. Waste by Umuria Park	17/07/2014	Yes	Yes
28. Stephens Building	16/07/2014	Yes	Yes
29. WAF Wailoku Compound	17/07/2014	No	No
30. National Archives of Fiji	17/07/2014	No	No
31. Parliament of Fiji Complex	17/07/2014	No	No
32. WAF Tavua Depot	18/07/2014	Yes	Yes
33. PJ Twomey Hospital, Suva	18/07/2014	Yes	Yes
34. Naboro Landfill, Suva	18/07/2014	No	No
35. Tumavua Hospital	18/07/2014	Yes	Yes
36. Nadi Airport	15/07/2014	Yes	Yes
37. Nisouri Airport	19/07/2014	Yes	Yes
38. Fiji National University, Labasa	19/07/2014	No	No
39. WAF Labasa Compound	20/07/2014	Yes	Yes
40. WAF stockpile by road	20/07/2014	Yes	Yes
41. Labasa Hospital	20/07/2014	Yes	Yes
42. Labasa College	20/07/2014	Yes	Yes
43. Bethel Primary School	20/07/2014	No	No
44. Holy Family Secondary School	20/07/2014	No	No
45. North Division Police Housing	20/07/2014	No	No
46. Shiri Guru Nanak Khalsa College	20/07/2014	No	No
47. Shiri Guru Nanak Primary School	20/07/2014	No	No
48. St Marys Girls Hostel	20/07/2014	No	No

Site Name	Date of Assessment	Suspected PACM?	Samples Collected of PACM?
49. Valebasoga School	20/07/2014	No	No
50. Suvasuva FEA Power Station	21/07/2014	Yes	Yes
51. Suvasuva Former Ministry of Agriculture	21/07/2014	Yes	Yes
52. Suvasuva Hospital	21/07/2014	Yes	Yes
53. Nasavusavu Public School	21/07/2014	No	No
54. Savusavu Market	21/07/2014	No	No
55. St Bedes College	21/07/2014	No	No
56. St Bedes Primary School	21/07/2014	No	No
57. WAF Savusavu	21/07/2014	No	No
58. Labasa FSC Sugar Mill	22/07/2014	Yes	Yes
59. FEA, Labasa, Cawaira Power Station	22/07/2014	No	No
60. Labasa Bus Depot	22/07/2014	No	No
61. Labasa Market	22/07/2014	No	No
62. Seaqaqa Central College	22/07/2014	No	No
63. Seaqaqa Primary School	22/07/2014	No	No
64. Labasa Airport	23/07/2014	No	No
65. WAF Wastewater Treatment Plant Labasa	23/07/2014	No	No
66. Nasouri Sila Central High School	23/07/2014	No	No
67. Ballantine Secondary School	30/07/2014	No	No
68. Marist Secondary School, Suva	31/07/2014	No	No
69. Cathedral Secondary School	31/07/2014	No	No
70. Pacific Regional Seminary School	31/07/2014	No	No
71. Stella Maris Primary School	31/07/2014	No	No
72. Suva Bus Stop	31/07/2014	No	No
73. Suva Fire Station	31/07/2014	No	No
74. Suva Market	31/07/2014	No	No
75. Suva Port	31/07/2014	No	No
76. Veiuto Primary School	31/07/2014	No	No
77. WM Hospital, Suva	31/07/2014	Yes	Yes

5.0 Laboratory Results

5.1 Laboratory Results

A total of 60 samples of suspected asbestos containing material were collected in the Fiji survey from 29 individual sites. Laboratory analysis confirmed asbestos present at 16 of the 29 sites

A summary of the laboratory analytical results is provided in Table 6 while the full laboratory report is provided in Appendix 4 of this report.

Table 6: Sample Analytical Results

Site Name	Sample Name(s)	Sample Description/ Building Material Type	Asbestos Type and %
Nadi College	FN1	Vinyl Floor	None detected
Nadi Hospital, Maternity Ward	FN2	Vinyl Floor	None detected
Ratu Navula College, Nadi	FN3	Vinyl Floor	None detected
Namaka Public School, Nadi	FN4	Vinyl Floor	None detected
3035 Nadi Primary School	FN5	Vinyl Floor	None detected
Abandoned House – Police Accomodation, Nadi	FN6	Board on door	None detected
	FN7	Vinyl Floor	None detected
Tavakubu Rd, Lautoka	FL1	Pipe	Chrysotile 60%
Sugar City Mall, Lautoka	FL2	Ceiling Tile	None detected
Rogorogoivada House, Lautoka	FL3	Textured ceiling	None detected
	FL4	Vinyl Floor	None detected
SP Distillery Lautoka	FL5	Pipe (outside)	Chrysotile 10% Amosite 5%
Water Authority Fiji (WAF), Sigatoka Depot	FSI1	Stockpile outside WAF yard.	Chrysotile 10%
	FSI2	Pipe inside WAF yard	Chrysotile 25%
Suva Grammar School	FSGS1	Vinyl Tile – entrance corridor	Chrysotile 5%
	FSGS2	Hall external panel	Chrysotile 15%
	FSGS3	Window panels – science classroom	Chrysotile 5%
Suva FMF Gym	FSGym4	Soffit	Chrysotile 10%
Waste by MacGregor Rd	FS5	Pipe	None detected
Waste by Umuria Park	FS6	Pipe	Chrysotile 5%
Stephens Building	FS7	Ground floor vinyl tile	Chrysotile 5%
WAF Tavua Depot	FS8	Pipe in yard	Chrysotile 10%
Twomey Hospital	FS9	Boiler room, boiler lagging	Amosite 5%
	FS10	Boiler room, pipe lagging	Amosite 5%
	FS11	Walkway pipe lagging	None detected
Tamavua Hospital	FS12	Ward 5 – boiler room, waste pile	None detected
	FS13	Ward 5 – cladding south	Chrysotile 5%
	FS14	Boiler 1 lagging	Amosite 5%
	FS15	Ward 5 – cladding north	Chrysotile 8%
	FS16	Ward 5 – outside pipe rope	Chrysotile 85%
	FS40	Rope lagging, beneath corridor slab	Chrysotile 45%
	FS41	Boiler 2 cladding	Chrysotile 7%, amosite 5%
	FS42	Boiler room – rope	Chrysotile 95%
Nausouri Airport	FS43	Former Office Façade	None detected
	FS44	Air Fiji – Flight Operations	None detected
WAF Labasa	FS45	Compound vinyl floor	Chrysotile 5%
	FS46	Pipe stockpile by road	Chrysotile 20%

Site Name	Sample Name(s)	Sample Description/ Building Material Type	Asbestos Type and %
	FS53	AC Pipe	Chrysotile 25%
Labasa Hospital	FS47	Boiler pipe lagging	None detected
	FS48	Boiler Rope	Chrysotile 95%
	FS49	Stairwell ceiling	None detected
	FS50	New boiler rope	None detected
	FS51	Sunshade	Chrysotile 5%
Labasa College	FS52	Library Sunshade	Chrysotile 15%, amosite 5%
Fiji Electricity Suvasuva	FS54	Power station gasket	None detected
	FS58	Rope lagging	None detected
Fiji Sugar Corporation Labasa Mill	FS55	Compressor lagging	Chrysotile 10%
	FS56	Evaporator rope	None detected
	FS57	Pipe lagging	None detected
Former Ministry of Agriculture, Savusavu	FS59	Abandoned building façade	None detected
Savusavu Hospital	FS60	Ward Vinyl Floor	Chrysotile 2%
	FS61	Entrance Vinyl Floor	Chrysotile 5%
WM Hospital, Suva	FS62	Wall east, external	None detected
	FS63	Boiler lagging 01	None detected
	FS64	Boiler lagging 02	None detected
Nadi Airport	FNA1	Sita Corridor 2	None detected
	FNA2	Façade Car Park (No.8)	Chrysotile 5%
	FNA3	Ground floor lounge ceiling	None detected
	FNA4	External façade, (No.13)	None detected
	FNA5	External Façade	None detected

Some of the above locations are presented in the photos below.

Photos 1 and 2 are of Water Authority of Fiji (WAF) stockpiles. Photo 1 was taken at Sigatoka and Photo 2 was taken at Labasa.

Photo 1 – WAF Sigatoka

Photo 2 – WAF Labasa

The photos below are of the Suva Grammar School. In Photo 3 the panels below the windows are asbestos sheeting. At the time of the visit there were about 200 of them but there was a plan to have them all removed. Photo 4 shows the broken vinyl flooring in the classrooms. This vinyl flooring contains 5% asbestos.

 

Photos 3 and 4 – Suva Grammar School

The photos below are of the Labasa Hospital. Photo 5 shows the sunshades. There are many such sunshades at the hospital. Photo 6 shows old fibreglass boiler pipe lagging. This lagging is 95% chrysotile asbestos.

 

Photos 5 and 6 – Labasa Hospital

There is also extensive old asbestos remaining at the Tamavua-Twomey Hospital Complex in Suva. Photos 7 and 8 show the asbestos-lined pipe ducting that runs along ward corridors for a long distance. Photo 9 shows the old Ward 5 complex which has asbestos cladding on the outside and asbestos lining and ceilings on the inside. Friable asbestos was removed from two boiler rooms at the Tamavua-Twomey Hospital Complex as part of emergency work carried out under this project. Appendix 7 contains a report written prior to the work being undertaken, as well as the Asbestos Management Plan for the emergency work and the results of the air clearance analyses.

Photos 7 and 8 – Pipe lagging in Tamavua-Twomey Hospital

Photo 9 – Old Ward 5 Building, Tamavua-Twomey Hospital

Photo 10 below shows a boiler and associated piping at the Tamavua-Twomey Hospital with friable asbestos lagging. There are also six hot water header tanks and associated piping in the roof space with friable asbestos cladding.

Photo 10 – Hospital Boiler

Photos 11 and 12 show the Stephens Building in the Suva CBD and the vinyl flooring in this building. These pictures were taken before the building was demolished. The results that established that the vinyl floor contained asbestos were available at an early stage of the demolition but the demolition still proceeded with no precautions taken to protect workers or the public. An investigation was carried out and the resulting report is contained in Appendix 8. There was no additional clean-up work undertaken but air monitoring for asbestos was carried out and no air-borne fibres were detected.

Photos 11 and 12 – Stephens Building, Suva

5.2 Residences

The survey sample size was based upon a 95% confidence level and 3.5% margin of error. With 167,400 households across the nation the number of houses to be surveyed to ensure a statistically representative number of households were included and to allow estimates to be made was 780.

Based on the 3,600 properties surveyed, none of the residential buildings were suspected of containing PACM in the exterior material. The majority of the households surveyed were located in and around the towns of Suva, Nadi and Lautoka. Given the sample size and conclusion based upon it, if this estimate is extrapolated to include the remaining residential properties on Vitu Levu and Vanua Levu, and also the outer islands, then based on a 95% confidence level the potential number of households in Fiji to contain ACM would be zero +/-1.7% (ie between 0 and 2846 houses).

Caution should be used with any extrapolation of data and especially in this project as the residential buildings encountered on Vitu Levu and Vanua Levu are likely to differ significantly from those on the outer islands where building resources are limited. As the survey did not visit the outer islands confirmation that the findings can be assumed for the other islands will need to be made. Another limitation of the extrapolation is that the survey results are based largely on visual observations of the exterior of the residential buildings.

5.3 Results Discussion

As Table 6 presents, asbestos fibres chrysotile or chrysotile and amosite ACM building materials were identified in 16 of 29 sites sampled and assessed. The percentages of fibres detected ranged from 2 – 95%.

It was concluded from an extensive survey of residences in Fiji based on 3600 residences that there were no houses in Fiji that had asbestos construction materials. The survey was not entirely random, however, especially as only two, islands were covered, and there is still a chance that some houses in Fiji may have asbestos. It should also be noted that the inspections were only “drive-by” inspections.

Otherwise apart from a few notable exceptions there appears to be little asbestos in Fiji. These include the following:

- There are stockpiles of water pipes and no doubt underground networks of pipes.
- The Suva Grammar School has asbestos panels which may now have been removed, as well as broken asbestos flooring in the classrooms.
- Labasa Hospital has many asbestos sunshades as well as old fibreglass boiler pipe lagging.
- There is also extensive old asbestos remaining at the Tamavua-Twomey Hospital Complex in Suva. Asbestos-lined pipe ducting that runs along ward corridors for a long distance, the old Ward 5 complex has asbestos cladding on the outside and asbestos lining and ceilings on the inside. There are also external pipes with deteriorating asbestos lagging in several parts of the ground.

6.0 Risk Assessment

Utilising the algorithms described in section 2 of this report and based on the laboratory analysis data of ACM samples (where available) and observations of the sites visited, the sites are listed in order of priority in Table 7.

Table 7: Risk Ranking Scores – Fiji

Site Name	Building Material Type	Asbestos Type and %	Risk Ranking Scores		
			ACM	Setting	Total Score
Tamavua Hospital	Rope lagging, beneath corridor slab	**Chrysotile 45%**	9	17	26
	Ward 5 – outside pipe rope	**Chrysotile 85%**	8	16	24
	Ward 5 – cladding north	**Chrysotile 8%**	6	17	23
	Ward 5 – cladding south	**Chrysotile 5%**	6	17	23
	In use boiler and 6 hot water header tanks	**Not tested**	9	17	26
	Boiler 2 cladding	**Chrysotile 7%, Amosite 5%**	11	11	22
	Boiler 1 lagging	**Amosite 5%**	11	11	22
	Boiler room – rope	**Chrysotile 95%**	9	10	19
Suva Grammar School	Window panels – science classroom	**Chrysotile 5%**	5	20	25
	Vinyl Tile – entrance corridor	**Chrysotile 5%**	4	20	24
	Hall external panel	**Chrysotile 15%**	4	12	16
Savasava Hospital	Ward Vinyl Floor	**Chrysotile 2%**	5	19	24
	Entrance Vinyl Floor	**Chrysotile 5%**	4	19	23
Fiji Sugar Corporation Labasa Mill	Compressor lagging	**Chrysotile 10%**	7	16	23
Twomey Hospital	Boiler room, boiler lagging	**Amosite 5%**	11	11	22
	Boiler room, pipe lagging	**Amosite 5%**	10	11	21
Stephens Building	Ground floor vinyl tile	**Chrysotile 5%**	4	17	21
Labasa Hospital	Boiler Rope	**Chrysotile 95%**	9	10	19
Labasa College	Sunshade	**Chrysotile 5%**	6	13	19
	Library Sunshade	**Chrysotile 15%, Amosite 5%**	5	12	17
WAF Labasa	Compound vinyl floor	**Chrysotile 5%**	4	14	18
	AC Pipe	**Chrysotile 25%**	4	7	11
	Pipe stockpile by road	**Chrysotile 20%**	5	4	9
Nadi Airport	Façade Car Park (No.8)	**Chrysotile 5%**	4	11	15
Suva FMF Gym	Soffit	**Chrysotile 10%**	4	10	14
Water Authority Fiji (WAF), Sigatoka Depot	Pipe inside WAF yard	**Chrysotile 25%**	4	7	11
	Stockpile outside WAF yard.	**Chrysotile 10%**	3	4	7
Tavakubu Rd, Lautoka	Pipe	**Chrysotile 60%**	4	6	10
WAF Tavua Depot	Pipe in yard	**Chrysotile 10%**	4	6	10
Waste by Umuria Park	Pipe	**Chrysotile 5%**	4	5	9
SP Distillery Lautoka	Pipe (outside)	**Chrysotile 10% Amosite 5%**	5	2	7

The risk assessment scoring and prioritisation presented in Table 7 above indicates that there are nine moderate to high risk ACM sites which would benefit from additional ACM management. The seven remaining sites are considered to present a low to very low risk to occupants and the public and should continue to be monitored.

7.0 Remedial and Management Options

7.1 General

Based on all of the country visits made by the consultants for the PacWaste asbestos surveys, it is evident that:

a. The types of asbestos problems are relatively similar from country to country although there are very significant variations in incidence and quantity of asbestos.

b. Most asbestos is non-friable, or at least was non-friable when installed. Often the asbestos has deteriorated significantly and, in part at least, could be considered friable because of the risk of release of significant amounts of fibres on a regular basis. Certainly where fibres have been involved the asbestos becomes friable.

c. There has been almost no asbestos identified anywhere that was friable when installed. Remediation of the few friable (at least friable when installed) asbestos projects in the Pacific will need specialist management as exceptions.

d. The predominant form of asbestos is Chrysotile (White) Asbestos, although incidences of Amosite (Brown) Asbestos and Crocidolite (Blue) Asbestos do occur occasionally. Chrysotile is hazardous, but not as hazardous as the other forms of asbestos.

e. Labour rates are similar from country to country.

f. There will most likely be a need to bring in specialist supervision for any remedial work, and rates for that supervision will be similar throughout the Pacific.

g. The cost of materials in most countries is similar as almost all materials need to be imported from manufacturing countries with similar pricing structures.

h. There is some level of awareness of asbestos management techniques in all countries (and certainly more in the countries where there are significant amounts of asbestos). Generally, however, there is little expertise available to perform professional asbestos removals to the standard that would be required in, for example, Europe, UK, USA or Australia.

i. The correct equipment for properly managing asbestos remediation is not available in any of the countries visited, with the exception of some PPE and the simpler tools required for removal operations.

j. Safe and acceptable remediation techniques will be the same everywhere.

A case can therefore easily be made for a universal policy and set of procedures to be developed across the whole Pacific region for addressing asbestos problems.

7.2 Management Options

Where ACM or PACM has been identified then there are some management measures that can be taken immediately as follows:

- communicate with building/property owners, employees, contractors and others of its presence, form, condition and potential health risks associated;
- monitor the condition of the ACM;
- put a safe system of work in place to prevent exposure to asbestos.

7.2.1 Communicating ACM Hazard

Although every attempt was made during the survey work to communicate the potential level of risk apparent during the site visits, further consultation with the relevant regulator, site/building owners and occupants will be required based upon the findings and specifically the laboratory confirmation of the presence of ACM. Where an immediate significant risk to human health was apparent during the surveys, regulators were informed and actions taken to manage/remedy the situation.

All site owners and employees should be made aware of the location of any ACMs in the buildings identified. This is particularly important for maintenance workers or contractors who may directly disturb ACMs while working. A means of communicating with contractors who come on site to carry out other work must also be set up to prevent disturbance of ACMs without implementing the correct controls. The means of communication could include a site induction sheet or training session on the hazards presented by the ACM on site together with a formal contractor acknowledgement sheet.

If the location is a private residence then an information sheet could be handed out and an education / awareness programme initiated.

7.2.2 Monitor ACM

ACMs which are in good condition, sealed and/or repaired, and are unlikely to be disturbed, are of a lower risk than those which are damaged and in certain situations can be left in place. Often, encapsulation and management is a safer option than removal, which can result in the ACMs being disturbed further and potential further exposure to the building occupants. The on-going operations at the site will also factor into whether the ACM can be left on site. It should be noted, however, that effective encapsulation, especially of roofing, can be expensive.

If ACMs are left in place, the condition of the ACMs will have to be monitored regularly and the results recorded. A useful way of monitoring the condition of the ACMs is to regularly take photographs, which can be used to compare the condition over time. When the condition of the ACM starts to deteriorate, remedial action can be taken. The time period between monitoring will vary depending on the type of ACM, its location and the activities in the area concerned, but as a minimum should be at least once every 12 months.

7.2.3 ACM Safe System

Where an ACM is going to be left in place, one option would be to label or colour-code the material. This may work in an industrial environment, but may not be acceptable in a suite of offices or suitable in public areas, for example, retail premises. The decision to label or not will in part depend on confidence in the administration of the asbestos management system and whether communication with workers and contractors coming to work on site is effective.

Labelling and colour coding alone should not be relied upon solely as the only control measure. The physical labels and colour coding may deteriorate over time without sufficient maintenance.

7.3 Remedial Options

The management options of ACM outlined in Section 7.1 above are administration controls that can assist with effectively managing the risk ACM presents. However, in certain situations, administration controls may not be sufficient or the risk posed by the ACM by way of its damaged condition or setting sensitivity may present an unacceptable risk. Remedial measures for managing the ACM may include one or a combination of the following;

- protect/enclose the ACM;

- seal/encapsulate the ACM;
- repair of the ACM;
- removal of the ACM.

7.3.1 Protection / enclosure of ACMs

Protecting ACMs means the construction or placing of a physical barrier of some sort to prevent accidental disturbance of the ACM. This may mean placing a bollard in front of a wall panel of asbestos insulating board to prevent accidental damage by fork lift truck movements. Enclosing the ACM involves the erection of a barrier around it, which should be as airtight as possible to prevent the migration of asbestos fibres from the original material. Enclosing the ACM is a good option if it is in reasonable condition and in a low sensitivity environment.

If enclosure is chosen as the desired management option it is important that the existence of the ACM behind the enclosure is notified to all who may work or visit the site. Labelling on the enclosure to indicate the presence of the hidden ACM would assist with communicating the hazard. The condition of the enclosure should also be periodically monitored and the results of the inspection recorded.

7.3.2 Sealing or encapsulation of ACM

Encapsulation of an ACM is only suitable if the ACM is in good condition and in a low sensitivity environment. The additional weight of the encapsulant is also an important consideration and this may unwittingly cause delamination and possible damage to the ACM.

According to the UKHSE (2001) there are two types of encapsulants; bridging and penetrating encapsulants. Bridging encapsulants adhere to the surface of the ACM and form a durable protective layer. Bridging encapsulants include high build elastomers, cementitious coatings and polyvinyl acetate (PVA). The different types of encapsulants available will suit different circumstances and ACMs and should therefore be selected by a specialist in asbestos management to ensure the correct encapsulant is chosen.

Of the bridging encapsulants, high-build elastomers can provide substantial impact resistance as well as elasticity, and are reported to provide up to 20 years of life if undisturbed. Cementitious coatings are generally spray-applied and are compatible with most asbestos applications. They provide a hard-set finish, but may crack over time. PVA is used for sealing of asbestos insulating board and may be spray or brush applied. PVA is not suitable for use on friable ACMs such as insulation or sprayed coatings. PVA will only provide a very thin coating and may not be suitable as a long-term encapsulant.

Penetrating encapsulants are designed to penetrate into the ACM before solidifying and locking the material together to give the ACM additional strength. Penetrative encapsulants are typically spray-applied and will penetrate non-friable and friable asbestos materials, strengthening them as well as providing an outer seal.

The selection, preparation and application of encapsulants requires skill, knowledge and experience with asbestos remedial work.

7.3.3 Repair of the ACM

To be readily repairable, the damage should be minimal, therefore repair should be restricted to patching/sealing small areas where cracks or exposed edges have become apparent. Where significant damage has occurred it may be more cost effective to remove the ACM.

The repair methodology selected will largely depend on the type of ACM to be repaired. For example, small areas of damaged pipe or boiler lagging can be filled with non-asbestos plaster and if necessary wrapped with calico (cotton cloth). Small areas of damaged sprayed asbestos can be treated with encapsulant and, if necessary, an open mesh scrim of glass fibre or calico reinforcement used. Damaged asbestos panelling or tiles can be sprayed with PVA sealant or a similar type of sealant such as an elastomeric paint. Asbestos cement products can be sealed using an alkali-resistant and water-permeable sealant or impermeable paint.

7.3.4 Removal of the ACM

Where ACMs have been identified that are not in good condition, or are in a vulnerable position and liable to damage, the remedial options described previously should be explored first. Where it is not practical to repair, enclose or encapsulate the ACMs, they will need to be removed. ACMs will also need to be removed if the area is due to undergo refurbishment which will disturb the ACM, or where a building is going to be demolished.

Rigorous safety procedures are required to be followed for the removal of ACM. Typically the following procedure should be followed for non-friable asbestos although some variations may be necessary from site to site.

a) Place warning barrier tape around the site at a minimum distance of ten metres, where practicable, and place warning signs to clearly indicate the nature of work.

b) The contractor shall wear protective disposable type overalls, gloves and at least a half face respirator with a P2 (and preferably a P3) replaceable filter.

c) Wet down the ACM to be removed and carefully remove any fasteners using hand tools. Attempt to remove the ACM intact – do not break it up, or throw it into a waste bin or skip.

d) Place asbestos material and debris in an approved asbestos waste bag and seal for disposal in accordance with local requirements. Sheets of asbestos cement product should be placed wet one on top of another into a skip lined with a heavy duty plastic liner, a portion of which remains outside the skip and is of sufficient size to cover the waste when the skip is full.

Vacuum asbestos removal area using a vacuum fitted with a high efficiency particulate air filter (HEPA filter).

Normally air monitoring is not required for the removal of non-friable asbestos containing materials, as if done correctly no excessive quantities of asbestos fibres should be generated. However, some operators prefer to undertake such monitoring to obtain evidence that no risks to health occurred during the removal exercise.

The whole project should be supervised by an experienced asbestos removalist. Certification processes are in place in several countries to make sure such removalists are suitably qualified and experienced.

In each case of an asbestos removal project a detailed **"Asbestos Removal Plan"** should be prepared that addresses the following matters:

1. Identification:

- Details of the asbestos-contaminated materials to be removed – for example, location/s, whether it is friable or non-friable, condition and quantity to be removed – include references to analyses.

2. Preparation:

- Consultation with regulators, owners and potentially affected neighbours
- Assigned responsibilities for the removal
- Programme of commencement and completion dates
- Consideration of other non-asbestos related safety issues such as safe working at heights
- Asbestos removal boundaries, including the type and extent of isolation required and the location of any signs and barriers
- Control of electrical and lighting installations
- Personal protective equipment (PPE) to be used, including respiratory protective equipment (RPE)
- Details of air monitoring programme
- Waste storage and disposal programme

3. Removal

- Methods for removing the asbestos-contaminated materials (wet or dry methods)
- Asbestos removal equipment (spray equipment, asbestos vacuum cleaners, cutting tools, etc)
- Details of required enclosures, including details on their size, shape, structure, etc, smoke-testing enclosures and the location of negative pressure exhaust units if needed
- Details of temporary buildings required for asbestos removal (eg decontamination units), including details on water, lighting and power requirements, negative air pressure exhaust units and their locations
- Other control measures to be used to contain asbestos within the asbestos work area. This includes dust suppression measures for asbestos-contaminated soil.

4. Decontamination:

- Detailed procedures for the workplace decontamination, the decontamination of tools and equipment, personal decontamination of non-disposable PPE and RPE, decontamination of soil removal equipment (excavator, bobcat etc)

5. Waste Disposal:

- Methods for disposing of asbestos waste, including details on the disposal of:
    - Disposable protective clothing and equipment and
    - Structures used to enclose the removal area

8.0 Selection of Possible Remedial Options

8.1 General

The flow chart presented below in Figure 3 has been adapted from that presented in UKHSE HSG227 'A Comprehensive Guide to Managing Asbestos in Premises'. It details the decision process adopted by this study in determining the most suitable management option for the majority of sites with ACM.

Figure 3: ACM Management Flow Chart

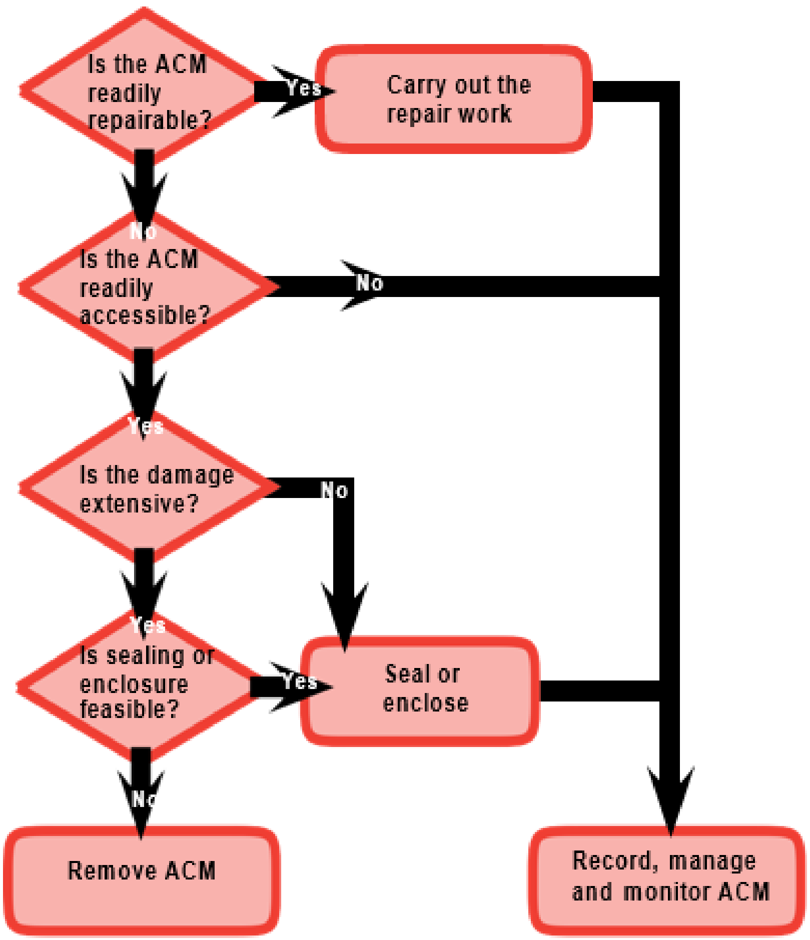

Figure adapted from; UKHSE HSG227 'A Comprehensive Guide to Managing Asbestos in Premises'.

Clearly there is a need to adopt a logical process such as above to select the correct management procedure in each case, and the flowchart above sets out such a procedure. There are some specific Pacific factors, however, that need to be considered.

8.2 Appropriate Asbestos Management for the Pacific

There are limited funds available for asbestos remediation in the Pacific and a wide range of health initiatives that may be deserving of funding besides asbestos remediation. It will therefore be necessary to prioritise which remediation projects are to be carried out, based on the risk ranking methodology and available funding. Whichever projects cannot be undertaken will need interim management until funding is available.

Management of un-remediated asbestos buildings is discussed in Section 7.2 above. The key factors in this management will be education and awareness so that minimising the generation of airborne fibres can be achieved.

Where remediation can be undertaken the first option that could be considered is encapsulation. Most asbestos roofs in the Pacific are, however, in a deteriorating condition and need to be encapsulated on the underside as well as the top surface. In most cases there is also a ceiling in place so the ceiling will need to be removed, as well as electrical and other services if they cannot be worked around. The top surface of the ceiling, as well as the services, must be treated as potentially contaminated with asbestos, especially if the asbestos roof is old, so the rooms below will need to be protected. The services and ceiling will then need to be returned or replaced as appropriate.

This process is expensive and, in fact may cause the project to be of a similar cost to removal and replacement of the roof. If there is no ceiling in place then the underside of the asbestos roof may, however, be able to be painted quite easily, although the project will still be an asbestos remediation project with all the resultant controls that must be put in place.

If an asbestos roof is encapsulated then it will still be necessary to replace any asbestos guttering and downpipes.

Asbestos cladding may be able to be satisfactorily encapsulated at a reasonable cost if it is in good condition. If there is also a wall cavity and an internal wall in good condition then there would be no need to encapsulate the inside of the asbestos cladding. Otherwise the inside would need to be encapsulated as well.

Encapsulation is discussed further in Section 8.3 below.

Removal of the asbestos roof would require all the appropriate asbestos management controls to be put in place as well as edge protection / fall arrest for safe working at heights and procedures for working on a brittle asbestos roof. Once the roof has been removed then the asbestos dust would need to be carefully vacuumed up in the ceiling space. Then a new roof would need to be put in place. With the hot conditions in the Pacific an insulating layer would also be required. Asbestos does have the merit of being cool to live under.

Removal is discussed further in Section 8.4 below.

8.3 Encapsulation

If encapsulation is to be used then several factors need to be considered as follows:

- Durability – the encapsulating system applied should last for a long time.
- There should be minimal (or preferably no) surface preparation involved as the high pressure washing and abrasive techniques normal for surface preparation for painting will generate a large amount of asbestos fibres.
- The encapsulant product should be simple to apply.
- Preferably the solar reflection should be enhanced by the use of light colours.

Normal priming type paints (especially oil or mineral turps based paints) generally do not bind well to asbestos cement roofs and cladding and special high quality alkali resistant primers are recommended prior to using a typical high quality 100% acrylic based exterior undercoat and exterior top coat system.

Alternatively, a semi-gloss, two-component epoxy paint suitable for metal, concrete, asbestos, cement and heavy machinery can be used. Such epoxy resin based paints exhibit long lasting durability under harsh conditions, such as acid, alkaline, salt and very humid conditions. Such paint can as used as a primer coat as well.

Another alternative is to use a special asbestos encapsulating system such as that offered by Global Encasement Inc (www.encasement.com). Global Encasement recommends for the Pacific a primer called "MPE" (Multi-Purpose Encapsulant) and a top coat called "Asbestosafe". MPE is promoted as not requiring any surface preparation and is described as a penetrating encapsulant. It does, however, require surfaces to be "clean and dry, and free of mould, mildew, chalking, dirt, grease and oil. In most cases old roofs in the Pacific would still therefore require surface preparation.

Based on coverage and cost per litre the Global Encasement paint systems are probably about 20-30% more expensive than high quality exterior acrylic paint systems and the cost of the paint (encapsulant) would in turn be about 40-50% of the overall cost of an encapsulating project, depending on labour costs. The additional cost of using a specialist coating like the Global Encasement systems may not therefore be that significant. Global Encasement do say that a 20 year life is expected while a high quality acrylic system is unlikely to last longer than 10-15 years. Global Encasement offer a guarantee for the 20 year life but it is a very limited and conditional guarantee.

The following steps would be typical for a roof asbestos encapsulation project:

a) Prepare asbestos removal plan, set up asbestos boundaries and signage, prepare PPE and decontamination area.
b) Set up scaffolding to both sides of building for access to roof sheeting & to remove asbestos guttering from building. Set up anchor point for fall arrest systems.
c) Spray with a particle capture technology such as Foamshield (www.foamshield.com.au) to the inside of the ceiling space before removal of the ceiling. This will control any asbestos dust in the ceiling space before removal of the ceiling. Alternatively the ceiling space could be vacuumed thoroughly if safe access is possible to all the ceiling space.
d) Lay down black plastic sheeting to the floor of each room, remove all ceiling linings and place all rubbish into suitable containers for disposal (plastic lined bins or fabric bags such as "Asbags" – see Photos 13 & 14 below) for correct removal & disposal. All ceiling material will need to be treated as asbestos-contaminated as debris and fibres fall from the roofing with roof movement and wear.
e) Disconnect & remove all electrical items, ceiling fans, lights, extractor fans. Vacuum thoroughly and store safely ready for reconnection after new ceilings are installed. Ensure all wiring is made safe for ongoing work.
f) Vacuum the underside of the existing roof sheeting and all timber roof framing. After removal of ceiling materials and plastic, vacuum all the inside of the premises.
g) Spray 3 coats of protective paint system (pre-coat, undercoat and top coat) to the underside of all the asbestos roof sheeting. Ensuring that all surface areas are correctly coated.
h) Supply & fix appropriate ceiling sheeting to ceilings of all rooms. Supply & fix timber battens to all sheet joints & to perimeter of each room.

i) Paint with 2 coats of acrylic ceiling paint to all new ceiling sheets & perimeter battens.
j) Reposition all wiring for lights & fans and connect up all fittings as previously set out.
k) Spray 3 coats of specialist paint finish (pre-coat, undercoat and top coat) to all the exterior roof area according to painting specifications.
l) Remove, and contain for disposal, asbestos gutters and downpipes from both sides of the building and supply & install new suitable box gutters (e.g. Colourbond) with down pipe each side leading to water tank.
m) Remove asbestos boundaries and signage and decontamination area and decommission from site.

NB: All vacuuming will need to be done with a specialist vacuum cleaner fitted with a high efficiency (HEPA) filter.

Asbags are fabric bags in various sizes with lifting strops – see photos below. There are special ones for roofing sizes.


Photos 13 & 14: Asbags in use

8.4 Removal

Removal of friable asbestos will need to be carried out with specialist asbestos contractors who will not normally be available in Pacific countries.

Removal of non-friable asbestos roofs and cladding will need to be done according to appropriate protocols and will again need specialist supervision and training.

The following steps would be typical for a roof asbestos removal project:

a) Prepare asbestos removal plan, set up asbestos boundaries and signage, prepare PPE and decontamination area.
b) Set up scaffolding to both sides of building to assist in removal of roof sheeting & to remove asbestos guttering from building. Set up anchor point for fall arrest systems.
c) Spray the entire roof with a water based PVA solution.
d) Carefully remove the roof sheeting by unscrewing, (not breaking) the roof sheets. All roof sheets to be stacked onto plastic sheeting sitting on bearers for ease of removal. Sheeting to be fully wrapped in plastic & taped shut. Roof sheeting and all materials, (ridging, barge

flashing, gutters etc) to be loaded into suitable containers for disposal (plastic lined bins or fabric bags such as "Asbags") for correct removal & disposal.

e) Vacuum clean the existing ceiling & roof space, (rafters, purlins, ceiling joists) with a suitable vacuum cleaner fitted with a HEPA filter.

f) Supply & fit heavy duty tarpaulins to keep the roof waterproof before installation of new roofing.

The new roof sheeting, insulation, guttering and downpipes should be durable (long life and resistant to corrosion from marine environments. Suitable insulation will also need to be installed to keep the building cool.

One option where a large amount of roofing is to be installed is to use a roof roll forming machine and form the roofs locally. Roofing materials could then be cut to suit and purchase of the sheet metal rolls would be cheaper than the finished roofing sheets. Of course the capital cost of the roll forming machine would need to be included in the cost calculations. It may also be appropriate to use aluminium rolls which would be corrosion resistant in marine environments.

Alternatively suitable roofing materials can just be imported such as Colourbond Ultra Grade, which is suitable for corrosive marine environments.

The following steps would be typical for a roof replacement project:

a) Supply & fit suitable roof netting over existing purlins & fix in place ready to support suitable insulation such as 50mm thick, foil coated, fiberglass insulation.

b) Supply & lay a top layer of sisalation foil over the fibreglass insulation blanket as a dust and moisture barrier.

c) Supply & screw fix suitable roofing material such as Colourbond Ultra Grade corrugated roofing, including for ridging & barge flashings.

Supply & fix suitable guttering such as Colourbond box guttering to both sides of the roof & include for one downpipe each side, feeding to a tank.

8.5 Options Specific to Fiji

Table 8: Possible Remedial Options – Fiji

Site Name	Building Material Type	Asbestos Type and %	Risk Score	Applicable Remedial Options			
				Repair	Isolate	Encap	Remove
Tamavua Hospital	Rope lagging, beneath corridor slab	**Chrysotile 45%**	26	×	×	×	✓
	Ward 5 – outside pipe rope	**Chrysotile 85%**	24	×	×	×	✓
	Ward 5 – cladding north	**Chrysotile 8%**	23	×	×	×	✓
	Ward 5 – cladding south	**Chrysotile 5%**	23	×	×	×	✓
	In use boiler and 6 hot water header tanks	**Not tested**	26	×	×	×	✓
	Boiler 2 cladding	**Chrysotile 7%, amosite 5%**	22	Removed by Contract Environmental in September 2014.			

Site Name	Building Material Type	Asbestos Type and %	Risk Score	Applicable Remedial Options			
				Repair	Isolate	Encap	Remove
	Boiler 1 lagging	**Amosite 5%**	22				
	Boiler room – rope	**Chrysotile 95%**	19				
Suva Grammar School	Window panels – science classroom	**Chrysotile 5%**	25	×	×	×	✓
	Vinyl Tile – entrance corridor	**Chrysotile 5%**	24	×	×	×	✓
	Hall external panel	**Chrysotile 15%**	16	×	×	×	✓
Savusavu Hospital	Ward Vinyl Floor	**Chrysotile 2%**	24	Removed by Contractors in July 2014 during building upgrade			
	Entrance Vinyl Floor	**Chrysotile 5%**	23	×	×	×	✓
Fiji Sugar Corporation Labasa Mill	Compressor lagging	**Chrysotile 10%**	23	×	×	×	✓
Twomey Hospital	Boiler room, boiler lagging	**Amosite 5%**	22	×	×	×	✓
	Boiler room, pipe lagging	**Amosite 5%**	21	×	×	×	✓
Stephens Building	Ground floor vinyl tile	**Chrysotile 5%**	21	Removed by Contractors in July 2014 during building upgrade			
Labasa Hospital	Boiler Rope	**Chrysotile 95%**	19	×	×	×	✓
	Sunshade	**Chrysotile 5%**	19	×	×	✓	✓
Labasa College	Library Sunshade	**Chrysotile 15%, amosite 5%**	17	×	×	✓	✓
WAF Labasa	Compound vinyl floor	**Chrysotile 5%**	18	×	×	×	✓

Preferred Remedial Strategy

In the majority of sites presented in Table 8, the asbestos is either friable or is damaged asbestos concrete material beyond repair. Encapsulation or isolation of these types of asbestos is not considered a suitable long term strategy, therefore removal of the ACM is the preferred remedial method.

Although the Fijian Ministry of Labour OHS Team have an approved list of contractors it believes are capable of completing the remedial repairs, the survey team witnessed inappropriate ACM removal being completed at two sites. One of those sites, the Stephens Building had been visited by OHS staff the previous day. Therefore it is recommended that ACM remedial works are supervised or conducted in entirety by contractors with New Zealand or Australian asbestos removal accreditation, such as the New Zealand Certificate of Competence (COC) scheme.

Complete Remediation

During the initial survey at Tamavua Hospital located on the outskirts of Suva, the condition of the friable asbestos boiler insulation was considered to present a significant risk to the staff and patients at the Hospital that steps were taken to restrict access to the boiler house and eventually remove the ACM.

In addition, during the surveys, two buildings were found to be undergoing upgrades, the Stephens Building in Suva and the Savusavu Hospital in Vanua Levu. In both building upgrades the vinyl flooring was about to or was in the process of being removed. In the Stephens Building case, the vinyl floor had not previously been tested for asbestos and the contractors appeared to be operating outside of the Ministry of Labours recommendations with regards to personal protective equipment (PPE).

At the Savusavu Hospital, hospital management confirmed that the local Rotary club had tested the vinyl floor prior to its removal and they had stated it did not contain asbestos. (The analytical results for this project have now confirmed the vinyl floor did contained asbestos.) The contractors who completed the ACM removal were not wearing appropriate PPE or undertaking necessary mitigation controls and the wards where the ACM was being removed were still occupied by patients.

9.0 Disposal

9.1 Relevant International Conventions

The three options for disposal of ACM and asbestos-contaminated wastes are as follows:

a) Local burial in a suitable landfill
b) Disposal at sea
c) Export to another country with suitable disposal

These three alternatives are discussed below.

Several International Conventions may be relevant to sea disposal and export of asbestos. These conventions and their status as at 2011 are set out in Table 9 below.

Table 9: Related International Conventions

Country	Rotterdam Convention	Basel Convention	London Convention & Protocol*	Waigani Convention	Noumea Convention
Australia	Y	Y	Y*	Y	Y
Cook Islands	Y	Y		Y	Y
FSM		Y		Y	Y
Fiji				Y	Y
Kiribati		Y	Y	Y	
Marshall Is	Y	Y	*		Y
Nauru		Y	Y		Y
New Zealand	Y	Y	Y*	Y	Y
Niue				Y	
Palau				Not ratified	
PNG		Y	Y	Y	Y
Samoa	Y	Y		Y	Y
Solomon Is			Y	Y	Y
Tonga	Y	Y	Y*	Y	
Tuvalu			Y	Y	
Vanuatu			Y*	Y	

Source; SPREP (2011) 'An Asbestos-Free Pacific: A Regional Strategy and Action Plan'

Later in 2011 Palau also became a party to the Basel Convention.

The Rotterdam Convention (formally, the *Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade*) is a multilateral treaty to promote shared responsibilities in relation to importation of hazardous chemicals. The convention promotes open exchange of information and calls on exporters of hazardous chemicals to use proper labelling, include directions on safe handling, and inform purchasers of any known restrictions or bans. Signatory nations can decide whether to allow or ban the importation of chemicals listed in the treaty, and exporting countries are obliged to make sure that producers within their jurisdiction comply.

The Convention covers asbestos as one of its listed chemicals but not Chrysotile asbestos. The Convention, however, is for the purpose of managing imports of products and not wastes.

The London Convention and Protocol, and the Noumea Convention and associated Dumping Protocol are both relevant to the issue of dumping at sea and hence are discussed in Section 9.3 below.

The Basel and Waigani Conventions are relevant to the issue of export of waste to another country and are hence discussed in Section 9.4 below.

9.2 Local Burial

In order for local burial of ACM and asbestos-contaminated wastes to occur in a local landfill that takes general refuse, there must be a suitable landfill available as follows:

a) The landfill must be manned and secure so that no looting of asbestos materials can occur.

b) The landfill must have proper procedures for receiving and covering asbestos waste. A suitable hole must be excavated, the asbestos waste placed in the hole, and the asbestos waste covered with at least one metre of cover material. The asbestos waste should be buried immediately on receipt at the landfill.

c) Machinery must be available to enable the excavation and covering to occur.

d) The location of the asbestos should be logged or an asbestos burial area designated.

e) Records of dates and quantities should be kept.

The alternative to burial in a local landfill is to construct a special monofill for asbestos waste. This landfill could be lined and sealed once it is full. This process is expensive, however, and would only be justified where there is a large amount of asbestos for disposal.

The other factor to consider in relation to local disposal is whether such a practice is acceptable to the local people. A programme of consultation is necessary to determine if this is the case.

9.3 Disposal at Sea

The international convention governing sea disposal is the *Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972*, (the London Convention), which has the objective to promote the effective control of all sources of marine pollution and to take all practicable steps to prevent pollution of the sea by dumping of wastes and other matter (International Maritime Organization (IMO)). The *1996 "London Protocol"* to the Convention which came into force in March 2006 updates the convention to prohibit the dumping of any waste or other matter that is not listed in Annex 1 to the Protocol.

Annex 1 to the Protocol covers the following wastes

1. Dredged material
2. Sewage sludge
3. Fish waste, or material resulting from industrial fish processing operations
4. Vessels and platforms or other man-made structures at sea.
5. Inert, inorganic geological material
6. Organic material of natural origin
7. Various bulky inert items – iron, steel, concrete etc.
8. Carbon dioxide streams form carbon dioxide capture processes for sequestration

Probably asbestos would come under the category of inert inorganic geological material.

Any dumping of such Annex 1 wastes requires a permit from the country of origin and is limited to those circumstances where such wastes are generated at locations with no land disposal (or other disposal) alternatives. The 1996 protocol also prohibits the exports of wastes or other matter to non-Parties for the purpose of dumping at sea.

The decision to issue a permit is to be made only if all impact evaluations are completed and the monitoring requirements are determined. The provisions of the permit are to ensure that, as far as practicable, any environmental disturbance and detriment are minimised and the benefits maximised. Any permit issued is to contain data and information specifying:

1. The types and sources of materials to be dumped
2. The location of the dumpsite(s)
3. The method of dumping
4. Monitoring and reporting requirements.

It should be noted that the overall thrust of the Convention (as amended by the Protocol), as set out at the start of the Protocol is to eliminate pollution of the sea caused by dumping and to protect and preserve the marine environment. The Protocol also recognises the particular interests of Small Island Developing States. It would be fair to say, therefore, that even if the dumping of asbestos met the requirements of the Convention and Protocol, it would probably be contrary to the overall thrust of the Convention and Protocol, particularly if such dumping was initiated by Small Island Developing States.

If asbestos was dumped at sea, the following information would be needed (in terms of Annex 2 of the Protocol), in order for a permit to be issued:

1. Full consideration of alternatives
2. Full assessment of human health risks, environmental costs, hazards (including accidents), economics, and exclusion of future uses.

The other relevant convention is the *Convention for the Protection of the Natural Resources and Environment of the South Pacific Region* (1986), known also as the SPREP Convention or Noumea Convention. This Convention, along with its two Protocols, is a comprehensive umbrella agreement for the protection, management and development of the marine and costal environment of the South Pacific Region. It is the Pacific region component of UNEP's Regional Seas Programme which aims to address the accelerating degradation of the world's oceans and coastal areas through the sustainable management and use of the marine and coastal environment. In order to protect the environment in the Pacific region, through the Noumea Convention the Parties agree to take all appropriate measures in conformity with international law to prevent, reduce and control pollution in the Convention Area from any source, and to ensure sound environmental management and development of natural resources.

One of two associated protocols is the Dumping Protocol which aims to prevent, reduce and control pollution by dumping of wastes and other matter in the South Pacific. Annexes associated with the protocol would permit the dumping of asbestos provided such dumping did not present a serious obstacle to fishing or navigation. A General Permit would be needed, however, that covers a number of matters including impacts on the marine environment and human health and whether sufficient scientific knowledge exists to determine such impacts properly. Parties are required to designate an appropriate authority to issue permits.

Again the overall thrust of the Noumea Convention and its associated Dumping Protocol is to eliminate pollution of the sea caused by dumping and to protect and preserve the marine environment. Again it would be fair to say, therefore, that even if the dumping of asbestos met the requirements of the Convention and Dumping Protocol, it would probably be contrary to the overall thrust of the Convention and Dumping Protocol.

Given all the above, it may still possibly be the best option to dump the asbestos at sea. In order to successfully carry out such dumping several operating requirements would need to be met as follows:

1. The asbestos waste would need to be sealed completely and packed so that it could be loaded and unloaded satisfactorily. Probably it would best be wrapped in plastic and then placed in fabric bags fitted with loading strops. “Asbags” would meet these criteria and have a maximum 3 tonne capacity.
2. There must be a way of loading the asbestos waste satisfactorily. A shore-based crane could load asbestos in Asbags.
3. There must be a means of sea transport. A barge that towed a raft would be suitable, or a vessel with sufficient deck space.
4. There must be a safe way to unload the waste asbestos at sea. If a vessel was available with a crane with at least 3 tonne capacity at a reasonable reach then that would meet this requirement. Otherwise a shore-based crane or crane truck (Hiab) could be tied to a raft. The raft would need to have side protection around its perimeter and operating personnel would need life jackets.
5. A suitable dumping location would need to be found that a) was deep enough to ensure that no asbestos would ever return to shore; and b) had no environmental sensitivity. It is likely that such a location would be some distance from shore.

It is evident that an operation that was able to meet the permit requirements of Annex 2 of the London Protocol and the operating requirements listed above would be an expensive one. Dumping at sea would, aside from any other considerations, therefore only be considered if there was a large enough amount of asbestos waste to justify it.

9.4 Export to Another Country

The final disposal option that should be considered is export to another country. Asbestos waste is a hazardous waste in terms of both the Basel Convention and the Waigani Convention.

The *Basel Convention on the Control of Trans-boundary Movements of Hazardous Wastes and their Disposal*, (the Basel Convention), is an international treaty that was designed to reduce the movements of hazardous waste between nations, and specifically to prevent transfer of hazardous wastes from developed to less developed countries. The Convention is also intended to minimise the amount and toxicity of wastes generated, to ensure their environmentally sound management as closely as possible to the source of generation. The Basel Convention states clearly that the trans-boundary movement of hazardous wastes and other wastes should be permitted only when the transport and the ultimate disposal of such wastes is environmentally sound.

The *Convention to Ban the Importation into Forum Island Countries of Hazardous and Radioactive Wastes and to Control the Trans-boundary Movement of Hazardous wastes within the South Pacific Region*, known also as the Waigani Convention, entered into force on the 21st October 2001. It represents the regional implementation of the international regime for controlling the trans-boundary movement of hazardous wastes. The objective of the Convention is to reduce and eliminate trans-boundary movements of hazardous and radioactive waste, to minimise the production of hazardous and toxic wastes in the Pacific region and to ensure that disposal of wastes in the Convention area is completed in an environmentally sound manner.

The two countries that border the Pacific and are able to receive asbestos waste are Australia and New Zealand. Both countries are parties to both the Basel Convention and the Waigani Convention. All Pacific countries that are part of the asbestos project are party to either the Basel or the Waigani Conventions or both. In terms of trans-boundary movement, therefore, asbestos wastes could be moved from these Pacific countries to Australia or New Zealand.

Australia is not known to have ever received asbestos waste but discussions with the Hazardous Waste Section of the Australian Department of the Environment confirmed that, in terms of the Basel and Waigani Consent requirements, there would be no problem importing asbestos waste into Australia if it was done properly and safely and met other legislative requirements such as Customs and Biosecurity.

Permits are currently held to import asbestos waste into New Zealand from New Caledonia, French Polynesia and Niue. The New Zealand Government is currently funding a project to import a large amount of waste asbestos from Niue into New Zealand for disposal. This is being done under the Waigani Convention.

Potentially also, Fiji could accept waste asbestos from other Pacific countries as it has a well-run landfill at Naboro near Suva with all the controls necessary to receive asbestos. It does receive asbestos waste from within Fiji in a properly managed way. At present, however, Fiji is a party to the Waigani Convention but not the Basel Convention so it would only be able to receive asbestos waste from Waigani Convention parties.

A suitable landfill must be found in the importing country, a suitable ship and shipping route is needed, and biosecurity concerns need to be addressed. Asbestos is regarded as a Class 9 Dangerous Good for shipment purposes.

9.5 Disposal Appropriate to Fiji

Fiji has a well-designed and well-operated landfill that can receive asbestos waste. This landfill is at Naboro west of Suva along the road to Nadi. Naboro Landfill will accept asbestos wastes and will charge $F40/tonne for this waste. Both friable and non-friable wastes can be accepted and it would be appropriate for all Fiji's asbestos wastes to go to Naboro Landfill.

10.0 Cost Considerations

A typical example of local Pacific costs has been obtained from Central Meridian Inc in Nauru, which is a contracting company that has worked for 14 years in Nauru and employs about 60 staff (see Appendix 5). Costs will likely vary according to local conditions but rates have been cross checked against established rates in New Zealand, and also informally with contractors in other Pacific countries, and it is believed that the figures put forward are reasonable for preliminary budgeting purposes.

10.1 Encapsulation

For the encapsulation option, cost build ups have been prepared for roofs and wall cladding based on the Central Meridian estimate. The Central Meridian costs have been changed from AUD to USD at an exchange rate of 0.8, and the figures have been reduced by 10% based on the assumption that cheaper prices could be obtained by competitive tendering, and also based on reconciliation with established rates in New Zealand.

The full cost build ups are presented in Appendix 5 and a summary is presented as follows:

<u>Roof Encapsulation</u>

Costs:

- Encapsulate roof where there is no ceiling present below the roof: USD49.64/m2 of roof (face area)
- Encapsulate roof where there is an existing ceiling below the roof that needs to be removed and replaced: USD90.79/m2 of roof (face area)

Assumptions:

- Rates have been built up based on a roof of a single storey building with a floor area of 14m x 12m with a roof pitch of 30 degrees. Extra will be required for scaffolding for buildings greater than 1 storey high.
- Rates assume that work is done in a tradesman like fashion to New Zealand or Australian standards, including compliance with applicable safety requirements relating to working at height and working with asbestos.
- Rates allow for an independent SPREP appointed representative to oversee works to ensure quality, safety and commercial requirements are complied with.
- Rates do not allow for any costs relating to disruption of the usual activities undertaken in the building being worked on – eg moving furniture in and out.
- Rates are approximate only and there will be country specific variances depending on the availability of resources and materials.

<u>Cladding Encapsulation</u>

Costs:

- Encapsulate wall cladding where there is no internal wall sheeting: USD25.92/m2 (face area)

- Encapsulate wall cladding where there is internal wall sheeting in good condition, which means only the exterior needs to be encapsulated: USD17.92/m2 (face area)
- Encapsulate wall cladding where there is internal wall sheeting in poor condition, which must be treated as asbestos contaminated and removed and replaced: USD65.92/m2 (face area)

Assumptions:

- Rates have been built up based on a single storey building with a floor area of 14m x 12m and walls 2.4m high. Extra will be required for scaffolding for buildings greater than 1 storey high.
- Rates assume that work is done in a tradesman like fashion to New Zealand or Australian standards, including compliance with applicable safety requirements relating to working at height and working with asbestos.
- Rates allow for an independent SPREP appointed representative to oversee works to ensure quality, safety and commercial requirements are complied with.
- Rates do not allow for any costs relating to disruption of the usual activities undertaken in the building being worked on – eg moving furniture in and out.
- Rates are approximate only and there will be country specific variances depending on the availability of resources and materials.

10.2 Removal and Replacement

For the removal and replacement option cost build ups have been prepared for roofs and wall cladding based on the Central Meridian estimate. As for the encasement option, the Central Meridian costs have been changed from AUD to USD at an exchange rate of 0.8, and the figures have been reduced by 10% based on the assumption that cheaper prices could be obtained by competitive tendering, and also based on reconciliation with established rates in New Zealand.

The full cost build ups are presented in Appendix 5 and a summary is presented as follows:

<u>Roof Removal and Replacement</u>

Cost:

- Remove and replace roof: USD96.31/m2 (face area)

Assumptions:

- Rates assume that the existing roofs are replaced with Colourbond Ultra grade roof sheeting (for sea spray environments) with 50mm of foil coated fibreglass insulation (to address heat issues).
- Rates have been built up based on a roof of a single storey building with a floor area of 14m x 12m with a roof pitch of 30 degrees. Extra will be required for scaffolding for buildings greater than 1 storey high.

- Rates assume that work is done in a tradesman like fashion to New Zealand or Australian standards, including compliance with applicable safety requirements relating to working at height and working with asbestos.
- Rates allow for an independent SPREP appointed representative to oversee works to ensure quality, safety and commercial requirements are complied with.
- Rates do not allow for any costs relating to disruption of the usual activities undertaken in the building being worked on – eg moving furniture in and out.
- A 10% contingency has been allowed for tidying up any damaged or inadequate rafters purlins and barge boards.
- Rates are approximate only and there will be country specific variances depending on the availability of resources and materials.
- Rates assume asbestos waste secure wrapping and disposal to a suitable nearby local landfill. If the waste needs to be exported or if sea disposal is being considered, then this will need to be costed as an extra.

Cladding Removal and Replacement

Costs:

- Remove and replace cladding: USD76.04/m2 (face area)

Assumptions:

- Rates assume that the existing cladding is replaced with a cement fibre board with treated timber battens to make water tight. An allowance has also been made to wrap the building in foil and to apply two coats of paint to complete the works.
- Rates have been built up based on a single storey building with a floor area of 14m x 12m and walls 2.4m high. Extra will be required for scaffolding for buildings greater than 1 storey high.
- Rates assume that work is done in a tradesman like fashion to New Zealand or Australian standards, including compliance with applicable safety requirements relating to working at height and working with asbestos.
- Rates allow for an independent SPREP appointed representative to oversee works to ensure quality, safety and commercial requirements are complied with.
- Rates do not allow for any costs relating to disruption of the usual activities undertaken in the building being worked on – eg moving furniture in and out.
- A 10% contingency has been allowed for tidying up any damaged or inadequate framing.
- Rates are approximate only and there will be country specific variances depending on the availability of resources and materials.
- Rates assume asbestos waste secure wrapping and disposal to a suitable nearby local landfill. If the waste needs to be exported or if sea disposal is being considered, then this will need to be costed as an extra.

Table 10: Summary of Costs for Various Remediation Options (Costs rounded to nearest $US)

Remediation Method	Cost per m^2 (face area) $US
Encapsulation	
Roofs:	
Encapsulate roof where there is no ceiling present below the roof	50.00
Encapsulate roof where there is an existing ceiling below the roof that needs to be removed and replaced	91.00
Cladding:	
Encapsulate wall cladding where there is no internal wall sheeting	26.00
Encapsulate wall cladding where there is internal wall sheeting in good condition, which means only the exterior needs to be encapsulated	18.00
Encapsulate wall cladding where there is internal wall sheeting in poor condition, which must be treated as asbestos contaminated and removed and replaced: USD65.92/m2 (face area)	66.00
Removal and Replacement	
Roofs:	
Remove and replace roof	96.00
Cladding:	
Remove and replace cladding	76.00
Miscellaneous	
Remove and replace floor tiles*	80.00
Pick up debris, pipes	40.00

**$US80 is the lower end of the cost spectrum for removing and replacing vinyl floor tiles and the cost could easily double (or more) for difficult removal projects. To balance this out, the vinyl tile matrix is stable and there is little risk of asbestos exposure unless they are badly deteriorating. Vinyl floor asbestos projects could therefore be lower down on the priority list.*

The above rates assume asbestos waste disposal to a suitable nearby local landfill. If the waste needs to be exported or if sea disposal is being considered, then this will need to be costed as an extra.

10.3 Local Contractors

An objective of the study was to identify any local contractors who may have the expertise and capacity to potentially partner with regional or international contractors with expertise in asbestos management, repair and removal. Attempts were made to identify and contact potentially suitable contractors prior to the visits in order to schedule meetings when the survey team were in the country. In addition, government officials were also requested to provide the details of potentially suitable contractors.

During discussions with the Occupational Health & Safety department of the Fijian Government a list of approved contractors considered suitable to remove asbestos was discussed. A copy of the list for contractors in the west of the country was provided by Hawkins. The list includes;

- Classic Resort Furniture & Construction
- Matech Commercial Interiors
- Jacks Manufacturing Ltd
- Fortech Construction
- Woodworks Fantastic Ltd
- Summit Construction

- Satendra Prasad Construction
- Aruns' Building Ltd

According to the Fijian OHS, all approved contractors must undertake formal training. The content, level and suitability of the training could not be established. The above contractors could not be located in Nadi or Lautoka during the survey.

Indicative Cost Information

Local costs obtained from Fiji are summarised in Table 12.

Table 12: Costs of Materials in Fiji

Item	Cost (US$)
Rubberised acrylic primer	$115 per 5 Gal
Rubberised acrylic exterior finish	$70 to $115 per 5 Gal
Landfill Disposal – Suva Landfill	$20/tonne

Indicative day rates for labour as well as truck and driver obtained in other Pacific Island Countries have been provided for Fiji rates. The rates are provided as an indicative guide to potential costs and exclude personal protective equipment and other consumables required during asbestos removal/repair work. The rates are summarised in Table 13.

Table 13: Indicative Rates – Contractors

Item	Cost (USD $/hr)
Supervision	$28
Leading Foreman	$8
Labour	$5
Driver	$5
Truck and driver	$49

There are numerous variables associated with producing a cost estimate for the management and removal of ACM at the identified properties. Costs would be dependent upon the buildings location and condition of the structure. As ACM is present it indicates the building is likely to be at least 30 years old and may require other structural engineering repairs or upgrades prior to removing and replacing the ACM.

The scope would need to be defined on a site by site basis and based on consultation with all of the properties stakeholders. However a building contractor firm operating in several South Pacific nations has stated that costs to remove and replace ACM with iron cladding could vary from $70 - $180 USD / m^2.

11.0 Review of Policies and Legal Instruments

In selecting a remedial approach, another factor to consider is that the remediation should meet all obligations to regional and international conventions to which Fiji is a Party. This section briefly summarises national and international regulations which relate to the handling and disposal of asbestos hazardous waste.

11.1 National Laws and Regulations

The Health and Safety at Work Act (HSAWA) 1996 came into force on 1st November 1997. The Act applies to all workplaces including schools and hospitals. The Act is administered by the Occupational Health and Safety (OHS) Division of the Ministry of Labour.

Discussions with representatives from OHS indicated that no regulations specific to asbestos have been developed. The HASAWA Act, and specifically Part IX, lays the framework for safety in the workplace. The OSH team conduct occupational health and safety audits of workplaces as part of its duties, as well as the supervision of asbestos removal in affected buildings around the country. In view of the high risks involved with asbestos removal, the OSH team is also responsible for the training of contractors workers involved in the actual asbestos removal and disposal processes.

Also enacted in Fijian legislation is the Environment Management Act (EMA) 2005. The Act sets guidelines and policies for environmental impact assessments, waste management and pollution control. The purpose of these Regulations is to prevent the pollution of the environment and of relevance for this study the handling, storage and disposal of wastes and hazardous substances. Part 5 of the EMA sets out the framework for waste management and pollution control in the Fiji Islands. It prohibits any commercial or industrial facility from handling or storing hazardous materials without a permit and gives the Waste and Pollution Control Administrator power to issue permits.

There is no legislation in place to prevent the importation of any new asbestos sheeting and building products. It should be noted that new asbestos building products are being imported into several countries in the Pacific, based on surveys carried out as part of this project.

11.2 National Strategies and Policies

With the exception of the SPREP (2011) 'An Asbestos-Free Pacific: A Regional Strategy and Action Plan' there are currently no national strategies or policies related to asbestos implemented in Fiji.

11.3 International Conventions

Should ACM be removed from the identified buildings in this study, options for disposal include- existing or proposed local hazardous waste facilities/landfills and international hazardous waste landfills. Several international conventions control the trans boundary movement of hazardous waste such as asbestos. Fiji is a party to the Waigani Convention and the Noumea Convention.

12.0 Recommended Actions for Minimising Asbestos Exposures

12.1 Discussion

ACM has been identified by this study to be present at several locations in Fiji. Based on an algorithm adopted as part of the risk assessment to prioritise asbestos management, this study has identified that there are eight sites in Fiji that are considered moderate to high risk with regards to the occupants' and/or public's potential exposure to asbestos. The remaining sites identified are considered to present a low to very low risk to human health. Management of the low risk sites will be required to ensure the risk to human health is not elevated further as the buildings condition deteriorates with age.

It was concluded from an extensive survey of residences in Fiji based on 3600 residences that there were no houses in Fiji that had asbestos construction materials. The survey was not entirely random, however, especially as only two, islands were covered, and there is still a chance that some houses in Fiji may have asbestos. It should also be noted that the inspections were only "drive-by" inspections. A closer inspection may produce a picture that could be quite different. For example, vinyl floor may contain asbestos, and there may be asbestos soffits, and ceilings.

Notable examples of asbestos in Fiji include:

- There are stockpiles of water pipes and no doubt underground networks of pipes.
- The Suva Grammar School has asbestos panels which may now have been removed, as well as broken asbestos flooring in the classrooms.
- Labasa Hospital has many asbestos sunshades as well as old fibreglass boiler pipe lagging.
- There is also extensive old asbestos remaining at the Tamavua-Twomey Hospital Complex in Suva. Asbestos-lined pipe ducting that runs along ward corridors for a long distance, the old Ward 5 complex has asbestos cladding on the outside and asbestos lining and ceilings on the inside. There are also external pipes with deteriorating asbestos lagging in several parts of the ground.

The quantities of asbestos-containing materials observed at the sites were used to estimate costs for abatement including where available local contractor rates and quotes.

Remediation of sites has been prioritised based on the level of risk posed to the building occupants and public at each site according to the methodology described in Section 2.

A summary of the recommended actions, estimated time and materials and estimated costs are included in Table 14 below.

Table 14: Remedial Cost Estimates for Fiji

Site Name	ACM	Risk Score	Recommended Remedial Actions	ACM Area (m^2)/ Volume (m^3)	Estimated Cost Range ($ USD)
Tamavua-Twomey Hospital	Rope lagging, beneath corridor slab	26	Remove and replace ACM	1-2m^3	20,000-30,000
	Ward 5 – outside pipe rope	24	Remove and replace ACM	1-2m^3	15,000-20,000
	Lagging on 1 boiler and lagging on 6 hot water header tanks	26	Remove and replace ACM	1-2m^3	50,000-100,000

Site Name	ACM	Risk Score	Recommended Remedial Actions	ACM Area (m^2)/ Volume (m^3)	Estimated Cost Range ($ USD)
	Ward 5 – cladding north	23	Remove ACM	1200m^2	91,200
	Ward 5 – cladding south	23			
Suva Grammar School	Window panels – science classroom	25	Remove and replace ACM	30m^2	2,280
	Vinyl Tile – entrance corridor	24	Remove and replace ACM	100m^2	7,600
	Hall external panel	16	Remove and replace ACM	60m^2	4,560
Suvasuva Hospital	Entrance Vinyl Floor	23	Remove and replace ACM	200m^2	15,200
Fiji Sugar Corporation Labasa Mill	Compressor lagging	23	Remove and replace ACM	0.5m^3	10,000
Twomey Hospital	Boiler room, boiler lagging	22	Remove and replace ACM	0.5m^3	10,000
	Boiler room, pipe lagging	21	Remove and replace ACM		
Labasa Hospital	Boiler Rope	19	Remove and replace ACM	0.1m^3	5,000
	Sunshade	19	Remove and replace ACM	160m^2	12,160
Labasa College	Library Sunshade	17	Remove and replace ACM	40m^2	3,040
WAF Labasa	Compound vinyl floor	18	Remove and replace ACM	100m^2	8,000

12.2 Recommendations

The following recommendations are therefore made in relation to asbestos in Fiji:

a) It is recommended that the above higher priority asbestos work is carried out in Fiji and that consideration be given to removing other asbestos as per Section 6 above. In particular the work at the Tamavua-Twomey Hospital should be completed.
b) No residential houses were identified as having asbestos in Fiji but it is still possible that houses may contain asbestos, so vigilance should still be maintained.
c) The Naboro Landfill is ideal for receiving asbestos wastes and should be used for all asbestos disposal.
d) Before asbestos remediation takes place (and after if all the asbestos is not removed) it would be appropriate to set in place suitable asbestos management practices and procedures to deal with the ongoing risk posed to human health by asbestos exposure. This should be accompanied by an appropriate education and training programme.
e) Consideration should be given to Fiji passing suitable legislation to prevent asbestos being imported into Fiji.

Appendix 1: Edited Copy of the Terms of Reference

Background

Asbestos-containing materials were in wide use in the past in Pacific Island countries for housing and building construction. The region is subject to periodic catastrophic weather and geological events such as tsunamis and cyclones which are highly destructive to built infrastructure, and as a consequence, asbestos has become a significant waste and human health issue in many Pacific countries. However, quantitative data on the location, quantity and condition of asbestos is not available for the region. This data is needed to define the problem and plan for future actions. This project will contribute to improved management of regional asbestos waste through collection, collation and review of such data on the location, quantity and status of asbestos-containing building materials in priority Pacific Island countries.

SPREP has received funding from the European Union under the EDF10 programme to improve the management of asbestos waste in priority Pacific Island countries.

The work for this consultancy is located in the following Sub-regions and countries;

- Sub-region A, (Nauru):
  Nauru
- Sub-region B, (Micronesia):
  FSM, Kiribati, Marshall Islands, Kiribati
- Sub-region C, (Melanesia):
  Fiji, Solomon Islands, Vanuatu
- Sub-region D, (Polynesia):
  Cook Islands, Niue, Samoa, Tonga, Tuvalu

Objective

Pacific asbestos status and management options are assessed and future intervention recommendations presented on a regional basis to identify prioritised areas for future intervention.

Scope of Work

The scope of work for this consultancy covers the following tasks:

Tasks
For each of the sub-regions and countries above, the Consultant will:

1. Collect and collate data on the location (geographic coordinates), quantity and condition of asbestos-containing building materials (including asbestos-containing waste stockpiles) in each nominated Pacific Island country.

2. Review, and recommend a prioritised list of local best-practice options for stabilisation, handling and final disposal of asbestos contaminated materials in each nominated Pacific Island country (including review of existing local institutional, policy and regulatory arrangements).

3. Recommend and prioritise actions necessary to minimise exposure (potential and actual) of the local population to asbestos fibres for each nominated Pacific Island country. An approximate itemised national cost should be presented for each option identified.

4. Identify any local contractors who have the expertise and capacity to potentially partner with regional or international experts in future asbestos management work.

5. Develop a schedule of rates for local equipment hire, mobilization, labour, etc., to guide the development of detailed cost estimates for future in-country asbestos remediation work.

Project Deliverables

1. Final report detailing the location, quantity and status of asbestos-containing building materials (including asbestos-contaminated waste stockpiles) for each Pacific Island country identified in the work region(s).

2. Final report providing recommendations for local best-practice options including local institutional and policy arrangements for national asbestos management for each Pacific Island country identified in the work region(s).

3. Final report identifying local labor and equipment hire rates and availability of in-country asbestos management expertise for each Pacific Island country identified in the work region(s).

4. Final report presenting costed priority actions necessary to minimise the exposure of the local population to asbestos fibres for each Pacific Island country identified in the work region(s).

Project Timeframe

All final reports completed and submitted to SPREP within twenty (20) weeks from signature of the contract.

Appendix 2: Organisational Details and List of Contacts

A2.1 Organisational Details

The visit to Fiji took place from Saturday 12th July to 24th July and 31st July to 2nd August 2014. The consultants were Gareth Oddy of Geoscience Consulting and John O'Grady of Contract Environmental. They were based in Vitu Levu but Gareth Oddy also visited the island of Vanua Levu from the 19th to 23rd July 2014.

The primary agency for liaison was the Department for Environment, and the following personnel were involved:

- Ms Eleni Tokaduadua, Acting Director, Department of Environment;
- Ms. Senivasa Q. Waqairamasi, senivasa.waqairamasi@environment.gov.fj

In addition, correspondence with the following other key government Departments and Authorities was undertaken in order to identify other potential ACM sites;

- Ministry of Labour;
- Water Authority Fiji;

The Ministry of Labour OSH officers were very helpful and provided considerable support during the visit especially during the proactive action at the Twomey and Tamavua Hospital. Full contact details are given below for all those who assisted during the survey and subsequent reporting.

A2.2. List of Contacts

Ms Eleni Tokaduadua
Acting Director
Department of Environment
PO Box 2109
Government Buildings
SUVA, Fiji
Phone: (679) 3311 699, email: eleni.tokaduadua@govnet.gov.fj

Mr Mervyn Lepper, Acting Director of Properties & Facilities.
The University of the South Pacific
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Phone: +679 32 32255, email: mervyn.lepper@usp.ac.fj

Mr Vishal Anand
Ministry of Labour
Occupational Health & Safety
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Mr. Mitesh Baran,
Acting Manager Wastewater Services, Water Authority Fiji,
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GPO Box 1272,
Suva,
Republic of Fiji.

Mr Mark Hirst,
Manager,
H G Leach (Fiji) Limited,
Naboro Landfill,
Queens Road,
Naboro,
G P O Box 674,
Suva,
Fiji.
Phone: 679 336 3446, Mobile: 679 999 6312, email: mark@hgleach.com.fj

Mr Peniasi Mateboto,
Station Manager,
Telesource (Fiji) Ltd
Kinoya Power Station, Suva
Ph: +679-334-1625

Appendix 3: Summaries of in-Country Discussions

Fiji Electricity Authority (FEA)

Spoke to Peniasi Mateboto, Station Manager, who gave the following information:

- Rakiraki - one generator may have asbestos
- Nadi - two generators - asbestos has been removed from the building.
- Have used asbestos on older generators in Suva - removed 5 years ago and "jackets' now used as lagging.
- Muda, Lautoka – maybe asbestos? – need to check. No asbestos pipes in Lautoka - all removed over three years.

Fiji Water Authority (FWA)

- Tavua yard may have leftovers in stockpile.
- People can request old asbestos pipes from Suva for driveways
- No plans for managing the old pipes.
- Asbestos pipes for reticulation in ground
- PVC used in Tavua – asbestos pipes replaced and buried.

Fiji Sugar Corporation

Spoke to Jito in Lautoka who said all asbestos had been removed from mills in Ba and Rakiraki.

Rakiraki Hospital

- Hospital buildings built 2013 and 2008
- No asbestos and no boiler room.
- Incinerator never used.
- Old building refurbished in 2010

Asbestos in Tamavua/Twomey Hospital

Ward 5 Building - cladding 4mx78m and 3.5mx40m

- Ducting outside exposed – about 120m
- Ducting outside underground – about 50m
- Contaminated Soil - 80m x 20m by Ward 5 and 60m x 40m by old boiler room.
- Inside Ward 5
    - Old building 70mx3m, 70mx2mx2m, 30mx2m
    - Rooms each 20mx4m
    - Passage 40mx4mx2m
    - Ceiling 80mx30m
- Would also need to clean under the floor
- Ceiling in Ward: 10mx3m and might be in other locations.
- Ducting in Ward: about 120m under the floor and maybe more.
- Kanito Lovobalavu – the Health contact with the Central Board of Health.
- Refer to survey conducted by Osea Cawaru – found quite a lot of asbestos.

Department of Labour, Suva

- Control of Hazardous Substances Reg 2006. Asbestos is in Schedule 3. Refer to Aus/NZ standards for asbestos.
- OHS will supervise the removal and removed asbestos is buried in Naboro Landfill.
- There is no certified lab in Fiji and normally use Pickford Consultants in Australia.
- OHS is responsible for ensuring enforcement and safe removal and they do the training.
- Friable asbestos is very rarely encountered in Fiji, although it is in the Tamavua Hospital.
- There is quite a lot of public awareness of asbestos in Fiji.
- There is a list of approved contractors in Fiji and reports can be made public – training, registration and certification.
- Osea Cawaru, current Permanent Secretary for Defence, wrote his thesis on asbestos when he worked for Labour. The thesis is held at USP.

Public Works Department – Building Section

- List of state-owned properties with asbestos
- Very rare in residences, although there were some cases in Samabula that have been removed. Aiming to eliminate, but largely removed.
- Naboro landfill – Leach, overseas contractor
- DHS may not be informed if asbestos present

Naboro Landfill

- Since September 2005 has received asbestos
- 600 compacted clay original
- Lining – 1.5mm HDPE
- Gas collection planned
- Rate is $F25.5 / tonne for non-special waste
- Rate is $F45 including VAT for special waste

Appendix 4: Laboratory Reports

EMS LABORATORIES INC.
117 W. Bellevue Drive, Pasadena, CA 91105-2548 626-568-4065

National Institute of Standards and Technology (NIST) NVLAP Lab Code 101218-0
California Department of Health Services Environmental Testing Laboratory ELAP 1119
County Sanitation Districts of Los Angeles County ID No. 10120
AIHA Laboratory Accreditation Programs, LLC 101634

CUSTOMER:	Contract Environmental 119 Johnson Rd. West Melton Christchurch NZ	PAGE #:	1 of 6
		REPORT #:	0162049
		PROJECT:	PLM ANALYSIS
CONTACT:	John O'Grady	DATE COLLECTED:	07/23/2014
REFERENCE:		COLLECTED BY:	
METHOD:	EPA 600/R-93/116	DATE RECEIVED:	07/23/2014
		ANALYSIS DATE:	07/23/2014

BULK SAMPLE ANALYSIS FOR ASBESTOS CONTENT BY POLARIZED LIGHT MICROSCOPY

Laboratory ID - Sample No.	Sample Location Description	Layer No. Layer %	Asbestos Type	(%)	Non-Asbestos Components	(%)
0162049-001 FN1	Vinyl Floor Tile, Beige, Homogeneous, Solid, melt, non-friable Note: 29°C, 1.55 Oil	LAYER 1 100%	None Detected		Non-Fibrous Material	100%
0162049-002 FN2	LAYER 1 Vinyl Floor Tile, Blue, Homogeneous, Rubbery, ash, non-friable Note: 29°C, 1.55 Oil	LAYER 1 90%	None Detected		Non-Fibrous Material	100%
	LAYER 2 Mastic, Yellow, Homogeneous, Sticky, melt, non-friable Note: 29°C, 1.55 Oil	LAYER 2 10%	None Detected		Non-Fibrous Material	100%
0162049-003 FN3	Vinyl Floor Tile, Beige, Homogeneous, Solid, melt, non-friable Note: 29°C, 1.55	LAYER 1 100%	None Detected		Non-Fibrous Material	100%
0162049-004 FN4	Vinyl Floor Tile, Beige, Homogeneous, Solid, melt, non-friable Note: 30°C, 1.55 Oil	LAYER 1 100%	None Detected		Non-Fibrous Material	100%
0162049-005 FN5	Vinyl Floor Tile, Beige, Homogeneous, Solid, melt, non-friable Note: 30°C, 1.55	LAYER 1 100%	None Detected		Non-Fibrous Material	100%

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CUSTOMER:	Contract Environmental 119 Johnson Rd. West Melton Christchurch NZ	PAGE #: REPORT #: PROJECT:	2 of 6 0162049 PLM ANALYSIS

BULK SAMPLE ANALYSIS FOR ASBESTOS CONTENT BY POLARIZED LIGHT MICROSCOPY

Laboratory ID - Sample No.	Sample Location Description	Layer No. Layer %	Asbestos Type	(%)	Non-Asbestos Components	(%)
0162049-006 FN6	Gray, Homogeneous, Fibrous, tease, non-friable Note: 30°C, 1.55 Oil	LAYER 1 100%	None Detected		Cellulose Fiber Non-Fibrous Material	60% 40%
0162049-007 FN7	Floor Tile, Beige, Homogeneous, Solid, melt, non-friable Note: 30°C, 1.55 Oil	LAYER 1 100%	None Detected		Non-Fibrous Material	100%
0162049-008 FL1	Gray, Homogeneous, Fibrous, tease, non-friable Note: 30°C, 1.55	LAYER 1 100%	Chrysotile	60%	Non-Fibrous Material	40%
0162049-009 FL2	Drywall, White/brown, Non-homogeneous, Granular, acid, non-friable Note: 30°C, Acid	LAYER 1 100%	None Detected		Cellulose Fiber Non-Fibrous Material	15% 85%
0162049-010 FL3	White, Homogeneous, Granular, acid, non-friable Note: 30°C, Acid	LAYER 1 100%	None Detected		Cellulose Fiber Non-Fibrous Material	5% 95%
0162049-011 FL4	Beige, Homogeneous, Solid, melt, non-friable Note: 30°C, 1.55 Oil	LAYER 1 100%	None Detected		Non-Fibrous Material	100%
0162049-012 FL5	Gray, Homogeneous, Fibrous, tease, non-friable Note: 30°C, 1.55, 1.68 Oil	LAYER 1 100%	Chrysotile Amosite	10% 5%	Non-Fibrous Material	85%
0162049-013 FSI1	Clear/Gray, Non-homogeneous, Fibrous/Hard, tease/crush, non-friable Note: 25°C, 1.550	LAYER 1 100%	Chrysotile	10%	Cellulose Fiber Non-Fibrous Material	5% 85%

CUSTOMER:	Contract Environmental 119 Johnson Rd. West Melton Christchurch NZ	PAGE #: REPORT #: PROJECT:	3 of 6 0162049 PLM ANALYSIS

BULK SAMPLE ANALYSIS FOR ASBESTOS CONTENT BY POLARIZED LIGHT MICROSCOPY

Laboratory ID - Sample No.	Sample Location Description	Layer No. Layer %	Asbestos Type	(%)	Non-Asbestos Components	(%)
0162049-014 FSI2	Beige, Homogeneous, Fibrous, tease, friable Note: 25°C, 1.550	LAYER 1 100%	Chrysotile	25%	Cellulose Fiber Synthetic Fiber Non-Fibrous Material	20% 15% 40%
0162049-015 FSI6	Brown/Clear, Non-homogeneous, Powdery/Fibrous, tease, friable Note: 25°C, 1.550	LAYER 1 100%	Chrysotile	85%	Cellulose Fiber Non-Fibrous Material	10% 5%
0162049-016 FSGS1	LAYER 1 Red, Homogeneous, Hard, melt, non-friable Note: 25°C, 1.550	LAYER 1 95%	Chrysotile	2%	Cellulose Fiber Non-Fibrous Material	<1% 98%
	LAYER 2 Black, Homogeneous, Tar Like, melt, non-friable Note: 25°C, 1.550	LAYER 2 5%	Chrysotile	5%	Non-Fibrous Material	95%
0162049-017 FSGS2	White/Beige, Non-homogeneous, Paint/Hard, ash/crush, non-friable Note: 25°C, 1.550	LAYER 1 100%	Chrysotile	15%	Cellulose Fiber Non-Fibrous Material	5% 80%
0162049-018 FSGS3	White/Gray, Non-homogeneous, Paint/Hard, ash/crush, non-friable Note: 25°C, 1.550	LAYER 1 100%	Chrysotile	5%	Cellulose Fiber Non-Fibrous Material	10% 85%
0162049-019 FSGYM4	White/Gray, Non-homogeneous, Paint/Fibrous, ash/tease, non-friable Note: 25°C, 1.550	LAYER 1 100%	Chrysotile	10%	Cellulose Fiber Non-Fibrous Material	15% 75%
0162049-020 FS5	White/Gray, Non-homogeneous, Paint/Fibrous, ash/tease, non-friable Note: 25°C, 1.550	LAYER 1 100%	None Detected		Cellulose Fiber Non-Fibrous Material	60% 40%
0162049-021 FS6	Brown/Gray, Non-homogeneous, Powdery/Fibrous, tease, non-friable Note: 25°C, 1.550	LAYER 1 100%	Chrysotile	5%	Cellulose Fiber Non-Fibrous Material	10% 85%

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CUSTOMER:	Contract Environmental 119 Johnson Rd. West Melton Christchurch NZ	PAGE #: REPORT #: PROJECT:	4 of 6 0162049 PLM ANALYSIS

BULK SAMPLE ANALYSIS FOR ASBESTOS CONTENT BY POLARIZED LIGHT MICROSCOPY

Laboratory ID - Sample No.	Sample Location Description	Layer No. Layer %	Asbestos Type	(%)	Non-Asbestos Components	(%)
0162049-022 FS7	LAYER 1 Red, Homogeneous, Hard, melt, non-friable Note: 26°C, 1.550	LAYER 1 90%	Chrysotile	5%	Non-Fibrous Material	95%
	LAYER 2 Black, Homogeneous, Tar Like, melt, non-friable Note: 26°C, 1.550	LAYER 2 10%	Chrysotile	5%	Cellulose Fiber Non-Fibrous Material	2% 93%
0162049-023 FS8	Gray, Homogeneous, Fibrous, tease, non-friable Note: 26°C, 1.550	LAYER 1 100%	Chrysotile	10%	Cellulose Fiber Non-Fibrous Material	15% 75%
0162049-024 FS9	White, Homogeneous, Powdery, Dissolve, friable Note: 26°C, 1.550	LAYER 1 100%	Amosite	5%	Cellulose Fiber Non-Fibrous Material	5% 90%
0162049-025 FS10	White, Homogeneous, Powdery, Dissolve Note: 26°C, 1.680	LAYER 1 100%	Amosite	5%	Cellulose Fiber Non-Fibrous Material	5% 90%
0162049-026 FS11	Brown, Homogeneous, Fibrous, tease, friable Note: 26°C, 1.550	LAYER 1 100%	None Detected		Fibrous Glass Cellulose Fiber Non-Fibrous Material	15% 60% 25%
0162049-027 FS12	White, Homogeneous, Chalky, crush, non-friable Note: 27°C, 1.550	LAYER 1 100%	None Detected		Non-Fibrous Material	100%
0162049-028 FS13	Cream/Beige, Non-homogeneous, Paint/Hard, crush, non-friable Note: 27°C, 1.550	LAYER 1 100%	Chrysotile	5%	Cellulose Fiber Non-Fibrous Material	25% 70%
0162049-029 FS14	White, Homogeneous, Powdery, Dissolve, friable Note: 27°C, 1.680	LAYER 1 100%	Amosite	5%	Cellulose Fiber Non-Fibrous Material	2% 93%

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CUSTOMER:	Contract Environmental 119 Johnson Rd. West Melton Christchurch NZ	PAGE #: REPORT #: PROJECT:	5 of 6 0162049 PLM ANALYSIS

BULK SAMPLE ANALYSIS FOR ASBESTOS CONTENT BY POLARIZED LIGHT MICROSCOPY

Laboratory ID - Sample No.	Sample Location Description	Layer No. Layer %	Asbestos Type	(%)	Non-Asbestos Components	(%)
0162049-030 FS15	Beige/Gray, Non-homogeneous, Paint/Fibrous, ash/tease, non-friable Note: 27°C, 1.550	LAYER 1 100%	Chrysotile	8%	Cellulose Fiber Non-Fibrous Material	10% 82%
0162049-031 FNA1	White/Yellow/Gray, Non-homogeneous, Hard/Resinous/Powdery, melt/ash, non-friable Note: 27°C, 1.550	LAYER 1 100%	None Detected		Cellulose Fiber Non-Fibrous Material	2% 98%
0162049-032 FNA2	White/Gray, Non-homogeneous, Paint/Fibrous, ash/acid, non-friable Note: 27°C	LAYER 1 100%	Chrysotile	5%	Cellulose Fiber Non-Fibrous Material	30% 65%
0162049-033 FNA3	Gray, Homogeneous, Fibrous, tease, friable Note: 27°C	LAYER 1 100%	None Detected		Fibrous Glass Cellulose Fiber Non-Fibrous Material	70% 15% 15%
0162049-034 FNA4	Blue/Beige, Non-homogeneous, Paint/Fibrous, ash/tease, non-friable Note: 27°C, 1.550	LAYER 1 100%	None Detected		Cellulose Fiber Synthetic Fiber Non-Fibrous Material	75% 5% 20%
0162049-035 FNA5	Gray/White/Tan, Non-homogeneous, Paint/Rubbery/Fibrous, ash/tease, non-friable Note: 27°C, 1.550	LAYER 1 100%	None Detected		Cellulose Fiber Non-Fibrous Material	25% 75%

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Analyst - MEGHAN SWEENEY

Approved Signatory Laboratory Director

The EPA method is a semi-quantitative procedure. The detection limit is between 0.1-1% by area and dependent upon the size of the asbestos fibers, the means of sampling and the matrix of the sampled material. The test results reported are for the sample(s) delivered to us and may not represent the entire material from which the sample was taken. The EPA recommends three samples or more be taken from a "homogeneous sampling area" before friable material is considered non-asbestos-containing. Negative floor tile samples may contain significant amounts (>1%) of very thin fibers which cannot be detected by PLM. Confirmation by TEM is recommended by the EPA (Federal Register Vol.59, No.146). Asbestos fibers bound in a non-friable organic matrix may not be detected by PLM. Alternative preparation methods are recommended. This report, from a NIST-accredited laboratory through NVLAP, must not be used by the client to claim product endorsement by NVLAP or any agencyof the U.S. government. This report shall not be reproduced, except in full, without the written approval of EMS Laboratories, Inc. Samples were received in good condition unless otherwise noted.

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NVLAP Lab Code: [illegible]

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National Institute of Standards and Technology (NIST) NVLAP Lab Code 101218-0
California Department of Health Services Environmental Testing Laboratory ELAP 1119
County Sanitation Districts of Los Angeles County ID No. 10120
AIHA Laboratory Accreditation Programs, LLC 101634

CUSTOMER:	Contract Environmental 119 Johnson Rd. West Melton Christchurch NZ	PAGE #:	1 of 4
		REPORT #:	0162208
		PROJECT:	PLM ANALYSIS
CONTACT:	John O'Grady	DATE COLLECTED:	
REFERENCE:	11173 SPREP-FIJI	COLLECTED BY:	
METHOD:	EPA 600/R-93/116	DATE RECEIVED:	08/06/2014
		ANALYSIS DATE:	08/06/2014

BULK SAMPLE ANALYSIS FOR ASBESTOS CONTENT BY POLARIZED LIGHT MICROSCOPY

Laboratory ID - Sample No.	Sample Location Description	Layer No. Layer %	Asbestos Type	(%)	Non-Asbestos Components	(%)
0162208-001 FS40	Gray, Homogeneous, Fibrous, tease, non-friable Note: 27°C, 1.55 Oil	LAYER 1 100%	Chrysotile	45%	Synthetic Fiber Non-Fibrous Material	45% 10%
0162208-002 FS41	White, Non-homogeneous, Granular, acid, non-friable Note: 27°C, Acid	LAYER 1 100%	Chrysotile Amosite	7% 5%	Non-Fibrous Material	88%
0162208-003 FS42	Gray, Homogeneous, Fibrous, tease, non-friable Note: 27°C, 1.55	LAYER 1 100%	Chrysotile	95%	Non-Fibrous Material	5%
0162208-004 FS43	Gray, Granular, crush, non-friable Note: 27°C, 1.55 Oil	LAYER 1 100%	None Detected		Non-Fibrous Material	100%
0162208-005 FS44	Gray, Solid, crush, non-friable Note: 27°C, 1.55 Oil	LAYER 1 100%	None Detected		Non-Fibrous Material	100%
0162208-006 FS45	LAYER 1 Floor Tile, Gray, Homogeneous, Solid, melt, non-friable Note: 27°C, 1.55	LAYER 1 95%	Chrysotile	2%	Non-Fibrous Material	98%
	LAYER 2 Mastic, Black, Homogeneous, Sticky, melt, non-friable Note: 28°C, 1.55 Oil	LAYER 2 5%	Chrysotile	5%	Non-Fibrous Material	95%

CUSTOMER:	Contract Environmental 119 Johnson Rd. West Melton Christchurch NZ	PAGE #: REPORT #: PROJECT:	2 of 4 0162208 PLM ANALYSIS

BULK SAMPLE ANALYSIS FOR ASBESTOS CONTENT BY POLARIZED LIGHT MICROSCOPY

Laboratory ID - Sample No.	Sample Location Description	Layer No. Layer %	Asbestos Type	(%)	Non-Asbestos Components	(%)
0162208-007 FS46	Gray, Homogeneous, Solid, tease, non-friable Note: 28°C, 1.55 Oil	LAYER 1 100%	Chrysotile	20%	Non-Fibrous Material	80%
0162208-008 FS47	White, Homogeneous, Granular, acid, non-friable Note: 28°C, 1.55 Oil	LAYER 1 100%	None Detected		Cellulose Fiber Non-Fibrous Material	20% 80%
0162208-009 FS48	White, Homogeneous, Fibrous, tease, non-friable Note: 28°C, 1.55 Oil	LAYER 1 100%	Chrysotile	95%	Non-Fibrous Material	5%
0162208-010 FS49	White/yellow, Non-homogeneous, Rubbery/Yellow, tease, non-friable Note: 28°C, 1.55 Oil	LAYER 1 100%	None Detected		Fibrous Glass Non-Fibrous Material	60% 40%
0162208-011 FS50	White, Homogeneous, Fibrous, tease, non-friable Note: 28°C, 1.55 Oil	LAYER 1 100%	None Detected		Fibrous Glass Cellulose Fiber Non-Fibrous Material	60% 10% 30%
0162208-012 FS51	Gray, Non-homogeneous, Solid, tease, non-friable Note: 28°C, 1.55 Oil	LAYER 1 100%	Chrysotile	5%	Cellulose Fiber Non-Fibrous Material	10% 85%
0162208-013 FS52	Gray, Homogeneous, Solid, tease, non-friable Note: 28°C, 1.55 Oil	LAYER 1 100%	Chrysotile Amosite	15% 5%	Non-Fibrous Material	80%
0162208-014 FS53	Gray, Non-homogeneous, Solid, tease, non-friable Note: 28°C, 1.55	LAYER 1 100%	Chrysotile	25%	Non-Fibrous Material	75%
0162208-015 FS54	Beige, Non-homogeneous, solid, crush, non-friable Note: 28°C, 1.55 Oil	LAYER 1 100%	None Detected		Non-Fibrous Material	100%

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CUSTOMER:	Contract Environmental 119 Johnson Rd. West Melton Christchurch NZ	PAGE #: REPORT #: PROJECT:	3 of 4 0162208 PLM ANALYSIS

BULK SAMPLE ANALYSIS FOR ASBESTOS CONTENT BY POLARIZED LIGHT MICROSCOPY

Laboratory ID - Sample No.	Sample Location Description	Layer No. Layer %	Asbestos Type	(%)	Non-Asbestos Components	(%)
0162208-016 FS55	White, Homogeneous, Fibrous, tease, non-friable Note: 28°C, 1.55	LAYER 1 100%	Chrysotile	10%	Cellulose Fiber Fibrous Glass Non-Fibrous Material	10% 75% 5%
0162208-017 FS56	Beige, Non-homogeneous, Fibrous, tease, non-friable Note: 28°C, 1.55 Oil	LAYER 1 100%	None Detected		Fibrous Glass Cellulose Fiber Non-Fibrous Material	30% 10% 60%
0162208-018 FS57	Yellow, Homogeneous, Fibrous, tease, non-friable Note: 28°C, 1.55 Oil	LAYER 1 100%	None Detected		Fibrous Glass Non-Fibrous Material	98% 2%
0162208-019 FS58	White, Homogeneous, Fibrous, tease, non-friable Note: 28°C, 1.55 Oil	LAYER 1 100%	None Detected		Fibrous Glass Non-Fibrous Material	95% 5%
0162208-020 FS59	Gray, Non-homogeneous, Granular, crush, non-friable Note: 28°C, 1.55 Oil	LAYER 1 100%	None Detected		Non-Fibrous Material	100%
0162208-021 FS60	LAYER 1 Brown, Homogeneous, Solid, melt, non-friable Note: 28°C, 1.55	LAYER 1 90%	None Detected		Non-Fibrous Material	100%
	LAYER 2 Black, Homogeneous, Sticky, melt, non-friable Note: 28°C, 1.55 Oil	LAYER 2 10%	Chrysotile	2%	Non-Fibrous Material	98%
0162208-022 FS61	LAYER 1 Beige, Homogeneous, Solid, melt, non-friable Note: 28°C, 1.55 Oil	LAYER 1 95%	Chrysotile	3%	Non-Fibrous Material	97%
	LAYER 2 Black, Homogeneous, Sticky, melt, non-friable Note: 28°C, 1.55	LAYER 2 5%	Chrysotile	5%	Non-Fibrous Material	95%

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CUSTOMER:	Contract Environmental 119 Johnson Rd. West Melton Christchurch NZ	PAGE #: REPORT #: PROJECT:	4 of 4 0162208 PLM ANALYSIS

BULK SAMPLE ANALYSIS FOR ASBESTOS CONTENT BY POLARIZED LIGHT MICROSCOPY

Laboratory ID - Sample No.	Sample Location Description	Layer No. Layer %	Asbestos Type	(%)	Non-Asbestos Components	(%)
0162208-023 FS62	Green/Gray, Non-homogeneous, Paint/Chalky, ash/crush, non-friable Note: 26°C, 1.550	LAYER 1 100%	None Detected		Cellulose Fiber Non-Fibrous Material	5% 95%
0162208-024 FS63	White/Gray, Non-homogeneous, fibrous/chalky, tease/crush, friable Note: 26°C, 1.550	LAYER 1 100%	None Detected		Cellulose Fiber Fibrous Glass Non-Fibrous Material	10% 5% 85%
0162208-025 FS64	Cream/Beige, Non-homogeneous, fibrous/chalky, tease/crush, friable Note: 26°C, 1.550	LAYER 1 100%	None Detected		Cellulose Fiber Fibrous Glass Non-Fibrous Material	10% 5% 85%

Analyst - Wesene Sebhat **Approved Signatory** Laboratory Director

The EPA method is a semi-quantitative procedure. The detection limit is between 0.1-1% by area and dependent upon the size of the asbestos fibers, the means of sampling and the matrix of the sampled material. The test results reported are for the sample(s) delivered to us and may not represent the entire material from which the sample was taken. The EPA recommends three samples or more be taken from a "homogeneous sampling area" before friable material is considered non-asbestos-containing. Negative floor tile samples may contain significant amounts (>1%) of very thin fibers which cannot be detected by PLM. Confirmation by TEM is recommended by the EPA (Federal Register Vol.59, No.146). Asbestos fibers bound in a non-friable organic matrix may not be detected by PLM. Alternative preparation methods are recommended. This report, from a NIST-accredited laboratory through NVLAP, must not be used by the client to claim product endorsement by NVLAP or any agencyof the U.S. government. This report shall not be reproduced, except in full, without the written approval of EMS Laboratories, Inc. Samples were received in good condition unless otherwise noted.

NVLAP Lab Code: 101218-0

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Appendix 5: Build Up to Costs for Remediation Options

Four scenarios have been costed:

1. Encapsulate asbestos roofing
2. Encapsulate asbestos exterior wall cladding
3. Remove and replace asbestos roofing
4. Remove and replace asbestos exterior wall cladding

Build ups are mostly based on costs provided by Central Meridian Inc based in Nauru, cross checked against costs in New Zealand.

It is noted that the costs prepared are for preliminary budgeting purposes only. Costs may vary according to local requirements, but we anticipate that the amounts allowed will be adequate to get the work done.

For the cost build ups prepared we have taken the Central Meridian rates, priced in Australian dollars, and converted them to United States dollars at an exchange rate of 0.8. We have then deducted 10% for savings that we anticipate would be achievable through competitive tendering of the work.

Provision has also been made for the works to be overseen by a SPREP appointed asbestos expert. The actual cost for this item will depend on the programme of works achievable and it is noted that this expert could also complete any contract administration and act as engineer to the contract ensuring safety, quality and commercial requirements are achieved.

Central Meridian Quote

central meridian inc

PO Box 106
Republic of Nauru
Central Pacific
T 674 557 3731
AH 674 557 3813
E pfcmnauru@gmail.com
paulfinch1954@gmail.com

02.12.14

Quotation: 6814

Mr John O'Grady
Contract Environmental Ltd.

Cost estimates to undertake various asbestos removal work.

Dear John,

As requested I have detailed below costs to undertake various items of work involved in the removal of asbestos roof sheeting and replacement with colourbond corrugated roofing.

A full schedule of work to be undertaken during the removal and replacement process is detailed to - provide a clear build-up of costs and the relevant stages of work involved.

All work will be undertaken to the relevant NZ & Australian standards for asbestos removal & disposal.

REMOVAL OF EXISTING ASBESTOS ROOF SHEETING.
The costings detailed below are based on a roof area of 165m2. This is a standard size of many of the houses on Nauru with asbestos roof sheeting.
The cost of set up & removal of existing roofing is based on our historical costs for undertaking a number of similar roof removals on the island.
There are additional costs included as detailed:
(a) purchase of a 60 Litre Foamer unit at a price of $5,000.00 (including ocean freight & 10% import duty.) The cost of this is spread over the removal of 20 roofs.
(b) purchase of specialist vacuum cleaner with HEPA filter at a price of $2,000.00 (including freight & 10% import duty.)
(c) delivery to a central staging point for removal off island.

Establish asbestos boundaries, mark out the property, set up relevant warning signage around the property, decontamination entry points, personal protective clothing, (PPE) for staff & disposal.
$1,400.00

Set up scaffolding to both sides of building to assist in removal of roof sheeting & to remove asbestos guttering from building. Set up anchor point for fall arrest systems
$2,200.00

Coat the roof with a sprayed on water based PVA solution.
$1,250.00

Carefully remove the roof sheeting by unscrewing, (not breaking) the roof sheets. All roof sheets to be stacked onto plastic sheeting sitting on bearers for ease of removal. Sheeting to be fully wrapped in plastic & taped shut. Roof sheeting and all materials, (ridging, barge flashing, gutters etc) to be loaded into 'Asbags' for safe removal.
All removed materials will be taken and stored at a suitable staging point ready to be loaded into containers for removal from Nauru.
$4,465.00

Vacuum clean the existing ceiling & roof space, (rafters, purlins, ceiling joists) with a specific vacuum cleaner with a HEPA filter. (dispose of contents of cleaner into an 'Asbag' for correct disposal $325.00

Supply & fit heavy duty tarpaulins to keep the roof waterproof before installation of new roofing. $300.00

TOTAL COST FOR REMOVAL OF EXISTING ROOFING & GUTTERS $9,940.00

INSTALLATION OF NEW ROOF SHEETING, INSULATION, GUTTERING, DOWNPIPES.
We have quoted for Ultra grade of colourbond roof sheeting. This has a greater protective coating & is better for an oceanside environment. (Long life heavy duty).
The sq metre costs & grade of materials for this work are the same as that for the TVET school project in Yaren we have recently completed to AusAID Standard.

Supply & fit 'Kiwisafe' roof netting over existing purlins & fix in place ready to support the 50mm thick, foil coated, fiberglass insulation. Supply & lay a top layer of sisalation foil over the fibreglass insulation blanket. $2,541.00

Supply & screw fix Colourbond Ultra grade corrugated roofing, including for ridging & barge flashings. $7,722.00

Supply & fix Colourbond box guttering to both sides of the roof & include for one downpipe each side, feeding to a tank. $1,060.00

TOTAL COST FOR SUPPLY & FIXING OF NEW ROOF, ROOF INSULATION & GUTTERS & DOWN PIPES. $11,323.00

NB A contingency of 10% may need to be added as necessary for repairs to roof purlins and rafters.

RETENTION OF EXISTING ASBESTOS ROOF SHEETING AND FULL ENCAPSULATION WITH CORRECT PAINT SYSTEM. INCLUDING REMOVAL & REPLACEMENT OF EXISTING CEILINGS.
The square area of ceiling to be replaced & painting to be undertaken is based on a house size of 14m x 12m in size. (168 m2)
Work involved in this process is as follows and detailed below:

Establish asbestos boundaries, mark out the property, set up relevant warning signage around the property, decontamination entry points, personal protective clothing, (PPE) for staff & disposal.
$1,400.00

Set up scaffolding to both sides of building to assist in removal of roof sheeting & to remove asbestos guttering from building. Set up anchor point for fall arrest systems
$2,200.00

Spray with Foamshield to the inside of the ceiling space before removal of the sheeting.
$475.00

Disconnect & remove all electrical items, ceiling fans, lights, extractor fans. Allow to store safely ready for reconnection after new ceilings are installed. Ensure all wiring is made safe for ongoing work. $350.00

Lay down black plastic sheeting to floor of each room, remove all ceiling linings and place all rubbish into Asbags for correct removal & disposal. $1,850.00

Vacuum with specialist cleaner the underside of the existing roof sheeting and all timber roof framing. After removal of ceiling materials vacuum clean all the inside of the premises with vacuum cleaner with specialist HEPA filter. $350.00

Prepare correct paint product to seal & spray 2 coats of protective paint system to the underside of all the asbestos roof sheeting. Ensuring that all surface areas are correctly coated. A total of 3 coats to be applied. $2,050.00

Supply & fix 4.8mm Masonite sheeting to ceiling of all rooms. Supply & fix 40x10mm timber batten to all sheet joints & to perimeter of each room. $6,370.00 (Standard Ceiling liner)

Paint with 2 coats of acrylic ceiling paint to all new ceiling sheets & perimeter battens. $1,425.00

Reposition all wiring for lights & fans and connect up all fittings as previously set out. $450.00

Prepare to apply 3 coats of specialist paint finish to all the exterior roof area according to painting specifications. $2,250.00

Remove and dispose of correctly asbestos gutters to both sides of the building and supply & install new colourbond box gutters with down pipe each side leading to water tank. $1,760.00

TOTAL COST FOR FULL PAINT ENCAPSULATION OF EXISTING ROOF SHEETING, INCLUDING FOR REMOVAL & REPLACEMENT OF EXISTING CEILINGS & ALL ASSOCIATED WORK. $20,930.00

Thank you for the opportunity to provide a quotation & I await your instructions.

Yours truly,

Paul Finch
Central Meridian Inc.

Build up to Encapsulation of Asbestos Roofing

BUILD UP TO RETENTION OF EXISTING ASBESTOS ROOF SHEETING AND FULL ENCAPSULATION WITH CORRECT PAINT SYSTEM, INCLUDING REMOVAL AND REPLACEMENT OF EXISTING CEILINGS.

The costing detailed below are based on building area of 168m2 (14m x 12m). For roof area multiply by 1.15 to account for the pitch, which gives an area of 193m2.

This estimate assumes that there is an existing ceiling in place within the building, which would need to be treated as asbestos contaminated and removed. Once the ceiling was removed the building would need to be cleaned of asbestos fibres, the existing roof encapsulated, and the ceiling then reinstated. The items relating to the ceiling removal are shaded in blue, and if there was no ceiling then these items could be deducted from the budgeted costs.

The estimate does not include any costs related to removing items from within the building prior to starting works, or putting them back, or any costs relating to the disruption of normal activities in the affected building.

Item	AUD estimate (based on Central Meridian costings)	Convert to USD (0.8 exchange rate)	Reduce by 10% to account for competitive tendering
Establish asbestos boundaries, mark out the property, set up relevant warning signage around the property, decontamination entry points, personal protective equipment (PPE) for staff.	1,400.00	1,120.00	1,018.18
Set up scaffolding to both sides of building to remove asbestos guttering from building and provide safe access to the roof. Set up anchor point for fall arrest systems.	2,200.00	1,760.00	1,600.00
Spray ceiling with Foamshield, or similar particle capture system, to the inside of the ceiling space before removal of the sheeting.	475.00	380.00	345.45
Disconnect and remove all electrical items, ceiling fans, lights, extractor fans. Allow to store safely ready for reconnection after new ceilings are installed. Ensure all wiring is made safe for ongoing work.	350.00	280.00	254.55
Lay down black plastic sheeting to floor of each room, remove all ceiling linings and place all rubbish into Asbags for correct removal and disposal.	1,850.00	1,480.00	1,345.45
After removal of ceiling materials vacuum clean all the inside of the premises with a vacuum cleaner with HEPA filter. Then vacuum the underside of the existing roof sheeting and all	350.00	280.00	254.55

timber roof framing.			
Prepare correct paint product to seal and spray 3 coats of protective paint system to the underside of all the asbestos roof sheeting. Ensuring that all surface areas are correctly coated.	2,050.00	1,640.00	1,490.91
Supply and fix 4.8mm Masonite sheeting to ceiling of all rooms. Supply and fix 40x10mm timber batten to all sheet joints and to perimeter of each room. (Standard ceiling liner)	6,370.00	5,096.00	4,632.73
Paint with 2 coats of acrylic ceiling paint to all new ceiling sheets and perimeter battens.	1,425.00	1,140.00	1,036.36
Reposition all wiring for lights and fans and connect up all fittings as previously set out.	450.00	360.00	327.27
Apply 3 coats of specialist paint finish to all the exterior roof area according to painting specifications.	2,250.00	1,800.00	1,636.36
Remove gutters to both sides of the building and supply and install new colourbond box gutters with down pipe each side leading to water tank. Transport asbestos contaminated materials to central collection point for disposal (cost of disposal not included).	1,760.00	1,408.00	1,280.00
Oversight by SPREP appointed asbestos management expert	2,875.00	2,300.00	2,300.00
Total	**23,805.00**	**19,044.00**	**17,521.82**
Work back in to a m2 rate for encapsulating asbestos roofs where there is a ceiling present (per area of roof assuming the roof has a 30 degree pitch)		/ 193m2	90.79
Work our alternate rate for where there is no ceiling			
Deduct ceiling related costs shaded in blue			-7,941.82
Adjusted cost for a 168m2 building			9,580.00
Adjusted m2 rate for encapsulating an asbestos roof where there is no ceiling present (per area of roof assuming the roof has a 30 degree pitch)		/ 193m2	49.64

Build Up to Encapsulating Asbestos Cladding

BUILD UP TO RETENTION OF EXISTING ASBESTOS WALL CLADDING AND FULL ENCAPSULATION (INSIDE AND OUT) WITH CORRECT PAINT SYSTEM.

The estimate assumes work is completed in a building 14m x 12m in size = 168m2 (single storey - 2.4m high). Assuming windows and doors account for 10% of building exterior, the total cladding area would be approximately 360m2.

This estimate assumes that there is no internal wall sheeting (eg plaster board) and that the asbestos containing material is exposed. For a scenario where there is internal wall sheeting in good condition within the building, only the exterior would need to be treated. Items where savings could be made in this scenario are shaded in blue.

In a situation where there is internal wall sheeting in poor condition that would need to be removed and replaced, an extra $40/m2 would need to be allowed for as an extra over cost.

The estimate does not include any costs related to removing items from within the building prior to starting works, or putting them back, or any costs relating to the disruption of normal activities in the affected building.

Item	AUD estimate (based on Central Meridian costings)	Convert to USD (0.8 exchange rate)	Reduce by 10% to account for competitive tendering
Establish asbestos boundaries, mark out the property, set up relevant warning signage around the property, decontamination entry points, personal protective equipment (PPE) for staff.	1,400.00	1,120.00	1,018.18
Vacuum clean all the inside of the premises with Vacuum cleaner with specialist HEPA filter. Then vacuum the inside of the existing cladding and all timber framing.	350.00	280.00	254.55
Prepare correct paint product to seal and spray 3 coats of protective paint system to the **outside** of all the cladding. Ensuring that all surface areas are correctly coated. A total of 3 coats to be applied.	3,960.00	3,168.00	2,880.00
Prepare correct paint product to seal and spray 3 coats of protective paint system to the **inside** of all the cladding. Ensuring that all surface areas are correctly coated.	3,960.00	3,168.00	2,880.00
Oversight by SPREP appointed asbestos management expert	2,875.00	2,300.00	2,300.00
Total	**12,545.00**	**10,036.00**	**9,332.73**

Work back in to a m2 rate for encapsulating wall cladding inside and out (per face area of cladding)	/ 360m2	25.92
Work out alternate rate for where there is adequate internal wall sheeting which would mean that the interior of the asbestos cladding would not need to be encapsulated.		
Deduct interior encapsulation costs		-2,880.00
Adjusted cost		6,452.73
Adjusted m2 rate for encapsulating asbestos cladding where there is adequate internal wall sheeting (per face area of cladding)	/ 360m2	17.92
Work out alternate rate for where the internal wall sheeting is in poor condition and would need to be stripped out and replaced.		
Add in cost of removing the existing interior walls and replacing after encapsulation		14,400.00
Adjusted cost (360m2 of cladding)		23,732.73
Adjusted m2 rate for scenario where internal wall sheeting is in poor condition and also needs to be stripped out and replaced.	/ 360m2	65.92

Build Up to Removing and Replacing Asbestos Roofing

BUILD UP TO REMOVAL OF EXISTING ASBESTOS ROOF SHEETING.

The costing detailed below are based on building area of 168m2 (14m x 12m). For roof area multiply by 1.15 to account for the pitch, which gives an area of 193m2.

The costs are as worked out with Central Meridian, who are an experienced contractor based in Nauru.

Transport and packaging costs are allowed for bring asbestos containing materials to a central point but disposal costs are excluded and treated separate.

Purchase of a 60 Litre FoamShield unit at a price of $5,000.00 (including ocean freight and 10% import duty) is allowed for and the cost of this is spread over the removal of 20 roofs.

Purchase of specialist vacuum cleaner with HEPA filter at a price of $2,000.00 (including freight and 10% import duty) is allowed for and the cost of this is spread over the removal of 20 roofs.

Item	AUD estimate (based on Central Meridian costings)	Convert to USD (0.8 exchange rate)	Reduce by 10% to account for competitive tendering
Establish asbestos boundaries, mark out the property, set up relevant warning signage around the property, decontamination entry points, personal protective equipment (PPE) for staff.	1,400.00	1,120.00	1,018.18
Set up scaffolding to both sides of building to assist in removal of roof sheeting and to remove asbestos contaminated guttering from building. Set up anchor point for fall arrest systems.	2,200.00	1,760.00	1,600.00
Coat the roof with a sprayed on water based PVA solution.	1,250.00	1,000.00	909.09
Carefully remove the roof sheeting by unscrewing, (not breaking) the roof sheets. All roof sheets to be stacked onto plastic sheeting sitting on bearers for ease of removal. Sheeting to be fully wrapped in plastic and taped shut. All removed materials will be taken and stored at a suitable staging point ready to be disposed of.	4,465.00	3,572.00	3,247.27
Vacuum clean the existing ceiling and roof space, (rafters, purlins, ceiling joists) with a specialised vacuum cleaner with a HEPA filter. Dispose of contents of cleaner into an 'Asbag' for correct disposal	325.00	260.00	236.36

Supply and fit heavy duty tarpaulins to keep the roof waterproof ready for installation of new roofing.	300.00	240.00	218.18
Oversight by SPREP appointed asbestos management expert.	2,875.00	2,300.00	2,300.00
Total	12,815.00	10,252.00	9,529.09
Work back in to a m2 rate		/ 193m2	49.37

BUILD UP TO INSTALLATION OF NEW ROOF SHEETING, INSULATION, GUTTERING, DOWNPIPES.

The cost estimate allows for Colourbond Ultra grade roof sheeting and 50mm of foil coated fibreglass insulation. This has a greater protective coating and is better for an oceanside environment. (Long life heavy duty.)

Item	AUD estimate (based on Central Meridian costings)	Convert to USD (0.8 exchange rate)	Reduce by 10% to account for competitive tendering
Supply and fit 'Kiwisafe' roof netting over existing purlins and fix in place ready to support the 50mm thick, foil coated, fiberglass insulation. Supply and lay a top layer of sisalation foil over the fibreglass insulation blanket.	2,541.00	2,032.80	1,848.00
Supply and screw fix Colourbond Ultra grade corrugated roofing, including for ridging and barge flashings.	7,722.00	6,177.60	5,616.00
Supply and fix Colourbond box guttering to both sides of the roof and include for one downpipe each side, feeding to a tank.	1,060.00	848.00	770.91
NB A contingency of 10% may need to be added as necessary for repairs to roof purlins and rafters.	1,132.30	905.84	823.49
Total	**12,455.30**	**9,964.24**	**9,058.40**
Work back in to a m2 rate		/ 193m2	46.93

SUMMARY OF COSTS TO REMOVE ROOF AND REPLACE WITH NEW ROOF

Cost to remove old roof	49.37
Cost to install new roof	46.93

Total cost to remove and replace asbestos roofing (per m2 of roof area)	**96.31**

Remove and Replace Asbestos Cladding

BUILD UP TO REMOVAL AND REPLACEMENT OF ASBESTOS WALL CLADDING.

The estimate assumes work is completed on a building 14m x 12m in size = 168m2 (single storey - 2.4m high). (Assume windows and doors account for 10% of building exterior, the total cladding area would be approximately 360m2).

If a building was two stories it is recommended that USD12.00 is added per m2 for scaffolding. This figure is a rough estimate only but should provide adequate coverage.

Item	AUD estimate (based on Central Meridian costings)	Convert to USD (0.8 exchange rate)	Reduce by 10% to account for competitive tendering
Establish asbestos boundaries, mark out the property, set up relevant warning signage around the property, decontamination entry points, personal protective equipment (PPE).	1,400.00	1,120.00	1,018.18
Coat the walls with a sprayed on water based PVA solution.	1,875.00	1,500.00	1,363.64
Carefully remove the existing cladding. All wall sheets to be stacked onto plastic sheeting sitting on bearers for ease of removal. Sheeting to be fully wrapped in plastic and taped shut. All misc asbestos contaminated material to be loaded into 'Asbags' for safe removal. All removed materials will be taken and stored at a suitable staging point ready to be disposed of.	6,697.50	5,358.00	4,870.91
Vacuum clean the existing wall cavities with a vacuum cleaner with a HEPA filter. (Dispose of contents of cleaner into an 'Asbag' for correct disposal	325.00	260.00	236.36
Wrap the building in building foil, supply and fix composite cement board sheeting to exterior of buildings. Supply and fix treated 40mmx10mm timber batten to all sheet joints.	18,000.00	14,400.00	13,090.91
Paint with 2 coats of acrylic paint to all new wall cladding sheets and perimeter battens.	3,060.00	2,448.00	2,225.45
NB A contingency of 10% may need to be added as necessary for repairs to framing.	3,135.75	2,508.60	2,280.55
Oversight by SPREP appointed asbestos management expert.	2,875.00	2,300.00	2,300.00

Total	**37,368.25**	**29,894.60**	**27,386.00**
Work back in to a m2 rate for removing and replacing asbestos cladding (per face area of cladding)		/ 360m2	76.07

Appendix 6: Abstract from Osea Cawaru's Thesis

A Masters Thesis has been completed on asbestos usage in colonial buildings in Suva. Details are as follows.

Title: The Extent of Usage and Hazards Associated with Asbestos in Colonial Buildings in the Municipality of Suva City, Fiji

Author: Osea Cawaru

Date: 1996

Abstract: A survey of Colonial buildings (October 1874 to October 1970) in the municipality of Suva City, Fiji has been made to determine the extent of asbestos products used in their construction. A sub sample of three hundred and ten (310) was selected for inspection and this amounted to about 40% to 60% of the colonial buildings in the four wards in Suva City. Samples of suspect building materials were collected and the presence of asbestos containing materials (ACM) were confirmed by laboratory analysis. The study showed that 49% of these colonial buildings contain some form of ACMs with the highest numbers coming from residential followed by government then commercial premises. The majority of the asbestos products found were bonded types where the asbestos is bonded into some form of matrix. The only form of friable asbestos was found in boiler insulation. Asbestos cement sheeting and roofing profiles accounted for 127 of the 140 asbestos products detected in the survey and no sprayed asbestos insulation was found. Chrysotile was the main asbestos type with only 2 samples found to contain a mixture of chrysotile and crocidolite. No amosite was detected in up the samples collected. Ten asbestos containing buildings were selected on the basis of limits of availability and permission of access for a para occupational air mointoring survey. For the twenty air samples collected all results were less than 0.01 fibres per millilitre below the limit of detection of the method. It can be concluded that the likely lifetime risk to occupants and visitors from the presence of asbestos is less than 0.006 deaths per thousand exposed persons. This is much less than risks associated with other occupational, recreational and lifestyle activities. Regulatory controls need to be developed to protect building workers under the recently adopted Fiji Occupational Health and Safety at Work Act, 1996 to cover removal, a renovation, demolition and disposal of asbestos wastes.

Appendix 7: Asbestos in Tamavua / Twomey Hospital

Asbestos in Tamavua / Twomey Hospital, Suva, Fiji

Assessment Carried out on 17-18 July 2014

1. Introduction

Visits were made to the Tamavua / Twomey Hospital in Suva, Fiji on 17 and 18 July 2014 as part of the asbestos component of the EU/SPREP PacWaste Project. This asbestos work covers 11 countries and the first stage work includes an assessment of asbestos arisings and a prioritised list of local best practice options for management. The visit was made by staff from the New Zealand consultants Contract Environmental Ltd and Geoscience Consulting Ltd who have been engaged to carry out the first stage work.

Hospitals are among the premises being targeted in the project as they are likely places to find asbestos and they are also locations where large numbers of people may be exposed.

2. Description of Asbestos Concerns

An earlier survey carried out by an employee of the Fiji Ministry of Labour in 1996 as part of his Masters Thesis identified Crocidolite (Blue Asbestos) in boiler lagging at the hospital. It was not thought to be a problem at that time but 18 years later it has become a problem.

There are a number of other potentially serious concerns in the hospital regarding asbestos, although full confirmation of these concerns will not be possible until the results of the analysis of samples are available. These samples have been sent to California for analysis and the results are expected within about two weeks.

Asbestos has potentially been identified as follows:

2.1 Derelict Room

This room is shown in the following nine photos. The room is open with windows facing towards the hospital. Broken down lagging is on two vessels and strewn over the floor. Rope lagging is coating some pipes. If this lagging is confirms as asbestos, especially blue asbestos, then this is a serious situation that needs to be addressed urgently.








2.2 Exterior Rope Lagging

Rope lagging in a deteriorating condition covers pipes that are attached to walls in numerous locations as shown in the following four photos. Rope lagging of this type has commonly been made from asbestos.


 

2.3 Exterior Ducting

Pipes encased in lagging runs through a large network of ducting through the grounds of the hospital. This is shown in the following two photos.

 

2.4 Internal Ducting

Pipes encased in lagging run through ducts in a network of corridors inside the hospital as shown in the following four photos. Lagging on the largest pipe is the rope lagging that has commonly been made from asbestos.




2.5 Old Boiler Storage Room

There is an old boiler room in the newer part of the hospital that is currently being regularly used as an equipment storeroom as shown in the four photos below. If the lagging on these old vessels is asbestos (especially blue asbestos) then this is another serious matter that needs to be addressed urgently. Lagging debris is spread on the floor of this room and the equipment stored in the room may be taken all round the hospital.

2.6 Old Ward 5

The old Ward 5 is known to be an asbestos building and “Keep Out” warnings have been painted on the building. It is a large old building as shown in the seven photos below. There is asbestos cladding on the outside and the internal walls are also understood to be asbestos. A network of pipes hang off the side of the building that are covered in very deteriorated rope lagging, some of which has fallen to the ground.


KEEP OUT

3.0 Discussion and Recommendations

The situation is a serious one that needs to be addressed urgently. If some or all of the material described above proves to be asbestos, which seems likely, based on previous information and the experience of the SPREP consultants, then urgent action is needed. Much of the hospital and its grounds may be contaminated with asbestos.

With the exception of the Ward 5 cladding and wall lining, all the asbestos is potentially friable. In fact such is the age of the Ward 5 Building that some of this cladding and lining could be also considered as friable. All friable asbestos must be removed using specialist technology. For example the old boiler rooms must be encased in plastic and put under a negative air environment using negative air units. Entry and exit from this area must be through a three stage decontamination chamber with showers. There are a number of other requirements such as wetting techniques and clearance monitoring. Under no circumstances should this material be removed without using this technology as this will result in asbestos being widely spread around.

It was not within the brief of the SPREP team to carry out a detailed survey although a careful assessment was done as above and numerous samples taken. A detailed asbestos survey that includes extensive air monitoring and the taking of wipe and dust samples should be carried out immediately and once the results of the survey are available and if and where asbestos is identified, then a detailed asbestos removal plan should be prepared and implemented without delay.

Roneel Nand of the Fiji Ministry of Labour has been notified of the above issues and he was taken to the site on the evening of 18 July.

John O'Grady
New Zealand Asbestos Certificate of Competence No 7186

Asbestos Management Plan, Tamavua-Twomey Hospital, Suva

There are 2 main boiler systems in the hospital both clad with Limpet asbestos. This methodology manages all asbestos within the 2 rooms. There is additional ACM outside the rooms that will be dealt with at another stage. The steps are similar for both rooms and include:

1/ Provide training for 3 Fijian staff members over one morning giving consideration to what asbestos is, it's dangers and methods of managing the hazard (PowerPoint presentation)

2/ On site, seal up all windows/ vents to the building using plastic/ tape. Set up Negative pressure unit with HEPA filter opposite to Decon unit.

3/ Construct a 2 stage Decontamination unit using a clean area and a dirty/ wash down area.

4/ On-site training for staff including mask fitting, Buddy system.

5/ Pass small mobile scaffold, tools, bags and hose/ water supply through decon unit

6/ Once inside, vacuum floor with HEPA vacuum, set up plastic drop sheet on floor

7/ Mist all ACM with water, allow to soak in. Erect scaffold on drop sheet.

8/ Strip ACM onto drop sheet, ensuring water has thoroughly soaked it.

9/ Bag ACM in 200 micron 'Danger Asbestos' bags, goose neck and tape shut

10/ Wire brush, gauze steel surfaces clean.

11/ Seal all surfaces with a PVA solution including walls and ceiling

12/ Pass bags through decon unit, double bagging as they pass through.

13/ Exit by vacuuming your buddy's suit of any debris, mist suit with water

14/ Remove and bag suit in first stage of decon unit, wash down using fresh water including mask, towel supplied.

15/ Remove mask and enter 2nd stage of decon, charge mask, get changed.

Minimum PPE to include disposable suit, full face PAPR with P3 HEPA filters, gloves, boots. Tools that can't be cleaned will be disposed of as asbestos waste once job is complete.

Bags will be removed to the Suva landfill once they have been removed from the work area. They will be buried. All equipment stored within the boiler rooms will be vacuumed and sprayed with PVA. They will be wrapped in plastic and disposed of as asbestos waste.

If you have any questions, please give me a call.

Regards Dirk Catterall

NZ Asbestos CoC 7026

Clearance Monitoring Results for the Tamavua-Twomey Clean-up

DOWDELL & ASSOCIATES LTD

OCCUPATIONAL HEALTH ANALYSTS & CONSULTANTS

4 Cain Rd, Penrose, PO Box 112-017 Auckland, Phone (09) 5260-246, Fax (09) 5795-389

30th September 2014

Contract Environmental Ltd
119 Johnson Rd
West Melton
Christchurch

Attention: John

Re : Airborne Fibre Concentration

Place of Measurement	:	Twomey/Tamavua Hospital – Old Boiler Room 1
Monitoring Conducted By	:	CBL Air Monitoring
Sampling Date	:	22nd September 2014
Laboratory No.	:	58403.1
Sample Type	:	Static Clearance Air Monitoring
Asbestos Type	:	Unspecified
Method	:	[NOHSC: 3003 (2005)] – Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres – 2nd Edition

Measuring Positions Reg No : K7793 – Old Boiler Room 1

Sample Registration No.	K7793
Sample Time (minutes)	360
Flow Rate (mL/min)	1515
Fibre Counts (fibres/100 fields)*	0
Respirable Fibre in Air (fibre/mL) *1	<0.01
Detection Limit (fibres/mL) (based on a count of 10 fibres/100 fields)	0.01

* The Laboratories Scope of Accreditation cover the Fibre Counts (fibres/100fields) results.
*1 OSH - Guidelines for the Management and Removal of Asbestos – Revised March 2011, Clearance Testing 0.01fibres/ml.

Yours faithfully
DOWDELL & ASSOCIATES LTD

R.Nicholson
Analyst/Consultant

Michael Sullivan
Analyst/Consultant

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DOWDELL & ASSOCIATES LTD

OCCUPATIONAL HEALTH ANALYSTS & CONSULTANTS

4 Cain Rd, Penrose, PO Box 112-017 Auckland. Phone (09) 5260-246. Fax (09) 5795-389

30th September 2014

Contract Environmental Ltd
119 Johnson Rd
West Melton
Christchurch

Attention: John

Re : Airborne Fibre Concentration

Place of Measurement	:	Twomey/Tamavua Hospital – Old Boiler Room 2
Monitoring Conducted By	:	CBL Air Monitoring
Sampling Date	:	25th September 2014
Laboratory No.	:	58403.2
Sample Type	:	Static Clearance Air Monitoring
Asbestos Type	:	Unspecified
Method	:	[NOHSC: 3003 (2005)] – Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres – 2nd Edition

Measuring Positions Reg No : K7794 – Old Boiler Room 2

Sample Registration No.	**K7794**
Sample Time (minutes)	360
Flow Rate (mL/min)	1515
Fibre Counts (fibres/100 fields)*	0
Respirable Fibre in Air (fibre/mL) *1	**<0.01**
Detection Limit (fibres/mL) (based on a count of 10 fibres/100 fields)	0.01

* The Laboratories Scope of Accreditation cover the Fibre Counts (fibres/100fields) results.
*1 OSH - Guidelines for the Management and Removal of Asbestos – Revised March 2011, Clearance Testing 0.01fibres/ml.

Yours faithfully
DOWDELL & ASSOCIATES LTD

R.Nicholson
Analyst/Consultant

Michael Sullivan
Analyst/Consultant

NOTE: This report must not be altered, or reproduced except in full.

Appendix 8: St Stephens Building Report

St Stephens Building, Suva, Fiji

Assessment undertaken on 16 July and 1 August 2014

1. Introduction

Visits were made to the St Stephens Building in Suva, Fiji initially on 16 July 2014 and a follow up visit conducted on 1 August 2014. The initial visit was undertaken as part of the asbestos component of the EU/SPREP PacWaste Project. This asbestos work covers 13 countries with the first stage of work including an assessment of asbestos arisings and a prioritised list of local best practice options for management. The visit was made by staff from the New Zealand consultants Contract Environmental Ltd (CEL) and Geoscience Consulting Ltd (GCL) who have been engaged to carry out the first stage work.

The St Stephens Building was targeted in the project following discussions held with Mr Kelepi Tuiloma of the Building Section of the Public Works Department on 16 July 2014. The discussion highlighted buildings of concern in Suva that are of an age where asbestos containing materials (acm) may be present. Mr Tuiloma also reported that the building was due to undergo a significant refurbishment programme commencing on 17 July 2014 for an unspecified period of time.

Initial Asbestos Survey

The initial survey was conducted by Gareth Oddy of Geoscience Consulting (NZ) Ltd and John O'Grady of Contract Environmental commencing at approximately 11:50am on 16 July 2014. The survey included a review of the external building cladding and internal building material easily accessible and visible to the surveyors. During the survey, the building construction was noted to be a concrete two storey structure with metal roof. Internal cladding included vinyl flooring throughout with wall cladding consisting of recycled cardboard panels with fibreglass insulation between the concrete.

Photographs of the building during the initial survey are presented below;

Photograph 1: View South West of St Stephens Building 16 July 2014.

Photograph 2: Damaged ground floor vinyl floor tiles sampled 16 July 2014.

Photograph 3: View of 1st floor 16 July 2014.

Asbestos Survey Results

A sample of the downstairs vinyl floor tile was collected (sample labelled FS7, EMS laboratory ID; 0162049-022) and dispatched to EMS laboratories in California in the United States of America. The sample was scheduled for bulk analysis to determine if asbestos fibres were present. No other building material present were considered as potential acm and as such no further samples were collected and analysed.

The sample was received by EMS laboratories on 21 July 2014 with analysis completed on 23 July 2014 and results provided to Contract Environmental by email on 25 July 2014.

A caption of the EMS analytical results is presented below;

CUSTOMER:	Contract Environmental 119 Johnson Rd. West Melton Christchurch NZ	PAGE #: REPORT #: PROJECT:	4 of 6 0162049 PLM ANALYSIS

BULK SAMPLE ANALYSIS FOR ASBESTOS CONTENT BY POLARIZED LIGHT MICROSCOPY

Laboratory ID - Sample No.	Sample Location Description	Layer No. Layer %	Asbestos Type	(%)	Non-Asbestos Components	(%)
0162049-022 FS7	LAYER 1 Red, Homogeneous, Hard, melt, non-friable Note: 26°C, 1.550	LAYER 1 90%	Chrysotile	5%	Non-Fibrous Material	95%
	LAYER 2 Black, Homogeneous, Tar Like, melt, non-friable Note: 26°C, 1.550	LAYER 2 10%	Chrysotile	5%	Cellulose Fiber Non-Fibrous Material	2% 93%

The laboratory analytical results concluded that chrysotile (white) asbestos fibres were present at approximately 5% of the vinyl floor tile as a non-friable component of both layers of the tile. Upon receipt and assessment of the results (25 July 2014), Contract Environmental immediately informed Mr Tuiloma of the Public Works Department and also Mr Stewart Williams of SPREP of the positive asbestos identification at the St Stephens Building. This was shortly followed by a detailed email to Mr Williams.

Initial recommendations were made by Contract Environmental that the renovation works should cease immediately until the asbestos can be removed by a Fiji Department of Labour Occupational Health and Safety (OHS) approved contractor under OHS supervision. Additional recommendations including additional personal protective equipment in the form of disposable overalls and P2/3 respirators would be necessary for all personnel working in the building. Further recommendations regarding the safe work method for the removal of the acm vinyl tiles including wetting the area with a fine mist of water and removing the tiles manually (i.e. no power tools) were also made to Mr Tuiloma of the Public Works Department and Mr Williams of SPREP.

Second Site Visit

On 1 August 2014 at the request of SPREP and Mr Johnny Engell-Hansen (EU) a further site visit was undertaken to assess the current situation at the site with regards to acm removal and disposal. During the site visit commencing at approximately 09:15, the renovation works were observed to be continuing. The survey was conducted by Gareth Oddy of Geoscience. During the site visit, Mr Oddy requested to speak with the contractor foreman to assess compliance with OHS asbestos removal requirements and determine if the works to remove acm were being completed to a satisfactory state.

The contractors (Templetec (Fiji) Ltd) lead foreman did not speak English and therefore communications were held with his deputy who informed Mr Oddy that both OHS and PWD had visited the site the day previously. According to the Templetec representative, both parties had advised that respirators and overalls were necessary for employees removing vinyl floor tiles.

Pieces of floor tiles varying in size from approximately 5 - 150 mm were observed on the ground (see photograph 4) on all four sides of the building covering an area of approximately 100m2. A small downstairs room was observed to still contain vinyl floor tiles. No renovation staff were observed to be wearing suitable PPE for a site containing damaged asbestos materials.

Photographs 4 – 6 taken on 1 August 2014 of the site are presented below;

Photograph 4; vinyl floor and other misc. building material on ground to north of building.

Photograph 5: View of site on 1 August 2014.

Photograph 6; acm vinyl floor tiles on ground adjacent to north facing façade

Discussion and Recommendations

We recommend that work at the site ceases immediately to prevent further potential exposure to contractor staff and the public to asbestos fibres. Access to the site should be restricted with areas containing acm vinyl floor tiles barricaded off until it can be all safely removed by a trained and competent asbestos removal contractor who is approved by OHS.

Following the closure of the site, work should begin to decontaminate the site of acm and asbestos fibres by an OHS asbestos removal contractor experienced in asbestos decontamination. This would include the use of an asbestos vacuum cleaner with HEPA filter to be used on all floors and surfaces to collect dust and debris into sealed air tight containers for appropriate disposal in Suva Landfill as hazardous waste.

External land would also be 'picked over' to remove acm debris. While this decontamination work is being conducted, access to the site would be via a decontamination zone. Access to the site would be restricted to solely the decontamination team to avoid further dispersion of acm and potentially further unnecessary exposure.

Further vinyl floor tile removal should be conducted by an approved contractor using wetting methods to minimise fibre release and non-destructive methods to prevent the tile being broken.

To prevent exposure to asbestos fibres, all staff involved handling of acm material and those working within the building should wear respiratory protection. At a minimum this shall include masks with a minimum P2 level of particulate protection. Half face respirators with asbestos fibre filters shall also be made available for workers where required.

The Contractor shall also ensure that appropriate application of a dust suppressant is used to minimise the generation of dust and airborne asbestos fibres.

A detailed asbestos survey that includes extensive air monitoring and the taking of wipe and dust samples should be carried out immediately to assess whether fibres from the site are airborne. Once the results of the survey are available and if and where asbestos is identified, then a detailed asbestos removal plan should be prepared and implemented without delay. Elements of this plan are presented above.

The Fiji Ministry of Labour, should also be notified of the above issues and recommendations.

For and on behalf of Geoscience Consulting (NZ) Ltd and Contract Environmental Ltd,

Gareth Oddy

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New Zealand Asbestos Certificate of Competence No 7186