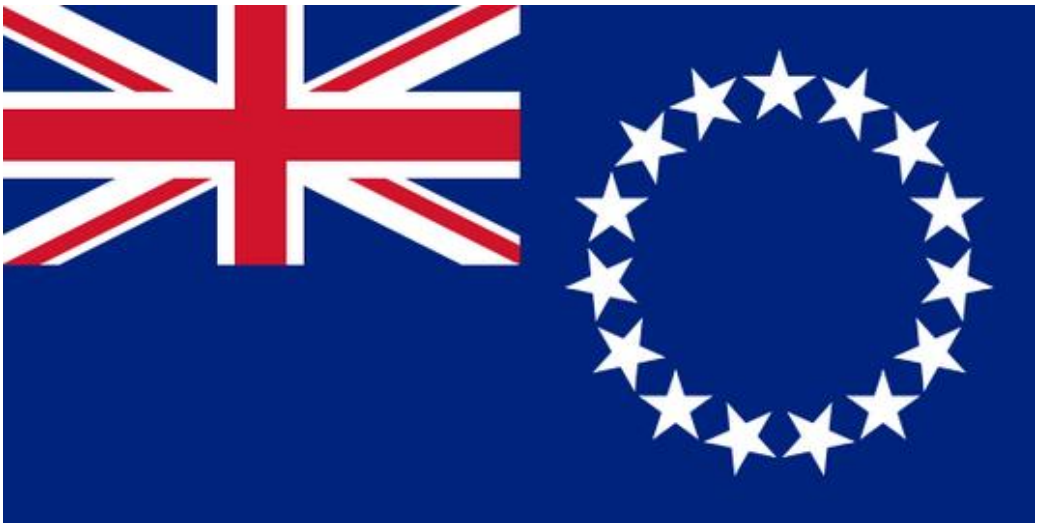
Survey of the Regional Distribution and Status of Asbestos-Contaminated Construction Material and Best Practice Options for its Management in Pacific Island Countries

Report for the Cook Islands



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Contact Details

John O'Grady
Director
Contract Environmental Ltd
14 Wookey Lane,
Kumeu 0841
Auckland, New Zealand
jogrady@actrix.co.nz
ph +64 21 311 532

Dirk Catterall
Managing Director
Morecroft Asbestos Contractors
North Harbour
Auckland, New Zealand
airborn@xtra.co.nz
ph +64 27 492 4135

Dave Robotham
Associate Environmental Consultant
Geoscience Consulting (NZ) Ltd
P O Box 373
Christchurch 8140
New Zealand
david@nzgeoscience.co.nz
ph +64 3 328 9012

Huw Williams
Senior Hydrogeologist
Geoscience Consulting (NZ) Ltd
P O Box 303129
North Harbour, Auckland 0751
New Zealand
hwilliams@nzgeoscience.co.nz
ph +64 3 328 9012

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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, in 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 Cook Islands component of a survey of the regional distribution and status of asbestos-contaminated construction material, 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, asbestos 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 a contract to the Secretariat of the Pacific Regional Environment Programme (SPREP), with funding provided by the European Union.

This report presents the information gathered for the Cook Islands during a field visit undertaken by Dirk Catterall and Huw Williams between 23 July and 1 August 2014. The visit was organised in collaboration with the Cook Islands' National Environmental Service and the Cook Islands Infrastructure Corporation. The report also draws on the results of 32 asbestos survey reports

completed by K2 Environmental in 2013 and 2014 investigating the extent of asbestos in mostly public buildings in the Cook Islands. These reports were commissioned by the Cook Islands Investment Corporation. A list of these reports is presented in Section 2.1.

Survey Methodology

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.

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 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

The results are a mixture of those obtained from this survey and those determined by K2 Environmental during their investigations and an attempt has been made to cover both sets of results in this report. Together, both sets of results indicate that there is still a substantial amount of

asbestos in the Cook Islands including at a number of schools spread throughout the country and in some at least, there are some serious situations that need to be addressed.

The K2 Reports that are summarised highlighted the Avarua School and Avatea School in Rarotonga where high air results were obtained, and also the fire-damaged old Government building in Mangaia where asbestos debris (and no doubt loose fibres) litter the site. There are also numerous examples of old asbestos buildings in poor condition and several sites (including schools) where asbestos debris litters the site.

Based on the 2,670 properties surveyed, 89 residential buildings were suspected of containing PACM in the exterior material observed (77 with cladding only and 12 with roofs and cladding). Given the sample size and conclusions based upon it, if this estimate is extrapolated to include the remaining residential properties in Rarotonga and Aitutaki then, based on a 95% confidence with a margin of error of 0.9%, the potential number of households in Rarotonga and Aitutaki to contain PACM would be 146 (of which 20 would also have roofs. Based on the fibreboard that was analysed (including this survey and K2 results) about 50% was asbestos. If this figure is used then this would reduce the number to 73 houses with ACM.

Extrapolation of the 146 total could be extended to the whole of the Cook Islands to give a figure of 186 houses, but there are doubts regarding the statistical validity of such an extension as the situation may be quite different on the other islands.

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 m² (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.

Recommendations and Prioritised List of Actions

The table below lists priority sites (high and moderate risk ranking and the estimated cost for remediating these sites.

Prioritised Recommended Actions and Indicative Costs

Location	Remedial Work	Comments	Area (m2)	Unit Cost	Total Cost	Risk Ranking
Rarotonga, Avarua School	Cladding	High Air Results	100	84	8400	25
Rarotonga, Avarua School	Soil cleanup	High Air Results	LS	LS	10000	25
Rarotonga, Tereora College	Cladding	Some broken bits to pick up	80	92	7360	25
Rarotonga, Takitumu School	Cladding		150	84	12600	25
Rarotonga, Arorangi School	Cladding		250	84	21000	25
Rarotonga, Avatea Primary School	Cladding	High Air Results	200	84	16800	25
Rarotonga, Nikao School	Cladding	Some broken bits to pick up	100	92	9200	24
Rarotonga, Titikaveka College	Cladding		300	84	25200	23
Arorangi Church, Rarotonga	Cladding	Encapsulate	30	23	690	22
Rarotonga, Rarotonga Airport	Cement Board Ceiling	Encapsulate	300	18	5400	21

Location	Remedial Work	Comments	Area (m2)	Unit Cost	Total Cost	Risk Ranking
Rarotonga, Rarotonga Airport	Roof		600	106	63600	20
NZ High Commission, Rarotonga	Roof		700	92	64400	20
Rarotonga Met Office	Roof		200	106	21200	20
Arorangi Commercial Bldg, Rarotonga	Cladding	Encapsulate	20	23	460	18
Aitutaki, Araura College	Cement Board Divider Panels	Encapsulate	50	18	900	24
Aitutaki, Araura Primary	Cement Board Divider Panels	Encapsulate	20	18	360	24
Aitutaki Hospital	Cladding	Encapsulate	100	18	1800	23
Aitutaki, Tekaaroa School	Cladding	Some broken bits to pick up	40	95	3800	23
Vaipae Church, Aitutaki	Broken Cladding on Ground		10	40	400	21
Atiu, Enuamanu School	Cladding		220	86	18920	23
Atiu, Agriculture Building	Cladding		300	86	25800	19
Atiu, Laundry behind hospital	Cladding		50	86	4300	19
Atiu, Marine Building	Cladding		120	86	10320	18
Atiu, Hospital	Cladding	Suspected, not confirmed	200	86	17200	17
Mangaia, Mangaia School	Cladding	Burnt Debris in Two Locations	100	95	9500	25
Mangaia, Old Government House	Roof (Burnt Building)	Old Fire Site	200	108	21600	24
Mangaia, Old Government House	Debris and Contaminated Soil	Old Fire Site	LS	LS	20,000	24
Mangaia, Ivirua School	Roof		120	108	12960	23
Mangaia, Ivirua School	Cladding		240	86	20640	23

Location	Remedial Work	Comments	Area (m2)	Unit Cost	Total Cost	Risk Ranking
Mauke, Old Hospital	Cladding		20	86	1720	23
Mauke, Mauke School	Cladding and Soffits		300	86	25800	22
Mauke, Packing Shed	Debris and Contaminated Soil		LS	LS	5000	17
Mauke, Old Asbestos Shed	Roof		300	108	32400	17
Mitiaro, Mitiaro School	Cladding	Some broken bits to pick up	350	95	33250	22
Mitiaro, Administration Building	Cladding - Exterior and Interior		340	86	29240	17

The disposal method for Cook Islands' asbestos wastes also needs to be determined. The cheapest solution would be for disposal at Rarotonga's Waste Management Facilty but this landfill is close to its full capacity and a longer term solution is now being sought. The lack of available land for a new facility is, however, providing a challenge in this respect

If no suitable disposal site can be found, then the other options are disposal at sea or export to another country. Both alternatives are permissible for Cook Islands although they would be expensive options.

Export from Cook Islands to another country would be viable and Auckland, New Zealand provides a suitable destination for receiving waste asbestos. Similar previous shipments from the Cook Islands (asbestos wastes in 2014), and other Southern Pacific countries have been made with little difficulty.

The following recommendations are made in relation to asbestos on Cook Islands:

a) It is recommended that the high and moderate priority asbestos work is carried out in the Cook Islands as identified above, including the removal of all loose asbestos and cleaning up contaminated sites.
b) In particular the urgent situations identified by K2 Environmental need to be addressed – Avarua School, Avatea School and Mangaia Government Building.
c) It has been concluded that abort 186 houses in the Cook Islands may have asbestos building materials in some form – mostly cladding. It is recommended that all houses with PACM in the Cook Islands are tested for asbestos and that all the houses tested positive are notified and included in an awareness campaign. They should be remediated (i.e. the asbestos removed or encapsulated) where resources permit.
d) If a large number of houses are found to contain asbestos cladding then encapsulation would probably be the most cost-effective option for remediation although ongoing management procedures then would be needed and re-encapsulation (i.e. re-painting) would probably be needed 10-15 years later. If a small number of houses are found to contain asbestos cladding then removal and replacement of the cladding should be considered.
e) Any asbestos roofs found on houses in the Cook Islands should preferably be removed rather than encapsulated as encapsulation of roofs costs only a little less than removal and removal is a permanent solution.

f) If a suitable cheap on-island disposal location can be found that was locally acceptable then on-island disposal would be the preferred disposal option. Otherwise the next preferred option is export to Auckland as has happened previously.
g) 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.
h) Consideration should be given to Cook Islands passing regulations under suitable legislation to enable the above work to be undertaken safely and also to enable the banning of the import of any asbestos building products for sale.

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

CIIC: Cook Islands Infrastructure Corporation

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

NES: National Environmental Service – Cook Islands

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 Cook Islands component of a survey of the regional distribution and status of asbestos-contaminated construction 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, asbestos 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. Most of the information required for the Cook Islands survey was obtained in a field visit to the islands of Rarotonga and Aitutaki undertaken by Dirk Catterall and Huw Williams between 23 July and 1 August 2014 and was organised in collaboration with the Cook Islands' National Environmental Service (NES) and the Cook Islands Infrastructure Corporation (CIIC).

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 Cook Islands

The Cook Islands is an island country in the South Pacific Ocean in free association with New Zealand. It comprises 15 major islands whose total land area is 240 square kilometres. The Cook

Islands' Exclusive Economic Zone (EEZ), however, covers 1,800,000 square kilometres of ocean. The total population in 2011 was 14,974.

The islands were formed by volcanic activity; the northern group is older and consists of six atolls, which are sunken volcanoes topped by coral growth. The climate is moderate to tropical.

The Cook Islands consists of two main groups, one in the north and one in the south. The southern group is nine "high" islands mainly of volcanic origin although some are virtually atolls. The majority of the population lives in the southern group and the main island of Rarotonga had 10,572 people in 2011. The rest of the Southern Group had a population of 3290 in 2011 (Aitutaki 1171 people). The northern group comprises six true atolls and had a total population of 1112 in 2011.

Southern Group – Aitutaki, Aitu, Mangaia, Manuae, Mauke, Mitiaro, Palmerston, Rarotonga, Takutea

Northern Group – Manuhiki, Nassau, Tongareva (Penrhyn), Pukapuka, Rakahanga, Suwarrow

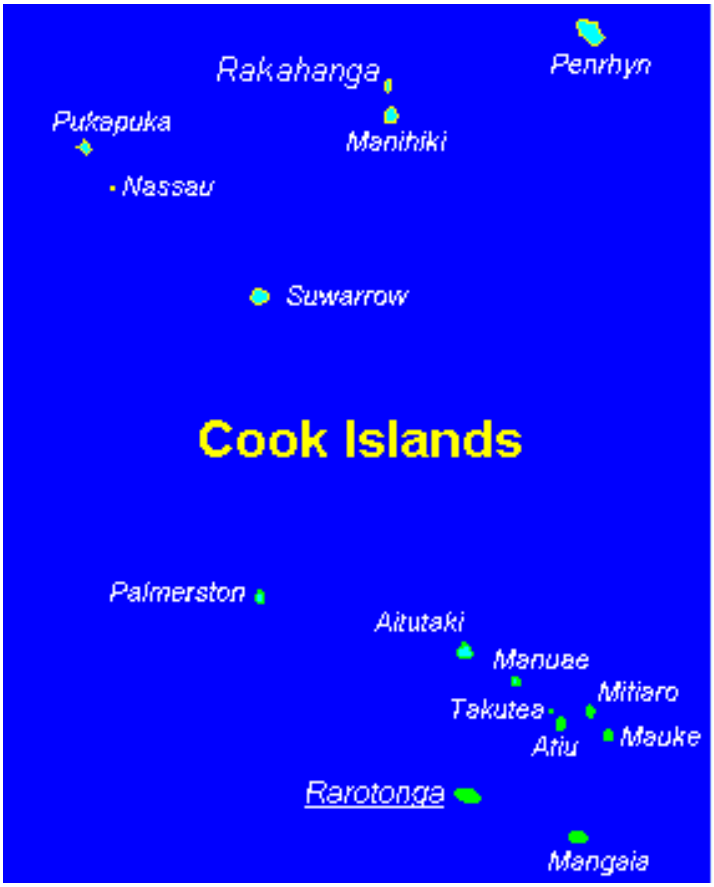

Figure 1 – Map of the Cook Islands

Figure 2 – Map of Rarotonga

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 THE Cook Islands.

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 the Cook Islands 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

This survey was based around a field visit to the Cook Islands undertaken by Dirk Catterall and Huw Williams (referred to as the surveyors) between 23 July and 1 August 2014. The work carried out during the visit included meetings with key government agencies, island-wide surveys across Rarotonga and Aitutaki, and specific investigations of a number of sites.

Prior to conducting the surveys and visiting Cook Islands, 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.

Information from previous investigations on asbestos contaminated building material in the Cook Islands Government's buildings was obtained as part of this survey. A number of previous reports, undertaken by the New Zealand Consultancy K2 Environmental Ltd in 2013 and 2014, were obtained and reviewed. The K2 information has been drawn upon to complete this study. These reports are available via SPREP and a list of report titles is as follows:

Aitutaki Asbestos Report
Aorangi Asbestos Report
Araura School Air Sampling Report
Arorangi School Air Sampling Report
AS14049 Air Clearance Report - High Commission
AS14049 Air Clearance Report Bookshop
AS14339 Air Sampling Report St Josephs
AS14339 Asbestos air Sample report Takitumu
AS14339 Nikao Moari
AS14339 Nukutere Asbestos Air Sampling
Atiu Government buildings Asbestos Report
Avarua School Air Sampling Report
Avatea School Air Sampling Report
CIIC asbestos Report
Cook Islands Investment Corporation Report Dec 2013 Ver 2
Enuamanu School Asbestos Final Report
Government House Mangaia Asbestos Report
Ivirua School Asbestos Report
Mangaia School Asbestos Report
Mask Fit Testing Report Rarotonga
Mauke Government buildings Asbestos Report
Mauke School Asbestos Report
Mitiaro Government buildings Asbestos Report
Mitiaro School Asbestos Report
Nikoa Maori School Asbestos Report
Rutaki School Air Sampling Report
Seventh Day adventist school Asbestos Report
Tekaaroa School Air Sampling Report
Tereora College Air Sampling Soil Removals

Titikaveka Asbestos Report
Titikaveka College Air Sampling Report
Vaitau School Air Sampling Report

The K2 reports are survey reports detailing observations of what was found at various building locations, including the results of laboratory tests for asbestos, including some air sampling. This information was therefore directly related to what was required for the present survey. It is noted that the K2 reports did not include coverage areas for ACM and that we have therefore made assessments as best we can as to what these areas are. This included looking at the photographs in the K2 reports and assessing information about the schools that was available on the internet. These areas need to be confirmed as part of the final decision making regarding the Phase 2 remediation work.

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

The primary focus was on residential properties and public buildings that might present the most significant potential risks for public exposure to asbestos. Therefore, a general survey of residential buildings was undertaken, and representative samples of domestic construction materials were obtained, where possible, throughout the survey.

During the field visits, the surveyors attended meetings with representatives from various government departments, notably the NES, CIIC, Ministry of Health, the Mayor of Aitutaki and tribal elders during an Island Council Meeting on Aitutaki. The representatives provided information regarding asbestos regulations, known Government assets containing asbestos and the development of a government policy specific to asbestos.

Government owned facilities visited included (but were not limited to) schools, police stations, hospitals and healthcare centres, power stations, airports, research centres, landfills and government administration buildings.

Due to the widespread nature of the Cook Islands, with a population spread over 15 islands (13 inhabited), a survey of each island and residential households was not feasible in the time frame 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 Rarotonga and Aitutaki, which are the most populous islands - containing together about 78% of the population.

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 survey 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.

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

In total, 196 individual facilities / sites were identified and site assessments undertaken for each one. Of the 196 individual facilities / sites, 21 samples were taken to confirm the presence of potentially ACM which could not be confirmed in the field without further laboratory testing.

The samples were sent by courier to EMS Laboratories Incorporated in the United States of America for analysis. The results for these samples are discussed in Section 5.1 and copies of the laboratory reports are given in Appendix 5 of this report.

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 5.3, and copies of the laboratory report are given in Appendix 5 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 1.

Table 1: 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 because 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 2.

Table 2: 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

Assessment factor	Score	Examples of score variables
	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 3.

Table 3: 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

Information on the population distribution of Cook Islands was provided by the 2011 population census. Cook Islands had a population of 14,974 in 4372 dwellings in 2011 across the country's 13 inhabited islands and total land area of 240 km^2. The survey was carried out on Rarotonga and Aitutaki and relevant survey information is presented in Table 4 below.

Table 4: Statistical Summary – Population and Households in Cook Islands

Location	Population	Houses
Rarotonga	10572	3154
Aitutaki	1171	482
Other Islands	3231	736
Total	**14974**	**4372**

Source: 2011 Cook Islands Census, Statistics Office.

4.2 Targeted Survey Coverage

The survey covered the islands of Rarotonga and Aitutaki. The primary focus was on residential properties and public buildings that might present the most significant potential risks for public exposure to asbestos. Therefore, a general survey of residential buildings was undertaken, and representative samples of domestic construction materials were obtained, where possible, throughout the survey.

During the field visits, the surveyors attended meetings with representatives from various government departments, notably the NES, CIIC, Ministry of Health, the Mayor of Aitutaki and tribal elders during an Island Council Meeting on Aitutaki. The representatives provided information regarding asbestos regulations, known Government assets containing asbestos and the development of a government policy specific to asbestos.

Government owned facilities visited included (but were not limited to) schools, police stations, hospitals and healthcare centres, power stations, airports, research centres, landfills and government administration buildings.

It is estimated that approximately 70% to 80% of the nation's government facilities were included in this process and the results are expected to be applicable to the remaining government buildings.

The survey involved two main methods of inspection, an overview survey and a site specific detailed survey:

- An overview survey was achieved using a visual assessment of external building materials visible from the street or public access path, to gain an understanding of the commonly used building materials. Where Potentially ACM was observed, further inspection or sampling was undertaken, where possible. Due to the limited access on to private property, the potential exists for ACM to be present at a greater number of residential properties than would be concluded from this survey. Due to the time constraints of the survey, it would have been unrealistic to undertake exhaustive door to door assessments; and

- Site specific detailed surveys were also undertaken at identified locations for which access or permission of access could be gained (e.g. government buildings, including those which were likely to be frequented by large numbers of individuals from the general public). Site specific surveys included (but were not limited to) schools, police and fire stations, hospitals and healthcare centres, power stations, water treatment facilities, research centres, government administration buildings and airports.

During site specific detailed survey sites that encountered building residents or staff, an introduction to the project was given along with a request to tour of the facilities.

A site specific detailed survey typically included an up-close visual assessment of construction materials and where possible, a guided tour through the buildings. In summary, site specific detailed surveys consisted of:

- 9 government owned or operated sites (consisting of 2 offices, 2 landfills, 1 airport, 1 community centre, 1 marine research lab, 1 airport and 1 PACM collection point);
- 7 residential buildings;
- 5 commercial buildings;
- 2 churches; and
- 1 golf club.

The site specific detailed survey sites visited are listed in Table 5.

Table 5: Site Specific Detailed Survey Locations Visited in the Cook Islands

Site Name	Site Location	Site Category	Sample Number
ACM Store / Collection Point	Avarua, Rarotonga	Government store / landfill	No Sample
Rarotonga Airport	Nikao, Rarotonga	Public / government	No Sample
Black Rock Landfill	Nikao, Rarotonga	Government store / landfill	No Sample
Residential 01	Avarua, Rarotonga	Residential	Sample #01
Residential 08	Tupapa, Rarotonga	Residential	Sample #02
Auau Enua Hostel	Avarua, Rarotonga	Public / government	Sample #03 & #04
Commercial 01	Avarua, Rarotonga	Commercial	Sample #05
Commercial 02	Avarua, Rarotonga	Commercial	Sample #06
Golf Club	Nikao, Rarotonga	Public	Sample #07
Infrastructure	Nikao, Rarotonga	Government structure	Sample #08
Commercial 03	Arorangi, Rarotonga	Commercial	Sample #10
Church 01	Arorangi, Rarotonga	Church	Sample #11
Land Fill 01	Arorrangi, Rarotonga	Government office	Sample #12
Back Road Survey2	Tupapa, Rarotonga	Residential	Sample #13
Garage	Matavere, Rarotonga	Commercial	Sample #14
Marine Research Centre	Near Airport, Aitutaki	Government office	Sample #15
Rinos Rentals	Ureia, Aitutaki	Commercial	Sample #16
Residential 66	Amuri, Aitutaki	Residential	Sample #17
Residential 67	Amuri, Aitutaki	Residential	Sample #18
Residential 68	Arutanga, Aitutaki	Residential	Sample #19

Site Name	Site Location	Site Category	Sample Number
Residential 76	Vaipae, Aitutaki	Residential	Sample #20
Church 02	Vaipae, Aitutaki	Church	Sample #21
Land Fill 02	Tautut, Aitutaki	Government store / landfill	Sample #22
Land Fill 03 ACM Dump Site	Tautut, Aitutaki	Government store / landfill	(See site: Land fill 02)

A computer generated assessment report was produced for all overview survey and site specific detailed survey sites where PACM was encountered. A total of 24 assessment reports were produced for the following sites:

Table 6: Sites where Assessment Reports were Completed

Site Name	Site Location	Site Category
AC Store	Rarotonga	government store / landfill
Airport	Rarotonga	public / government
Auau Enua Hostel	Rarotonga	public / government
Back Road Survey1	Rarotonga	residential
Back Road Survey2	Rarotonga	residential
Back Road Survey3	Rarotonga	residential
Back Road Survey4	Rarotonga	residential
Black Rock Landfill	Rarotonga	government store / landfill
Church 01	Rarotonga	church
Church 02	Rarotonga	church
Commercial 01	Rarotonga	commercial
Commercial 02	Rarotonga	commercial
Commercial 03	Rarotonga	commercial
Commercial 04	Rarotonga	commercial
Commercial 05	Rarotonga	commercial
Commercial 06	Rarotonga	commercial
Commercial 07	Rarotonga	commercial
Dental Clinic	Rarotonga	Government
Garage	Rarotonga	commercial
Golf Club	Rarotonga	public
Infrastructure	Rarotonga	government structure
Land Fill 01	Rarotonga	government office
Land Fill 03 ACM Dump Site	Rarotonga	government store / landfill

Site Name	Site Location	Site Category
Residential 34	Rarotonga	residential
Residential 35	Rarotonga	residential
Residential 36	Rarotonga	residential
Residential 37	Rarotonga	residential
Residential 38	Rarotonga	residential
Residential 39	Rarotonga	residential
Residential 40	Rarotonga	residential
Residential 41	Rarotonga	residential
Residential 42	Rarotonga	residential
Residential 43	Rarotonga	residential
Residential 44	Rarotonga	residential
Residential 45	Rarotonga	residential
Residential 46	Rarotonga	residential
Residential 47	Rarotonga	residential
Residential 48	Rarotonga	residential
Residential 49	Rarotonga	residential
Residential 50	Rarotonga	residential
Residential 52	Rarotonga	residential
Residential 53	Rarotonga	residential
Ritaki Re-survey	Rarotonga	residential
Shop 01	Rarotonga	commercial
Shop 02	Rarotonga	commercial
Titikaveka Re-survey	Rarotonga	residential

Site Name	Site Location	Site Category
Matavera Re-survey	Rarotonga	residential
Muri Re-survey	Rarotonga	residential
Ngatangiia Re-survey	Rarotonga	residential
Power Station 01	Rarotonga	government structure
Raina Lagoon Villas	Rarotonga	commercial
Residential 01	Rarotonga	residential
Residential 02	Rarotonga	residential
Residential 03	Rarotonga	residential
Residential 04	Rarotonga	residential
Residential 05	Rarotonga	residential
Residential 06	Rarotonga	residential
Residential 07	Rarotonga	residential
Residential 08	Rarotonga	residential
Residential 09	Rarotonga	commercial
Residential 10	Rarotonga	residential
Residential 11	Rarotonga	residential
Residential 12	Rarotonga	residential
Residential 13	Rarotonga	residential
Residential 14	Rarotonga	residential
Residential 15	Rarotonga	residential
Residential 16	Rarotonga	residential
Residential 17	Rarotonga	residential
Residential 18	Rarotonga	residential
Residential 19	Rarotonga	residential
Residential 20	Rarotonga	residential
Residential 21	Rarotonga	residential
Residential 22	Rarotonga	residential
Residential 23	Rarotonga	residential
Residential 24	Rarotonga	residential
Residential 25	Rarotonga	residential
Residential 26	Rarotonga	residential
Residential 27	Rarotonga	residential
Residential 28	Rarotonga	residential
Residential 29	Rarotonga	residential
Residential 30	Rarotonga	residential
Residential 31	Rarotonga	residential
Residential 32	Rarotonga	residential
Residential 33	Rarotonga	residential

Site Name	Site Location	Site Category
Land Fill 02	Aitutaki	government store / landfill
Marine Research Centre	Aitutaki	government office
Power Station 02	Aitutaki	government structure
Residential 54	Aitutaki	residential
Residential 55	Aitutaki	residential
Residential 57	Aitutaki	residential
Residential 58	Aitutaki	residential
Residential 59	Aitutaki	residential
Residential 60	Aitutaki	residential
Residential 61	Aitutaki	residential
Residential 62	Aitutaki	residential
Residential 63	Aitutaki	residential
Residential 64	Aitutaki	residential
Residential 65	Aitutaki	residential
Residential 66	Aitutaki	residential
Residential 67	Aitutaki	residential
Residential 68	Aitutaki	residential
Residential 69	Aitutaki	residential
Residential 70	Aitutaki	residential
Residential 71	Aitutaki	residential
Residential 72	Aitutaki	residential
Residential 73	Aitutaki	residential
Residential 74	Aitutaki	residential
Residential 75	Aitutaki	residential
Residential 76	Aitutaki	residential
Residential 78	Aitutaki	residential
Residential 79	Aitutaki	residential
Residential 80	Aitutaki	residential
Residential 81	Aitutaki	residential
Residential 82	Aitutaki	residential
Residential 83	Aitutaki	residential
Residential 84	Aitutaki	residential
Residential 85	Aitutaki	residential
Residential 86	Aitutaki	residential
Residential 87	Aitutaki	residential
Residential 88	Aitutaki	residential
Rinos Rentals	Aitutaki	commercial

5.0 Laboratory Results

5.1 Laboratory Results

A total of 21 samples were collected in the Cook Islands survey. Asbestos was confirmed in 7 of these. Copies of the laboratory reports are given in Appendix 5 of this report.

In addition to the Site Specific Detailed Surveys carried out as part of this project, CIIC also provided the survey team with previous asbestos investigation reports undertaken by K2 Environmental. K2 Environmental was requested by CIIC to visit a number of government owned buildings to test for asbestos.

The laboratory results from this survey as well as the CIIC commissioned survey (carried out by K2 Consultants) are summarised in Table 7. Appendix 4 contains a summary of relevant information from the K2 Consultants Reports. This information includes the K2 coverage of the additional islands Atiu, Mangaia, Mitiaro and Mauke. As this survey covered only Rarotonga and Aitutake, this is the only data presented in Table 7, but the results from the other islands are covered in other relevant sections below.

Table 7 – Laboratory Results

Site Name	Site Location	Site Category	No of Bldgs	Sample No	Source of Sample	Lab Results
SPREP PacWaste Project Sites						
CIIC ACM Store / Collection Point	Avarua, Rarotonga	Government store / landfill	1	None		
Black Rock Landfill	Nikao, Rarotonga	Government store / landfill		None		
Residential 01	Avarua, Rarotonga	Residential	1	#01	1 bulk sample: Broken gable cladding on ground	Chrysotile 15% Amosite 3% Crocidolite 3%
Commercial 03	Arorangi, Rarotonga	Commercial	2	#10	1 bulk sample: Cladding from end wall	Amosite 5%
Church 01	Arorangi, Rarotonga	Church	1	#11	1 bulk sample: Cladding from end wall	Chrysotile 15% Amosite 2%
Residential 66	Amuri, Aitutaki	Residential	1	#17	1 bulk sample: Cladding from end wall	Chrysotile 5%
Residential 68	Arutanga, Aitutaki	Residential	1	#19	1 bulk sample:	Chrysotile 15%

Site Name	Site Location	Site Category	No of Bldgs	Sample No	Source of Sample	Lab Results
					Cladding from end wall	Crocidolite 5%
Residential 76	Vaipae, Aitutaki	Residential	1	#20	1 bulk sample: Broken cladding on ground	Chrysotile 15%
Church 02	Vaipae, Aitutaki	Church	1	#21	1 bulk sample: Broken cladding on ground	Chrysotile 15%
Cook Islands Investment Corp project sites						
Avarua School	Avarua, Rarotonga	School	9*		15 air samples	15 positive results from 0.01 to 0.05 fibres/mL
					3 bulk sample: cladding	Chrysotile, Amosite
					6 soil samples	White/brown clading: Chrysotile, Amosite
						Blue/white cladding: Chrysotile, Amosite, Crocidolite
					3 swab samples	No asbestos detected
Nukutere College	Avarua, Rarotonga	School	11*		3 air samples	3 results of < 0.01 fibres/mL
					1 bulk sample: cladding	No asbestos detected
					1 swab sample	No asbestos detected
Tareora College	Nikao, Rarotonga	School	10*		13 air samples	Air Sampling of <0.01 to 0.05 fibres/mL
					2 bulk samples: cladding	Chrysotile, Crocidolite
Takitumu School	Matavera, Rarotonga	School	6*		9 air samples	All results of <0.01 fibres/mL
					1 bulk sample: cladding	Chrysotile, Amosite
Arorangi School	Arorangi, Rarotonga	School	7*		5 air samples	1 positive result of 0.01 fibres/mL
						3 results of <0.01 fibres/mL

Site Name	Site Location	Site Category	No of Bldgs	Sample No	Source of Sample	Lab Results
					4 bulk sample: cladding	Chrysotile, Amosite, Crocidolite
					1 swab sample	No asbestos detected
Rutaki School	Rutaki, Rarotonga	School	3*		4 air samples	All results of <0.01 fibres/mL
					1 swab sample	No asbestos detected
Avatea Primary School	Nikao, Rarotonga	School	12		5 air samples	2 positive results of 0.02 to 0.01 fibres/mL
						3 results of <0.01 fibres/mL
					2 bulk samples	1 positive for Chrysotile, Amosite, Crocidlite
					2 swab samples	No asbestos detected
					7 soil samples	2 positive for Chrysotile
St Joseph's School	Avarua, Rarotonga	School	2*		2 air samples	All resuts of <0.01 fibres/mL
Dental Clinic	Tupapa, Rarotonga	Government Clinic	1		5 air samples	2 positive results of 0.01 fibres/mL
						3 results of <0.01 fibres/mL
High Commission	Avarua, Rarotonga	Government Office	1		1 swab sample: Ceiling Space	Super 6 roofing: Amosite
Rarotonga Airport (including Met Office)	Nikao, Rarotonga	Public / government	13		7 bulk and swab samples: cladding	Super 6/7 roofing: Chrysotile, Amosite
						Cement board ceiling: Chrysotile, Amosite

Photo 1 - Church in Aitutaki

Photo 2 - Disused Shop – Arorangi, Rarotonga

Photos 3 and 4 – Government Collection Point for ACM

Photo 5 – Asbestos Contaminated Soil – Rarotonga Landfill

Photo 6 - Typical Commercial Building

5.2 Residences

The relevant statistical information is presented in Table 8 below

Table 8: Survey of Houses in Cook Islands:

Location	Population	Houses	Houses Surveyed
Rarotonga	10572	3154	2400
Aitutaki	1171	482	270
Other Islands	3231	736	Nil
Total	14974	4372	2670

Source: 2011 Cook Islands Census, Statistics Office.

NB: The houses with asbestos roofs were also included in the 89 houses with asbestos cladding

Based on the 2,670 properties surveyed, 89 residential buildings were suspected of containing PACM in the exterior material observed (77 with cladding only and 12 with roofs and cladding). An example dwelling is shown in Photo 7. Given the sample size and conclusions based upon it, if this estimate is extrapolated to include the remaining residential properties in Rarotonga and Aitutaki then, based on a 95% confidence with a margin of error of +/- 0.9%, the potential number of households in Rarotonga and Aitutaki to contain PACM would be 146 (of which 20 would also have roofs. Any roof suspected of being asbestos is usually confirmed, but a fibre board cladding can have other fibres in apart from asbestos. Based on the fibreboard that was analysed (including this survey and K2 results) about 50% was asbestos. If this figure is used then this would reduce the number to 73 houses with ACM.

Extrapolation of the 146 total could be extended to the whole of the Cook Islands to give a figure of 186 houses, but there are doubts regarding the statistical validity of such an extension as the situation may be quite different on the other islands.

Photo 7 - Typical Private Residential Building

5.3 Discussion

Considering the limitations of the survey, the potential exists for more asbestos to be present in the Cook Islands. The major sources of asbestos that were not possible or difficult to observe include, but are not limited to:

- Buried cement pipes; and
- Internal building material such as floor tiles and internal partition walls, especially in ablution areas.

Based on the methodology for the replacement of the water ring main, to leave the existing pipe in the ground, the area potentially affected by this is considered to be small.

Internal building material, where observed (e.g. hospital, schools and government offices) contained little or no ACM. The amount of material thought to potentially contain asbestos is therefore considered to be limited.

However, if asbestos regulations are not incorporated into the Cook Islands legislature, new asbestos-containing products could be imported and used for construction purposes.

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 9, for each individual island. Additional islands surveyed by K2 are included, as well as the survey islands Rarotonga and Aitutaki.

Table 9 – Risk Assessment of Cook Islands Asbestos Locations

Location	Type	Comments	RiskRanking		
			ACM Score	Setting Score	Total
Rarotonga, Avarua School	Cladding	High Air Results	7	18	25
Rarotonga, Avarua School	Soil cleanup	High Air Results	7	18	25
Rarotonga, Tereora College	Cladding	Some broken bits to pick up	6	19	25
Rarotonga, Takitumu School	Cladding		7	18	25
Rarotonga, Arorangi School	Cladding		6	19	25
Rarotonga, Avatea Primary School	Cladding	High Air Results	7	18	25
Rarotonga, Nikao School	Cladding	Some broken bits to pick up	6	18	24
Rarotonga, Titikaveka College	Cladding		6	17	23
Arorangi Church, Rarotonga	Cladding	Encapsulate	6	16	22
Rarotonga, Rarotonga Airport	Cement Board Ceiling	Encapsulate	5	16	21
Rarotonga, Rarotonga Airport	Roof		6	14	20
NZ High Commission, Rarotonga	Roof		6	14	20
Rarotonga Met Office	Roof		6	14	20

Location	Type	Comments	RiskRanking		
			ACM Score	Setting Score	Total
Arorangi Commercial Bldg, Rarotonga	Cladding	Encapsulate	5	13	18
Aitutaki, Araura College	Cement Board Divider Panels	Encapsulate	7	17	24
Aitutaki, Araura Primary	Cement Board Divider Panels	Encapsulate	6	18	24
Aitutaki Hospital	Cladding	Encapsulate	5	18	23
Aitutaki, Tekaaroa School	Cladding	Some broken bits to pick up	6	17	23
Vaipae Church, Aitutaki	Broken Cladding on Ground		5	16	21
Atiu, Enuamanu School	Cladding		6	17	23
Atiu, Agriculture Building	Cladding		5	14	19
Atiu, Laundry behind hospital	Cladding		6	13	19
Atiu, Marine Building	Cladding		5	13	18
Atiu, Hospital	Cladding	Suspected, not confirmed	5	12	17
Mangaia, Mangaia School	Cladding	Burnt Debris in Two Locations	7	18	25
Mangaia, Old Government House	Roof (Burnt Building)	Old Fire Site	7	17	24
Mangaia, Old Government House	Debris and Contaminated Soil	Old Fire Site	7	17	24
Mangaia, Ivirua School	Roof		6	17	23

Location	Type	Comments	RiskRanking		
			ACM Score	Setting Score	Total
Mangaia, Ivirua School	Cladding		6	17	23
Mauke, Old Hospital	Cladding		5	18	23
Mauke, Mauke School	Cladding and Soffits		6	16	22
Mauke, Packing Shed	Debris and Contaminated Soil		6	11	17
Mauke, Old Asbestos Shed	Roof		6	11	17
Mitiaro, Mitiaro School	Cladding	Some broken bits to pick up	7	15	22
Mitiaro, Administration Building	Cladding - Exterior and Interior		5	12	17

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

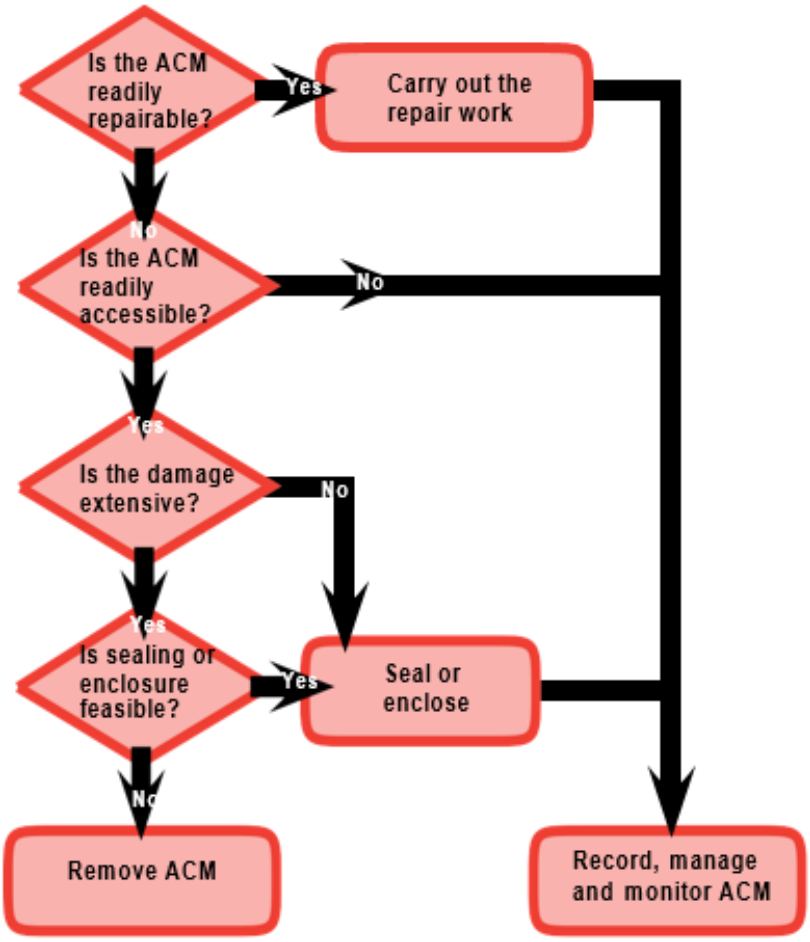

Figure adapted from; UKHSE HSG227 'A Comprehensive Guide to Managing Asbestos in Premises'.

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 8 & 9 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 8 & 9: 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.
d) 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 Cook Islands

Table 10 below shows the sites on Cook Islands that returned a positive result for ACM and the most suitable, cost effective remedial options based on the flow chart process described above.

Table 10: Possible Remedial Options – Cook Islands

Location	Remedial Work	Comments	Risk Ranking	Applicable Remedial Options			
				Repair	Isolate	Encapsulate	Remove
Rarotonga, Avarua School	Cladding	High Air Results	25	×	×	×	✓
Rarotonga, Avarua School	Soil cleanup	High Air Results	25	×	×	×	✓
Rarotonga, Tereora College	Cladding	Some broken bits to pick up	25	✓	×	×	✓
Rarotonga, Takitumu School	Cladding		25	×	×	×	✓
Rarotonga, Arorangi School	Cladding		25	×	×	×	✓
Rarotonga, Avatea Primary School	Cladding	High Air Results	25	×	×	×	✓
Rarotonga, Nikao School	Cladding	Some broken bits to pick up	24	✓	×	×	✓
Rarotonga, Titikaveka College	Cladding		23	×	×	×	✓
Arorangi Church, Rarotonga	Cladding	Encapsulate	22	✓	×	×	×
Rarotonga, Rarotonga Airport	Cement Board Ceiling	Encapsulate	21	✓	×	×	×
Rarotonga, Rarotonga Airport	Roof		20	×	×	×	✓
NZ High Commission, Rarotonga	Roof		20	×	×	×	✓
Rarotonga Met Office	Roof		20	×	×	×	✓
Arorangi Commercial Bldg, Rarotonga	Cladding	Encapsulate	18	×	×	✓	×
Aitutaki, Araura College	Cement Board Divider Panels	Encapsulate	24	×	×	✓	×

Location	Remedial Work	Comments	Risk Ranking	Applicable Remedial Options			
				Repair	Isolate	Encapsulate	Remove
Aitutaki, Araura Primary	Cement Board Divider Panels	Encapsulate	24	×	×	✓	×
Aitutaki Hospital	Cladding	Encapsulate	23	×	×	✓	×
Aitutaki, Tekaaroa School	Cladding	Some broken bits to pick up	23	✓	×	×	✓
Vaipae Church, Aitutaki	Broken Cladding on Ground		21	✓	×	×	✓
Atiu, Enuamanu School	Cladding		23	×	×	×	✓
Atiu, Agriculture Building	Cladding		19	×	×	×	✓
Atiu, Laundry behind hospital	Cladding		19	×	×	✓	×
Atiu, Marine Building	Cladding		18	×	×	✓	×
Atiu, Hospital	Cladding	Suspected, not confirmed	17	×	×	✓	×
Mangaia, Mangaia School	Cladding	Burnt Debris in Two Locations	25	×	×	×	✓
Mangaia, Old Government House	Roof (Burnt Building)	Old Fire Site	24	✓	✓	×	✓
Mangaia, Old Government House	Debris and Contaminated Soil	Old Fire Site	24	✓	✓	×	✓
Mangaia, Ivirua School	Roof		23	×	×	×	✓
Mangaia, Ivirua School	Cladding		23	×	×	×	✓
Mauke, Old Hospital	Cladding		23	×	×	×	✓
Mauke, Mauke School	Cladding and Soffits		22	×	×	×	✓

Location	Remedial Work	Comments	Risk Ranking	Applicable Remedial Options			
				Repair	Isolate	Encapsulate	Remove
Mauke, Packing Shed	Debris and Contaminated Soil		17	✓	×	×	✓
Mauke, Old Asbestos Shed	Roof		17	×	×	×	✓
Mitiaro, Mitiaro School	Cladding	Some broken bits to pick up	22	✓	×	×	✓
Mitiaro, Admin Building	Cladding - Exterior and Interior		17	×	×	×	✓

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 10 below.

Table 11: 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 Suitable for the Cook Islands

The disposal method for Cook Islands' asbestos wastes also needs to be determined. The cheapest solution would be for disposal at Rarotonga's Waste Management Facilty but this landfill is close to its full capacity and a longer term solution is now being sought. The lack of available land for a new facility is, however, providing a challenge in this respect

If no suitable disposal site can be found, then the other options are disposal at sea or export to another country as discussed in Sections 9.3 and 9.4 above. Both alternatives are permissible for Cook Islands although they would be expensive options.

Disposal at sea would require permits under the London Convention and protocol although Cook Islands is not a party to this convention or protocol. Consent would also be needed under the Noumea Convention and Cook Islands is a party to this convention. A suitable barge would be required with a crane mounted on it. Another crane for loading the asbestos on the barge would be required and a suitable deep dumping location would be needed. This option is probably impractical for the Cook Islands. The process of obtaining the necessary Noumea Convention permit would also be expensive as there would be a need to carry out expensive and detailed investigations before such a permit could be obtained.

Export from Cook Islands to another country would be viable and Auckland, New Zealand provides a suitable destination for receiving waste asbestos. Similar previous shipments from the Cook Islands (asbestos wastes in 2014), and other Southern Pacific countries have been made with little difficulty. It is understood that about 10% can be added to the overall cost of asbestos removal and replacement to cover export of the asbestos waste for disposal in Auckland.

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 6). 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 6 and a summary is presented as follows:

Roof Encapsulation

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.

Cladding Encapsulation

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 6 and a summary is presented as follows:

Roof Removal and Replacement

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 12: 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

There are a number of contractors operating within the Cook Islands that have handled ACM in the past and would be willing to do so again. These include:

- Recycle Cook Islands Ltd. John Wichman (Senior Project Manager) email: jbwichmanci@hotmail.com, NZ phone +64 21 936 234, Cook Islands phone + 68 255 773.
- Landholdings Ltd had ACM removal experience with CIIC and are contactable at PO Box 94, Nikao, Phone +68 223 415, Fax + 68 223 416;
- RVK Contractors Ltd had ACM removal experience with CIIC. No contact details could be obtained; and
- T&M Heather Ltd, Ara Metua, Arorangi District, Cook Islands, Phone+ 68 224 249.

The above contractors were all known by CIIC or NES. Evidence of their experience could not be obtained. NES was aware of their use of breathing apparatus and overalls during ACM handling, however this was not likely to be up to a high standard and training and more personal protective equipment would likely be necessary to reduce the risk to exposure for the workers.

11.0 Review of Cook Islands Policies and Legal Instruments

11.1 Review of Policies and Legal Instruments

Discussions with NES and CIIC demonstrated an awareness of asbestos in the Cook Islands. While there are no specific regulations covering asbestos, there are guidelines in place: Guidelines for the Management of Asbestos in the Cook Islands, by the participants of the Inaugural National Asbestos Management Training Workshop, 2003.

NES officers have been trained to inform the public of the risk from asbestos. Typically, NES are made aware of ACM removal through CIIC or where a member of the public contacts them for advice.

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 exposure or asbestos removal and management implemented in Cook Islands.

Cook Islands has confirmed its support for the aims and objectives of the PacWaste Project.

11.2 Relevant National Programmes and Policies

The NES has undertaken training for its employees to advise the public on dealing with asbestos. The current advice was to bury it within the property in which it was found. This was believed to be an unpopular option as members of the public did not believe this to be safe.

The CIIC was aware of the problem posed by asbestos and were currently undertaking an audit of government buildings constructed before 1990. When this survey was complete, CIIC plan to write some guidelines. Particular problems arose from potentially ACM that was not Super 6 roofing material, as members of CIIC, NES and other authorities were not aware of other ACM (e.g cladding and cement board). CIIC intend to develop a short to medium term plan for removal or encapsulating where possible. The issue they face is location for disposal. Previous exporting to New Zealand was not considered cost-effective for the future.

Despite this, CIIC were continuing to collect potentially ACM in a secure location for disposal.

Cook Islands has confirmed its support for the aims and objectives of the PacWaste Project.

12.0 Recommended Actions for Minimising Asbestos Exposures

12.1 Discussion

The results are a mixture of those obtained from this survey and those determined by K2 Environmental during their investigations and an attempt has been made to cover both sets of results in this report. There is still a substantial amount of asbestos in the Cook Islands including at a number of schools spread throughout the country and in some at least, there are some serious situations that need to be addressed.

The K2 Reports that are summarised in Appendix 4 highlighted the Avarua School and Avatea School in Rarotonga where high air results were obtained, and also the fire-damaged old Government building in Mangaia where asbestos debris (and no doubt loose fibres) litter the site. There are also numerous examples of old asbestos buildings in poor condition and several sites (including schools) where asbestos debris litters the site.

Based on the 2,670 properties surveyed, 89 residential buildings were suspected of containing PACM in the exterior material observed (77 with cladding only and 12 with roofs and cladding). Given the sample size and conclusions based upon it, if this estimate is extrapolated to include the remaining residential properties in Rarotonga and Aitutaki then, based on a 95% confidence with a margin of error of 0.9%, the potential number of households in Rarotonga and Aitutaki to contain PACM would be 146 (of which 20 would also have roofs. Based on the fibreboard that was analysed (including this survey and K2 results) about 50% was asbestos. If this figure is used then this would reduce the number to 73 houses with ACM.

Extrapolation of the 146 total could be extended to the whole of the Cook Islands to give a figure of 186 houses, but there are doubts regarding the statistical validity of such an extension as the situation may be quite different on the other islands.

As no regulations currently exist, the remediation methods can be easily implemented without the need for permits. Potentially ACM can be collected under specialist supervision and transported to the CIIC collection point for secure disposal. There were already a number of contractors who have basic asbestos handling experience and who indicated would be willing to undertake further training in this field. There are a number of issues identified with this solution, including:

- The location of the CIIC collection point was a concern, as it was located near the centre of Avarua town, directly behind the CIIC office; and
- A suitable methodology for disposal should be identified before more potentially ACM is stored at the CIIC.

Encapsulation of asbestos-containing materials can be achieved by painting the materials with a rubberised acrylic paint applied to a primer. This may be particularly relevant to the potentially ACM found in residential properties.

Specialist supervision is recommended during remedial works to ensure that appropriate protection measures are implemented to eliminate the risks to workers, the environment and the surrounding population.

The experience of surveying and handling potentially ACM on the Cook Islands has established the capability of the CIIC and NES to deal with the problem, within the available funds and resources at their disposal.

There are a number of sites identified by CIIC that will require redevelopment within the proceeding years, including:

- Further school redevelopment during 2015; and
- Airport master plan.

The volume of potentially ACM generated by these projects has been identified as a problem. A preferred option for CIIC is to either ship the waste material to New Zealand, as occurred in 2014, or find a secure disposal site within the Cook Islands. Due to the limited Government land available, the second option is believed to be problematic.

The was an identified requirement and desire for training, personal protective equipment and monitoring equipment to be brought to the Cook Islands for further asbestos work, both from NES, CIIC and private contractors willing to undertaken asbestos removal work.

Smaller islands, such as Aitutaki, were generally believed to be unwilling to provide space for asbestos burial at their land fill sites, as indicated at the Aitutaki Island Council meeting. This was mainly due to pressure for available land and the perceived risk from asbestos burial.

The large amount of ACM waste from the airport redevelopment may benefit from local disposal. If an opportunity arises to bury the ACM within the airport land, this would provide a beneficial and cost effective solution, in particular if other ACM (e.g. from recent school redevelopment and currently at the CIIC ACM store) can be suitably disposed of at this site.

Considering the limitations of the survey, the potential exists for more asbestos to be present in the Cook Islands. The major sources of asbestos that were not possible or difficult to observe include, but are not limited to:

- Buried cement pipes; and
- Internal building material such as floor tiles and internal partition walls, especially in ablution areas.

Based on the methodology for the replacement of the water ring main, to leave the existing pipe in the ground, the area potentially affected by this is considered to be small.

Internal building material, where observed (e.g. hospital, schools and government offices) contained little of no ACM. The amount of material thought to potentially contain asbestos is therefore considered to be limited.

However, if asbestos regulations are not incorporated into the Cook Islands legislature, new asbestos-containing products could be imported and used for construction purposes.

Table 13 below lists priority sites (high and moderate risk ranking and the estimated cost for remediating these sites.

Table 13: Prioritised Recommended Actions and Indicative Costs

Location	Remedial Work	Comments	Area (m2)	Unit Cost	Total Cost	Risk Ranking
Rarotonga, Avarua School	Cladding	High Air Results	100	84	8400	25
Rarotonga, Avarua School	Soil cleanup	High Air Results	LS	LS	10000	25
Rarotonga, Tereora College	Cladding	Some broken bits to pick up	80	92	7360	25
Rarotonga, Takitumu School	Cladding		150	84	12600	25
Rarotonga, Arorangi School	Cladding		250	84	21000	25
Rarotonga, Avatea Primary School	Cladding	High Air Results	200	84	16800	25
Rarotonga, Nikao School	Cladding	Some broken bits to pick up	100	92	9200	24
Rarotonga, Titikaveka College	Cladding		300	84	25200	23
Arorangi Church, Rarotonga	Cladding	Encapsulate	30	23	690	22
Rarotonga, Rarotonga Airport	Cement Board Ceiling	Encapsulate	300	18	5400	21
Rarotonga, Rarotonga Airport	Roof		600	106	63600	20
NZ High Commission, Rarotonga	Roof		700	92	64400	20
Rarotonga Met Office	Roof		200	106	21200	20
Arorangi Commercial Bldg, Rarotonga	Cladding	Encapsulate	20	23	460	18
Aitutaki, Araura College	Cement Board Divider Panels	Encapsulate	50	18	900	24
Aitutaki, Araura Primary	Cement Board Divider Panels	Encapsulate	20	18	360	24
Aitutaki Hospital	Cladding	Encapsulate	100	18	1800	23
Aitutaki, Tekaaroa School	Cladding	Some broken bits to pick up	40	95	3800	23

Location	Remedial Work	Comments	Area (m2)	Unit Cost	Total Cost	Risk Ranking
Vaipae Church, Aitutaki	Broken Cladding on Ground		10	40	400	21
Atiu, Enuamanu School	Cladding		220	86	18920	23
Atiu, Agriculture Building	Cladding		300	86	25800	19
Atiu, Laundry behind hospital	Cladding		50	86	4300	19
Atiu, Marine Building	Cladding		120	86	10320	18
Atiu, Hospital	Cladding	Suspected, not confirmed	200	86	17200	17
Mangaia, Mangaia School	Cladding	Burnt Debris in Two Locations	100	95	9500	25
Mangaia, Old Government House	Roof (Burnt Building)	Old Fire Site	200	108	21600	24
Mangaia, Old Government House	Debris and Contaminated Soil	Old Fire Site	LS	LS	20,000	24
Mangaia, Ivirua School	Roof		120	108	12960	23
Mangaia, Ivirua School	Cladding		240	86	20640	23
Mauke, Old Hospital	Cladding		20	86	1720	23
Mauke, Mauke School	Cladding and Soffits		300	86	25800	22
Mauke, Packing Shed	Debris and Contaminated Soil		LS	LS	5000	17
Mauke, Old Asbestos Shed	Roof		300	108	32400	17
Mitiaro, Mitiaro School	Cladding	Some broken bits to pick up	350	95	33250	22
Mitiaro, Administration Building	Cladding - Exterior and Interior		340	86	29240	17

The disposal method for Cook Islands' asbestos wastes also needs to be determined. The cheapest solution would be for disposal at Rarotonga's Waste Management Facilty but this landfill is close to its full capacity and a longer term solution is now being sought. The lack of available land for a new facility is, however, providing a challenge in this respect

If no suitable disposal site can be found, then the other options are disposal at sea or export to another country as discussed in Sections 9.3 and 9.4 above. Both alternatives are permissible for Cook Islands although they would be expensive options.

Export from Cook Islands to another country would be viable and Auckland, New Zealand provides a suitable destination for receiving waste asbestos. Similar previous shipments from the Cook Islands (asbestos wastes in 2014), and other Southern Pacific countries have been made with little difficulty.

12.2 Recommendations

The following recommendations are therefore made in relation to asbestos on Cook Islands:

A. It is recommended that the high and moderate priority asbestos work is carried out in the Cook Islands as identified above, including the removal of all loose asbestos and cleaning up contaminated sites.
B. In particular the urgent situations identified by K2 Environmental need to be addressed – Avarua School, Avatea School and Mangaia Government Building.
C. It has been concluded that abort 186 houses in the Cook Islands may have asbestos building materials in some form – mostly cladding. It is recommended that all houses with PACM in the Cook Islands are tested for asbestos and that all the houses tested positive are notified and included in an awareness campaign. They should be remediated (i.e. the asbestos removed or encapsulated) where resources permit.
D. If a large number of houses are found to contain asbestos cladding then encapsulation would probably be the most cost-effective option for remediation although ongoing management procedures then would be needed and re-encapsulation (i.e. re-painting) would probably be needed 10-15 years later. If a small number of houses are found to contain asbestos cladding then removal and replacement of the cladding should be considered.
E. Any asbestos roofs found on houses in the Cook Islands should preferably be removed rather than encapsulated as encapsulation of roofs costs only a little less than removal and removal is a permanent solution.
F. If a suitable cheap on-island disposal location can be found that was locally acceptable then on-island disposal would be the preferred disposal option. Otherwise the next preferred option is export to Auckland as has happened previously.
G. 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.
H. Consideration should be given to Cook Islands passing regulations under suitable legislation to enable the above work to be undertaken safely and also to enable the banning of the import of any asbestos building products for sale.

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, Palau
- 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 survey team of Dirk Catterall and Huw Williams visited The Cook Islands from 23 to 30 July 2014, involving a visit to Rarotonga, between 23 to 29 July with Huw Williams visiting Aitutaki between 26 to 29 July.

The primary agencies who assisted in the survey were:

- **Cook Islands Investment Corporation** (CIIC); Anne Taoro (Property Manager), Phone: (682) 29391, Mobile: (682) 54434, Address: PO Box 51, Rarotonga, Cook Islands. Web www.ciic.gov.ck, Email: anne.taoro@cookislands.gov.ck; and
- **National Environment Service** (NES); Vavia Tangatataia (Manager - Advisory & Compliance Division), Tu'anga Taporoporo, phone: +(682) 21256, fax: +(682) 22256, Address: PO Box 371, Avarua, Rarotonga, Cook Islands. web: http://www.environment.gov.ck, Email: vavia.tangatataia@cookislands.gov.ck

Both organisations provided extremely helpful support and advice during the visit.

Appendix 3: Summaries of in-Country Discussions

Extrapolation from other islands not visited for the purposes of this survey was gained from meetings with NES and CIIC. They gave the following information on known potentially ACM through the Cook Islands:

- It was known that potentially ACM was buried at the Black Rock landfill on Rarotonga (Site Name: Black Rock Landfill, Appendix 4);
- A quantity of potentially ACM was sotred at the main landfill on Rarotonga (Site Name: Land Fill 03 - ACM Dump Site, Appendix 4);
- Pukapuka was thought to be the only Northern Island with potentially ACM in the Government buildings there; and
- Most southern Cook Islands are likely to have some ACM.

A meeting with the Island Council on Aitutaki concluded that there is potentially ACM in the landfill, with a possible burial site within the Araura School grounds, from redevelopment of the school, although this could not be verified by the survey or discussions with a teacher at the school.

Historical Asbestos Handling

From meeting with NES and CIIC, it was noted that much of the ACM from schools and damaged buildings from previous cyclones has been collected and disposed of in four separate phases up to the present time:

1. Late 1990's: Redevelopment at Aitutaki School found possible ACM which was buried within the school grounds beneath the footprint of the 1st stage of building at the site;
2. 2006 / 2007: Further school redevelopment across Rarotonga discovered possible ACM. All possibly ACM was collected on a boat in Avarua harbour. The boat was taken out to sea and scuttled. The repercussions from this option were not favourable and the government of the Cook Islands do not seek to repeat this option; and
3. 2014: A secondary phase of ACM collection was undertaken after a cyclone caused significant damage in the area. In particular, all possibly ACM was removed from Aitutaki in a container and shipped to Rarotonga in the CIIC collection point in Avarua (site name: CIIC ACM Store / Collection Point, Appendix 4). This collection point also stored possibly ACM removed from various school sites. In total, 4 containers of 20 foot each were shipped to NZ for disposal in 2014. It was estimated that this option cost US$ 15,500 (NZ$ 20,000) per 20 foot container; and
4. Current practice (2014): Potentially ACM is collected and wrapped at the CIIC store. There is no planned disposal methodology for this collected ACM. IT has been estimated that disposal at the local landfill will cost US$ 31,000 (NZ$ 40,000) for a disposal pit 10 x 10 x 6 m. It was noted that the master plan for the Rarotonga airport (Site Name: Airport, Appendix 4) was currently being worked on by the consultants GHD and that options of disposal of potentially ACM should be included as part of this plan.

There is limited or no additional land for asbestos collection or disposal due to the paucity of government owned land on all of the Cook Islands.

Anecdotal information has been gathered since departing the Cook Islands from the local newspaper report (dated August 2014) stating that a portion of the roofing from the airport authority building has been removed and replaced. The disposal method is not clear, but was stated that disposal to land was the intended methodology. It was unclear where this disposal was intended to occur.

Appendix 4: Relevant Information from the K2 Reports

NB: The quantity estimates have not been taken from the K2 reports but have been estimated from the K2 photos, so they may be inaccurate and thus need to be verified.

Rarotonga

Avarua School
- URGENT - High air sample results
- Contaminated soil - asbestos debris
- Pre-school cladding - 100m2

Avatea School
- CONCERN - One high air result
- Building by road – 100m2
- Side of school building
- Caretaker's shed - 80m2
- No bulk samples taken

Arorangi School (near Edgewater)
- Front of classroom
- Central room by classrooms
- Central complex
- Cladding outside dental clinic
- Approx. 250m2

Tereora College
- Corrugated cement sheeting – 80m2
- Some debris positive

Takitumu School
- One building - 150m2

Nikao School
- Soil samples positive – debris
- Some panels – 80m2

Nukutere College
- Clear

Titikaveka College
- Cladding on two story block asbestos 200 m2

Seventh Day Adventist School
- Cladding positive – 200 m2

Airport
- High swab samples
- Airport Engineering, Cargo Area Super Six Roof 600m2,

- Electrical Store Ceiling 200 m2

NZ High Commission
- Air test negative
- High swab sample in ceiling space
- Super Six ceiling 30 x 20 x 1.15

Meterological Office
- High swab sample
- Asbestos roof 200m2

Dental Clinic
- Asbestos roof, 100 m2

Aitutaki

Aitutaki Hospital
- Doctor's residence ok – roof removed
- Ridged material, probably asbestos 100m2 good condition

Araura College
- Panel dividers between classrooms 50m2
- Soil samples positive

Araura Primary
Panel dividers between classrooms 20m2
Loose stuff 1m2 – soil

Department of Environment
- Okay – negative for asbestos

Tekaaroa Primary
- Soil – brown bits - 3m2
- Back of classroom block at end - 20m2
- Front of classroom - 20m2

Atiu

Hospital
- Cladding suspected -200 m2

Laundry behind hospital
- Cladding 50m2

Marine building
- Cladding 120m2

Agriculture Building
- Cladding 300m2

Atiu Police Station

- Clear

Enuamanu School

- Roof removed several years ago, leaving soil contamination
- Dividing supports positive - 20m2
- External cladding gym block - 200m2

Mangaia

Government House

- URGENT - fire damage
- Asbestos detected in burnt boards and sheets, soil samples, etc
- Super Six in bad condition, Old roof still there
- Building about 20m x 10m - 200 m2

Ivirua School

- Cladding - 200m2
- Super Six roof on one building, poor condition 100m2
- Soil sample positive
- Super Six End Cladding – 40m2

Mangaia School

- Two fire sites as a result of arson
- Soil and burnt ACM positive
- Unburnt part - panels/cladding - 100m2

Mitiaro

Mitiaro School

- Broken sheeting / evidence of fire
- Cladding - 200m2
- Principal's house - 150m2

Mac's House

- Asbestos cladding, broken panels

Generator building

- Fuse Board

Administration Building near harbour

- ACM cladding - 8x30 = 240m2
- Internal wall panels in some rooms - 100m2

Mauke

Packing Shed

- Contaminated Site
- Asbestos debris on ground

Mauke House, Tengaru 6B

- Contaminated Site
- Asbestos Debris

Mauke Old Hospital

- Corrugated Cladding, about 20m2
- Contaminated Site

Motorbike Workshop

- Super Six Roof – 120 m2

Mauke Old Hospital Sheds

- 4 x 120 = 480 m2 (all cladding)

Old Shed

- Bad condition – lots of broken pieces
- About 300 m2 cladding
- Grass-cutting slasher spreads contaminated around

Mauke School

- Cladding and Soffits – about 300 m2
- Debris and Contaminated Soil but contaminated soil results low

Appendix 5: Copies of 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	PAGE #:	1 of 4
	119 Johnson Rd. West Melton	REPORT #:	0162339
	Christchurch NZ	PROJECT:	PLM ANALYSIS
CONTACT:	John O'Grady	DATE COLLECTED:	07/23/2014
REFERENCE:	11178	COLLECTED BY:	
METHOD:	EPA 600/R-93/116	DATE RECEIVED:	08/11/2014
		ANALYSIS DATE:	08/15/2014

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	(%)
0162339-001						
1	Transite, Gray/white/blue, Non-homogeneous, Granular/fibrous/paint, crush/tease, non-friable Note: 26°C, 1.55, 1.68 Oil	LAYER 1 100%	Chrysotile Amosite Crocidolite	15% 5% 3%	Non-Fibrous Material	77%
0162339-002						
2	Transite, Gray, Homogeneous, Granular, crush, non-friable Note: 26°C, 1.55 Oil	LAYER 1 100%	None Detected		Non-Fibrous Material	100%
0162339-003						
3	Cladding, White/gray, Non-homogeneous, Granular, crush, acid, non-friable Note: 26°C	LAYER 1 100%	None Detected		Cellulose Fiber Non-Fibrous Material	<1% 100%
0162339-004						
4	White/gray, Non-homogeneous, paint/granular, ash, crush, acid, non-friable Note: 27°C	LAYER 1 100%	None Detected		Non-Fibrous Material	100%
0162339-005						
5	Cladding, White/gray, Non-homogeneous, granular/paint, ash, crush, acid, non-friable Note: 27°C	LAYER 1 100%	None Detected		Non-Fibrous Material	100%

CUSTOMER:	Contract Environmental	PAGE #:	2 of 4
	119 Johnson Rd. West Melton	REPORT #:	0162339
	Christchurch NZ	PROJECT:	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	(%)
0162339-006						
6	Cladding, Yellow/gray, Non-homogeneous, paint/fibrous, ash, tease, non-friable Note: 27°C, 1.55 Oil	LAYER 1 100%	None Detected		Cellulose Fiber Non-Fibrous Material	45% 55%
0162339-007						
7	Beige/gray/gray, Non-homogeneous, paint/granular/fibrous, ash, acid, non-friable Note: 27°C, 1.55 Oil 27°C	LAYER 1 100%	None Detected		Cellulose Fiber Non-Fibrous Material	15% 85%
0162339-008						
8	Transite, Gray, Homogeneous, Granular, crush, non-friable Note: 27°C, 1.55 Oil	LAYER 1 100%	None Detected		Cellulose Fiber Non-Fibrous Material	20% 80%
0162339-009						
10	Cladding, Gray/white, Homogeneous, Granular/Fibrous, crush, non-friable Note: 27°C, 1.55 Oil 27°C, 1.55, 1.68 Oil	LAYER 1 100%	Amosite	5%	Cellulose Fiber Non-Fibrous Material	20% 75%
0162339-010						
11	Green/gray/white, Non-homogeneous, paint/granular/fibrous, ash, crush, non-friable Note: 27°C, 1.55, 1.68 Oil	LAYER 1 100%	Chrysotile Amosite	15% 2%	Non-Fibrous Material	83%
0162339-011						
12	White/gray, Non-homogeneous, paint/fibrous, ash, tease, non-friable Note: 27°C, 1.55 Oil	LAYER 1 100%	None Detected		Cellulose Fiber Non-Fibrous Material	20% 80%
0162339-012						
13	Black/gray, Non-homogeneous, paint/fibrous, ash, tease, non-friable Note: 27°C, 1.55 Oil	LAYER 1 100%	None Detected		Cellulose Fiber Non-Fibrous Material	65% 35%

CUSTOMER:	Contract Environmental	PAGE #:	3 of 4
	119 Johnson Rd. West Melton	REPORT #:	0162339
	Christchurch NZ	PROJECT:	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	(%)
0162339-013						
14	Orange/gray, Non-homogeneous, paint/granular, ash, crush, acid, non-friable Note: 27°	LAYER 1 100%	None Detected		Cellulose Fiber Non-Fibrous Material	<1% 100%
0162339-014						
15	Green/gray, Non-homogeneous, paint/fibrous, ash, tease, non-friable Note: 27°C, 1.55 Oil	LAYER 1 100%	None Detected		Cellulose Fiber Non-Fibrous Material	<1% 100%
0162339-015						
16	Gray, Homogeneous, Granular, crush, acid, non-friable Note: 27°C	LAYER 1 100%	None Detected		Non-Fibrous Material	100%
0162339-016						
17	Green/gray, Non-homogeneous, paint/granular, ash, crush, acid, non-friable Note: 27°C	LAYER 1 100%	Chrysotile	5%	Non-Fibrous Material	95%
0162339-017						
18	Gray, Homogeneous, Fibrous, tease, non-friable Note: 27°C, 1.55 Oil	LAYER 1 100%	None Detected		Cellulose Fiber Non-Fibrous Material	25% 75%
0162339-018						
19	Transite, Gray/white/blue, Non-homogeneous, granular/fibrous/fibrous, crush, non-friable Note: 27°C, 1.55, 1.68 Oil	LAYER 1 100%	Chrysotile Crocidolite	15% 5%	Non-Fibrous Material	80%
0162339-019						
20	Transite, Gray/white/brown, Non-homogeneous, Granular/fibrous/paint, crush, non-friable Note: 27°C, 1.55 Oil	LAYER 1 100%	Chrysotile	15%	Non-Fibrous Material	85%
0162339-020						
21	Beige, Homogeneous, Granular, crush, non-friable Note: 27°C, 1.55 Oil	LAYER 1 100%	Chrysotile	15%	Non-Fibrous Material	85%

CUSTOMER:	Contract Environmental	PAGE #:	4 of 4
	119 Johnson Rd. West Melton	REPORT #:	0162339
	Christchurch NZ	PROJECT:	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	(%)
0162339-021 22	Gray, Homogeneous, Fibrous, tease, non-friable Note: 27°C, 1.55 Oil	LAYER 1 100%	None Detected		Cellulose Fiber Non-Fibrous Material	40% 60%

Analyst - JEFF WAN **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

Appendix 6: 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

02.12.14

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

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 timber roof framing.	350.00	280.00	254.55
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