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 Sovereign Republic of Kiribati

Prepared for the Secretariat of the Pacific Regional Environment Programme (SPREP)

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

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

The work was carried out by a consortium led by Contract Environmental Ltd and Geoscience Consulting (NZ) Ltd, under contract to the Secretariat of the Pacific Regional Environment Programme (SPREP), with funding provided by the European Union. The majority of information relating to the distribution of ACM in Kiribati was obtained in a field visit undertaken by Gareth Oddy between the 8th and 16th of August 2014 and was organised with the Kiribati Government and in particular through the Ministry of Environment, Lands and Agriculture Development (MELAD).

Survey Outcomes

Asbestos fibres, including chrysotile and amosite, were identified in ACM building materials at eight of 12 sites sampled and assessed. The percentages of fibres detected ranged from 2 – 60%.

Apart from residences there were only a few locations where asbestos building materials were detected in Betio, Bairiki and Bikenibeu. These are not major and they include:

- Sunshades at the Ministry of Fisheries
- Loose fibreboard at the rear of the old Powerhouse.
- AC guttering at the Kiribati Community Club.
- AC cladding at Bobotin Kiribati Ltd.
- Sunshade panels at the Ministry of Finance
- AC guttering at Bonriki International Airport.

Banaba Island is quite different and has very large deposits of badly decayed asbestos. Of the 26 samples analysed by the laboratory, asbestos fibres were detected in all 26 samples analysed. Ther is a major clean-up needed on Banaba. Chrysotile fibres were detected in 23 of the 26 samples with percentages reported between 7 – 95%, amosite detected in four samples at percentages between 10 – 95% and crocidolite was detected in eight of the 26 samples at concentrations between 2 – 5%.

No fibres were detected in either of the two air samples collected on the island of Banaba.

A detailed interim report was prepared for Banaba and this is contained in Appendix 7.

The picture is quite different with residences, however, and the survey indicates that possibly 29% of the houses in Kiribati (excluding Banaba, which is a special case) may contain asbestos building materials in some form or other. For example the KHC has identified that there are 133 houses in Betio and South Tarawa that contain asbestos exterior wall claddings or as ceiling materials or both.

The table below provides a summary of the Kiribati census data and the survey data collected during this assessment.

Statistical Summary

2010 Census Data				Survey Data	
	Population	**Land area (sq km)**	**No of Households**	**No. of Households Surveyed**	**No. of Households ACM Suspected**
National Total	103,058	726	16,043	750	244
Population included in survey					
Banaba	295	6.3	57	52	42
South Tarawa	34,427	14.1	4,728	498	125

Betio	15,755	1.7	1,977	200	77
Potential Survey Total	50,477	22.1	6,762	-	-
	49%	3%	42%	-	-

The survey sample size was based upon a 95% confidence level and 3.5% margin of error. With 16,043 households across the nation and 6,762 within the survey area the number of houses to be surveyed in order to ensure a statistically representative number of households, and also to allow estimates to be made, was 710. In fact 750 properties were surveyed including 52 on Banaba.

Based on the 750 properties surveyed, 202 were suspected of containing PACM, excluding the 42 identified in Banaba. Based on the number of properties surveyed and the statistical approach adopted, an estimate with a 95% level of confidence of the properties within the surveyed area (i.e. 6,705 households in Betio and South Tarawa) to be constructed of asbestos containing material is approximately 1,940 +/- 3.5%. If this estimate is extrapolated to include the outer islands (i.e. 15,986 households - not including Banaba) then the potential number of households to contain ACM is approximately 4,626 +/- 3.5%, the figure of 29% is arrived at for the total households in the nation.

Such an extrapolation is speculative, however, and is an indication only. Residential buildings encountered on the main Island of Kiribati are likely to differ significantly from those on the outer islands.

Survey Methodology

The survey work undertaken in Kiribati included meetings with key government agencies, area-wide surveys of residential properties, and targeted investigations of public and commercial buildings.

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

The survey sample size was based upon a 95% confidence level and 3.5% margin of error. With 16,043 households across the nation and 6,762 within the survey area the number of houses to be surveyed in order to ensure a statistically representative number of households, and also to allow estimates to be made, was 710. In fact 750 properties were surveyed including 52 on Banaba.

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.

Cost Estimates

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

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

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

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

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

A summary of the recommended actions and estimated costs for Kiribati is included in the Table below.

Remedial Cost Estimates for South Tarawa, Kiribati

Location	Remedial work	Area (m2)	Unit Cost	Total Cost ($US)	Risk Ranking
Kiribati MELAD, Bairiki	Loose fibre board	60	71	4260	24
Kiribati MELAD, Bairiki	Vinyl floor tiles	120	87	10440	21
Ministry of Fisheries, Bairiki	Guttering	20	71	1420	23
Ministry of Finance, Betio	Sunshades and facades	200	71	14200	21
Bonriki International Airport	Guttering	40	71	2840	21
Kiribati Community Club, Bairiki	Guttering	20	71	1420	17
The Old Powerhouse	Loose fibre board	50	71	3550	16
Bobotin Kiribati Limited (BKL)	Exterior wall panel	20	23	460	15
Bobotin Kiribati Limited (BKL)	Roof down-pipe	16	71	1136	15

The disposal method for Kiribati's asbestos wastes also needs to be determined. The preference would be for disposal on South Tarawa in the landfill, but South Tarawa is low-lying with a high groundwater and ensuring permanent coverage may be difficult. It could be buried in a special lined cell and covered with concrete, assuming a suitable site for the cell could be obtained.

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 Kiribati although they would be expensive options. Export from Kiribati to another country would be viable and probably Brisbane in Australia would provide a suitable destination although shipping routes would need to be confirmed and obtaining Waigani consents for transit ports may be difficult and time-consuming.

Shipping costs for a container of asbestos from Nauru to Brisbane for disposal have been calculated at $US768/tonne including disposal to the Remondis Landfill in Brisbane. There is a direct route from Nauru to Brisbane and a much higher shipping volume than from Kiribati to Brisbane, so a safe figure from Kiribati to Brisbane would be about 1.5 times that figure or $US1150/tonne, which would be $19,550 per container, plus the cost of the container. If a figure of $25,000 per container is chosen then this would be a reasonable estimate.

It is very difficult to estimate the costs for carrying out asbestos remediation work on Banaba as the costings developed of the rest of the Pacific are unlikely to have much relevance due to the numerous logistical difficulties. These include:

- No regular shipping route.
- No airfield
- No local support structure
- No ready available accommodation or food.
- No suitable local disposal

It is recommended that a detailed feasibility study is carried out to undertake the necessary asbestos remediation work, with options developed and detailed costings linked to the options. Is it in turn difficult to even estimate the cost of such a feasibility study but with the transport and accommodation difficulties it may be around $30,000 - $50,000. This could be reduced with assistance from the Kiribati Government, and this assistance will probably be forthcoming.

Recommendations

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

a) It is recommended that the high and moderate priority asbestos work is carried out in South Tarawa and Betio as well as removal of all loose asbestos.
b) It would be huge project to remove the asbestos waste from Banaba and there would be numerous logistical difficulties. It is recommended that a further feasibility study is undertaken to determine the preferred options for undertaking the task and determining the costs of undertaking such a project.
c) It has been concluded that possibly 29% of houses in Kiribati (aside from Banaba) may have asbestos building materials in some form – mostly cladding. It is recommended that all houses with PACM on Kiribati 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 Kiribati 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 placement in a 20 ft shipping containers and export to Brisbane for disposal in the Remondis Landfill as another option
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 Kiribati 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

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.

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

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

Amosite: Brown or Grey Asbestos

Chrysotile: White Asbestos

Crocidolite: Blue Asbestos

PPE: Personal Protective Equipment

SMF: Synthetic Mineral Fibres

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.

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

Hazard: Is a potential to cause harm.

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

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

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

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

CEL: Contract Environmental Limited

SPREP: Secretariat of the Pacific Regional Environment Programme

GPS: Global Positioning System

EMS: EMS Laboratories Incorporated

MDHS100: Methods for the Determination of Hazardous Substances: Surveying, Sampling and Assessment of Asbestos-Containing Materials

MELAD: The Kiribati Ministry of Environment, Lands and Agricultural Development

1. Introduction

1.1 Purpose

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

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

The work was carried out by a consortium led by Contract Environmental Ltd and Geoscience Consulting (NZ) Ltd, under contract to the Secretariat of the Pacific Regional Environment Programme (SPREP), with funding provided by the European Union. The majority of information relating to the distribution of ACM in Kiribati was obtained in a field visit undertaken by Gareth Oddy between the 8th and 16th of August 2014 and was organised with the Kiribati Government and in particular through the Ministry of Environment, Lands and Agriculture Development (MELAD).

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 Report Content and Layout

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

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

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

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

Section 11 contains a review of Kiribati 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.

1.4 Background to Kiribati

Kiribati, officially the Republic of Kiribati, is an island nation in the central Pacific Ocean. The nation comprises 33 atolls and reef islands and one raised coral island, Banaba. They have a total land area of 800 square kilometres and are dispersed over 3.5 million square kilometres. Their spread straddles the equator and the International Date Line, although the Date Line is indented to bring the Line Islands in the same day as the Kiribati Islands. The permanent population is just over 100,000 (2011), half of whom live on Tarawa Atoll.

Kiribati became independent from the United Kingdom in 1979. The capital and now most populated area, South Tarawa, consists of a number of islets, connected by a series of causeways. These comprise about half the area of Tarawa Atoll.

There are a total of 21 inhabited islands in Kiribati. Kiribati is divided into three island groups, including a group that unites the Line Islands and the Phoenix Islands (ministry at London, Kiritimati) Island. The groups have no administrative function.

Each of the 21 inhabited island has a local council that takes care of the daily affairs. Tarawa Atoll has three councils: Betio Town Council, Te Inainano Urban Council (for the rest of South Tarawa) and Eutan Tarawa Council (for North Tarawa).

The island groups include:

- Gilbert Islands
- Phoenix Islands
- Line Islands.

Four of the former districts (including Tarawa) lie in the Gilbert Islands, where most of the country's population lives. Five of the Line Islands are uninhabited. The Phoenix Islands are uninhabited except for Kanton, and have no representation. Banaba itself is sparsely inhabited now. There is also a non-elected representative of the Banabans on Rabi Island in Fiji.

Banaba (or Ocean Island) is a raised-coral island. It was once a rich source of phosphates, but was mostly mined out before independence. The rest of the land in Kiribati consists of the sand and reef rock islets of atolls or coral islands, which rise only one or two metres above sea level.

Kiritimati (Christmas Island) in the Line Islands is the world's largest atoll.

The climate is pleasant from April to October, with predominant north-eastern winds and stable temperatures close to 30 °C. From November to March, western gales bring rain and occasional cyclones. Precipitation varies significantly between islands. For example, the annual average is 3,000 mm in the north and 500 mm in the south of the Gilbert Islands. Most of these islands are in the dry belt of the equatorial oceanic climatic zone and experience prolonged droughts.

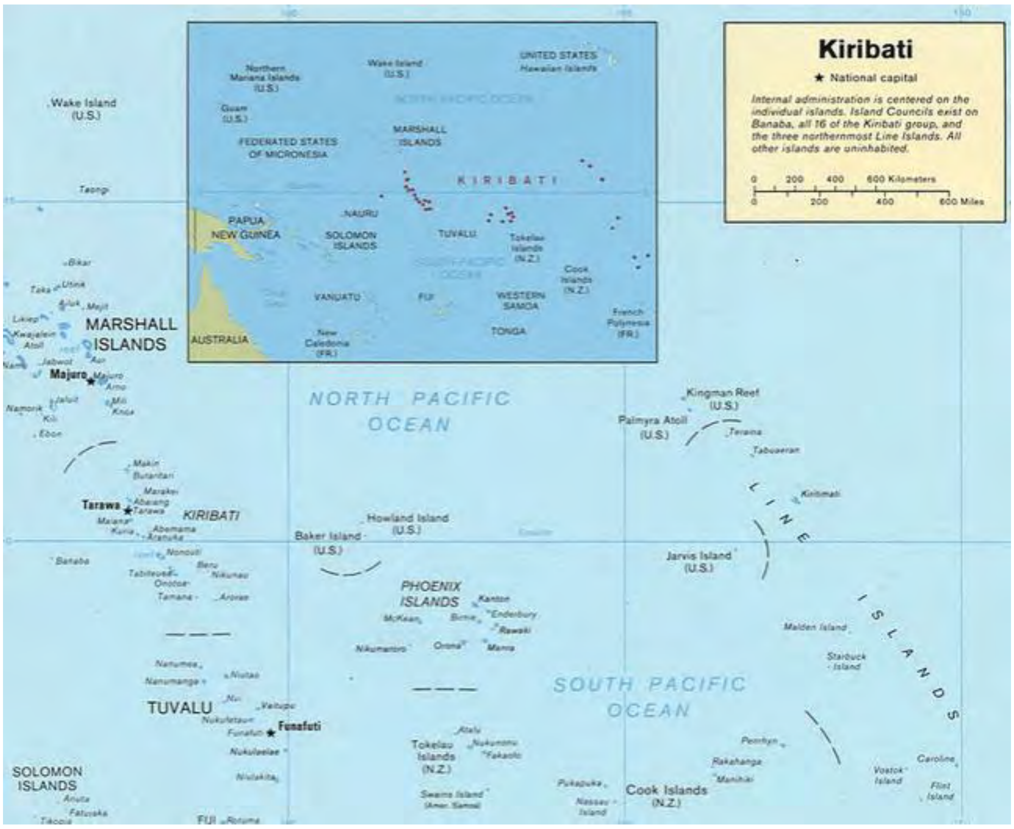

Figure 1 – Map of Kiribati

2.0 Survey Methodology

2.1 Pre-Survey Desk Study

The survey work undertaken during the visit to Kiribati included meetings with key government agencies, area-wide surveys across the Island of Tarawa and Banaba Island (Ocean Island) and specific investigations of 90 individual sites.

Prior to conducting the surveys and visiting Kiribati, 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 discuss and evaluate if the agencies were aware of any buildings where ACM was a concern. In addition, the consultation aimed to evaluate local regulations and practices with respect to ACM identification, removal and disposal practices.

Reports provided by the Government agencies on the distribution of asbestos or if available on specific sites, were reviewed by the survey team. Three reports relevant to this project were provided by the Kiribati Government. These reports were:

- MELAD, February 2008, prepared by PCU/ECD and MELAD, 'Brief Information Paper on Asbestos Use in Kiribati' (contained in Appendix 7);
- GHD, August 2008, 'Kiribati chemical and waste management advice and Banaba reconnaissance mission'; and,
- New Zealand Foreign Affairs, April 2013, 'Kiribati Solid Waste Management.

In addition a March 2009 paper was obtained regarding the *"Remediation of Kiritimati Island and the Challenges of Hazardous Waste Disposal to the United Kingdom from the Central Pacific"* by R. W. Kerr of Safety & Ecology Corporation Ltd, United Kingdom. This paper describes the work undertaken by Safety and Ecology Corporation Ltd (SEC) between 2005-2008 on Kiritimati Island (Christmas Island) to remove the remains of the legacies left after British nuclear testing. The legacy wastes included asbestos (pipework, building materials, loose fibrous asbestos etc. To quote from the paper:

> "All asbestos containing materials were removed using licensed asbestos sub-contractors from either the USA or the UK. In total, 383.4 metric tonnes of asbestos containing materials were removed from sites around the island. Where friable asbestos was encountered on the island, samples of soil were sent for analysis at a suitable laboratory abroad. If greater than 0.001% by weight asbestos was found then the ground was excavated until the remediation criteria had been satisfied."

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.

When population centres were identified a review of existing aerial photographs provided on Google Earth and where available, photographs that were geographically positioned included in Google Earth. 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 presumed 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 survey covered the islands of Banaba and Tarawa. In particular the Tarawa survey was restricted to South Tarawa and Betio due to the majority of historical development and population being located in these centres.

According to the Ministry of Finance and Economic Planning National Statistics Office, 2010 population census, Kiribati had a population of 103,058 in 2010 across the Republic's 21 inhabited islands. The population is housed in approximately 16,043 residential households with over a quarter of those households in South Tarawa.

Due to the large population of Kiribati spread over 21 inhabited islands, a survey of each residential household was not feasible in the timeframes and budget of the project. A statistical approach was therefore adopted to ensure a sufficient number of residential properties were included in the survey to allow a confident estimate of the number of houses with certain characteristics related to asbestos to be made.

Removal of British legacy ACM from Kiritimati Island (Christmas Island) from 2005 to 2008 is discussed in Section 2.1 above. Although a very large volume of legacy ACM was removed from the atoll, other unrelated ACM buildings may still be present on Kiritimati. Kiritimati was not covered by the survey.

The statistical approach adopted is a technique commonly used in household marketing surveys, political polls and the like. For a specified total population size you calculate the required sample numbers needed to give a target level of uncertainty, or conversely, you can determine the uncertainty level associated with an actual sample number.

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

2.3 Identification of Target Sites

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

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

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

During the initial day of the survey, the surveyor attended meetings with representatives from the Kiribati government department responsible for hazardous waste, MELAD. The representatives provided information regarding asbestos regulations, a report produced by MELAD in 2008 on 'Asbestos use in Kiribati' and potential state assets containing asbestos.

The MELAD (2008) report was reviewed and utilised by the survey team to locate and include government owned residential houses in the asbestos surveys. The report is provided in Appendix 7.

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

A total of 90 sites were surveyed in Kiribati to assess for the presence of ACM. This included 35 sites in South Tarawa and 55 in Banaba.

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

2.5.1 Sample Collection Methodology

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

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

- Permission was granted by the property owner;

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

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

The samples were collected in accordance with the following procedure;

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

As with any environmental assessment, sampling of a media, in this case building material, can vary over 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.

2.5.2 Air Sampling

Two air samples were taken at locations on the Island of Banaba. These locations were at places where exposure to people could be expected and where a significant amount of asbestos was present.

The air sampling pumps were hired from the New Zealand Air Monitoring Company CBL Air Monitoring Ltd. The pumps were all Gillian BDX II Abatement Air Samplers and they were set for a flow-rate of 2 litres/minute. They were all run for at least four hours and a careful record of the run time was kept. The air sampling pumps were placed on surfaces at approximately 1.5 metres above ground level and secured in place with tape. The sampler was located at the Banaba Hospital and at the Residential property No.18 where friable asbestos lagging on a boiler was suspected. Air filter cassettes were attached to the sampling pumps and after each sampling run the cassettes were sealed, labelled and double-bagged.

2.6 Sample Laboratory Analysis

2.6.1 Bulk Sample 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 below, and copies of the laboratory report are given in Appendix 4 of this report.

2.6.2 Air Sampling Analysis

The samples were sent by courier to Dowdell and Associates of Auckland, New Zealand and the results of these analyses are presented in Appendix 4.

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

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. The potential for exposure is much less 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 1 2 3	Rare disturbance activity (eg little used store room) Low disturbance activities (eg office type activity) Periodic disturbance (eg industrial or vehicular activity may contact ACMs) High levels of disturbance, (eg fire door with asbestos insulating board sheet in constant use)
Likelihood of disturbance Location	0 1 2 3	Outdoors Large rooms or well-ventilated areas Rooms up to 100 m2 Confined spaces
Accessibility	0 1 2 3	Usually inaccessible or unlikely to be disturbed Occasionally likely to be disturbed Easily disturbed Routinely disturbed
Extent/amount	0 1 2 3	Small amounts or items (eg strings, gaskets) <10 m2 or <10 m pipe run. >10 m2 to ≤50 m2 or >10 m to ≤50 m pipe run >50 m2 or >50 m pipe run
Human exposure potential Number of occupants	0	None

Assessment factor	Score	Examples of score variables
	1	1 to 3
	2	4 to 10
	3	>10
Frequency of use of area	0	Infrequent
	1	Monthly
	2	Weekly
	3	Daily
Average time area is in use	0	<1 hour
	1	>1 to <3 hours
	2	>3 to <6 hours
	3	>6 hours
Total		Out of 21

Each of the parameters is scored and added together to give a total score between 0 and 21. The setting score is then added to the ACM score to provide an overall score and risk rating in order to rank the sites in order of priority for management and/or remedial action. The scoring system is detailed in Table 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
7 – 9	11 - 15	17 – 23	Moderate risk
5 – 6	8 - 10	12 – 16	Low risk
0 – 4	0 – 7	0 – 11	Very low risk

4.0 Asbestos Survey

4.1 Residential Survey Coverage

The majority of residential dwellings observed were constructed using plywood or fibre board, concrete blocks and corrugated iron. Most shade houses were constructed using traditional materials consisting of tree branches as the pillars and woven palm fronds as the roof cladding. The residential properties containing fibre board external walls were the primary residential building type observed in Kiribati.

Information on the population distribution of Kiribati was provided by the 2010 population census produced by the Ministry of Finance and Economic Planning National Statistics Office. Kiribati has a population of 103,058 in 2010 across the Republics 21 inhabited islands. The population were reportedly housed in approximately 16,043 residential households with over a quarter of those households in South Tarawa. The survey of Kiribati focused on South Tarawa and the Island of Banaba.

Table 4 provides a summary of the Kiribati census data and the survey data collected during this assessment.

Table 4: Statistical Summary

2010 Census Data				Survey Data	
	Population	**Land area (sq km)**	**No of Households**	**No. of Households Surveyed**	**No. of Households ACM Suspected**
National Total	103,058	726	16,043	750	244
Population included in survey					
Banaba	295	6.3	57	52	42
South Tarawa	34,427	14.1	4,728	498	125
Betio	15,755	1.7	1,977	200	77
Potential Survey Total	50,477	22.1	6,762	-	-
	49%	3%	42%	-	-

The survey sample size was based upon a 95% confidence level and 3.5% margin of error. With 16,043 households across the nation and 6,762 within the survey area the number of houses to be surveyed in order to ensure a statistically representative number of households, and also to allow estimates to be made, was 710. In fact 750 properties were surveyed including 52 on Banaba.

4.2 Targeted Survey Coverage

Following consultation with MELAD a number of buildings were shortlisted for a more detailed assessment. These included buildings of sufficient age to have been constructed of ACM such as the former Tarawa Hospital, former power plant in Bikenibeu and an industrial property in Betio known as Bobotin Kiribati Limited (BKL).

The MELAD (2008) assessment report on the Kiribati Housing Corporation (KHC) owned residential housing, states several of the residential houses build in the 1970's contain ACM in exterior wall cladding or as ceiling materials. According to the report, there are 41 houses in each of the three main towns Betio, Bairiki and Bikenibeu known to contain ACM.

To collaborate the MELAD report and substantiate the findings, a number of the properties identified in the report in each Town were surveyed and a selection of those sampled to assess for the presence of asbestos.

MELAD also provided their 2008 report which provided a number of residential properties in which to target to verify the data provided in the report.

The remainder of the survey consisted of visits to government buildings, including those which were likely to be frequented by large numbers of individuals. The buildings included (but were not limited to) schools, hospitals and healthcare centres, libraries, research centres, government administration buildings, power stations and waste disposal facilities. The specific sites visited in Tarawa are listed in Table 5.

Table 5: Specific Sites Surveyed in Tarawa Kiribati.

Site Name	Date of Assessment	Suspected PACM?	Samples Collected of PACM?
1. Former Tarawa Hospital	08/08/2014	Yes	Yes (KT01)
2. School and Centre for Children with Special Needs	08/08/2014	No	No
3. Kiribati Ministry of Fisheries, Betio	08/08/2014	Yes	Yes (KT02 & KT04)
4. Kiribati MELAD, Betio	08/08/2014	Yes	Yes (KT03 & KT05)
5. Kiribati National Library and Archives	08/08/2014	Yes	Yes (KT06)
6. KGV School	08/08/2014	Yes	Yes (KT07 – KT10)
7. Kiribati National Tourism Office	08/08/2014	No	No
8. Eita Gas Station	08/08/2014	No	No
9. The Old Powerhouse (Bikenibeu)	08/08/2014	Yes	Yes (KT11)
10. Kiribati Community Club	08/08/2014	Yes	Yes (KT12)
11. Betio Hospital	09/08/2014	No	No
12. Betio Power House	09/08/2014	No	No
13. P.U.B. Electrical Workshop	09/08/2014	No	No
14. Betio Sports Stadium	09/08/2014	No	No
15. Kiribati Institute of Technology (KIT)	09/08/2014	Yes	Yes (KT13 & KT14)
16. Bobotin Kiribati Limited (BKL)	09/08/2014	Yes	Yes (KT15 & KT16)
17. Betio Town (Numerous Sites)	09/08/2014	Yes	Yes (KT17)
18. Red Beach Primary School	09/08/2014	No	No
19. Betio Landfill	09/08/2014	No	No
20. Betio Housing Estate – E-Grade 2 Storey	09/08/2014	No	No
21. Betio Police Station	09/08/2014	No	No
22. Kiribati Fish	09/08/2014	No	No
23. Bairiki Town (Numerous Sites)	16/08/2014	Yes	No

Site Name	Date of Assessment	Suspected PACM?	Samples Collected of PACM?
24. E45a Bairiki Residential	16/08/2014	Yes	No
25. E49a Bairiki Residential	16/08/2014	Yes	Yes (KT18)
26. E50a Bairiki Residential	16/08/2014	Yes	Yes (KT19 & KT20)
27. E51a Bairiki Residential	16/08/2014	Yes	No
28. E52a Bairiki Residential	16/08/2014	Yes	No
29. E53a Bairiki Residential	16/08/2014	Yes	No
30. Bairiki Shopping Centre	16/08/2014	No	No
31. ANZ Bairiki	16/08/2014	No	No
32. Ministry of Finance, Betio	16/08/2014	Yes	No
33. Taaken Bairiki Primary School	16/08/2014	No	No
34. USP Kiribati Campus	16/08/2014	No	No
35. Bonriki International Airport	17/08/2014	Yes	No

Table 6: Specific Sites Surveyed on Banaba Island, Kiribati.

Site Name	Date of Assessment	Suspected PACM?	Samples Collected of PACM? (sample ID)
36. Warehouse 01	12/08/2014	Yes	Yes (KB01)
37. Warehouse 02	12/08/2014	Yes	No
38. Abandoned House 1	12/08/2014	Yes	No
39. Abandoned House 2	12/08/2014	Yes	No
40. Abandoned House 3	12/08/2014	Yes	No
41. Abandoned House 4	12/08/2014	Yes	No
42. Former Power House	12/08/2014	Yes	Yes (KB02, KB03)
43. Hospital	12/08/2014	Yes	Yes (KB04, KB05, KB06)
44. The Restaurant	12/08/2014	Yes	Yes (KB07)
45. Warehouse 03	12/08/2014	Yes	Yes (KB08)
46. Warehouse 04	12/08/2014	Yes	Yes (KB09)
47. Residential House 1	12/08/2014	Yes	No
48. Residential House 2	12/08/2014	Yes	No
49. Residential House 3	12/08/2014	Yes	No
50. Residential House 4	12/08/2014	Yes	No
51. Residential House 5	12/08/2014	Yes	No
52. The Guest House	12/08/2014	Yes	No
53. Vice Majors House	12/08/2014	Yes	No
54. Banaba Captains Arms	12/08/2014	Yes	No
55. Aarons Camp	12/08/2014	Yes	Yes (KB10)
56. Warehouse07	12/08/2014	Yes	Yes (KB11)
57. SDA Church	12/08/2014	Yes	Yes (KB12)
58. Former Workers Accommodation	12/08/2014	Yes	Yes (KB13)
59. Residential 16	12/08/2014	Yes	Yes (KB14)
60. Workshop	12/08/2014	Yes	Yes (KB15)
61. Mechanics	13/08/2014	Yes	No
62. Mechanics Stockpile	13/08/2014	Yes	Yes (KB16)
63. Boat sheds	13/08/2014	Yes	Yes (KB17)
64. Warehouse 6	13/08/2014	Yes	Yes (KB18)
65. Warehouse 5	13/08/2014	Yes	Yes (KB19)
66. Meeting House 1	13/08/2014	Yes	Yes (KB20)
67. Meeting House 2	13/08/2014	Yes	Yes (KB21)
68. Former BPC Processing Plant	13/08/2014	Yes	Yes (KB22)
69. Fatima Residential	13/08/2014	Yes	Yes (KB23)
70. Primary School	13/08/2014	Yes	Yes (KB24)

Site Name	Date of Assessment	Suspected PACM?	Samples Collected of PACM? (sample ID)
71. Junior Secondary School	13/08/2014	Yes	No
72. Residential 7	13/08/2014	Yes	No
73. Residential 8	13/08/2014	Yes	No
74. Residential 9	13/08/2014	Yes	No
75. Residential 10	13/08/2014	Yes	No
76. Residential 11	13/08/2014	Yes	No
77. Residential 12	13/08/2014	Yes	No
78. Residential 13	13/08/2014	Yes	No
79. Residential 14	13/08/2014	No	No
80. Residential 15	13/08/2014	No	No
81. Residential 16	13/08/2014	Yes	No
82. Residential 17	13/08/2014	Yes	No
83. Residential 18	13/08/2014	Yes	Yes (KB25, KB26)
84. Residential 19	13/08/2014	Yes	No
85. Residential 20	13/08/2014	Yes	No
86. Banaba Radio Station	13/08/2014	No	No
87. Banaba Police Station	13/08/2014	Yes	No
88. Salination Plant	13/08/2014	Yes	No
89. Council Buildings	13/08/2014	Yes	No
90. Catholic Church	13/08/2014	Yes	No

5.0 Laboratory Results and Findings

5.1 Laboratory Results

A total of 20 samples of suspected asbestos containing material were collected in the South Tarawa survey from 12 individual sites. Laboratory analysis confirmed asbestos present at 8 of the 12 sites. A total of 55 sites were surveyed in Banaba and PACM identified at 52 sites. Samples of PACM were collected at 22 sites and asbestos detected by laboratory analysis at all of the sites.

A summary of the laboratory analytical results is provided in Table 7 while the full laboratory report is provided in Appendix 4 of this report.

Table 7: Sample Analytical Results

Site Name		Sample Name(s)	Sample Description/ Building Material Type	Asbestos Type and %
Tarawa, Kiribati	Former Tarawa Hospital	KT01	Vinyl floor tile	Not detected
	Kiribati Ministry of Fisheries, Bairiki	KT02	Sun shades/facades	Chrysotile 15%
		KT04	Concrete guttering	Chrysotile 15%
	Kiribati MELAD, Bairiki	KT03	Loose fibre board (sun shades)	Chrysotile 10% Amosite 10%
		KT05	Vinyl floor tile	Chrysotile 2%
	Kiribati National Library and Archives, Bairiki	KT06	Vinyl floor tile	Not detected
	KGV School	KT07	Clinic roof tile	Not detected
		KT08	Library vinyl floor tile	Not detected
		KT09	1st floor fibreboard ceiling (loose)	Not detected
		KT10	Classroom exterior fibre board	Not detected
	The Old Powerhouse	KT11	Loose fibre board (rear of property)	Chrysotile 15% Amosite 10%
	Kiribati Community Club, Bairiki	KT12	Loose concrete guttering	Chrysotile 15%
	Kiribati Institute of Technology	KT13	Vinyl floor – former building	Not detected
		KT14	Cement roof	Not detected
	Bobotin Kiribati Limited (BKL)	KT15	Exterior wall panel	Chrysotile 15%
		KT16	Roof down pipe	Chrysotile 20%
	Betio Town (Numerous Sites)	KT17	Loose concrete tile	Chrysotile 15% Amosite 7%
	E49a Bairiki Residential	KT18	Loose fibre board (external & internal panels)	Chrysotile 15% Amosite 5%
	E50a Bairiki Residential	KT19	Fibre board wall - front	Chrysotile 15% Amosite 5%
		KT20	Fibre board wall joiners	Chrysotile 60%
Banaba Island, Kiribati	Warehouse 01	KB01	Loose pacm	Amosite 20%
	Former Power House	KB02	Rope Lagging	Chrysotile 85%
		KB03	Wall Panels	Chrysotile 7% Amosite 20%
	Hospital	KB04	Internal wall panel	Chrysotile 25%
		KB05	Loose pacm, guttering/drains	Chrysotile 20% Crocidolite 5%
		KB06	Roof	Chrysotile 25%
	The Restaurant	KB07	Front Porch Pillars	Chrysotile 20%
	Warehouse 03	KB08	Loose pacm	Chrysotile 10%
	Warehouse 04	KB09	Loose pacm	Chrysotile 20%

	Site Name	Sample Name(s)	Sample Description/ Building Material Type	Asbestos Type and %
	Aarons Camp	KB10	Loose pacm	Chrysotile 7%
	Warehouse07	KB11	Roof loose acm	Chrysotile 20% Crocidolite 2%
	SDA Church	KB12	External wall panel	Chrysotile 10%
	Former Workers Accommodation	KB13	Louvre	Chrysotile 15%
	Residential 16	KB14	Pacm under house (loose)	Chrysotile 10%
	Workshop	KB15	Louvre	Chrysotile 20% Crocidolite 5%
	Mechanics Stockpile	KB16	Pacm sheets	Chrysotile 20% Crocidolite 5%
	Boat sheds	KB17	Roof loose pacm	Chrysotile 20% Crocidolite 5%
	Warehouse 06	KB18	Wall panel	Chrysotile 20%
	Warehouse 5	KB19	Roof loose pacm	Chrysotile 20% Crocidolite 2%
	Meeting House 1	KB20	Roof loose pacm	Chrysotile 20%
	Meeting House 2	KB21	Roof loose pacm	Chrysotile 20% Crocidolite 2%
	BPC Former Phosphate Processing Plant	KB22	Roof sheeting loose	Chrysotile 20%
	Fatima Residential	KB23	East wall – external	Crocidolite 5% Amosite 10%
	Primary School	KB24	Classroom external wall	Chrysotile 15%
	Residential 18	KB25	Boiler rope lagging on pipework	Chrysotile 95%
		KB26	Boiler insulation	Amosite 95%

Some of the above locations are presented in the photos below

Photo 1 shows sunshades at the Ministry of Fisheries and Photo 2 shows loose – Old Powerhouse – loose fibreboard at the rear of the old Powerhouse.

Photo 1 – Ministry of Fisheries

Photo 2 – Rear of Old Powerhouse

Photo 3 below shows the AC guttering at the Kiribati Community Club. Photo 4 below shows AC cladding at Bobotin Kiribati Ltd.

Photo 3 – Kiribati Community Club **Photo 4 – Bobotin Kiribati Ltd**

Photo 5 below shows the sunshade panels at the Ministry of Finance and Photo 6 shows the AC guttering at Bonriki International Airport.

Photo 5 – Ministry of Finance **Photo 6 – Bonriki Airport**

The Photos 7 - 22 below are from the visit to Banaba

Photo 7: Banaba Hospital; Damaged ACM roof sheets and loose ACM

Photo 8: Banaba Hospital – ACM Roof

Photo 9: Warehouse 4; fire damaged structure previously containing PACM. Site covered in ACM fragments. Public roadway in background.

Photo 10: Warehouse 4; view of ACM debris

Photo 11: Banaba former power house. ACM Roof

Photo 12: Catholic Church in Fatima village with ACM Roof

Photo 13: Residential property 18, boilers with ACM lagging

Photo 14: Banaba school, ACM roof and cladding on brick building.

Photo 15: Former phosphate processing plant. In disrepair with significant ACM scattered across entire site.

Photo 16: Former phosphate processing plant. View towards hoppers at rear

Photo 17: Former mechanical repair workshop building with no cladding or roof

Photo 18: Adjacent and down gradient of former mechanical repair workshop building

Photo 19: ACM stockpile behind mechanics to south

Photo 20: ACM stockpile behind mechanics to south

Photograph 21: Warehouse 7 by wharf – another badly damaged building with ACM scattered across site.

Photo 22: Warehouse 3 – badly damaged ACM roof and walls.

5.2 Residences

The MELAD Report in Appendix 7 has been taken into account in determining how many residences have asbestos. This report examined houses owned by the Kiribati Housing Company (KHC) that were first constructed in the early 1970's. Based on this data obtained from each of the KHC branches in Betio, Bairiki and Bikenibeu, there are 51, 41 and 41 houses consecutively that have asbestos materials used as exterior wall claddings or as ceiling materials or both. That is 133 houses in Betio and South Tarawa.

Table 8 provides a summary of the Kiribati census data and the survey data collected during this assessment.

Table 8: Statistical Summary

2010 Census Data				Survey Data	
	Population	**Land area (sq km)**	**No of Households**	**No. of Households Surveyed**	**No. of Households ACM Suspected**
National Total	103,058	726	16,043	750	244
Population included in survey					
Banaba	295	6.3	57	52	42
South Tarawa	34,427	14.1	4,728	498	125

2010 Census Data				Survey Data	
Betio	15,755	1.7	1,977	200	77
Potential Survey Total	50,477	22.1	6,762	-	-
	49%	3%	42%	-	-

The survey sample size was based upon a 95% confidence level and 3.5% margin of error. With 16,043 households across the nation and 6,762 within the survey area the number of houses to be surveyed in order to ensure a statistically representative number of households, and also to allow estimates to be made, was 710. In fact 750 properties were surveyed including 52 on Banaba.

Based on the 750 properties surveyed, 244 of them were suspected of containing PACM. This included 42 out of a total of 52 properties surveyed on the island of Banaba suspected to contain ACM roofing, drains and/or asbestos cement cladding. The remaining 202 households suspected of containing ACM were randomly surveyed in Betio, Bairiki and Bikenibeu.

The suspected ACM in the 202 properties predominately included a fibre cement exterior cladding observed to be similar in appearance and material properties (i.e. strength, thickness and damage characteristics) to those observed on the MELAD properties where asbestos was reported and since corroborated by this survey.

Given the small number (57) of households in Banaba, this sample population was excluded from the remaining South Tarawa sample population size to avoid the estimate being unbalanced and biased. This left a total of 698 houses surveyed. Based on the number of properties surveyed and the statistical approach adopted, an estimate with a 95% level of confidence of the properties within the surveyed area (i.e. 6,705 households in Betio and South Tarawa) to be constructed of asbestos containing material is approximately 1,940 +/- 3.5%. Based on the survey, all these houses are included because of PACM cladding. It should be noted, however, that the MELAD Report in Appendix 7 also said that AC fibre board was used extensively for ceilings. In addition it was noted that the houses on Banaba had asbestos roofs.

If this estimate is extrapolated to include the outer islands (i.e. 15,986 households - not including Banaba) then the potential number of households to contain ACM is approximately 4,626 +/- 3.5% or 29% of the total households in the nation.

Such an extrapolation is speculative, however, and is an indication only. Residential buildings encountered on the main Island of Kiribati are likely to differ significantly from those on the outer islands. As the survey did not visit the outer islands (the exception being Banaba), confirmation is needed that the findings on Tarawa can be assumed for the other islands.

Another limitation of the extrapolation is that the survey results are based largely on visual observations of the exterior of the residential buildings. The assumption that the building material may contain ACM has been based on comparisons to the material encountered at the government owned residential properties which appeared to be of a similar age and construction to the 202 properties identified. Some of the cladding may not be asbestos but some other form of fibre cement board. Photos 23-26 below show typical houses in South Tarawa with fibre cement cladding.

Photos 23-26: Typical South Tarawa Houses

5.3 Air Monitoring

Airborne asbestos is monitored using NIOSH Method 7400 (NIOSH is the US National Institute for Occupational Safety and Health). The method involves drawing a measured volume of air through a 25 millimetre diameter membrane filter to collect the airborne dust and fibres. The filters are then sent to a laboratory for analysis.

The Table 9 below shows the Air Monitoring Results obtained from Dowdells.

Table 9: Air Monitoring Results

Lab Sample No	Location	Fibres Counted	Respirable Fibres in Air
		(Fibres/100 Fields)	(Fibres/ml Air
K7277	Former Banaba Hospital	0	<0.01
K7278	Banaba Residential	0	<0.01

5.4 Comments on the Results

As Table 7 presents, ssbestos fibres, including chrysotile and amosite, were identified in ACM building materials at eight of 12 sites sampled and assessed. The percentages of fibres detected ranged from 2 – 60%.

The percentages of fibres detected ranged from 2 – 60%.

Apart from residences there were only a few locations where asbestos building materials were detected in Betio, Bairiki and Bikenibeu. These are not major and they include:

- Sunshades at the Ministry of Fisheries
- Loose fibreboard at the rear of the old Powerhouse.
- AC guttering at the Kiribati Community Club.
- AC cladding at Bobotin Kiribati Ltd.
- Sunshade panels at the Ministry of Finance
- AC guttering at Bonriki International Airport.

Banaba Island is quite different and has very large deposits of badly decayed asbestos. Of the 26 samples analysed by the laboratory, asbestos fibres were detected in all 26 samples analysed. Ther is a major clean-up needed on Banaba. Chrysotile fibres were detected in 23 of the 26 samples with percentages reported between 7 – 95%, amosite detected in four samples at percentages between 10 – 95% and crocidolite was detected in eight of the 26 samples at concentrations between 2 – 5%.

No fibres were detected in either of the two air samples collected on the island of Banaba.

A detailed interim report was prepared for Banaba and this is contained in Appendix 6.

The picture is quite different with residences, however, and the survey indicates that possibly 29% of the houses in Kiribati (excluding Banaba, which is a special case) may contain asbestos building materials in some form or other. For example the KHC has identified that there are 133 houses in Betio and South Tarawa that contain asbestos exterior wall claddings or as ceiling materials or both.

6.0 Risk Assessment

6.1 Tarawa, Kiribati Prioritisation of Sites

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.

Table 9: Risk Ranking Scores – Tarawa, Kiribati

Site Name	Building Material Type	Asbestos Type and %	Risk Ranking Scores		
			ACM	Setting	Total Score
E49a Bairiki Residential	Loose fibre board (external & internal panels)	Chrysotile 15% Amosite 5%	5	19	24
Government owned residential housing	Fibre board cladding	Assumed Amosite	5	19	24
E50a Bairiki Residential	Fibre board wall – front	Chrysotile 15% Amosite 5%	5	19	24
	Fibre board wall joiners	Chrysotile 60%	4	19	23
Kiribati MELAD, Bairiki	Loose fibre board (sun shades)	Chrysotile 10% Amosite 10%	7	14	21
	Vinyl floor tiles (internal offices)	Chrysotile 2%	6	17	23
Kiribati Ministry of Fisheries, Bairiki	Sun shades/facades	Chrysotile 15%	6	15	21
	Concrete guttering	Chrysotile 15%			
Ministry of Finance, Betio	External sunshades and facades	Assumed Amosite	7	14	21
Bonriki International Airport	Guttering	Assumed Amosite	5	12	17
Kiribati Community Club, Bairiki	Loose concrete guttering	Chrysotile 15%	6	10	16
The Old Powerhouse	Loose fibre board (rear of property)	Chrysotile 15% Amosite 10%	7	8	15
Bobotin Kiribati Limited (BKL)	Exterior wall panel	Chrysotile 15%	5	10	15
	Roof down pipe	Chrysotile 20%			
Betio Town (Numerous Sites)	Loose concrete tile	Chrysotile 15% Amosite 7%	7	7	14

6.2 Banaba Island, Kiribati Prioritisation of Sites

Table 10, details the risk ranking scores for the properties surveyed in Banaba.

Table 10: Risk Ranking Scores – Banaba Island, Kiribati

Site Name	Building Material Type	Asbestos Type and %	Risk Ranking Scores		
			ACM	Setting	Total Score
Residential 18	Boiler rope lagging on pipework	Chrysotile 95%	12	16	28
	Boiler insulation	Amosite 95%			
Hospital	Internal wall panel	Chrysotile 25%	8	20	28
	Loose pacm, guttering/drains	Chrysotile 20%, Crocidolite 5%			
	Roof	Chrysotile 25%			
Primary School	Classroom external wall	Chrysotile 15%	6	19	25
Fatima Residential	East wall – external	Crocidolite 5%, Amosite 10%	8	16	24
Junior/Secondary School	Roof and wall cladding	Assumed Amosite	7	16	23
Residential Houses 1 - 20	Roofs	Assumed Amosite	5 – 7	15 – 16	20 – 23
Mechanics	Former AC roof and walls	Assumed Amosite	7	15	22
Meeting House 2	Roof loose pacm	Chrysotile 20%, Crocidolite 2%	8	14	22
Captains Arms (Wharf)	Roof	Assumed Amosite	6	16	22
Meeting House 1	Roof loose pacm	Chrysotile 20%	6	16	22
The Guest House	Sun shades and windows	Assumed Amosite	5	16	21
Former Workers Accommodation	Louvre	Chrysotile 15%	6	15	21
SDA Church	External wall panel	Chrysotile 10%	5	16	21
Council Office Building	Cladding	Assumed Amosite	5	16	21
Fatima Catholic Church	Roof	Assumed Amosite	4	14	18
Police Station	Roof Facades	Assumed Amosite	4	13	17
Former Power House	Rope Lagging	Chrysotile 85%	11	5	16
	Wall Panels	Chrysotile 7%, Amosite 20%			
Boat sheds	Roof loose pacm	Chrysotile 20%, Crocidolite 5%	7	9	16
Warehouse 4	PACM – roof	Assumed Amosite	7	7	14
Workshop	Louvre	Chrysotile 20%, Crocidolite 5%	8	5	13
Warehouse 5	Roof loose pacm	Chrysotile 20%, Crocidolite 2%	8	5	13
Warehouse 7	Roof loose acm	Chrysotile 20%, Crocidolite 2%	8	5	13
The Restaurant	Front Porch Pillars	Chrysotile 20%	4	8	12
Warehouse 1	Loose pacm	Amosite 20%	7	5	12
Warehouse 6	Wall panel	Chrysotile 20%	6	5	11
BPC Former Phosphate Processing Plant	Roof sheeting loose	Chrysotile 20%	6	5	11
Abandoned Houses 1-3	Roofs	Assumed Amosite	5	5	10
Warehouse 3	Loose pacm	Chrysotile 10%	6	4	10
Warehouse 4	Loose pacm	Chrysotile 20%	6	4	10
Mechanics Stockpile	Pacm whole sheets	Chrysotile 20%, Crocidolite 5%	7	3	10
Aarons Camp	Loose pacm	Chrysotile 7%	6	1	7

The risk assessment scoring presented in Table 10 above indicates that there are some moderate to high risk ACM sites, but because the buildings are unoccupied, exposure is likely to be minimal and the setting and overall risk score is low to very low. However, the majority of the former phosphate industrial buildings on Banaba are abandoned, with no security fences and access is unrestricted.

During the surveys, local children were observed playing in or adjacent to badly damaged properties containing ACM. Although the final score for these sites indicates that risk is low to very low this is assuming the properties do not have any long term occupants. Should access remain unrestricted, the ACM should be removed to ensure exposure is minimised to those who may enter the sites.

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 2 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 2: ACM Management Flow Chart

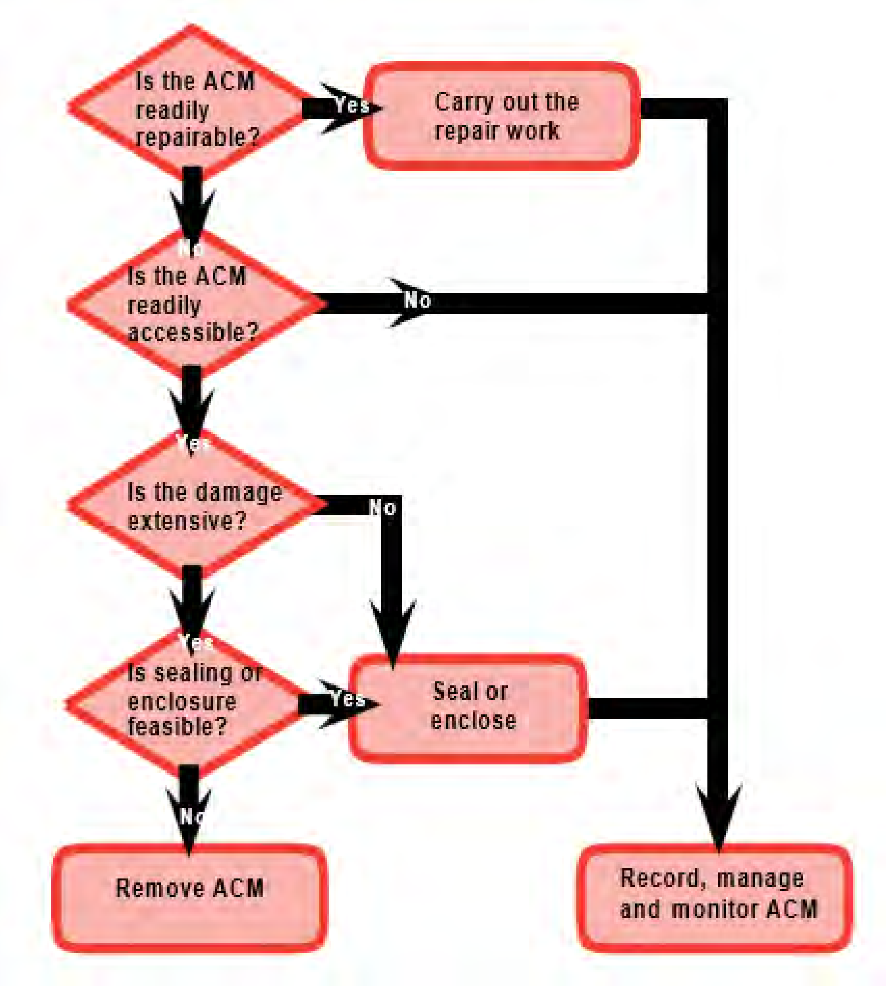

Figure adapted from; UKHSE HSG227 'A Comprehensive Guide to Managing Asbestos in Premises'.

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 27 & 28 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 27 & 28: 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 Kiribati

Following this flow chart process, the most suitable, cost effective possible remedial options are presented in Table 11.

Table 11: Possible Remedial Options – South Tarawa, Kiribati

Site Name	Building Material Type	Asbestos Type and %	Risk Score	Applicable Remedial Options			
				Repair	Isolate	Encapsulate	Remove
E49a Bairiki Residential	Loose fibre board (external & internal panels)	Chrysotile 15% Amosite 5%	24	✓	✗	✓	✓
Government owned residential housing	Fibre board cladding	Assumed Amosite	24	✓	✗	✓	✓
E50a Bairiki Residential	Fibre board wall – front	Chrysotile 15% Amosite 5%	24	✓	✗	✓	✓
	Fibre board wall joiners	Chrysotile 60%	23	✓	✗	✓	✓
Kiribati MELAD, Bairiki	Loose fibre cement (sun shades)	Chrysotile 10% Amosite 10%	21	✗	✗	✗	✓
	Vinyl floor tiles (internal offices)	Chrysotile 2%	23	✗	✗	✗	✓
Kiribati Ministry of Fisheries, Bairiki	Sun shades/facades	Chrysotile 15%	21	✗	✗	✗	✓
	Concrete guttering	Chrysotile 15%		✗	✗	✗	✓
Ministry of Finance, Bairiki	External sunshades and facades	Assumed Amosite	21	✗	✗	✗	✓
Bonriki International Airport	Concrete guttering	Assumed Amosite	17	✗	✗	✗	✓
Kiribati Community Club, Bairiki	Loose concrete guttering	Chrysotile 15%	16	✗	✗	✗	✓
The Old Powerhouse	Loose fibre board (rear of property)	Chrysotile 15% Amosite 10%	15	✗	✓	✗	✓
Bobotin Kiribati Limited (BKL)	Exterior wall panel	Chrysotile 15%	15	✗	✓	✓	✓
	Roof down pipe	Chrysotile 20%		✗	✗	✗	✓
Betio Town (Numerous Sites)	Loose concrete tile	Chrysotile 15% Amosite 7%	14	✗	✗	✗	✓

Table 12: Possible Remedial Options –Banaba Island, Kiribati

Site Name	Building Material Type	Asbestos Type and %	Risk Score	Applicable Remedial Options			
				Repair	Isolate	Encapsulate	Remove
Residential 18	Boiler rope lagging on pipework	Chrysotile 95%	28	✗	✗	✗	✓
	Boiler insulation	Amosite 95%		✗	✗	✗	✓
Hospital	Internal wall panel	Chrysotile 25%	28	✗	✗	✗	✓
	Loose pacm, guttering/drains	Chrysotile 20%, Crocidolite 5%		✗	✗	✗	✓
	Roof	Chrysotile 25%		✗	✗	✗	✓
Primary School	Classroom external wall	Chrysotile 15%	24	✗	✓	✗	✓
Junior/Secondary School	Roof and wall cladding	Assumed Amosite	24	✗	✓	✗	✓
Fatima Residential	East wall – external	Crocidolite 5%, Amosite 10%	24	✗	✓	✗	✓
Residential Houses 1 - 20 (excl No.18)	Roofs	Assumed Amosite	20 – 23	✗	✗	✗	✓
Mechanics	Former AC roof and walls	Assumed Amosite	22	✗	✗	✗	✓
Meeting House 2	Roof loose pacm	Chrysotile 20%, Crocidolite 2%	22	✗	✗	✗	✓
Captains Arms (Wharf)	Roof	Assumed Amosite	22	✗	✗	✓	✓
Meeting House 1	Roof loose pacm	Chrysotile 20%	22	✗	✗	✗	✓
The Guest House	Sun shades and windows	Assumed Amosite	21	✗	✗	✓	✓
Former Workers Accommodation	Louvre	Chrysotile 15%	21	✗	✗	✗	✓
SDA Church	External wall panel	Chrysotile 10%	21	✗	✗	✗	✓
Council Office Building	Cladding	Assumed Amosite	21	✗	✗	✗	✓
Fatima Catholic Church	Roof	Assumed Amosite	18	✗	✗	✗	✓
Police Station	Roof Facades	Assumed Amosite	17	✗	✗	✓	✓
Former Power House	Rope Lagging	Chrysotile 85%	16	✗	✗	✗	✓
	Wall Panels	Chrysotile 7%, Amosite 20%		✗	✗	✗	✓
Boat sheds	Roof loose pacm	Chrysotile 20%, Crocidolite 5%	16	✗	✗	✗	✓
Warehouse 4	PACM – roof	Assumed Amosite	14	✗	✗	✗	✓
Workshop	Louvre	Chrysotile 20%, Crocidolite 5%	13	✗	✓	✗	✓
Warehouse 5	Roof loose pacm	Chrysotile 20%, Crocidolite 2%	13	✗	✓	✗	✓
Warehouse 7	Roof loose acm	Chrysotile 20%, Crocidolite 2%	13	✗	✓	✗	✓
The Restaurant	Front Porch Pillars	Chrysotile 20%	12	✓	✗	✗	✓
Warehouse 1	Loose pacm	Amosite 20%	12	✗	✓	✗	✓
Warehouse 6	Wall panel	Chrysotile 20%	11	✗	✓	✗	✓
BPC Former Phosphate Processing Plant	Roof sheeting loose	Chrysotile 20%	11	✗	✓	✗	✓
Abandoned Houses 1-3	Roofs	Assumed Amosite	10	✗	✓	✗	✓
Warehouse 3	Loose pacm	Chrysotile 10%	10	✗	✓	✗	✓

Site Name	Building Material Type	Asbestos Type and %	Risk Score	Applicable Remedial Options			
				Repair	Isolate	Encapsulate	Remove
Warehouse 4	Loose pacm	Chrysotile 20%	10	✗	✓	✗	✓
Mechanics Stockpile	Pacm whole sheets	Chrysotile 20%, Crocidolite 5%	10	✗	✗	✗	✓
Aarons Camp	Loose pacm	Chrysotile 7%	7	✓	✗	✗	✓

8.6 Preferred Remedial Strategy

In the majority of sites presented in Tables 11 and 12, the asbestos is either friable or is damaged asbestos concrete material beyond repair. Encapsulation or isolation of these types of asbestos is not considered a suitable long term strategy, therefore removal of the ACM is the preferred remedial method.

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 13 below.

Table 13: 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 Kiribati

The disposal method for Kiribati’s asbestos wastes also needs to be determined. The preference would be for disposal on South Tarawa in the landfill, but South Tarawa is low-lying with a high groundwater and ensuring permanent coverage may be difficult. It could be buried in a special lined cell and covered with concrete, assuming a suitable site for the cell could be obtained.

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 Kiribati although they would be expensive options.

Disposal at sea would require permits under the London 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 Kiribati and may be unacceptable to customary law that operates in Kiribati. The process of obtaining permits would also be expensive as there would be a need to carry out expensive and detailed investigations before permits could be obtained.

Export from Kiribati to another country would be viable and probably Brisbane in Australia would provide a suitable destination although shipping routes would need to be confirmed and obtaining Waigani consents for transit ports may be difficult and time-consuming.

Shipping costs for a container of asbestos from Nauru to Brisbane for disposal have been calculated at $US768/tonne including disposal to the Remondis Landfill in Brisbane. There is a direct route from Nauru to Brisbane and a much higher shipping volume than from Kiribati to Brisbane, so a safe figure from Kiribati to Brisbane would be about 1.5 times that figure or $US1150/tonne, which would be $19,550 per container, plus the cost of the container. If a figure of $25,000 per container is chosen then this would be a reasonable estimate.

10.0 Cost Considerations

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

10.1 Encapsulation

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

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

<u>Roof Encapsulation</u>

Costs:

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

Assumptions:

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

<u>Cladding Encapsulation</u>

Costs:

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

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

Assumptions:

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

10.2 Removal and Replacement

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

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

<u>Roof Removal and Replacement</u>

Cost:

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

Assumptions:

- Rates assume that the existing roofs are replaced with Colourbond Ultra grade roof sheeting (for sea spray environments) with 50mm of foil coated fibreglass insulation (to address heat issues).
- Rates have been built up based on a roof of a single storey building with a floor area of 14m x 12m with a roof pitch of 30 degrees. Extra will be required for scaffolding for buildings greater than 1 storey high.
- Rates assume that work is done in a tradesman like fashion to New Zealand or Australian standards, including compliance with applicable safety requirements relating to working at height and working with asbestos.

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

Cladding Removal and Replacement

Costs:

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

Assumptions:

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

Table 14: 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 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 added as an extra.

10.3 Local Contractors

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

During discussions with Kiribati Government officials and several potential contractors identified it was apparent that there were no in-country contractors who regularly worked in the asbestos removal/repair field and would be considered suitable without basic initial training.

10.4 Indicative Cost Information

Difficulties in obtaining local costs for services include a lack of understanding regarding the concept of day rates. Contractors are unable to provide day rates for casual labour or the use of a truck and driver as they didn't know what the rates were. One contractor provided a formal quote for the completion of a painting project was provided with no breakdown of how the costs were calculated. The cost of materials was obtained by contacting the local hardware store.

Local costs obtained from Kiribati are summarised in Table 15.

Table 15: Costs of Materials in Kiribati

Item	Cost (US$)
Rubberised acrylic primer	$115 per 5 Gal
Rubberised acrylic exterior finish	$70 to $115 per 5 Gal
Landfill Disposal	No charge

Indicative day rates for labour as well as truck and driver obtained in other Pacific Island Countries have been provided in the absence of Kiribati rates. The rates are provided as an indicative guide to potential costs and exclude personal protective equipment and other consumables required during asbestos removal/repair work. The rates are summarised in Table 16.

Table 16: Indicative Rates – Contractors

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

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

Several buildings in Banaba are former industrial buildings related to the phosphate mining and processing on the Island. Further stakeholder discussions should be undertaken to determine if the buildings can and should be retained and therefore have the ACM removed and replaced. If the building structures are significantly damaged and the buildings are no longer required, the removal of ACM should be undertaken to prevent its further damage and distribution around the site.

The scope would need to be defined on a site by site basis and based on consultation with all of the properties stakeholders. However a building contractor firm operating in several South Pacific nations has stated that costs to remove and replace ACM with iron cladding could vary from $80 - $280 USD / m^2.

11.0 Review of Kiribati Policies and Legal Instruments

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

11.1 National Laws and Regulations

Discussions with representatives from MELAD indicated that no regulations specific to asbestos have been developed. The Environment Act 1999 (as amended in 2007) lays the framework for environment protection in Kiribati however there are no separate provisions for management of hazardous wastes. The current legislative review is likely to address some of the requirements with respect to hazardous wastes.

There is also no current legislation to ban the importation of asbestos building materials for sale. This is becoming important as this survey project has identified asbestos building materials for sale in Pacific countries.

11.2 National Strategies and Policies

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

11.3 International Conventions

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

Kiribati has accepted the Basel Convention and has amended the Environment Act (1999) definition of waste to reflect this. Asbestos is included as a hazardous waste. Under the Basel Convention, every state has the right to ban the entry and disposal of foreign hazardous waste and other wastes in its territory. Should ACM be removed from the identified buildings, options for disposal could include transporting it to international disposal facilities if it is concluded that disposal within Kiribati would not be an appropriate location.

Kiribati is Party to the London Convention but not the London Dumping Protocol. Should disposal at sea be considered for the ACM in Kiribati, the requirements of the Convention will need to be met.

Kiribati is also a party to the Waigaini Convention.

12.0 Recommended Actions for Minimising Asbestos Exposures

12.1 Discussion

ACM has been identified by this study to be present at numerous residential locations in Kiribati. Firstly there are approximately 133 properties in South Tarawa that are considered high risk with regards to the occupant's potential exposure to asbestos. The 133 properties are the KHC owned residential properties. This conclusion is based on the MELAD (2008) report, observations and sample analysis results of a limited number of the properties and refers to asbestos exterior wall claddings or ceiling materials or both. In fact the survey indicates that possibly 29% of the houses in Kiribati (excluding Banaba, which is a special case) may contain asbestos building materials in some form or other.

Apart from residences the incidence of asbestos in South Tarawa and Betio is quite low. There are four moderate risk sites identified including the Bonriki International Airport and Government owned offices and Library in Bairiki. The remaining sites identified are considered to present a low to very low risk to human health. Management of the low risk sites will be required to ensure the risk to human health is not elevated further as the buildings condition deteriorates with age.

The volume of the ACM identified in Banaba Island is substantial and the numerous buildings were significantly damaged or derelict. As the majority of the buildings are unoccupied, the risk to the public health may not be that high, although undoubtedly the small Banaba population is vulnerable, especially children who play around the abandoned buildings.

The quantities of asbestos-containing materials observed at the sites were used to estimate costs for abatement. This was achieved by estimating the amount of time and materials required to abate the source and multiplying the time by rates received from contractors and amount of asbestos-containing materials identified.

Remediation of sites has been prioritised based on the level of risk posed to the building occupants and public at each site according to the methodology described in Section 3.

A summary of the recommended actions, estimated time and materials and estimated costs are included in Tables 16 below.

Table 16: Remedial Cost Estimates for South Tarawa, Kiribati

Location	Remedial work	Area (m2)	Unit Cost	Total Cost ($US)	Risk Ranking
Kiribati MELAD, Bairiki	Loose fibre board	60	71	4260	24
Kiribati MELAD, Bairiki	Vinyl floor tiles	120	87	10440	21
Ministry of Fisheries, Bairiki	Guttering	20	71	1420	23
Ministry of Finance, Betio	Sunshades and facades	200	71	14200	21
Bonriki International Airport	Guttering	40	71	2840	21
Kiribati Community Club, Bairiki	Guttering	20	71	1420	17
The Old Powerhouse	Loose fibre board	50	71	3550	16
Bobotin Kiribati Limited (BKL)	Exterior wall panel	20	23	460	15

Bobotin Kiribati Limited (BKL)	Roof down-pipe	16	71	1136	15

The disposal method for Kiribati's asbestos wastes also needs to be determined. The preference would be for disposal on South Tarawa in the landfill, but South Tarawa is low-lying with a high groundwater and ensuring permanent coverage may be difficult. It could be buried in a special lined cell and covered with concrete, assuming a suitable site for the cell could be obtained.

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 Kiribati although they would be expensive options. Export from Kiribati to another country would be viable and probably Brisbane in Australia would provide a suitable destination although shipping routes would need to be confirmed and obtaining Waigani consents for transit ports may be difficult and time-consuming.

Shipping costs for a container of asbestos from Nauru to Brisbane for disposal have been calculated at $US768/tonne including disposal to the Remondis Landfill in Brisbane. There is a direct route from Nauru to Brisbane and a much higher shipping volume than from Kiribati to Brisbane, so a safe figure from Kiribati to Brisbane would be about 1.5 times that figure or $US1150/tonne, which would be $19,550 per container, plus the cost of the container. If a figure of $25,000 per container is chosen then this would be a reasonable estimate.

It is very difficult to estimate the costs for carrying out asbestos remediation work on Banaba as the costings developed of the rest of the Pacific are unlikely to have much relevance due to the numerous logistical difficulties. These include:

- No regular shipping route.
- No airfield
- No local support structure
- No ready available accommodation or food.
- No suitable local disposal

It is recommended that a detailed feasibility study is carried out to undertake the necessary asbestos remediation work, with options developed and detailed costings linked to the options. Is it in turn difficult to even estimate the cost of such a feasibility study but with the transport and accommodation difficulties it may be around $US30,000 - $50,000. This could be reduced with assistance from the Kiribati Government, and this assistance will probably be forthcoming.

12.2 Recommendations

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

A. It is recommended that the high and moderate priority asbestos work is carried out in South Tarawa and Betio as well as removal of all loose asbestos.
B. It would be huge project to remove the asbestos waste from Banaba and there would be numerous logistical difficulties. It is recommended that a further feasibility study is undertaken to determine the preferred options for undertaking the task and determining the costs of undertaking such a project.
C. It has been concluded that possibly 29% of houses in Kiribati (aside from Banaba) may have asbestos building materials in some form – mostly cladding. It is recommended that all houses

with PACM on Kiribati 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 Kiribati 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 placement in a 20 ft shipping containers and export to Brisbane for disposal in the Remondis Landfill as another option
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 Kiribati 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, Kiribati
- Sub-region C, (Melanesia):
  Fiji, Solomon Islands, Vanuatu
- Sub-region D, (Polynesia):
  Cook Islands, Niue, Samoa, Tonga, Tuvalu

Objective

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

Scope of Work

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

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

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

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

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

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

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

Project Deliverables

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

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

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

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

Project Timeframe

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

Appendix 2: Organisational Details and List of Contacts

A2.1 Organisational Details

The visit to Kiribati took place from Thursday 7th to Sunday 17th August 2014. The consultant was Gareth Oddy of Geoscience Consulting. They were based in South Tarawa but also visited the island of Banaba from the evening of Sunday 10th to the evening of Friday 15th August.

The primary agency for liaison was the Kiribati MELAD, and the following personnel were involved:

Nenenteiti Teariki-Ruatu, Director for Environment & Conservation Division (ECD) of MELAD;

Mr. Tiimi Kaiekieki, Secretary of MELAD;

Mr. Farran Redfern, Environment Inspector of MELAD;

Mr. Taulehia Pulefou, Pollution Control Officer of MELAD;

Mr. Kautu Tekanene, Pollution Control Officer of MELAD;

In addition, correspondence with the Ministry of Public Works & Utilities (MPWU) was undertaken in order to identify potentially suitable contractors;

Teuea Tebau, MPWU

The MELAD officers were very helpful and provided considerable support during the visit especially on the visit to Banaba Island. Full contact details are given below for all those who assisted during the survey and subsequent reporting.

A2.2 List of Contacts

Nenenteiti Teariki-Ruatu
Environment and Conservation Division
Ministry of Environment, Lands and Agricultural Division
P O Box 234, Bikenibeu, Tarawa, KIRIBATI
Phone; 686 28000/28425, email; nenenteitir@environment.gov.ki.

Taulehia Pulefou (Mr.)
Environment and Conservation Division
Ministry of Environment, Lands and Agricultural Division
P O Box 234, Bikenibeu, Tarawa, KIRIBATI
Phone; 686 28000/28425, email; jc132766@gmail.com, mobile; 686 61933.

Farran Redfern (Mr.)
Environment and Conservation Division
Ministry of Environment, Lands and Agriculture Development
P.O.Box 234, Bikenibeu, Tarawa, KIRIBATI
Phone: 686 28211/28425/28000, email; farranredfern@gmail.com, mobile: 686 96444.

Kautu Tekanene (Mr.)
Environment and Conservation Division
Ministry of Environment, Lands and Agriculture Development
P.O.Box 234, Bikenibeu, Tarawa, KIRIBATI
Phone: 686 28211/28425/28000, email; kautut@environment.gov.ki, mobile: 686 95045.

Appendix 3: Summaries of in-Country Discussions

Farran Redfern, MELAD

MELAD and specifically Farran Redfern and Taulehia Pulefou are responsible for chemicals and waste management matters including asbestos at national level for the Kiribati Government. The Chemical and Waste Management Unit (CWMU) of MELAD is responsible for monitoring pollution and improving solid and hazardous waste management.

Asbestos is managed under the regulations to prohibit the discharge of hazardous substances. However, specific regulations regarding asbestos are proposed and are in the process of being drafted. A copy of the draft regulations or draft waste management plan was not available for review at the time of writing.

Mr Redfern provided the MELAD (2008) report of the asbestos materials within properties owned by the National Housing Corporation (NHC) and previously provided the GHD hazardous waste assessment of Banaba Island. Mr Redfern was not aware of any other reports relating to asbestos within the nation.

Taulehia Pulefou, MELAD

Mr Pulefou provided details on buildings of sufficient age to warrant further investigation as to the potential for ACM to be present.

Appendix 4: Laboratory Reports

DOWDELL & ASSOCIATES LTD

OCCUPATIONAL HEALTH ANALYSTS & CONSULTANTS

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

17th September 2014

Geoscience Consulting
PO Box 373
Christchurch 8140

Attention: Gareth Oddy

Re : Airborne Fibre Concentration

Place of Measurement	:	Banaba Hospital - Kiribati
Monitoring Conducted By	:	Geoscience Consulting – 11178 Kiribati
Sampling Date	:	Not given
Laboratory No.	:	58238
Sample Type	:	Static Background Air Monitoring
Asbestos Type	:	Unspecified
Method	:	[NOHSC: 3003 (2005)] – Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres – 2nd Edition

Measuring Positions Reg No : K7277 – Banaba Hospital K7278 – Banaba Boiler - Resi

Sample Registration No.	K7277	K7278
Sample Time (minutes)	240	2480
Flow Rate (mL/min)	1980	1980
Fibre Counts (fibres/100 fields)*	0	0
Respirable Fibre in Air (fibre/mL) *1	<0.01	<0.01
Detection Limit (fibres/mL) (based on a count of 10 fibres/100 fields)	0.01	0.01

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

Yours faithfully
DOWDELL & ASSOCIATES LTD

R.Nicholson
Analyst/Consultant

Laura Sands
Occupational Hygienist

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

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

CUSTOMER:	Contract Environmental 119 Johnson Rd. West Melton Christchurch NZ	PAGE #:	1 of 6
		REPORT #:	0162533
		PROJECT:	PLM ANALYSIS
CONTACT:	John O'Grady	DATE COLLECTED:	08/08/2014
REFERENCE:	Sprep kiribati	COLLECTED BY:	
METHOD:	EPA 600/R-93/116	DATE RECEIVED:	08/26/2014
		ANALYSIS DATE:	08/26/2014

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	(%)
0162533-001 KT1	LAYER 1 Floor Tile, Blue, Homogeneous, Solid, melt, non-friable Note: 29°C, 1.55 Oil	LAYER 1 95%	None Detected		Non-Fibrous Material	100%
	LAYER 2 Mastic, Yellow, Homogeneous, Sticky, melt, non-friable Note: 29°C, 1.55 Oil	LAYER 2 5%	None Detected		Non-Fibrous Material	100%
0162533-002 KT2	Gray, Non-homogeneous, Granular, crush, non-friable Note: 29°C, 1.55 Oil	LAYER 1 100%	Chrysotile	15%	Non-Fibrous Material	85%
0162533-003 KT3	Gray, Non-homogeneous, Granular, crush, non-friable Note: 29°C, 1.55 Oil	LAYER 1 100%	Chrysotile Amosite	10% 10%	Non-Fibrous Material	80%
0162533-004 KT4	Gray, Non-homogeneous, Granular, crush, non-friable	LAYER 1 100%	Chrysotile	15%	Non-Fibrous Material	85%
0162533-005 KT5	Floor Tile, Green, Homogeneous, Solid, melt, non-friable Note: 29°C, 1.55 Oil	LAYER 1 100%	Chrysotile	2%	Non-Fibrous Material	98%
0162533-006 KT6	Floor Tile, Beige, Homogeneous, solid, melt, non-friable Note: 26°C, 1.55 Oil	LAYER 1 100%	None Detected		Non-Fibrous Material	100%

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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	(%)
0162533-007 KT7	Gray, Non-homogeneous, Granular, acid, non-friable Note: 28°C, Acid	LAYER 1 100%	None Detected		Non-Fibrous Material	100%
0162533-008 KT8	FloorTile, Gray, Homogeneous, Solid, melt, non-friable	LAYER 1 100%	None Detected		Non-Fibrous Material	100%
0162533-009 KT9	White, Homogeneous, Granular, acid, non-friable Note: 27°C, Acid	LAYER 1 100%	None Detected		Non-Fibrous Material	100%
0162533-010 KT10	Gray, Homogeneous, Fibrous, tease, non-friable Note: 27°C, 1.55 Oil	LAYER 1 100%	None Detected		Cellulose Fiber Non-Fibrous Material	80% 20%
0162533-011 KT11	Blue/Gray, Non-homogeneous, Granular, crush, non-friable Note: 27°C, 1.55, 1.68 Oil	LAYER 1 100%	Chrysotile Amosite	15% 10%	Non-Fibrous Material	75%
0162533-012 KT12	Gray, Non-homogeneous, Granular, crush, non-friable Note: 27°C, 1.55 Oil	LAYER 1 100%	Chrysotile	15%	Cellulose Fiber Non-Fibrous Material	20% 65%
0162533-013 KT13	Floor Tile, White, Homogeneous, Solid, melt, non-friable Note: 27°C, 1.55 Oil	LAYER 1 100%	None Detected		Non-Fibrous Material	100%
0162533-014 KT14	Cement, Gray, Non-homogeneous, Granular, crush, non-friable Note: 27°C, Acid	LAYER 1 100%	None Detected		Non-Fibrous Material	100%
0162533-015 KT15	Wall Panel, Gray, Non-homogeneous, Granular, crush, non-friable Note: 27°C, 1.55 Oil	LAYER 1 100%	Chrysotile	15%	Non-Fibrous Material	85%

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	119 Johnson Rd. West Melton	REPORT #:	0162533
	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	(%)
0162533-016 KT16	Gray, Non-homogeneous, Granular, crush, non-friable Note: 27°C, 1.55 Oil	LAYER 1 100%	Chrysotile	20%	Non-Fibrous Material	80%
0162533-017 KT17	Gray, Non-homogeneous, Granular, crush, non-friable Note: 27°C, 1.55 Oil	LAYER 1 100%	Chrysotile Amosite	15% 7%	Non-Fibrous Material	78%
0162533-018 KT18	Gray, Non-homogeneous, Granular, crush, non-friable Note: 27°C, 1.55 Oil	LAYER 1 100%	Chrysotile Amosite	15% 5%	Cellulose Fiber Non-Fibrous Material	2% 78%
0162533-019 KT19	Gray, Non-homogeneous, Granular, crush, non-friable Note: 27°C, 1.55 Oil	LAYER 1 100%	Chrysotile Amosite	15% 3%	Non-Fibrous Material	82%
0162533-020 KT20	Gray, Non-homogeneous, Fibrous, tease, non-friable Note: 26°C, 1.55 Oil	LAYER 1 100%	Chrysotile	60%	Non-Fibrous Material	40%
0162533-021 KB01	Gray, Non-homogeneous, Granular, crush, non-friable Note: 26°C, 1.55 Oil	LAYER 1 100%	Amosite	20%	Non-Fibrous Material	80%
0162533-022 KB02	Gray, Non-homogeneous, Granular, crush, friable Note: 26°C, 1.55 Oil	LAYER 1 100%	Chrysotile	85%	Non-Fibrous Material	15%
0162533-023 KB03	Gray, Non-homogeneous, Solid, crush, non-friable Note: 28°C, 1.55 Oil	LAYER 1 100%	Chrysotile Amosite	7% 20%	Non-Fibrous Material	73%
0162533-024 KB04	Gray, Non-homogeneous, Solid, acid, non-friable Note: 28°C, 1.55 Oil	LAYER 1 100%	Chrysotile	25%	Non-Fibrous Material	75%

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	(%)
0162533-025 KB05	Gray, Non-homogeneous, Granular, crush, non-friable Note: 26°C, 1.56 Oil	LAYER 1 100%	Chrysotile Crocidolite	20% 5%	Non-Fibrous Material	75%
0162533-026 KB06	Gray, Non-homogeneous, Fibrous, tease, non-friable Note: 26°C, 1.55 Oil	LAYER 1 100%	Chrysotile	25%	Non-Fibrous Material	75%
0162533-027 KB07	Gray, Non-homogeneous, Granular, crush, non-friable Note: 26°C, 1.55 Oil	LAYER 1 100%	Chrysotile	20%	Non-Fibrous Material	80%
0162533-028 KB08	Gray, Non-homogeneous, Granular, crush, non-friable	LAYER 1 100%	Chrysotile	10%	Non-Fibrous Material	90%
0162533-029 KB09	Gray, Non-homogeneous, Granular, crush, non-friable Note: 26°C, 1.55 Oil	LAYER 1 100%	Chrysotile	20%	Non-Fibrous Material	80%
0162533-030 KB10	Gray, Non-homogeneous, Granular, crush, non-friable Note: 26°C, 1.55 Oil	LAYER 1 100%	Chrysotile	7%	Non-Fibrous Material	93%
0162533-031 KB11	Gray, Non-homogeneous, Granular, crush, non-friable Note: 26°C, 1.55 Oil	LAYER 1 100%	Chrysotile Crocidolite	20% 2%	Non-Fibrous Material	78%
0162533-032 KB12	Brown, Non-homogeneous, Granular, crush, non-friable Note: 27°C, 1.55 Oil	LAYER 1 100%	Chrysotile	10%	Non-Fibrous Material	90%
0162533-033 KB13	White/Pink, Non-homogeneous, Granular, crush, non-friable Note: 26°C, 1.55 Oil	LAYER 1 100%	Chrysotile	15%	Non-Fibrous Material	85%

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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	(%)
0162533-034 KB14	White/Pink, Non-homogeneous, Solid, crush, non-friable Note: 27°C, 1.55 Oil	LAYER 1 100%	Chrysotile	10%	Cellulose Fiber Non-Fibrous Material	20% 70%
0162533-035 KB15	Gray, Non-homogeneous, Granular, crush, non-friable Note: 26°C, 1.55 Oil	LAYER 1 100%	Chrysotile Crocidolite	20% 5%	Non-Fibrous Material	75%
0162533-036 KB16	Gray, Non-homogeneous, Granular, crush, non-friable Note: 27°C, 1.55 Oil	LAYER 1 100%	Chrysotile Crocidolite	20% 5%	Non-Fibrous Material	75%
0162533-037 KB17	Gray, Non-homogeneous, Granular, crush, non-friable Note: 27°C, 1.55 Oil	LAYER 1 100%	Chrysotile Crocidolite	20% 5%	Non-Fibrous Material	75%
0162533-038 KB18	Gray, Non-homogeneous, Granular, crush, non-friable Note: 27°C, 1.55 Oil	LAYER 1 100%	Chrysotile	20%	Non-Fibrous Material	80%
0162533-039 KB19	Gray, Non-homogeneous, Granular, crush, non-friable Note: 27°C, 1.55 Oil	LAYER 1 100%	Chrysotile Crocidolite	20% 2%	Non-Fibrous Material	78%
0162533-040 KB20	Gray, Non-homogeneous, Granular, crush, non-friable Note: 27°C, 1.55 Oil	LAYER 1 100%	Chrysotile	20%	Non-Fibrous Material	80%
0162533-041 KB21	Gray, Non-homogeneous, Granular, crush, non-friable Note: 27°C, 1.55 Oil	LAYER 1 100%	Chrysotile Crocidolite	20% 2%	Non-Fibrous Material	78%
0162533-042 KB22	Gray, Non-homogeneous, Granular, crush, non-friable Note: 27°C, 1.55 Oil	LAYER 1 100%	Chrysotile	20%	Non-Fibrous Material	80%

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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	(%)
0162533-043 KB23	Gray, Non-homogeneous, Granular, crush, non-friable Note: 28°C, 1.55 Oil	LAYER 1 100%	Crocidolite Amosite	15% 10%	Non-Fibrous Material	75%
0162533-044 KB24	Gray, Non-homogeneous, Granular, crush, non-friable Note: 28°C, 1.55 Oil	LAYER 1 100%	Chrysotile	15%	Cellulose Fiber Non-Fibrous Material	20% 65%
0162533-045 KB25	Gray, Homogeneous, Fibrous, tease, non-friable Note: 28°C, 1.55 Oil	LAYER 1 100%	Chrysotile	95%	Non-Fibrous Material	5%
0162533-046 KB26	White, Homogeneous, Fibrous, tease, non-friable Note: 28°C, 1.55 Oil	LAYER 1 100%	Amosite	95%	Non-Fibrous Material	5%

Analyst - Wesene Sebhat

Approved Signatory Laboratory Director

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

NVLAP Lab Code: [illegible]

Appendix 5: Build Up to Costs for Remediation Options

Four scenarios have been costed:

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

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

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

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

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

Central Meridian Quote

central meridian INC

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

02.12.14

Quotation: 6814

Mr John O'Grady
Contract Environmental Ltd.

Cost estimates to undertake various asbestos removal work.

Dear John,

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Yours truly,

Paul Finch
Central Meridian Inc.

Build up to Encapsulation of Asbestos Roofing

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

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

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

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

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

After removal of ceiling materials vacuum clean all the inside of the premises with a vacuum cleaner with HEPA filter. Then vacuum the underside of the existing roof sheeting and all 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

Appendix 6: Interim Banaba Report

Banaba, Kiribati

Asbestos Assessment undertaken on 12 & 13 August 2014

1. Introduction

The visit to Banaba was undertaken as part of the asbestos component of the EU/SPREP PacWaste Project. This asbestos work covers 11 countries with the first stage of work including an assessment of asbestos arisings and a prioritised list of local best practice options for management. The visit was made by staff from the New Zealand consultants Geoscience Consulting Ltd (GCL) working with Contract Environmental Ltd (CEL) whom have been engaged to carry out the first stage work.

2. Initial Asbestos Survey

A boat charter was organised by the Kiribati Government Environment and Conservation Division, Ministry of Environment, Lands and Agriculture Development. The boat left Tarawa on Sunday 10th August at 20:30 and arrived in Banaba at mid-day Tuesday 12th August. The initial survey was conducted by Gareth Oddy of Geoscience commencing at approximately 12:30pm on Tuesday 12 August and concluding at approximately 16:00 on Wednesday 13th August. The return boat journey arrived back in Tarawa 2 days later at around 17:00 on Friday 15th August 2014.

The survey included a review of the external building cladding and internal building material easily accessible and visible to the surveyors. During the surveys, the building construction was noted, photographs, approximate measurements and samples where possible taken.

The majority of the buildings on the island were surveyed, with approximately thirty of the buildings present, sampled, where possible.

Photographs of the building discussed in this letter are presented in Attachment 1;

Figure 1: Banaba Island

Figure 2: SE Banaba

The former British Phosphate Company (BPC) buildings are in a very poor condition with possible asbestos containing material (pacm) super six sheet observed at the majority visibly damaged with small fragments and fines scattered across the sites. One in particular (Warehouse 4, photograph 3 & 4) appears to have suffered fire damage and pacm sheets and pieces are scattered across the site. Other BPC buildings appear to have had whole pacm sheets removed with sheets observed on more recent structures, so the pacm is being re-used and damaged further in the process.

The current school buildings, hospital and majority of residential properties contain what appear to be pacm roofs as well. The hospital contains nine former wards, each around 30m long by 13m wide. All nine have pacm roofs in various conditions. There was a significant volume of loose pacm at the hospital site (See Photograph 1 & 2). Some of the former wards appear to have been converted to residential properties and so an air monitoring kit for sampling was set up here.

One residential property with large garage/extension also housed two boilers with what appears to be friable pacm lagging on one boiler and also insulating rope on the pipework (Photograph 7). The boilers appeared to be very old and given the proximity to residential properties the decision was also made to conduct air sampling here.

A stockpile of what appears to be pacm sheets and pipes were discovered in scrub behind the former mechanics workshop (Photographs 13 & 14) in addition to the former roof and walls of the workshop building which have been deposited down the bank (Photograph 12).

A preliminary estimate on volumes of pacm easily exceeds 1,000m3. There are currently no landfills on the island, domestic waste is simply deposited in any of the closest mining depressions. There is one council owned flat-bed truck which could be utilised however no earth moving machinery. The islands population is around 400. No formal asbestos removal contractors are registered in Kiribati.

There was unfortunately insufficient time to survey potentially suitable disposal locations outside of the main centres.

3. Discussion and Recommendations

Given the poor condition of asbestos at the former BPC sites close to the main public road on Banaba and the unrestricted access to the sites, public exposure to asbestos fibres is likely. The results of the asbestos air and bulk sampling are currently outstanding.

The majority of the residential properties on Banaba also appear to have asbestos roofing material in mixed condition. Information on the hazard posed by asbestos could be circulated to the homeowners so that maintenance can be conducted in a safe manner if and when required.

We recommend that access to the BPC sites is restricted if possible to prevent further potential exposure to the public to asbestos fibres. Access to the site should be restricted with areas containing acm barricaded off until it can be all safely removed by a trained and competent asbestos removal contractor.

Following the closure of the site, work should begin to decontaminate the sites of acm and asbestos fibres by an asbestos removal contractor experienced in asbestos decontamination.

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

To prevent exposure to asbestos fibres, all staff involved handling of acm material and those working within the building should wear respiratory protection. At a minimum this shall include masks with a minimum P2 level of particulate protection. Half face respirators with P3 asbestos fibre filters shall also be made available for workers where required.

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

Once the results of the survey are available, then a detailed asbestos removal plan should be prepared and implemented without delay. It is acknowledged that this work will be difficult, given the problems with access to Banaba.

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

Gareth Oddy
Senior Environmental Scientist

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

Photograph 1: Banaba Hospital; Damaged acm roof sheets and loose acm

Photograph 2: Banaba Hospital – acm roof.

Photograph 3: Warehouse 4; fire damaged structure previously containing pacm. Site covered in acm fragments. Public roadway in background.

Photograph 4: Warehouse 4; view of pacm debris.

Photograph 5: Banaba former power house. pacm roof.

Photograph 6: Catholic Church in Fatima village with pacm roof.

Photograph 7: Residential property 18, boilers with pacm lagging.

Photograph 8: Banaba school, pacm roof and cladding on pink building.

Photograph 9: Former phosphate processing plant. In disrepair with significant pacm scattered across entire site.

Photograph 10: Former phosphate processing plant. View towards hoppers at rear.

Photograph 11: Former mechanical repair workshop building with no cladding or roof.

Photograph 12: Adjacent and down gradient of former mechanical repair workshop building.

Photograph 13: pacm stockpile behind mechanics to south.

Photograph 14: pacm stockpile behind mechanics to south.

Photograph 15: Warehouse 7 by wharf – another badly damaged building with acm scattered across site.

Photograph 16:Warehouse 3 – badly damaged pacm roof and walls.

Appendix 7: Brief Information Paper on Asbestos Use in Kiribati – MELAD

Brief Information Paper on Asbestos Use in Kiribati.

Prepared by PCU/ECD
Ministry of Environment, Lands and Agriculture Development
(MELAD)

27th February, 2008

1. Introduction.

The purpose of this brief report is to provide MELAD Administration with background information on potential human health risks posed by asbestos fibres when people are being exposed to them. The concern with asbestos use and presence in Kiribati was first raised and discussed at the last parliament session held in Nov/Dec 2007 in which MELAD and other concerned Ministries were requested to investigate the presence of asbestos in Kiribati including its health impacts.

The scope of this report will not investigate all types of imported products into Kiribati to determine whether these products have asbestos in them but rather focus mainly on building materials used by KHC in all of its existing houses.

In that regard, the following staffs from Kiribati Housing Corporation (KHC) were interviewed on the phone in which their information and data gathered were used and form the basis of this report.

1. Mr Tekeraoi Nangkaa, General Manager, KHC
2. Mr Hongkai Kwong, Housing Superintend, Betio KHC
3. Mr Taraia Mwaitonga, Property Officer, Bikenibeu, KHC
4. Mr Taata Mikaere, Housing Superintended, Bairiki, KHC

2. What is Asbestos?

Asbestos is the generic name used for a group of naturally occurring mineral fibres. Common forms of asbestos include amosite (brown), anthophyllite (grey), chrysotile (white) (shown in Figure 1) and crocidolite (blue). Asbestos is commonly used for its insulation and chemical resistant properties and may be found in lagging, heat and fire retardant materials including:

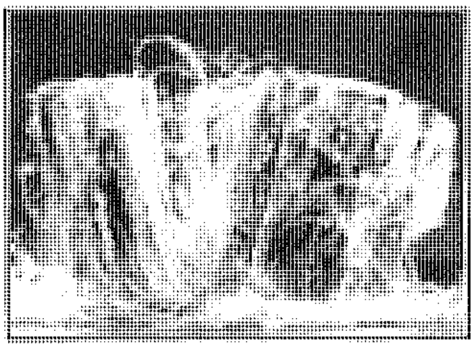

Figure 1. Chrysotile Fibre

- Insulation (Pipe, boiler, and block insulation; sprayed-in insulation; electrical wiring insulation)
- Fireproofing and acoustical texture products such as decorative plaster, fire blankets and fire doors,
- Spackling, Patching & Taping Compounds (includes caulking, putties, joint compounds, adhesives, tapes, thermal taping compounds),
- Asbestos -cement pipe and sheet material,

- Tiles, wallboard, siding and roofing (includes roofing shingles, roofing felt, base flashing, cement wallboard, cement siding, ceiling tiles and lay-in panels, asphalt floor tile, vinyl floor tile, vinyl sheet flooring, flooring backing, vinyl wall coverings),
- Vermiculite (used in some horticultural potting mixes, brake pads),
- Asbestos may also be found in elevator brake shoes, elevator equipment panels, ductwork, electrical panel partitions, electrical cloth, cooling towers, and chalkboards,
- Asbestos has been used in home appliances (coffee pots, toasters, irons, popcorn poppers, and crock pots). Until 1980, handheld hair dryers commonly contained asbestos also.

These are but a small sampling of the thousands of products that contained asbestos.

3. Human Health Risks Associated with Asbestos Materials

The asbestos fibres are capable of remaining in animal (also humans) tissue for months. All forms of asbestos are confirmed cancer causing materials, mostly affecting the respiratory system. Breathing in asbestos may cause damage to the lungs and chest cavity, and cause scarring. Scarring of the lungs is referred to as asbestosis, or mesothelioma, which is a severe form of lung cancer. Cancer of the lung and chest cavity and is inevitably fatal. These diseases may not form for a long period of time and may not show for 10 to 50 years after exposure. Asbestos fibres are very stable in the environment and do not evaporate, dissolve in water or break down over time.

4. Asbestos Use in Kiribati

The use of asbestos in Kiribati is found mostly in building materials used in houses as exterior wall claddings and ceilings. These houses are currently owned by Kiribati Housing Company (KHC) and were first constructed in early 1970s. These asbestos have been mixed with cement or other hard bonding material and includes materials such as flat and corrugated asbestos cement sheeting, asbestos cement pipes and pump and valve packing and they are also known as non-friable asbestos.

According to data obtained from each of KHC Branches in Betio, Bairiki and Bikenibeu, there are 51, 41 and 41 houses consecutively that have asbestos materials used as exterior wall claddings or as ceiling materials or both. In Kiritimati Island, a total of 282,490kg which is equivalent to 282.5 tonnes of bagged non-friable asbestos were removed off the island as part of the British Nuclear Testing Relics Cleanup Project undertaken by Safety & Ecology Corporation (SEC) based in the States.

The following is the list of KHC houses that have asbestos contained materials (exterior wall claddings and ceilings) for South Tarawa only.

Betio:	A & B Grades:	- A16e, A17e, B11e, B12e, C32e, C33e (6 houses)
	D Grades:	- D42e to D45e (4 houses)
	E Grades:	- E1e to E23e, E35e to E37e, E299e to 317e (41 houses)

Housing Corporation by travel agent

Bairiki:	A Grades:	- A3A, A36 (2 houses)
	B Grades:	- D1A, D2A (2 houses)
	E Grades:	- E3A to E22A (20 houses)
		- E45A to E54A (10 houses)
		- E112A, E121A to E126A (7 houses)
Bikenibeu:	B Grades:	- B25, B27 (2 houses)
	D Grades:	- D25, D27, (2 houses)
	E Grades:	- E69 to E94, E96-E107, E109-E111 (37 houses)

Information and data on asbestos presents in Banaba, Kanton, Tabuaeran, and Teraina as well as in outer islands (Makin to Arorae) could not be obtained and confirmed in this report. However, it is suspected that asbestos is also present and used as construction materials and water pipings on Banaba, Tabuaeran, Teraina and Kanton.

A Grade E House in Betio at St Betero, Temakin that has asbestos contained materials in its exterior wall claddings is shown in Figure 2. The house condition is deteriorating with holes and paintings worn out hence need immediate renovation to avoid asbestos fibres from being exposed to air which then could easily inhaled by occupants. In Figure 3, pieces of exterior wall claddings are depicted to show how asbestos fibres could be easily blown away and inhaled by occupants.

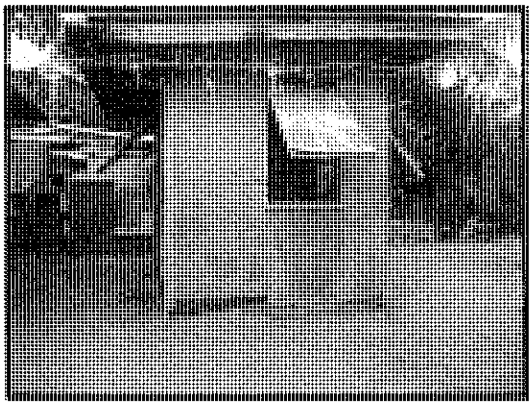

Figure 2. Grade E – Kitchen with asbestos used in exterior walls as heat and fire retardant

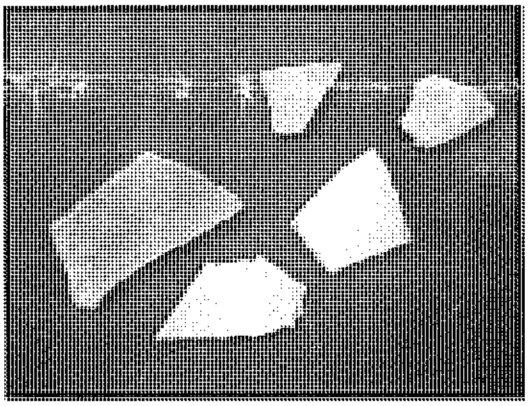

Figure 3. Fragments of wall claddings contained with asbestos fibres

5. Conclusions & Recommendations

In conclusion, it is imperative to know that asbestos is used in many of the products outlined in 2 above. Some of these products have already been imported into Kiribati for many years and simultaneously it is difficult to identify them as technical expertise is required to do so.

This report, however, concludes that there are currently 133 houses owned by KHC that have asbestos contained materials on South Tarawa only. It is also expected that asbestos contained materials are also used in Banaba as building construction materials; however this needs to be confirmed.

As far as human health risks posed by asbestos fibres are concerned, the following are some of the recommendations that require further discussions with concerned Ministries with guidance from MELAD Administration on how to move forward in disposing asbestos materials in a sound manner.

- An inventory of asbestos materials presents in Kiribati (outer islands including Banaba, Kanton, Tabuaeran and Teraina) should be made and presented to Cabinet for further information. Kiritimati is believed and assumed to be free from asbestos materials following the SEC Project which had been completed in 2007.
- Precautions on asbestos handling as well as public awareness programs through radios and national papers should be made particularly for tenant's information as well as contractors employed by KHC for maintenance work.
- Concerned Ministries (MELAD, MHMS, MPWD) including KHC should work together as a team to develop a strategy on how to remove these asbestos materials from identified houses as mentioned above and also to dispose them in a sound manner. Not only that but banning of these hazardous materials from importation should also be made.
- A risk assessment should be conducted to ensure that no harm is likely to affect occupants if the material is left to remain. If there is no-one capable of doing a risk assessment, specialist advice should be sought from regional organizations such as SPREP and other recognized laboratories in New Zealand and Australia for proper testing and also in identifying sound disposal methods.
- Other PICs experience in asbestos removal should be also sought to ensure that there is no harm to the public in particular occupants when these hazardous materials finally removed offshore.
- It is possible that current tenants of the above mentioned houses who have been living in these houses for decades may demand compensations from KHC after realizing potential health risks associated with asbestos. So far ECD have received public concerns made by phone seeking our advice on how to remove asbestos materials with precautionary measures they should undertake at this stage.

References:

1. Asbestos Management Guideline (12 pages) provided by Frank Griffin (SPREP)
2. Microsoft Encarta 2006