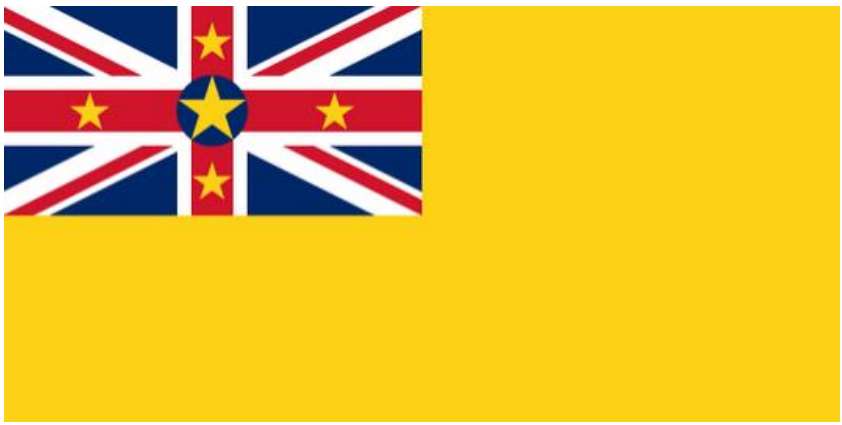
# Survey of the Regional Distribution and Status of Asbestos-Contaminated Construction Material and Waste - Best Practice Options for its Management in Pacific Island Countries

## Report for Niue



**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 Niue component of a survey of the regional distribution and status of asbestos-contaminated construction material, and best practice options for its management, in selected Pacific island communities. The objectives of the survey are summarised as follows:

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

The work was carried out by a consortium led by Contract Environmental Ltd (CEL) and Geoscience Consulting (NZ) Ltd (Geoscience), 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 Niue was obtained during a field visit undertaken by John O'Grady of CEL and Stewart Williams of SPREP on 21-28 February 2015. This visit was at the same time as a three person visit from the EU lead by Jesus Lavina. During this visit several meetings were held with key personnel on Niue and in addition, bulk, air and wipe samples were taken.

A subsequent visit was also made by Dirk Catterall on 14-21 April to carry out practical asbestos training and work with the Niue crew who are removing the asbestos. Dirk Catterall also took further bulk, air and wipe samples to back up those samples already taken.

It is clearly noted and acknowledged that much work had already been carried out by the Government of Niue and in particular by John Wichman of Recycle Cook Islands which has set Niue on a firm and effective path to deal with all the Niue asbestos issues. Niue is therefore further down the track than most Pacific Island countries and the SPREP visit on 21-28 Feb 15 was intended to complement and assist the work already being done in Niue.

The visit was also to provide support to the EU for its intention to make a special grant of $US200,000 to assist Niue with the work already being carried out to deal with its asbestos issues.

## Risk Assessment

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

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

## Survey Outcomes

A total of 47 bulk samples were taken and analysed and the analytical results are summarised in the table below. Three other buildings were noted as having asbestos roofs but were not sampled as samples could not be conveniently obtained.

**Bulk Sample Analytical Results – First Visit**

| Number | Location | Asbestos Type | Percentage |
|---|---|---|---|
| NU1 | Avatele Church panels | Chrysotile | 7% |
| NU2 | Sassy Sissy Fashions cladding | Chrysotile | 10% |
| | | Amosite | 7% |
| NU3 | Jenna's Restaurant cladding | Chrysotile | 15% |
| NU4 | Avatele Old School panels | Chrysotile | 10% |
| NU5 | Primary School North classroom soffits | None detected | |
| NU6 | Power Station large shed claddings | None detected | |
| NU7 | Alofi Rentals cladding | None detected | |
| NU8 | Peta Paints / St Francis cladding (roofing) | Chrysotile | 10% |
| | | Amosite | 7% |
| NU9 | Falalafa Restaurant cladding | None detected | |
| NU10 | Makini Handcrafts cladding | None detected | |
| NU11 | Alofi South Hall cladding | Chrysotile | 15% |

| Number | Location | Asbestos Type | Percentage |
|---|---|---|---|
| NU1 | Avatele Church panels | Chrysotile | 7% |
| NU2 | Sassy Sissy Fashions cladding | Chrysotile | 10% |
| | | Amosite | 7% |
| NU3 | Jenna's Restaurant cladding | Chrysotile | 15% |
| NU4 | Avatele Old School panels | Chrysotile | 10% |
| NU5 | Primary School North classroom soffits | None detected | |
| NU6 | Power Station large shed claddings | None detected | |
| NU7 | Alofi Rentals cladding | None detected | |
| NU8 | Peta Paints / St Francis cladding (roofing) | Chrysotile | 10% |
| | | Amosite | 7% |
| NU9 | Falalafa Restaurant cladding | None detected | |
| NU10 | Makini Handcrafts cladding | None detected | |
| NU11 | Alofi South Hall cladding | Chrysotile | 15% |
| NU12 | Makini Handcrafts old toilet fence/cladding | Chrysotile | 10% |
| | | Amosite | 10% |
| NU13 | Paleni's Travel cladding | Chrysotile | 7% |
| NU14 | Abbatoir cladding | None detected | |
| NU15 | G's Minimart cladding | None detected | |
| NU16 | Prison cladding | Chrysotile | 15% |
| NU17 | Abandoned house Makefu cladding | Chrysotile | 15% |
| NU18 | Bitumen tank C lagging near hospital | None detected | |
| NU19 | Bitumen tank A lagging Hui Hui | None detected | |
| NU20 | Abandoned house Taumatatoga cladding | Chrysotile | 10% |
| | | Amosite | 7% |
| NU21 | Abandoned house Taumatatoga cladding debris | None detected | |
| NU22 | Abandoned house Taumatatoga roof | Chrysotile | 10% |
| | | Amosite | 7% |
| NU23 | Primary School cladding back toilet block | Chrysotile | 2% |
| NU24 | Secondary School cladding | Chrysotile | 15% |
| NU25 | Via Mamali /Rock Bak Bakery cladding | Chrysotile | 15% |
| NU26 | Niue Golf/Sports Club cladding | None detected | |
| NU27 | Daniel Makaia's shed cladding | None detected | |
| NU28 | Public Works cladding | Chrysotile | 20% |
| NU29 | Primary School debris back of EC block | Chrysotile | 10% |
| | | Amosite | 10% |
| NU 30 | Police Station cladding | Chrysotile | 20% |
| NU31 | Katuali Coffee Shop cladding | None detected | |
| NU32 | Power Station small shed cladding | None detected | |
| NU33 | Tuapa Hall cladding | Chrysotile | 15% |
| NU34 | Liku abandoned house south vinyl floor | None detected | |
| NU35 | Liku abandoned house wall | Chrysotile | 15% |

| Number | Location | Asbestos Type | Percentage |
|---|---|---|---|
| NU1 | Avatele Church panels | Chrysotile | 7% |
| NU2 | Sassy Sissy Fashions cladding | Chrysotile | 10% |
| | | Amosite | 7% |
| NU3 | Jenna's Restaurant cladding | Chrysotile | 15% |
| NU4 | Avatele Old School panels | Chrysotile | 10% |
| NU5 | Primary School North classroom soffits | None detected | |
| NU6 | Power Station large shed claddings | None detected | |
| NU7 | Alofi Rentals cladding | None detected | |
| NU8 | Peta Paints / St Francis cladding (roofing) | Chrysotile | 10% |
| | | Amosite | 7% |
| NU9 | Falalafa Restaurant cladding | None detected | |
| NU10 | Makini Handcrafts cladding | None detected | |
| NU11 | Alofi South Hall cladding | Chrysotile | 15% |
| NU36 | Liku abandoned house sheeting on ground | None detected | |
| NU37 | Lakepa occupied house vinyl floor tiles | None detected | |
| NU38 | Lakepa abandoned house cladding | Chrysotile | 7% |
| | | Amosite | 10% |
| NU39 | Lakepa waste roofing stockpile behind old school | Chrysotile | 5% |
| | | Amosite | 10% |
| NU40 | Toi Meeting Hall | Chrysotile | 15% |
| NU41 | Vaiea Community Centre soffit | None detected | |
| NU42 | Kupa's Piggery Lakepa roof | Chrysotile | 10% |
| | | Amosite | 3% |
| NU43 | Old Hakupu School cladding | Chrysotile | 8% |
| | | Amosite | 5% |
| | | Crocidolite | 2% |
| NU44 | Lakepa Pre-school cladding | Chrysotile | 7% |
| | | Amosite | 7% |
| NU45 | Liku abandoned house south vinyl floor | None detected | |
| NU46 | Lakepa Church back cladding | None detected | |
| NU47 | Liku abandoned house piping | Chrysotile | 15% |

There are at least four old bitumen tankers abandoned on Niue by Fulton Hogan from an earlier roading project on Niue. One of these tankers (and possibly more) has been abandoned at Hui Hui (Tank D) and the other three have been abandoned in an area near the hospital adjacent to a reservoir (Tanks A, B and C).

There is an old Dowdell New Zealand Analysis (October 2011) for Tank D which indicates that the lagging is Amosite. Additional sampling was done on the First PacWaste Visit for Tanks A and D (Samples NU18 and NU19 above) which produced negative results for asbestos. This was puzzling as they contradicted the Oct 11 Dowdell result. More sampling was carried out during the Second

PacWaste visit in order to clear this matter up and the results are presented below together with the earlier Oct 11 Dowdell result.

**Bulk Sample Analytical Results – Second Visit**

| Number | Laboratory | Location | Asbestos Type | Percentage |
|---|---|---|---|---|
| 4 | EMS | Reservoir Tank Mid Tank A | Amosite | 20% |
| 5 | EMS | Reservoir Tank End Tank A | Amosite | 20% |
| 6 | EMS | Reservoir Tank Mid Tank B | Amosite | 70% |
| 7 | EMS | Reservoir Tank End Tank B | Amosite | 35% |
| 8 | EMS | Hui Hui Tank (Split Sample) | Not Detectable | Nil |
| Oct-11 | Dowdell | Hui Hui Tank | Amosite | Not Given |
| 8 | Dowdell | Hui Hui Tank (Split Sample) | Not Detectable | Nil |

On the first visit a total of 9 air samples were taken and analysed by Phase Contrast Microscopy (PCM). No results of any significance were obtained as they were all below the Limit of Detection (LOD).

On the second visit three air samples were taken around the operational activities of packing up the asbestos. As the PCM results obtained were all above the LOD, the samples were then further examined using the Transmission Electron Microscope (TEM) method. The PCM method can include fibres that are not asbestos but the TEM method identifies only asbestos fibres as the resolution is greater. The TEM results confirmed that asbestos fibres were present in the air for all three samples, which raises concerns regarding the operational methodology.

On the first visit four wipe samples were taken and two further wipe samples were taken on the second visit including an additional one in Peta Paints where a high wipe result was obtained on the first visit. The results are summarised in the table below.

**Wipe Sample Analytical Results – First and Second Visits**

| **Sample No** | **Location** | **First Visit** | | **Second Visit** | |
|---|---|---|---|---|---|
| | | Chrysotile (Str/cm2) | Amphibole (Str/cm2) | Chrysotile (Str/cm2) | Amphibole (Str/cm2) |
| W1 | Primary School Red Classroom | <2000 | <2000 | | |
| W2 | Secondary School Classroom Ledge | <10000 | <10000 | | |
| W3 | Inside Peta Paints | 910000 | 81000 | | |
| W4 | Makini Handcrafts Shed at Back | 60000 | <10000 | | |
| 9 | Honey Processing Building - Top Shelf | | | 71000 | 5800 |
| 10 | Peta Paints - Window Sill | | | 350000 | 13000 |

The two results from Peta Paints demonstrate significant chrysotile contamination and moderate amphibole contamination. The Makini Handicrafts shed and the Honey Processing Building demonstrate moderate chrysotile contamination.

Based on the 2011 Census there were 27 occupied houses out of a total of 477 occupied houses that had asbestos roofs. This included 17 with complete asbestos roofs and 10 with a combination of asbestos and steel.

The number of unoccupied houses with asbestos or partial asbestos roofs was not counted in the 2011 survey. The 2014/2015 report from the Niue Asbestos Project Manager indicates, however, that as at September 2014, a total of 317 unoccupied houses were counted as having asbestos roofs. By January 2015 a total of 126 of these roofs had been removed from unoccupied houses, leaving 191 remaining. Concern was expressed in this report about the difficulty of obtaining consents to remove the roofs from the unoccupied houses.

During the first visit of the PacWaste team, it was decided to carry out a survey of houses with fibreboard cladding. This was done via a drive around the island where houses were counted with clickers. A total of 865 houses (occupied and unoccupied) were counted. A total of 85 unoccupied houses were counted with cladding and 79 occupied houses were counted with cladding. If a simple scale-up is applied from the 865 houses counted to the 1015 houses counted in the 2011 Census, then there will be 100 unoccupied houses with fibreboard cladding and 93 occupied houses with fibreboard cladding. A total of 34 cladding samples were analysed and 21 samples were positive for asbestos, or 61.8%. Based on this figure, there are therefore 62 unoccupied houses with asbestos cladding and 57 occupied houses with asbestos cladding. The accuracy of these figures needs to be tested, however, and the individual houses that have asbestos cladding needs to be discovered. Each house, therefore, that has fibreboard cladding needs to be tested individually.

## Cost Estimates

General cost estimates have been developed for the Pacific as part of the PacWaste Study and these general costs have been adjusted a little to suit Niue conditions. An overall costings spreadsheet is presented in the table below. The figures will need to be reviewed by the Niuean asbestos management team in light of the experience they have gathered from their work to date.

**Table: Niue Estimated Overall Costings**

| Item | Type | Unit | Amount | Unit Cost (NZD) | Total Cost (NZD) | Total Cost Adjusted for Disposal at 10% Extra (NZD) | Risk Ranking | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | ACM Score | Setting Score | Total Score |
| Empty House roofs to go - assume 200 houses @ 120 m2/house | Roofs | m2 | 24000 | 25 | 600,000.00 | 660,000.00 | 6 | 13 | 19 |
| Occupied House roofs - assume 27 based on 2011 census @ 120 m2/house | Roofs | m2 | 4320 | 65 | 280,800.00 | 308,880.00 | 5 | 16 | 21 |
| Empty House cladding - assume 100 houses @ 120 m2/house and 55% asbestos | Cladding | m2 | 6600 | 20 | 132,000.00 | 145,200.00 | 6 | 16 | 22 |

| Item | Type | Unit | Amount | Unit Cost (NZD) | Total Cost (NZD) | Total Cost Adjusted for Disposal at 10% Extra (NZD) | Risk Ranking | | |
|---|---|---|---|---|---|---|---|---|---|
| Occupied House cladding - assume 93 @ 120 m2/house and 55% asbestos | Cladding | m2 | 6138 | 50 | 306,900.00 | 337,590.00 | 5 | 18 | 23 |
| Public Works | Cladding | m2 | 65 | 50 | 3,250.00 | 3,575.00 | 3 | 16 | 19 |
| Honey Processing | Roof | m2 | 270 | 65 | 17,550.00 | 19,305.00 | 5 | 17 | 22 |
| Vai Mamali / Rockbak Building | Cladding | m2 | 260 | 50 | 13,000.00 | 14,300.00 | 3 | 16 | 19 |
| Niue Broadcasting | Cladding / Soffits | m2 | 125 | 50 | 6,250.00 | 6,875.00 | 3 | 15 | 18 |
| Alofi Bread Shop | Cladding / Soffits | m2 | 80 | 50 | 4,000.00 | 4,400.00 | 4 | 15 | 19 |
| Primary School | Cladding / Soffits | m2 | 280 | 50 | 14,000.00 | 15,400.00 | 4 | 18 | 22 |
| Primary School Debris at Back | Debris | LS | LS | 500 | 500.00 | 550.00 | 6 | 16 | 22 |
| Secondary School | Cladding | m2 | 490 | 50 | 24,500.00 | 26,950.00 | 3 | 17 | 20 |
| Avatele Old School | Panels | m2 | 10 | 20 | 200.00 | 220.00 | 3 | 14 | 17 |
| Police Station | Cladding / Soffits | m2 | 200 | 50 | 10,000.00 | 11,000.00 | 3 | 16 | 19 |
| Makini Handcrafts | Roofing Fence | m2 | 10 | 20 | 200.00 | 220.00 | 5 | 13 | 18 |
| Alofi South Hall | Cladding | m2 | 234 | 50 | 11,700.00 | 12,870.00 | 3 | 17 | 20 |
| Jenna's Restaurant | Cladding | m2 | 114 | 50 | 5,700.00 | 6,270.00 | 3 | 15 | 18 |
| Sassy Fashions / Breakthrough | Cladding | m2 | 224 | 50 | 11,200.00 | 12,320.00 | 3 | 15 | 18 |
| Peleni's Travel | Cladding | m2 | 120 | 50 | 6,000.00 | 6,600.00 | 3 | 15 | 18 |
| St Joseph Automechanics / Peta Paints | Roofing / Cladding | m2 | 1250 | 75 | 93,750.00 | 103,125.00 | 6 | 20 | 26 |
| Prison | Cladding | m2 | 60 | 50 | 3,000.00 | 3,300.00 | 4 | 18 | 22 |
| Prison Toilet Vent Pipe | Pipe | m2 | 3 | 20 | 60.00 | 66.00 | 3 | 10 | 13 |
| Abbatoir / Meat Processing | Roof | m2 | 60 | 60 | 3,600.00 | 3,960.00 | 4 | 14 | 18 |
| Avatele Church Panels | Panels | m2 | 120 | 65 | 7,800.00 | 8,580.00 | 3 | 15 | 18 |
| Catholic Church | Roofing | m2 | 260 | 65 | 16,900.00 | 18,590.00 | 4 | 15 | 19 |
| Tuapa Hall | Cladding | m2 | 90 | 50 | | | 3 | 15 | 18 |

| Item | Type | Unit | Amount | Unit Cost (NZD) | Total Cost (NZD) | Total Cost Adjusted for Disposal at 10% Extra (NZD) | Risk Ranking | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | 4,500.00 | 4,950.00 | | | |
| Toi Meeting Hall | Cladding | m2 | 525 | 50 | 26,250.00 | 28,875.00 | 3 | 14 | 17 |
| Old Hakupu School | Cladding | m2 | 572 | 50 | 28,600.00 | 31,460.00 | 5 | 14 | 19 |
| Lakepa Pre-School | Cladding | m2 | 8 | 50 | 400.00 | 440.00 | 4 | 16 | 20 |
| Old Lapeka School Waste Roof Stockpile | Waste Roofing | LS | LS | 20000 | 20,000.00 | 22,000.00 | 4 | 4 | 8 |
| Piping in Old Liku House | Piping | LS | LS | 3000 | 3,000.00 | 3,300.00 | 2 | 11 | 13 |
| **TOTAL** | | | | | **1,655,610.00** | **1,821,171.00** | | | |
| Old Fulton Hogan bitumen Tankers (Cost includes setting up as friable asbestos project and also cleaning up and disposing of soil) | Friable Amosite Lagging | Tanker | 5 | 30000 | 150,000.00 | 165,000.00 | 11 | 7 | 18 |
| **TOTAL WITH TANKERS** | | | | | **1,805,610.00** | **1,986,171.00** | | | |

## Recommendations and Prioritised List of Actions

Niue is currently implementing a very effective programme to deal with a legacy of asbestos issues and they have made excellent progress so far. All the waste asbestos that was stockpiled at the Hui Hui site has now been removed as well as other stockpiles. The removal of asbestos from abandoned houses is proving more difficult as permission for each removal has to be obtained. It is understood, however, that all the abandoned houses for which permission can easily be obtained have had their asbestos removed.

It is important that the momentum of this programme is maintained and the EU has agreed to an additional $US200,000 to be provided to assist in maintaining this momentum. Based on the costings above, the estimated total cost to remove all asbestos from Niue is about $NZ1.82 million. This is a large amount but it is understood that priority will continue to be given to removing asbestos from abandoned houses as they come available. It will also be important to clean up any asbestos debris around these houses.

The two visits made as part of the PacWaste project, and particularly the second visit from Dirk Catterall, highlighted some safety matters and concerns relating to the ongoing asbestos removal programme that are summarised in the recommendations below.

There is one site that is ranked as high risk and that is the St Joseph's Automotive / Peta Paints site. This site should be remediated as a special project with all the safeguards of a full asbestos

remediation project. Based on the results of the very high wipe tests a thorough site clean-up will be needed of all the material inside the building. Considerable care will also be needed regarding safe working at heights, especially with regard to the brittle asbestos roof. If the building is to remain as a workshop and retail store, then a new roof will be needed, and probably a re-build of the roof supporting structure.

The other matter that needs to be focussed on urgently is the bitumen tankers at two locations. The asbestos is friable amosite (at least part of it is) and this is very serious. Ground contamination is also occurring. At least the sites are not very accessible which reduces the risk. Because of the serious nature of the contamination, however, and the fact that the tankers are deteriorating, this matter should be addressed urgently. The original New Zealand owners of the tankers should be approached, perhaps through the New Zealand High Commission, as the clean-up should be funded as a special project.

Another issue is the asbestos in the schools. The Secondary School has a large amount of asbestos cladding which is at present in good condition and well painted so it is presenting little risk. Seeing as children are at risk it may pay to program in the replacement of this cladding and in the meantime precautionary measures should be taken regarding maintenance and any damage sustained to the cladding.

The Primary School has asbestos soffits and cladding in various places as indicated and it is more damaged than the cladding at the Secondary School. There is also some asbestos debris behind classrooms at the back of the school. It would be a simple matter to clean up this debris. It is understood that a new school is to be built soon so for now it would probably be sufficient to carefully repair the damaged asbestos and encapsulate the rest with a good paint system pending the construction of the new primary school.

Apart from the houses there are three roofs that should be replaced, i.e. the abbatoir, the honey processing building and the Catholic Church as all are deteriorating. There may also be other non-residential roofs that were not spotted as part of this survey.

The rest of the asbestos work that has been identified is cladding and panelling on commercial and community facilities and much (but not all) of this is in good condition. The costings table above sets out costs for the removal and replacement of this cladding and panelling but each case should be subject to a risk assessment. In most cases the risk is not high and if these buildings are kept painted and carefully maintained then replacement will not be necessary for quite a long time. Building owners and occupiers should be made aware of the asbestos risk, however, and maintenance that involves drilling or cutting the asbestos should be done with the correct asbestos protocols in place. If these buildings are demolished then this also needs to be done with the correct asbestos protocols in place.

Overall, the initiatives set in place by the Niue Government, and the work done to date by their contractor RCI, are excellent. If these initiatives can be maintained and supported then the risks currently posed by asbestos in Niue will be progressively and effectively dealt with. It is hoped that the PacWaste interventions, and the recommendations that flow from these interventions, will assist and support the ongoing work.

The following recommendations are therefore made in connection with asbestos in Niue:

a) The excellent work now being done by the Niue Government should be supported and encouraged, so that momentum is not lost and all asbestos is either removed of rendered into a safe condition.
b) There is a range of safety measures that need to be adopted to ensure that the work continues in a way that ensures the work crew and the public are not exposed to hazardous levels of asbestos fibres or in the case of the work crew, other hazards such as working at heights. These measures include:
    - There is a need to adhere to a strictly enforced Asbestos Removal Plan (ARP) that sets out clean and dirty areas and ensures that no asbestos contamination extends beyond the dirty area. This will involve, among other things, signage, temporary fencing and temporary washing facilities.
    - The use of Personal Protective Equipment (PPE) needs to be improved and this may require additional funding. This is a high priority area for the use of funds.
    - Other aspects of crew safety need to be kept in mind and especially working at heights. Edge protection and scaffolding should be used as routine for roof removals and care should be taken with brittle asbestos roofs as old roofs do break easily. It may also be advisable to set up a simple rope access system for this work.
    - Other than Lin Lee (the crew supervisor) there is a high turnover of staff so ongoing training becomes important so knowledge is not lost.
    - The use of a good HEPA vacuum cleaner should be routine on the asbestos projects. Debris and dust should be cleaned up before a site is decommissioned. Ceiling spaces in occupied houses should also be vacuumed.
    - The scraping and cleaning of asbestos in preparation for export is a substantial source of dangerous airborne asbestos and asbestos contamination of soils. It would be preferable to avoid the scraping and cleaning altogether and this may be possible seeing as the container are buried unopened at the Redvale Landfill in Auckland. This matter should be investigated.
    - An ideal set up for the ongoing work would be a changing/ decontamination area at the location where the asbestos export preparation work is done (Reef Shipping), so the crew can clean themselves at the end of the day. It would be advisable to put a cheap shower and lockers in one of the containers.
    - For any work on houses where there are occupants, asbestos dust is most likely to fall down on the interior possessions when it is removed. Protective measures should put in place to keep these possessions uncontaminated.
    - Heavy duty tarpaulins that can be cleaned, of disposable plastic sheeting, should be used to cover the sheeting on the back of the asbestos transport truck.
c) The focus should continue to be on the removal of asbestos from unoccupied houses which should be done as they become available. It is understood that permission needs to be granted for the removal of the asbestos in each case. Cladding needs to be removed as well as roofing.
d) There should also be a focus on the removal of asbestos roofing and cladding from occupied houses as the risk of exposure is greater with these houses than unoccupied houses. The expense is also greater, however, as replacement roofs and cladding will be needed.
e) When consideration is given to removing cladding then it would be appropriate to send samples away for testing in each case. Only about 62% of the cladding tested as part of the PacWaste work proved to be positive for asbestos.
f) The St Josephs / Peta Paints Building should have all asbestos removed together with a thorough site clean-up. The workers in this building are at risk and this work should now be considered as urgent.

g) The friable amosite asbestos associated with the abandoned Fulton Hogan bitumen tankers should be removed safely and the two locations where these tankers are located should be cleaned up. This is specialist work and is also urgent, given the hazardous nature of the asbestos. Until this remediation work can be carried out, fencing and danger signs should be erected.
h) Asbestos at both the primary and secondary schools should be rendered safe and preferably removed, although repair and encapsulation will probably be sufficient for now.
i) Consideration should be given to removing some asbestos roofs other than the house roofs – e.g the Honey Processing Building, the Abbatoir and the Catholic Church.
j) The asbestos cladding and panelling identified on commercial and community facilities should be examined and subjected to a risk assessment. In most cases the risk is not high and if these buildings are kept painted and carefully maintained then replacement will not be necessary for quite a long time. Building owners and occupiers should be made aware of the asbestos risk, however, and maintenance that involves drilling or cutting the asbestos should be done with the correct asbestos protocols in place. If these buildings are demolished then this also needs to be done with the correct asbestos protocols in place.

# Contents

# Definitions

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

**Amosite:** Brown or Grey Asbestos

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

**AusAid:** Australian Agency for International Development

**CEL:** Contract Environmental Limited

**CES:** Capital Environmental Services

**Chrysotile:** White Asbestos

**Crocidolite:** Blue Asbestos

**EMS:** EMS Laboratories Incorporated

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

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

**GPS:** Global Positioning System

**Hazard:** Is a potential to cause harm

**IANZ:** International Accreditation New Zealand

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

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

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

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

**PPE:** Personal Protective Equipment

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

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

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

**SMF**: Synthetic Mineral Fibres

**SPREP:** Secretariat of the Pacific Regional Environment Programme

**GON:** Government of Niue

**RCI:** Recycle Cook Islands

# 1. Introduction

## 1.1 Purpose

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 Niue component of a survey of the regional distribution and status of asbestos-containing material (ACM) and wastes, 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 , and human health risks for ACM in thirteen Pacific Island countries; 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 (CEL) and Geoscience Consulting (NZ) Ltd (Geoscience), 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 Niue was obtained during a field visit undertaken by John O'Grady of CEL and Stewart Williams of SPREP on 21-28 February 2015. This visit was at the same time as a visit from a three person EU team headed by Jesus Lavina. During this visit several

meetings were held with key personnel on Niue and in addition, bulk, air and wipe samples were taken.

A subsequent visit was also made by Dirk Catterall on 14-21 April 2015 to carry out practical asbestos training and work with the Niue drew who are removing the asbestos. Dirk Catterall also took further bulk, air and wipe samples to back up those samples already taken.

It is clearly noted and acknowledged that much work had already been carried out by the GON and in particular by John Wichman of RCI which has set Niue on a firm and effective path to deal with all the Niue asbestos issues. Niue is therefore further down the track than most Pacific Island countries and the SPREP visits were intended to complement and assist the work already being done in Niue.

The visit was also to provide support to the EU for its intention to make a special grant of $US200,000 to assist Niue with the work already being carried out to deal with its asbestos issues.

## 1.2 Scope of Work

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

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

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

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

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

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

## 1.3 Background to Niue

Niue an island country in the South Pacific Ocean, 2,400 kilometres (1,500 mi) northeast of New Zealand within the triangle formed by Tonga to the west, Samoa to the north, and the Cook Islands to the east. Its land area is 260 square kilometres (100 sq mi) and its population, predominantly Polynesian, is around 1,400.

Niue, whose capital city is Alofi, is a self-governing state in free association with New Zealand. Niueans are New Zealand citizens and between 90–95% of Niuean people live in New Zealand. Niue is not a member of the United Nations, but its status as a freely-associated state has been accepted by UN organisations as equivalent to independence for international law purposes.

The map of Niue is shown in Figure 1.

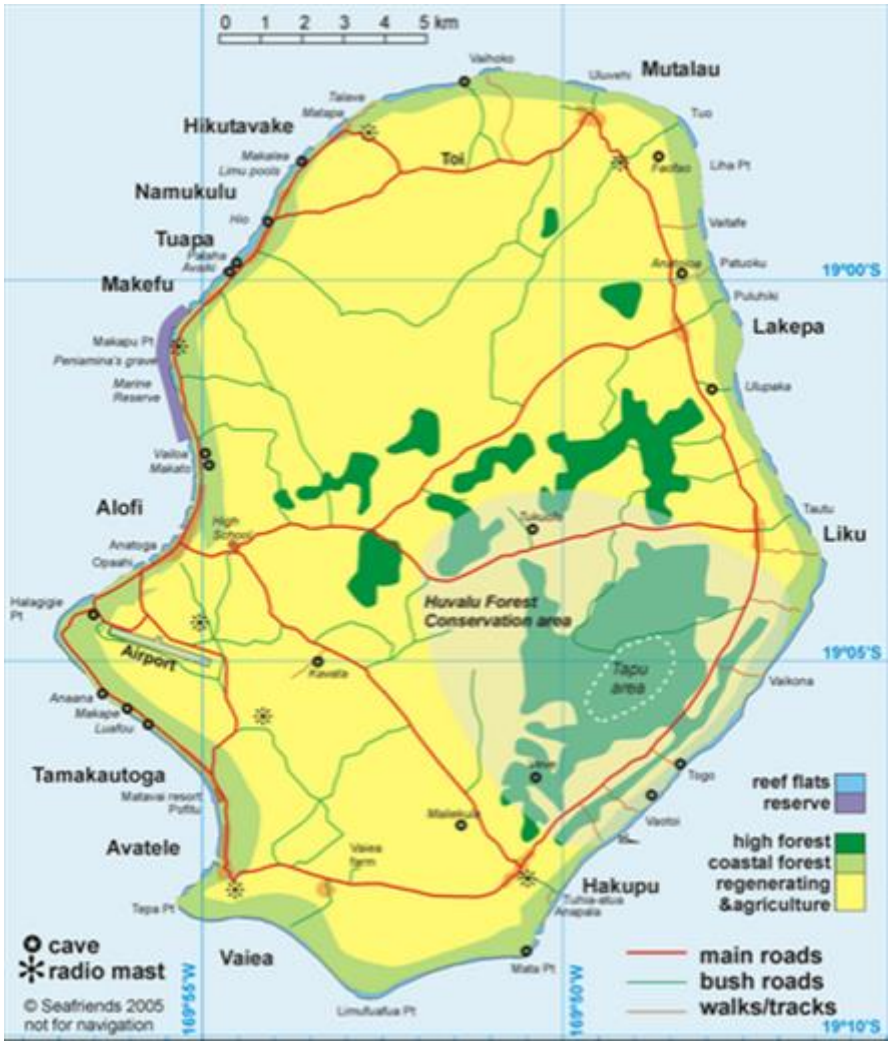


**Figure 1 – Map of Niue**

Niue is one of the world's largest coral islands. The terrain consists of steep limestone cliffs along the coast with a central plateau rising to about 60 metres above sea level. A coral reef surrounds the island, with the only major break in the reef being in the central western coast, close to the capital,

Alofi. A notable feature is the number of limestone caves found close to the coast. The island has a tropical climate, with most rainfall occurring between November and April.

## 1.4 Report Content and Layout

Section 2 of this report gives details of the methodology used for the study including the approach used for determining the survey coverage, the identification of specific target sites, procedures for site inspections, and 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 results of the survey are presented in section 4 of the report, with supporting information on, and assessment of, the laboratory results given in section 5. The risk assessment results are given 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 Niue.

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

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

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

Additional supporting information is given in a series of appendices.

# 2.0 Survey Methodology

## 2.1 Pre-Survey Desk Study and Aims

The survey work undertaken during the visit to Niue included meetings with key government agencies, EU representatives, area-wide surveys across the Island of all villages including residences, and specific investigations of 24 non-residential sites in Alofi.

Prior to conducting the surveys and visiting Niue, 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 understand the work already being undertaken, as well as assess further work that may be needed.

In addition, the consultation aimed to evaluate local regulations and practices with respect to ACM identification, removal and disposal.

The following aims for the visit were set in place:

a. Assessment of buildings and houses still containing asbestos (Government, infrastructure and residential);
b. Assessment of any stockpiles remaining and any areas of soil potentially contaminated with asbestos.
c. Assessment of possible friable asbestos.
d. Taking of samples of suspected asbestos (It will very likely be obvious and unnecessary to do this for roofing material but may be useful for cladding material and flooring).
e. Carrying out air monitoring in selected locations.
f. Gaining an understanding of the asbestos removal work to date.
g. Gaining an understanding of how much more removal work is to be done and what plans are in place to undertake the work.

## 2.2 Statistical Backgound

According to the 2011 Niue Census of Population and Households produced by Statistics Niue, Department of Finance, Planning and Statistics, the total residential population of Niue was 1607 in 2011. This population was spread out over 14 villages which include the main centre Alofi as two villages (Alofi North and Alofi South) where 39.7% of the total population live.

The total number of houses in Niue in 2011 was 1015 houses which included 477 occupied houses and 538 unoccupied houses. These unoccupied houses were owned by Niueans who had moved overseas, mainly to New Zealand. Of the 538 unoccupied houses 184 were listed as still being used, presumably as storage or some sort of other back-up use to the occupied houses. The other 384 houses were listed as unused and presumably abandoned (although they may not be considered as abandoned by their previous owners now living overseas).

Of the 477 occupied houses, 49% were considered to be modern houses and 33% were “hurricane houses”. These hurricane houses were built by New Zealand in the 1950’s after severe cyclone damage had been experienced. They were constructed with concrete walls and asbestos-cement roofs and were built to a template consisting only of three bedrooms, and one sitting room. There

was no built-in toilet or proper kitchen and bathroom facilities. Based on the 2011 survey, 15% of the 477 inhabited houses on Niue consisted of unmodified hurricane houses and 33% consisted of upgraded hurricane houses. This left a small percentage (3% or 14 houses) as "other" including traditional puga construction.

Of the 477 occupied houses in 2011, a total of 27 were counted as having asbestos roofs. This included 17 with complete asbestos roofs and 10 with a combination of asbestos and steel. The number of unoccupied houses with asbestos or partial asbestos roofs was not counted in the 2011 survey.

## 2.3 Identification of Target Sites

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

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

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

## 2.4 Sample Collection Methodology

### 2.4.1 Bulk Samples

Samples of PACM were collected if the following conditions were met;

- Whether the sample could be taken safely and conveniently;
- 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 CEL / 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 were required to wear adequate personal protective equipment (PPE), as determined by the risk assessment (which may include 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 was easier to remove a small sample. The sample size collected was approximately 5 $cm^2$
- 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.
- After sampling, water was sprayed onto the sample area to prevent fibre release;
- Sampling points were further sealed by PVC tape where necessary;
- Samples were labelled with a unique identifier and in the survey documentation;
- Each sample was noted on a chain of custody form provided by the laboratory, and secured in a sealable container.

### 2.4.2 Air Sampling

A total of 9 air samples were taken during the first visit at various representative locations. These locations were at places where maximum exposure to people could be expected and the locations are listed in Section 4.2 below. A further three air samples were taken during the second visit by Dirk Catterall.

The air sampling pumps used in the first visit were hired from the New Zealand Air Monitoring Company CBL Air Monitoring Ltd. The pumps used in the second visit were owned by Dirk Catterall's company Morecroft Contracting Ltd. The pumps were all Gillian BDX II Abatement Air Samplers and they were set for a flowrate 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 tripods or at convenient locations where they could be secured with tape.

### 2.4.3 Wipe Sampling

Four wipe samples were taken for quantitative analysis during the first visit and two were taken during the second visit. The swab area in each case was 100 mm x 100 mm and was marked out using a template. A horizontal surface was generally chosen. Some swab samples were also taken from air conditioning units. PPE was worn where appropriate.

The swab collection procedure is as follows:

a. Mark off a 100mmx100mm square with masking tape.
b. Unfold wipe (about 150mm square)
c. Wipe the square
d. Fold in half so that any debris is retained inside the fold
e. Place in polythene sample bag, seal and label.
f. Place in another polythene sample bag.

## 2.5 Sample Laboratory Analysis

### 2.5.1 Bulk Sample Analysis

The samples were sent by courier to EMS Laboratories Incorporated (EMS) located in California, United States of America. Analysis of the bulk samples was performed by EMS using Polarised Light Microscopy. According to EMS the analysis method is a semi-quantitative procedure with a detection limit between 0.1-1% by surface area of the bulk sample, depending on the size of the asbestos fibres, sampling method and sample matrix.

Where similar building materials were encountered at numerous sites, a single sample was considered sufficient for use in drawing conclusions. 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.

The results for these samples are discussed in Section 4, and copies of the laboratory reports are included in Appendix 6 of this report.

### 2.5.2 Air Sampling Analysis

The samples were sent by courier to EMS Laboratories Incorporated (EMS) located in California in the United States of America for analysis.

The EMS results are presented in Section 4.2 and copies of the laboratory reports are given in Appendix 6 of this report.

Analysis of the samples was performed by EMS using Phase Contrast Microscopy – NIOSH Fiber Count (Method 7400, Issue 2, A Rules). The three samples taken during the second visit were analysed by Transmission Electron Microscopy.

### 2.5.3 Swab Sampling 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 carried out using the method described in ASTM 6480 — "Standard Test Method for Wipe Sampling of Surfaces, Indirect Preparation, and Analysis for Asbestos Structure Number Concentration by Transmission Electron Microscopy".

The EMS results are presented in Section 4.3 and copies of the laboratory reports are given in Appendix 6 of this report.

Method ASTM 6480 is used to identify asbestos in samples wiped from surfaces. The method provides the concentration of asbestos structures per unit area of sampled surface.

Asbestos is identified by transmission electron microscopy (TEM) for morphology, by electron diffraction (ED) for crystalline composition and by energy dispersive x-ray analysis (EDXA) for elemental composition. This method defines the type of asbestos present. The method incorporates all asbestos fibers equal or greater than 0.5um in length.

The analytical sensitivity is reported in asbestos structures per square centimeter is equivalent to counting one asbestos structure in the analysis. The limit of detection for a single sided distribution is 2.99 times the analytical sensitivity.

Asbestos structures are defined as isolated fibers, bundles composed of 3 or more parallel fibers closer than one fiber diameter, clusters that are intermixed fibers with no single fiber isolated from the group, and matrix in which fibers or bundles are attached or partially concealed by non-fibrous particles. In the method, the surface of known area (100 $cm^2$ for these samples) is wiped to collect the samples.

The sample is transferred from the wipe to a fiber-free aqueous solution of known volume. To obtain s suitable loading of particulates for TEM examination, aliquots of the suspension are filtered through a membrane filter and transferred to a TEM grid using the direct transfer method. The asbestiform structures are identified, sized and counted by TEM at 18,000X magnification and identified by ED and EDXA.

# 3.0 Risk Assessment Methodology

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

The documents present a simple scoring system to allow an assessment of the 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 method used 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 vs 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(s). The setting assessment therefore considers the normal occupant activity in that area of the site and the likelihood of disturbance. Each ACM setting is scored and these scores are added to those for the material assessment to produce a total score.

## 3.1 ACM Assessment

The algorithm in MDHS100 considers four parameters that determine the risk from an ACM: that is the ability to release fibres if disturbed. The 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 – ACM**

| 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 MDHS100, 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 and / or owners at the majority of the survey sites were considered to be low. Therefore any maintenance undertaken is likely to be 'unplanned' with little or no controls around asbestos exposure. In addition, the amount of maintenance activity was often extremely difficult to quantify through discussion with the building management contacts.

The three areas of the algorithm adopted for the ACM setting assessment are:

- Occupant activity
- Likelihood of disturbance
- Human exposure potential

Each of the above parameters are summarised below.

### 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 has much less exposure potential than 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 ACM setting is shown in Table 2.

**Table 2: HSG227 (2002) Priority Assessment Algorithm – Setting**

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

Each of the parameters is scored and added together to give a total score between 0 and 21. The setting score is then added to the ACM score to provide an overall value. The final value will help 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 Results

## 4.1 Bulk Results

A total of 47 bulk samples were taken and analysed and the analytical results are presented in Appendix 6. The results are summarised in Table 4 below. Three other buildings were noted as having asbestos roofs but were not sampled as samples could not be conveniently obtained. They were:

- The Honey Processing Building
- Niue Broadcasting Building
- The Catholic Church

**Table 4: Bulk Sample Analytical Results – First Visit**

| Number | Location | Asbestos Type | Percentage |
|---|---|---|---|
| NU1 | Avatele Church panels | Chrysotile | 7% |
| NU2 | Sassy Sissy Fashions cladding | Chrysotile | 10% |
| | | Amosite | 7% |
| NU3 | Jenna's Restaurant cladding | Chrysotile | 15% |
| NU4 | Avatele Old School panels | Chrysotile | 10% |
| NU5 | Primary School North classroom soffits | None detected | |
| NU6 | Power Station large shed claddings | None detected | |
| NU7 | Alofi Rentals cladding | None detected | |
| NU8 | Peta Paints / St Francis cladding (roofing) | Chrysotile | 10% |
| | | Amosite | 7% |
| NU9 | Falalafa Restaurant cladding | None detected | |
| NU10 | Makini Handcrafts cladding | None detected | |
| NU11 | Alofi South Hall cladding | Chrysotile | 15% |
| NU12 | Makini Handcrafts old toilet fence/cladding | Chrysotile | 10% |
| | | Amosite | 10% |
| NU13 | Paleni's Travel cladding | Chrysotile | 7% |
| NU14 | Abbatoir cladding | None detected | |
| NU15 | G's Minimart cladding | None detected | |
| NU16 | Prison cladding | Chrysotile | 15% |
| NU17 | Abandoned house Makefu cladding | Chrysotile | 15% |
| NU18 | Bitumen tank C lagging near hospital | None detected | |
| NU19 | Bitumen tank A lagging Hui Hui | None detected | |
| NU20 | Abandoned house Taumatatoga cladding | Chrysotile | 10% |
| | | Amosite | 7% |
| NU21 | Abandoned house Taumatatoga cladding debris | None detected | |
| NU22 | Abandoned house Taumatatoga roof | Chrysotile | 10% |
| | | Amosite | 7% |
| NU23 | Primary School cladding back toilet block | Chrysotile | 2% |

| Number | Location | Asbestos Type | Percentage |
|---|---|---|---|
| NU24 | Secondary School cladding | Chrysotile | 15% |
| NU25 | Via Mamali /Rock Bak Bakery cladding | Chrysotile | 15% |
| NU26 | Niue Golf/Sports Club cladding | None detected | |
| NU27 | Daniel Makaia's shed cladding | None detected | |
| NU28 | Public Works cladding | Chrysotile | 20% |
| NU29 | Primary School debris back of EC block | Chrysotile | 10% |
| | | Amosite | 10% |
| NU 30 | Police Station cladding | Chrysotile | 20% |
| NU31 | Katuali Coffee Shop cladding | None detected | |
| NU32 | Power Station small shed cladding | None detected | |
| NU33 | Tuapa Hall cladding | Chrysotile | 15% |
| NU34 | Liku abandoned house south vinyl floor | None detected | |
| NU35 | Liku abandoned house wall | Chrysotile | 15% |
| NU36 | Liku abandoned house sheeting on ground | None detected | |
| NU37 | Lakepa occupied house vinyl floor tiles | None detected | |
| NU38 | Lakepa abandoned house cladding | Chrysotile | 7% |
| | | Amosite | 10% |
| NU39 | Lakepa waste roofing stockpile behind old school | Chrysotile | 5% |
| | | Amosite | 10% |
| NU40 | Toi Meeting Hall | Chrysotile | 15% |
| NU41 | Vaiea Community Centre soffit | None detected | |
| NU42 | Kupa's Piggery Lakepa roof | Chrysotile | 10% |
| | | Amosite | 3% |
| NU43 | Old Hakupu School cladding | Chrysotile | 8% |
| | | Amosite | 5% |
| | | Crocidolite | 2% |
| NU44 | Lakepa Pre-school cladding | Chrysotile | 7% |
| | | Amosite | 7% |
| NU45 | Liku abandoned house south vinyl floor | None detected | |
| NU46 | Lakepa Church back cladding | None detected | |
| NU47 | Liku abandoned house piping | Chrysotile | 15% |

There are at least four old bitumen tankers abandoned on Niue by Fulton Hogan from an earlier roading project on Niue. One of these tankers (and maybe more than one) has been abandoned at Hui Hui (Tank D) and the other three have been abandoned in an area near the hospital adjacent to a reservoir (Tanks A, B and C).

There is an old Dowdell New Zealand Analysis (October 2011) for Tank D which indicates that the lagging is amosite. Additional sampling was done on the First PacWaste Visit of Tanks A and D (Samples NU18 and NU19 above) which produced a negative result for asbestos. This was puzzling as they contradicted the Oct 11 Dowdell result.

More sampling was carried out during the Second PacWaste visit in order to clear this matter up and the results are presented in Table 5 below together with the earlier Oct 11 Dowdell result.

This time two samples were taken from each of Tanks A and B and the four results were all positive for amosite although with varying concentrations of amosite. One sample was taken from Tank D and split, with half sent to EMS and half sent to Dowdell. Both labs gave a similar result – i.e. not detectable. The EMS result indicated that the insulation material was fibreglass. It is evident, therefore, that part of the insulation on the tanks is amosite asbestos and part is fibreglass. The amosite concentration varies at different locations on the tanks.

**Table 5: Bulk Sample Analytical Results – Second Visit**

| Number | Laboratory | Location | Asbestos Type | Percentage |
|---|---|---|---|---|
| 4 | EMS | Reservoir Tank Mid Tank A | Amosite | 20% |
| 5 | EMS | Reservoir Tank End Tank A | Amosite | 20% |
| 6 | EMS | Reservoir Tank Mid Tank B | Amosite | 70% |
| 7 | EMS | Reservoir Tank End Tank B | Amosite | 35% |
| 8 | EMS | Hui Hui Tank (Split Sample) | Not Detectable | Nil |
| Oct-11 | Dowdell | Hui Hui Tank | Amosite | Not Given |
| 8 | Dowdell | Hui Hui Tank (Split Sample) | Not Detectable | Nil |

## 4.2 Air Results

On the first visit a total of 9 air samples were taken and analysed by Phase Contrast Microscopy (PCM). No results of any significance were obtained as they were all below the Limit of Detection (LOD). The results are presented in Appendix 6 and summarised in Table 6 below.

**Table 6: Air Sample Analytical Results – First Visit**

| Sample No | Location | Fibres Counted (Fibres / 100 Fields) | Above LOD of 5.5 Fibres / 100 Fields |
|---|---|---|---|
| A1 | Hui Hui Site 1 | 1 | No |
| A2 | Hui Hui Site 2 | 0 | No |
| A3 | Daniel's House Site, Avatele | 0 | No |
| A4 | Alofi North Houses | 0 | No |
| A5 | Primary School EC Block Area | 0 | No |
| A6 | Inside Peta Paints | 0 | No |
| A7 | Makini Handicrafts Inside Shed at Back | 0.5 | No |
| A8 | Secondary School Above Classroom Door | 0.5 | No |
| A9 | Taloa Heights Accommodation on Outside Deck | 0.5 | No |

On the second visit three air samples were taken around the operational activities of packing up the asbestos. As the PCM results obtained were all above the LOD, the samples were then further examined using the Transmission Electron Microscope (TEM) method. The PCM method can include fibres that are not asbestos but the TEM method identifies only asbestos fibres as the resolution is greater.

The TEM results confirmed that asbestos fibres were present in the air for all three samples. Both sets of results are presented in Appendix 6 and summarised in Table 7 below:

**Table 7: Air Sample Analytical Results – Second Visit**

| Sample No | Location | Fibres Counted (Fibres / 100 Fields) | Above LOD of 5.5 Fibres / 100 Fields | TEM Result (Fibres Counted) |
|---|---|---|---|---|
| 1 | On Truck at Lakepa | 5.5 | Yes | 3 |
| 2 | On Truck at Container Process Area | 7 | Yes | 10.5 |
| 3 | By Entrance to Container at Container Process Area | 17.5 | Yes | 8.5 |

A further note was provided with the TEM results that Amosite was present in all three samples.

## 4.3 Wipe Results

On the first visit four wipe samples were taken and two further wipe samples were taken on the second visit including an additional one in Peta Paints where a high wipe result was obtained on the first visit. The results are presented in Appendix 6 and summarised in Table 8 below.

**Table 8: Wipe Sample Analytical Results – First and Second Visits**

| Sample No | Location | First Visit | | Second Visit | |
|---|---|---|---|---|---|
| | | Chrysotile (Str/cm2) | Amphibole (Str/cm2) | Chrysotile (Str/cm2) | Amphibole (Str/cm2) |
| W1 | Primary School Red Classroom | <2000 | <2000 | | |
| W2 | Secondary School Classroom Ledge | <10000 | <10000 | | |
| W3 | Inside Peta Paints | 910000 | 81000 | | |
| W4 | Makini Handcrafts Shed at Back | 60000 | <10000 | | |
| 9 | Honey Processing Building - Top Shelf | | | 71000 | 5800 |
| 10 | Peta Paints - Window Sill | | | 350000 | 13000 |

The ASTM 6480 method mentioned in Section 2.5.3 above does not describe procedures for the evaluation of the relationship between asbestos sampled from a surface and potential human exposure. The usual interpretation on the results of wipe testing is that below 10,000 asbestos structures/ $cm^2$ would be considered a low level of contamination, 10,000 to 100,000 would be considered moderate contamination, and above 100,000 asbestos structures/ $cm^2$ would be considered significantly contaminated. "*Settled Asbestos Dust Sampling and Analysis*" by Steve M. Hays and James R. Millette, Pages 49 — 51 discusses interpretation of the results, and this is the suggestion the authors make. James Millette was the ASTM vice-chairman on the Sampling and Analysis of Asbestos, until 2007 and chairman from 2007 to 2014.

Based on Millette's interpretation, therefore, the two results from Peta Paints demonstrate significant chrysotile contamination and moderate amphibole contamination. The Makini Handicrafts shed and the Honey Processing Building demonstrate moderate chrysotile contamination.

# 5.0 Analysis of the Results

## 5.1 Residential Survey

As discussed in Section 2.2 above, based on the 2011 Census there were 27 occupied houses out of a total of 477 occupied houses that had asbestos roofs. This included 17 with complete asbestos roofs and 10 with a combination of asbestos and steel.

The number of unoccupied houses with asbestos or partial asbestos roofs was not counted in the 2011 survey. The 2014/2015 report from the Niue Asbestos Project Manager (Appendix 4) indicates, however, that as at September 2014, a total of 317 unoccupied houses were counted as having asbestos roofs. By January 2015 a total of 126 of these roofs had been removed from unoccupied houses, leaving 191 remaining. Concern was expressed in this report about the difficulty of obtaining consents to remove the roofs from the unoccupied houses. Reference is made in the report to the ability to exercise powers provided by a local regulation but that there is reluctance to use this power.

To quote from the report: *"It's a big task trying to convince the owners and custodians of the remaining houses to provide consents so we can take out the roofs and effectively complete this part of the project. We could have easily used the regulation available but we had to respect the wishes of the family first and always tried to maintain a constructive approach for an appropriate end result."*

The report said that the house owners were looking for a deal to remove the asbestos roofs and replace them with steel roofs but that this was beyond the budget of the project. It is noted that if the asbestos roofs are to be removed from the 27 occupied houses that have asbestos roofs then this needs to be done in conjunction with the replacement with steel roofs. It should also be noted that some of these occupied houses with asbestos roofs may already have had the asbestos roofs replaced.

Reference was also made in the 2014/2015 report to a "Future Aspiration" to remove the asbestos cladding from houses. To quote the report again: *"Government is looking also at getting rid of the flat asbestos materials used for hurricane houses that came together with the corrugated ones in the 1960s, so Niue would be truly free of asbestos materials once and for all as we move forward intot he future. The survey for the houses with flat asbestos still had to be done but a few of these houses have been dealt with alongside with the work done for the removal of the corrugated roofs."*

During the first visit of the PacWaste team, it was decided to carry out a survey of houses with fibreboard cladding. This was done via a drive around the island where houses were counted with clickers. A total of 865 houses (occupied and unoccupied) were counted. A total of 85 unoccupied houses were counted with cladding and 79 occupied houses were counted with cladding. If a simple scale-up is applied from the 865 houses counted to the 1015 houses counted in the 2011 Census, then there will be 100 unoccupied houses with fibreboard cladding and 93 occupied houses with fibreboard cladding.

The question now remains as to how many of the houses with fibreboard cladding actually have asbestos board cladding. Some assistance can be gained from analysing the cladding part of the results presented in Table 4 above. A total of 34 cladding samples were analysed and 21 samples were positive for asbestos, or 61.8%. Based on this figure, there are therefore 62 unoccupied

houses with asbestos cladding and 57 occupied houses with asbestos cladding. The accuracy of these figures needs to be tested, however, and the individual houses that have asbestos cladding needs to be discovered. Each house, therefore, that has fibreboard cladding needs to be tested individually.

Photos 1-4 below show some typical houses with asbestos roofs, two of which are in very poor condition.




**Photos 1-4: Houses with Asbestos Roofs**

Photos 5-6 below show houses with asbestos cladding (and roof in one case). This cladding is also in bad condition.


**Photos 5-6: Houses with Asbestos Cladding**

## 5.2 Non-Residential Survey

Numerous non-residential buildings have asbestos roofs and cladding and many of these are in Alofi. Table 9 sets out the locations that have been identified, together with assigned risk rankings. Some photos and descriptions are also set out below.


**Photo 7: Public Works Department – Cladding Front and Sides**

**Photo 8: Vai Mamali/Rockbak Building Cladding**

**Photo 9: Honey Processing Building Roof**

**Photo 10: Niue Broadcasting Cladding/Soffits**

It should be noted that a wipe sample taken in the Honey Processing Building on the second visit produced a moderately high result for chrysotile of 71,000 Str/cm2.

**Photos 11-12: Primary School – Cladding and Soffits**

**Photo 13: Asbestos Debris Behind Primary School**

**Photo 14: Secondary School Cladding**

**Photo 15: Alofi Bread Shop Soffits**

**Photo 16: Police Station Cladding**

**Photos 17-18: The Shed and Fence Behind Makini Handicrafts**

The shed in Photo 17 tested negative but the fence shown in Photo 18 that is made out of asbestos roofing materials tested positive. An air sample was taken from this shed that proved to be negative. A wipe sample was also taken that demonstrated moderate surface chrysotile contamination.

**Photo 19: Alofi South Hall Cladding**

**Photo 20: Sassy Fashions/Breakthrough Cladding**

**Photo 21: Peleni's Travel Cladding**

**Photo 22: St Joseph's/Peta Paints Roof and Cladding**

The old building housing the St Joseph's Automotive Repair Shop and the Peta Paints Retail Shop has a large amount of old asbestos roofing and cladding. An air sample was taken inside Peta Paints that proved to be negative. A wipe sample taken on the first visit produced a very high result of 910,000 Str/cm2 for chrysotile and a moderately high result of 81,000 Str/cm2 for amphibole (amosite and crocidolite). A second sample was taken on the second visit and chrysotile was still high at 350,000 Str/cm2 and amphibole was still significant at 12,000 Str/cm2.

This building needs to have the asbestos removed and the structure needs to be cleaned. It is an old high building and some significant safety issues need to be addressed, regarding the removal of the asbestos.

**Photo 23: Avatele Church Panels**

**Photo 24: Catholic Church Roof**

**Photo 25: Reservoir Bitumen Tank A**

**Photo 26: Three Reservoir Bitumen Tanks**

**Photo 27: Close-up of Tank A Lagging**

**Photo 28: Bitumen Tank at Hui Hui**

Photos 25-28 show the bitumen tanks abandoned by Fulton Hogan from an earlier roading project. There are three tanks in one location on the road to the hospital near a reservoir and at least one (and possibly more than one) near the entrance to the Hui Hui hazardous waste site. Based on the analyses done to date and reported in section 4.1 above, a large amount of the lagging in these tankers is amosite asbestos. Some of the lagging has tested negative but seeing as much of it has tested positive for amosite, probably all the lagging should be regarded as amosite or at least potentially amosite contaminated.

This large amount of lagging is friable asbestos and the removal of this asbestos, as well as the clean-up of the contaminated ground under the tanks, is a major and specialist project that needs to be carried out using appropriate asbestos management protocols.

## 5.3 Asbestos Removal Operation

During the second PacWaste visit by Dirk Catterall some air monitoring was carried out in conjunction with asbestos removal operations by the asbestos removal crew operating on Niue. Three air samples were taken as follows:

- Sample 1 was taken on the truck at Lakepa during loading of asbestos
- Sample 2 was taken on the truck just outside the container where the scraping was being done prior to shipment.
- Sample 3 was taken to one side of this container.

These sample locations are shown in Photos 29-31 below.

**Photo 29: Air Sample Pump 1**

**Photo 30: Air Sample Pump 2**

**Photo 31: Air Sample Pump 3**

The analyses of these air samples demonstrated significant amounts of airborne asbestos around these operations. The PCM results may pick up other fibres besides asbestos but they were verified by further analyses using the Transmission Electron Microscope (TEM). These results are reported in Section 4.2 above. High results were reported from Sample Pumps 2 and 3 but Sample Pump 1 also registered a significant result.

Photo 32 below shows the operations at the container area. The worker shown in the container is scraping the asbestos in preparation for export. Based on the air results, the conclusion can be drawn that these workers are at risk of asbestos exposure. The ground may also be in the process of becoming contaminated.


**Photo 32: Asbestos Processing Operations**

The second PacWaste visit by Dirk Catterall was arranged to assist with the removal operation. Training was provided and Dirk Catterall worked with the crew to provide further on-the-job training. To support the training an "Asbestos Removal Plan" (ARP) has been prepared and also a "Standard Operating Procedure" (SOP). The ARP and SOP have been included in Appendix 5 together with a report from Dirk Catterall. The main points from this report are summarised below:

- It is evident that the asbestos removal crew members do need guidance. One problem is that a number of the sites where ACM has been removed will have been contaminated with their methodology.
- Moving forward, all debris will now be cleaned and bagged in the container, although it would be preferable to discard the cleaning process altogether.
- The training component completed should assist the work crew and give them more confidence in what they are doing.
- There is an urgent need for PPE, Lee's mask is perishing; there is no replacement for that at present. Suits should be replaced every time someone exits and accesses the dirty area. Mask filters should be replaced weekly. Other tools needed are an 'H' class HEPA vacuum cleaner, barrier tape and 'Danger Asbestos' signs.
- There are 180 houses left to remediate, along with this, many of them have AC cladding which will need to be removed.
- An ideal set up for the ongoing work would be a changing/ decontamination area at Reef Shipping where the work crew can clean themselves at the end of the day. It would be advisable to put a cheap shower/ washing machine/ lockers in one of the containers for this work. Shorts and T shirt could be provided for wearing under the suit.
- There needs to be a stockpile of PPE consumables, say 10 silicone masks, boxes of filters, to be changed weekly, enough suits for the work crew to change into/out of without contaminating themselves, which does easily happen when suits are re-used. Also some P2 disposable paper masks, more suitable for when it's very hot.
- They need 'barrier tape' and a 'Danger Asbestos' sign or two.
- For any work on houses where there are occupants, asbestos dust is most likely to fall down on the interior possessions when it is removed. The work crew will need to gather all furnishings into the centre of the room and cover them with plastic sheet, they will also need an 'H' class HEPA vacuum to clean the interior of the house including the roofing timbers prior to the home being reoccupied.

- Lee has told me they have had one instance where someone has fallen through the roof and broken a leg. Working on fragile roofs is dangerous. A harness for the 2 workers who work on the roof would be a big safety plus. Lee might need some training on how to rig a simple rope access system up properly.
- Lee has asked for a couple of heavy duty tarpaulins that can be cleaned, to cover the sheeting on the back of the truck. In NZ we would use 250 micron plastic, and then throw it away. Either of these solutions will help keep the ACM safe during transportation to the Reef Shipping site.
- Lee should re-visit some of the sites where a lot of 'brushing' of ACM has occurred and attempt to collect contaminated soil using a shovel and nylon/ asbestos bags.
- The work crew would like to have a dedicated truck with 4 seats instead of a hire truck, suggested they use an additional car for labour.
- There is a high turnover of staff, other than Lee, so there is a need for additional PPE such as steel capped boots and tinted safety glasses.

## 6.0 Risk Assessment

Utilising the algorithms described in Section 2 of this report, the laboratory analysis data for PACM samples (where available) and observations of the sites visited, each site was listed in order of priority in Table 9 below.

**Table 9: Risk Ranking Scores – Niue**

| Item | Type | Asbestos Type | Risk Ranking | | | Comments |
|---|---|---|---|---|---|---|
| | | | ACM Score | Setting Score | Total Score | |
| Empty House roofs | Roofs | Mostly Chrysotile and some Amosite | 6 | 13 | 19 | Typical Scores only - the Risk Ranking will vary from house to house depending on the condition of each house |
| Occupied House roofs | Roofs | Mostly Chrysotile and some Amosite | 5 | 16 | 21 | |
| Empty House cladding | Cladding | Mostly Chrysotile and some Amosite | 6 | 16 | 22 | |
| Occupied House cladding | Cladding | Mostly Chrysotile and some Amosite | 5 | 18 | 23 | |
| Public Works | Cladding | Chrysotile | 3 | 16 | 19 | |
| Honey Processing | Roofs | Not Tested - very likely Chrysotile and maybe Amosite | 5 | 17 | 22 | The wipe test was high here |
| Vai Mamali / Rockbak Building | Cladding | Chrysotile | 3 | 16 | 19 | |
| Niue Broadcasting | Cladding / Soffits | Not Tested - likely Chrysotile and maybe Amosite | 3 | 15 | 18 | |
| Alofi Bread Shop | Cladding / Soffits | Not Tested - likely Chrysotile and maybe Amosite | 4 | 15 | 19 | |
| Primary School | Cladding / Soffits | Chrysotile | 4 | 18 | 22 | |
| Primary School Debris at Back | Debris | Chrysotile, Amosite | 6 | 16 | 22 | |
| Secondary School | Cladding | Chrysotile | 3 | 17 | 20 | |
| Avatele Old School | Panels | Chrysotile | 3 | 14 | 17 | |
| Police Station | Cladding / Soffits | Chrysotile | 3 | 16 | 19 | |
| Makini Handcrafts | Fence made from Roofing | Chrysotile, Amosite | 5 | 13 | 18 | |
| Alofi South Hall | Cladding | Chrysotile | 3 | 17 | 20 | |
| Jenna's Restaurant | Cladding | Chrysotile | 3 | 15 | 18 | |
| Sassy Fashions / | Cladding | Chrysotile | 3 | 15 | 18 | |

| Item | Type | Asbestos Type | Risk Ranking | | | Comments |
|---|---|---|---|---|---|---|
| Breakthrough | | | | | | |
| Peleni's Travel | Cladding | Chrysotile | 3 | 15 | 18 | |
| St Joseph's Automechanics / Peta Paints | Roofing / Cladding | Chrysotile, Amosite | 6 | 20 | 26 | |
| Prison | Cladding | Chrysotile | 4 | 18 | 22 | |
| Prison Toilet Vent Pipe | Pipe | Not Tested - very likely Chrysotile | 3 | 10 | 13 | |
| Abbatoir / Meat Processing | Roof | Not Tested - very likely Chrysotile and maybe Amosite | 4 | 14 | 18 | |
| Avatele Church Panels | Panels | Chrysotile | 3 | 15 | 18 | |
| Catholic Church | Roofing | Not Tested - very likely Chrysotile and maybe Amosite | 4 | 15 | 19 | |
| Tuapa Hall | Cladding | Chrysotile | 3 | 15 | 18 | |
| Toi Meeting Hall | Cladding | Chrysotile | 3 | 14 | 17 | |
| Old Hakupu School | Cladding | Chrysotile, Amosite, Crocidolite | 5 | 14 | 19 | |
| Lakepa Pre-School | Cladding | Chrysotile, Amosite | 4 | 16 | 20 | |
| Old Lapeka School Waste Roof Stockpile | Waste Roofing | Chrysotile | 4 | 4 | 8 | This has now all been removed |
| Piping in Old Liku House | Piping | Chrysotile | 2 | 11 | 13 | This may have been removed |
| Old Fulton Hogan Bitumen Tankers | Friable Amosite | | 11 | 7 | 18 | Very serious ACM Score but not very accessible |

There is therefore one site that is ranked as high risk and that is the St Joseph's Automotive / Peta Paints site. The house scores are, however, typical scores only and some of these may also rank individually as high risk.

Apart from the houses there are 24 locations that rank as moderate risk, mainly by virtue of their settings. In fact of these 24 locations, ten have high risk settings. The bitumen tankers have a very serious ACM score but are not very accessible so they score low in setting, giving an overall "moderate" risk ranking. It should be noted, however, that these tankers will continue to deteriorate and thus the risk associated with them will continue to increase. They should be fenced off with danger notices erected, so that contact with them is minimised.

# 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 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 administrative controls that can assist with effectively managing the risk ACM presents. However, in certain situations, administrative 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 UK Health and Safety Executive (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 contractors 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.

e) 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.

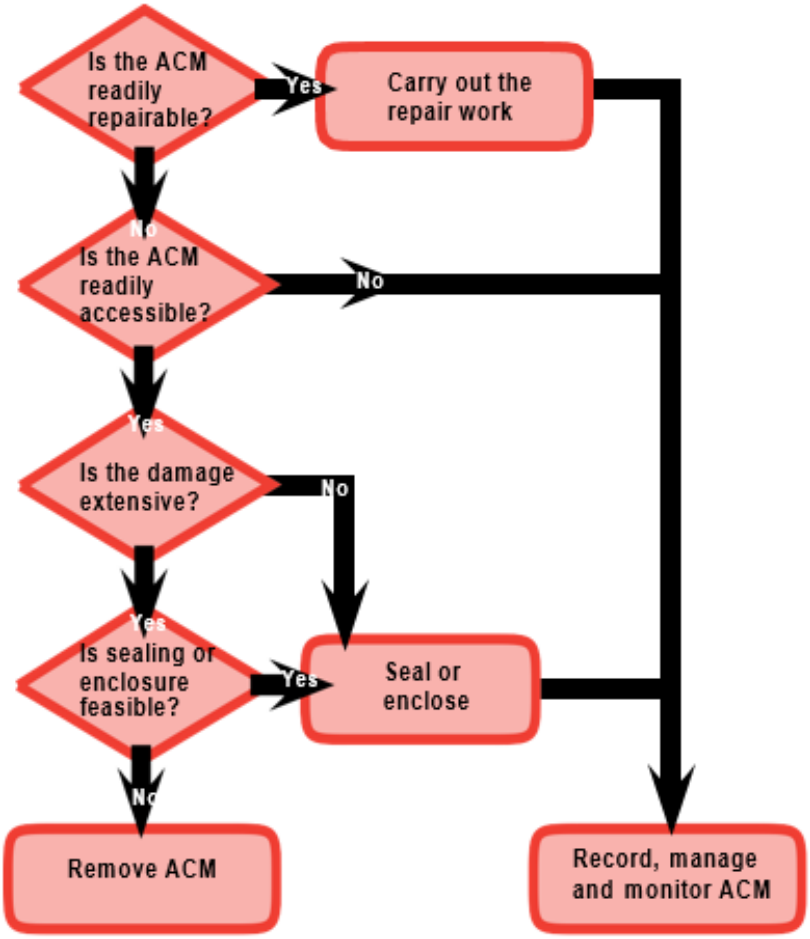


**Figure 2: ACM Management Flow Chart**

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 33 and 34 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 33 and 34: 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 Niue

Table 9 below shows the sites on Niue that returned a positive result for ACM and the most suitable, cost effective remedial options based on the flow chart process described above. This table excludes the houses. The “repair” and “isolate” options selected for some locations are suggested temporary measures only.

**Table 10: Possible Remedial Options for Niue**

| Item | Type | Asbestos Type | Risk Ranking | Applicable Remedial Options | | | |
|---|---|---|---|---|---|---|---|
| | | | | Repair | Isolate | Encap-sulate | Remove |
| Public Works | Cladding | Chrysotile | 19 | × | × | ✓ | ✓ |
| Honey Processing | Roofs | Not Tested - very likely Chrysotile and maybe Amosite | 22 | × | × | ✓ | ✓ |
| Vai Mamali / Rockbak Building | Cladding | Chrysotile | 19 | × | × | ✓ | ✓ |
| Niue Broadcasting | Cladding / Soffits | Not Tested - likely Chrysotile and maybe Amosite | 18 | × | × | ✓ | ✓ |
| Alofi Bread Shop | Cladding / Soffits | Not Tested - likely Chrysotile and maybe Amosite | 19 | ✓ | × | ✓ | ✓ |
| Primary School | Cladding / Soffits | Chrysotile | 22 | ✓ | × | × | ✓ |
| Primary School Debris at Back | Debris | Chrysotile, Amosite | 22 | × | × | × | ✓ |
| Secondary School | Cladding | Chrysotile | 20 | × | × | × | ✓ |
| Avatele Old School | Panels | Chrysotile | 17 | × | × | ✓ | ✓ |
| Police Station | Cladding / Soffits | Chrysotile | 19 | × | × | ✓ | ✓ |
| Makini Handcrafts | Fence made from Roofing | Chrysotile, Amosite | 18 | × | × | × | ✓ |
| Alofi South Hall | Cladding | Chrysotile | 20 | × | × | ✓ | ✓ |
| Jenna's Restaurant | Cladding | Chrysotile | 18 | × | × | ✓ | × |
| Sassy Fashions / Breakthrough | Cladding | Chrysotile | 18 | × | × | ✓ | ✓ |
| Peleni's Travel | Cladding | Chrysotile | 18 | × | × | ✓ | × |
| St Joseph's Automechanics / Peta Paints | Roofing / Cladding | Chrysotile, Amosite | 26 | × | × | × | ✓ |
| Prison | Cladding | Chrysotile | 22 | × | × | ✓ | ✓ |
| Prison Toilet Vent Pipe | Pipe | Not Tested - very likely Chrysotile | 13 | × | × | ✓ | ✓ |

| Item | Type | Asbestos Type | Risk Ranking | Applicable Remedial Options | | | |
|---|---|---|---|---|---|---|---|
| Abbatoir / Meat Processing | Roof | Not Tested - very likely Chrysotile and maybe Amosite | 18 | × | × | ✓ | ✓ |
| Avatele Church Panels | Panels | Chrysotile | 18 | × | × | ✓ | ✓ |
| Catholic Church | Roofing | Not Tested - very likely Chrysotile and maybe Amosite | 19 | × | × | × | ✓ |
| Tuapa Hall | Cladding | Chrysotile | 18 | × | × | ✓ | ✓ |
| Toi Meeting Hall | Cladding | Chrysotile | 17 | × | × | ✓ | ✓ |
| Old Hakupu School | Cladding | Chrysotile, Amosite, Crocidolite | 19 | × | × | ✓ | ✓ |
| Lakepa Pre-School | Cladding | Chrysotile, Amosite | 20 | × | × | × | ✓ |
| Old Lapeka School Waste Roof Stockpile | Waste Roofing | Chrysotile | 8 | × | × | × | ✓ |
| Piping in Old Liku House | Piping | Chrysotile | 13 | × | × | × | ✓ |
| Old Fulton Hogan Bitumen Tankers | Lagging | Friable Amosite | 18 | × | ✓ | × | ✓ |

# 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 11 below.

**Table 11: Related International Conventions**

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

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

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

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

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

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

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

## 9.2 Local Burial

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

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

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

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

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

e) Records of dates and quantities should be kept.

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

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

## 9.3 Disposal at Sea

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

Annex 1 to the Protocol covers the following wastes

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

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

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

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

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

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

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

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

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

One of two associated protocols is the Dumping Protocol which aims to prevent, reduce and control pollution by dumping of wastes and other matter in the South Pacific. Annexes associated with the protocol would permit the dumping of asbestos provided such dumping did not present a serious obstacle to fishing or navigation. A General Permit would be needed, however, that covers a

number of matters including impacts on the marine environment and human health and whether sufficient scientific knowledge exists to determine such impacts properly. Parties are required to designate an appropriate authority to issue permits.

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

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

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

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

## 9.4 Export to Another Country

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

The *Basel Convention on the Control of Trans-boundary Movements of Hazardous Wastes and their Disposal*, (the Basel Convention), is an international treaty that was designed to reduce the movements of hazardous waste between nations, and specifically to prevent transfer of hazardous wastes from developed to less developed countries. The Convention is also intended to minimise the amount and toxicity of wastes generated, to ensure their environmentally sound management as

closely as possible to the source of generation. The Basel Convention states clearly that the trans-boundary movement of hazardous wastes and other wastes should be permitted only when the transport and the ultimate disposal of such wastes is environmentally sound.

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

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

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

Permits are currently held to import asbestos waste into New Zealand from New Caledonia, French Polynesia and Niue.

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 Niue Situation

Niue has already examined the various disposal options and rejected local disposal. It does not have a suitable landfill and the option of constructing a specially-dedicated monofill was considered and rejected as unacceptable.

Disposal at sea was also considered and rejected as expensive and unacceptable.

The option of export to New Zealand was chosen as the preferred option and has been successfully implemented. This is being done under the Waigani Convention. The Niue Asbestos Annual Report in Appendix 4 lists the following shipments as having been made to New Zealand:

- First Shipment June 2014: 20 Containers
- Second Shipment September 2014: 20 Containers
- Third Shipment November 2014: 18 Containers

A total of 58 containers were therefore shipped up to November 2014. The containers are shipped via Matson Shipping and are delivered to Redvale Landfill in Auckland where they are buried unopened.

Loading of containers is via a barge at the wharf in Niue and the barge delivers the containers to the ship – see Photo 35 below.

**Photo 35: Niue Wharf Cargo Transfers**

# 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 7). 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 7 and a summary is presented as follows:

Roof Encapsulation

Costs:

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

Assumptions:

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

Cladding Encapsulation

Costs:

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

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

Assumptions:

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

## 10.2 Removal and Replacement

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

The full cost build ups are presented in Appendix 7 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. In the case of Niue an additional 10% has been added for the cost of disposal, based on information provided.

<u>Cladding Removal and Replacement</u>

Costs:

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

Assumptions:

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

**Table 12: Summary of Costs for Various Remediation Options (Costs rounded to nearest $US)**

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

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

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

## 10.3 Niue Costings

The above costings have been adjusted a little to suit Niue conditions and an overall costings spreadsheet has been prepared and presented in Table 13 below. The figures will of course need to be reviewed by the Niuean asbestos management team in light of the experience they have gathered from their work to date.

**Table 13: Niue Estimated Overall Costings**

| Item | Type | Unit | Amount | Unit Cost (NZD) | Total Cost (NZD) | Total Cost Adjusted for Disposal at 10% Extra (NZD) | Risk Ranking | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | ACM Score | Setting Score | Total Score |
| Empty House roofs to go - assume 200 houses @ 120 m2/house | Roofs | m2 | 24000 | 25 | 600,000.00 | 660,000.00 | 6 | 13 | 19 |

| Item | Type | Unit | Amount | Unit Cost (NZD) | Total Cost (NZD) | Total Cost Adjusted for Disposal at 10% Extra (NZD) | Risk Ranking | | |
|---|---|---|---|---|---|---|---|---|---|
| Occupied House roofs - assume 27 based on 2011 census @ 120 m2/house | Roofs | m2 | 4320 | 65 | 280,800.00 | 308,880.00 | 5 | 16 | 21 |
| Empty House cladding - assume 100 houses @ 120 m2/house and 55% asbestos | Cladding | m2 | 6600 | 20 | 132,000.00 | 145,200.00 | 6 | 16 | 22 |
| Occupied House cladding - assume 93 @ 120 m2/house and 55% asbestos | Cladding | m2 | 6138 | 50 | 306,900.00 | 337,590.00 | 5 | 18 | 23 |
| Public Works | Cladding | m2 | 65 | 50 | 3,250.00 | 3,575.00 | 3 | 16 | 19 |
| Honey Processing | Roof | m2 | 270 | 65 | 17,550.00 | 19,305.00 | 5 | 17 | 22 |
| Vai Mamali / Rockbak Building | Cladding | m2 | 260 | 50 | 13,000.00 | 14,300.00 | 3 | 16 | 19 |
| Niue Broadcasting | Cladding / Soffits | m2 | 125 | 50 | 6,250.00 | 6,875.00 | 3 | 15 | 18 |
| Alofi Bread Shop | Cladding / Soffits | m2 | 80 | 50 | 4,000.00 | 4,400.00 | 4 | 15 | 19 |
| Primary School | Cladding / Soffits | m2 | 280 | 50 | 14,000.00 | 15,400.00 | 4 | 18 | 22 |
| Primary School Debris at Back | Debris | LS | LS | 500 | 500.00 | 550.00 | 6 | 16 | 22 |
| Secondary School | Cladding | m2 | 490 | 50 | 24,500.00 | 26,950.00 | 3 | 17 | 20 |
| Avatele Old School | Panels | m2 | 10 | 20 | 200.00 | 220.00 | 3 | 14 | 17 |
| Police Station | Cladding / Soffits | m2 | 200 | 50 | 10,000.00 | 11,000.00 | 3 | 16 | 19 |
| Makini Handcrafts | Roofing Fence | m2 | 10 | 20 | 200.00 | 220.00 | 5 | 13 | 18 |
| Alofi South Hall | Cladding | m2 | 234 | 50 | 11,700.00 | 12,870.00 | 3 | 17 | 20 |
| Jenna's Restaurant | Cladding | m2 | 114 | 50 | 5,700.00 | 6,270.00 | 3 | 15 | 18 |
| Sassy Fashions / Breakthrough | Cladding | m2 | 224 | 50 | 11,200.00 | 12,320.00 | 3 | 15 | 18 |
| Peleni's Travel | Cladding | m2 | 120 | 50 | 6,000.00 | 6,600.00 | 3 | 15 | 18 |
| St Joseph Automechanics / Peta Paints | Roofing / Cladding | m2 | 1250 | 75 | 93,750.00 | 103,125.00 | 6 | 20 | 26 |
| Prison | Cladding | m2 | 60 | 50 | 3,000.00 | 3,300.00 | 4 | 18 | 22 |

| Item | Type | Unit | Amount | Unit Cost (NZD) | Total Cost (NZD) | Total Cost Adjusted for Disposal at 10% Extra (NZD) | Risk Ranking | | |
|---|---|---|---|---|---|---|---|---|---|
| Prison Toilet Vent Pipe | Pipe | m2 | 3 | 20 | 60.00 | 66.00 | 3 | 10 | 13 |
| Abbatoir / Meat Processing | Roof | m2 | 60 | 60 | 3,600.00 | 3,960.00 | 4 | 14 | 18 |
| Avatele Church Panels | Panels | m2 | 120 | 65 | 7,800.00 | 8,580.00 | 3 | 15 | 18 |
| Catholic Church | Roofing | m2 | 260 | 65 | 16,900.00 | 18,590.00 | 4 | 15 | 19 |
| Tuapa Hall | Cladding | m2 | 90 | 50 | 4,500.00 | 4,950.00 | 3 | 15 | 18 |
| Toi Meeting Hall | Cladding | m2 | 525 | 50 | 26,250.00 | 28,875.00 | 3 | 14 | 17 |
| Old Hakupu School | Cladding | m2 | 572 | 50 | 28,600.00 | 31,460.00 | 5 | 14 | 19 |
| Lakepa Pre-School | Cladding | m2 | 8 | 50 | 400.00 | 440.00 | 4 | 16 | 20 |
| Old Lapeka School Waste Roof Stockpile | Waste Roofing | LS | LS | 20000 | 20,000.00 | 22,000.00 | 4 | 4 | 8 |
| Piping in Old Liku House | Piping | LS | LS | 3000 | 3,000.00 | 3,300.00 | 2 | 11 | 13 |
| **TOTAL** | | | | | **1,655,610.00** | **1,821,171.00** | | | |
| Old Fulton Hogan bitumen Tankers (Cost includes setting up as friable asbestos project and also cleaning up and disposing of soil) | Friable Amosite Lagging | Tanker | 5 | 30000 | 150,000.00 | 165,000.00 | 11 | 7 | 18 |
| **TOTAL WITH TANKERS** | | | | | **1,805,610.00** | **1,986,171.00** | | | |

## 10.4 Local Contractors

A removal team has been working steadily on the removal and packing of asbestos since February 2014. They are supervised by Mr Lin Lee and have been trained and are experienced asbestos workers.

Aside from this team Mr John Wichman of Recycle Cook Islands (RCI) provides oversight of the removal and packing operation. More recently some additional training has been provided by Dirk Catterall on the second PacWaste visit.

# 11.0 Review of Niue Policies and Legal Instruments

## 11.1 National Laws and Regulations

The main relevant legislation covering the asbestos removal from Niue is the Environment Act 2003. The objectives of the Act are to, provide a mechanism for the development of environmental policy and law, establish an Environment Department, and provide enforcement powers for environment officers.

The Act takes into consideration the following;

- The maintenance and enhancement of the quality of the environment;
- The efficient use and development of natural and physical resources;
- The concept of sustainable development;
- The protection of the water lens from contamination;
- The protection of indigenous flora and indigenous fauna and their habitats;
- The protection of the coastal zone from inappropriate use and development;
- The protection of historic areas from inappropriate use and development;
- The relationship of Niueans and their culture and traditions to their lands and historic areas;
- The conservation and sustainable use of biological resources;
- The compliance to multilateral environment agreements Niue is a party to.

The Environment Act in itself is a general multipurpose act designed to be constantly reviewed and updated by additional regulations as deemed appropriate by Government.

## 11.2 National Strategies and Policies

Niue has a clear goal to remove asbestos from the Island according to a managed and structured programme. This is supported by several cabinet decisions and the Annual Asbestos Report presented in Appendix 4 is further evidence of the success of this programme.

The SPREP (2011) 'An Asbestos-Free Pacific: A Regional Strategy and Action Plan' is also endorsed by Niue as a further endorsement of the national strategies or policies that are in place to reduce and eliminate to asbestos exposure in Niue.

Niue has also confirmed its support for the aims and objectives of the PacWaste Project including the asbestos component.

# 12.0 Recommended Actions for Minimising Asbestos Exposures

## 12.1 Discussion

Niue is currently implementing a very effective programme to deal with a legacy of asbestos issues and they have made excellent progress so far. All the waste asbestos that was stockpiled at the Hui Hui site has now been removed as well as other stockpiles. The removal of asbestos from abandoned houses is proving more difficult as permission for each removal has to be obtained. It is understood, however, that all the abandoned houses for which permission can easily be obtained have had their asbestos removed.

It is important that the momentum of this programme is maintained and the EU has agreed to an additional $US200,000 to be provided to assist in maintaining this momentum. Based on Table 13 above, the estimated total cost to remove all asbestos from Niue is about $NZ1.82 million. This is a large amount but it is understood that priority will continue to be given to removing asbestos from abandoned houses as they come available. It will be important to clean up any asbestos debris around these houses too.

The two visits made as part of the PacWaste project, and particularly the second visit from Dirk Catterall, highlighted some matters relating to the ongoing asbestos removal programme.

- There is a need to adhere to a strictly enforced Asbestos Removal Plan (ARP) that sets out clean and dirty areas and ensures that no asbestos contamination extends beyond the dirty area. This will involve, among other things, signage, temporary fencing and temporary washing facilities.
- The use of Personal Protective Equipment (PPE) needs to be improved and this may require additional funding. It is a high priority area for the use of funds. Disposable items such as overalls and gloves need to be changed every time the dirty area is exited. The hoods of the disposable overalls should always be kept on heads while in the dirty area. Respirators need to always be in sound condition with filters changed regularly. They must fit faces properly and this needs to be checked regularly. There should always be a good supply of spare respirators. Other PPE items such as rubber safety boots and safety goggles should be well maintained and cleaned each time the dirty area is exited.
- Other aspects of crew safety need to be kept in mind and especially working at heights. One incident has already occurred where a worker has fallen from a roof and broken a leg. Edge protection and scaffolding should be used as routine for roof removals and care should be taken with brittle asbestos roofs as old roofs do break easily. It may also be advisable to set up a simple rope access system for this work.
- Other than Lin Lee the crew supervisor there is a high turnover of staff so ongoing training becomes important so knowledge is not lost. The high crew turnover is also another reason why a good back-up supply of PPE is needed.
- The use of a good HEPA vacuum cleaner should be routine on the asbestos projects. Debris and dust should be cleaned up before a site is decommissioned. Ceiling spaces in occupied houses should also be vacuumed.
- The scraping and cleaning of asbestos in preparation for export is a substantial source of dangerous airborne asbestos and asbestos contamination of soils. The scraping now takes place at the container locations but the results of the air monitoring indicate that the scraping, as well as other aspects of the asbestos processing, is still causing problems. It would be preferable to avoid the scraping and cleaning altogether and this may be possible seeing as the container are buried unopened at the Redvale Landfill in Auckland.

- An ideal set up for the ongoing work would be a changing/ decontamination area at the location where the asbestos export preparation work is done (Reef Shipping), so the crew can clean themselves at the end of the day. It would be advisable to put a cheap shower and lockers in one of the containers.
- For any work on houses where there are occupants, asbestos dust is most likely to fall down on the interior possessions when it is removed. The work crew will need to gather all furnishings into the centre of the room and cover them with plastic sheeting. They will also need the 'H' class HEPA vacuum cleaner to clean the interior of the house including the roofing timbers prior to the home being reoccupied.

- Lin Lee has asked for a couple of heavy duty tarpaulins that can be cleaned, to cover the sheeting on the back of the truck. In New Zealand 250 micron plastic would be used for this purpose and then thrown away. Either of these solutions will help keep the ACM safe during transportation to the Reef Shipping site.

With regard to the ongoing work, as well as a focus on the houses, there is therefore one site that is ranked as high risk and that is the St Joseph's Automotive / Peta Paints site. This site should be remediated as a special project with all the safeguards of a full asbestos remediation project. Based on the results of the very high wipe tests a thorough site clean-up will be needed of all the material inside the building. Considerable care will also be needed regarding safe working at heights, especially with regard to the brittle asbestos roof. If the building is to remain as a workshop and retail store, then a new roof will be needed, and probably a re-build of the roof supporting structure.

The other matter that needs to be focused on urgently is the bitumen tankers at two locations. The asbestos is friable amosite (at least part of it is) and this is very serious. Ground contamination is also occurring. At least the sites are not that accessible which reduces the risk. Because of the serious nature of the contamination, however, and the fact that the tankers are deteriorating, this matter should be addressed urgently. The original owners of the tankers should be approached, perhaps through the New Zealand High Commission, as the clean-up should be funded as a special project. Until these sites can be remediated, they should be fenced off with danger signs.

Another issue is the asbestos in the schools. The secondary school has a large amount of asbestos cladding which is at present in good condition and well painted so it is presenting little risk. Seeing as children are at risk it may pay to program in the replacement of this cladding and in the meantime precautionary measures should be taken regarding maintenance and any damage sustained to the cladding.

The primary school has asbestos soffits and cladding in various places as indicated and it is more damaged than the cladding at the secondary school. There is also some asbestos debris behind classrooms at the back of the school. It would be a simple matter to clean up this debris. It is understood that a new school is to be built soon so for now it would probably be sufficient to carefully repair the damaged asbestos and encapsulate the rest with a good paint system pending the construction of the new primary school.

Apart from the houses there are three roofs that should be replaced, i.e. the abbatoir, the honey processing building and the Catholic Church as all are deteriorating. There may also be other non-residential roofs that were not spotted as part of this survey.

The rest of the asbestos work that has been identified is cladding and panelling on commercial and community facilities and much (but not all) of this is in good condition. Table 13 above sets out costs for the removal and replacement of this cladding and panelling but each case should be subject to a risk assessment. In most cases the risk is not high and if these buildings are kept painted and carefully maintained then replacement will not be necessary for quite a long time. Building owners and occupiers should be made aware of the asbestos risk, however, and maintenance that involves drilling or cutting the asbestos should be done with the correct asbestos protocols in place. If these buildings are demolished then this also needs to be done with the correct asbestos protocols in place.

Overall, the initiatives set in place by the Niue Government, and the work done to date by their contractor RCI, are excellent. If these initiatives can be maintained and supported then the risks currently posed by asbestos in Niue will be progressively and effectively dealt with. It is hoped that the PacWaste interventions, and the recommendations that flow from these interventions, will assist and support the ongoing work.

## 12.2 Recommendations

The following recommendations are therefore made in connection with asbestos in Niue:

i. The excellent work now being done by the Niue Government should be supported and encouraged, so that momentum is not lost and all asbestos is either removed of rendered into a safe condition.

ii. There is a range of safety measures that need to be adopted to ensure that the work continues in a way that ensures the work crew and the public are not exposed to hazardous levels of asbestos fibres or in the case of the work crew, other hazards such as working at heights. These measures include:

- There is a need to adhere to a strictly enforced Asbestos Removal Plan (ARP) that sets out clean and dirty areas and ensures that no asbestos contamination extends beyond the dirty area. This will involve, among other things, signage, temporary fencing and temporary washing facilities.
- The use of Personal Protective Equipment (PPE) needs to be improved and this may require additional funding. This is a high priority area for the use of funds.
- Other aspects of crew safety need to be kept in mind and especially working at heights. Edge protection and scaffolding should be used as routine for roof removals and care should be taken with brittle asbestos roofs as old roofs do break easily. It may also be advisable to set up a simple rope access system for this work.
- Other than Lin Lee the crew supervisor there is a high turnover of staff so ongoing training becomes important so knowledge is not lost.
- The use of a good HEPA vacuum cleaner should be routine on the asbestos projects. Debris and dust should be cleaned up before a site is decommissioned. Ceiling spaces in occupied houses should also be vacuumed.
- The scraping and cleaning of asbestos in preparation for export is a substantial source of dangerous airborne asbestos and asbestos contamination of soils. It would be preferable to avoid the scraping and cleaning altogether and this may be possible seeing as the containers are buried unopened at the Redvale Landfill in Auckland. This matter should be investigated.
- An ideal set up for the ongoing work would be a changing/ decontamination area at the location where the asbestos export preparation work is done (Reef Shipping), so the

crew can clean themselves at the end of the day. It would be advisable to put a cheap shower and lockers in one of the containers.

- For any work on houses where there are occupants, asbestos dust is most likely to fall down on the interior possessions when it is removed. Protective measures should put in place to keep these possessions uncontaminated.
- Heavy duty tarpaulins that can be cleaned, of disposable plastic sheeting, should be used to cover the sheeting on the back of the asbestos transport truck.

iii. The focus should continue to be on the removal of asbestos from unoccupied houses which should be done as they become available. It is understood that permission needs to be granted for the removal of the asbestos in each case. Cladding needs to be removed as well as roofing.

iv. There should also be a focus on the removal of asbestos roofing and cladding from occupied houses as the risk of exposure is greater with these houses than unoccupied houses. The expense is also greater, however, as replacement roofs and cladding will be needed.

v. When consideration is given to removing cladding then it would be appropriate to send samples away for testing in each case. Only about 62% of the cladding tested as part of the PacWaste work proved to be positive for asbestos.

vi. The St Josephs / Peta Paints Building should all asbestos removed together with a thorough site clean-up. The workers in this building are at risk and this work should now be considered as urgent.

vii. The friable amosite asbestos associated with the abandoned Fulton Hogan bitumen tankers should be removed safely and the two locations where these tankers are located should be cleaned up. This is specialist work and is also urgent, given the hazardous nature of the asbestos. Until these sites can be remediated, fences and danger signs should be erected.

viii. Asbestos at both the primary and secondary schools should be rendered safe and preferably removed, although repair and encapsulation will probably be sufficient for now.

ix. Consideration should be given to removing some asbestos roofs other than the house roofs – e.g the Honey Processing Building, the Abbatoir and the Catholic Church.

x. The asbestos cladding and panelling identified on commercial and community facilities should be examined and subjected to a risk assessment. In most cases the risk is not high and if these buildings are kept painted and carefully maintained then replacement will not be necessary for quite a long time. Building owners and occupiers should be made aware of the asbestos risk, however, and maintenance that involves drilling or cutting the asbestos should be done with the correct asbestos protocols in place. If these buildings are demolished then this also needs to be done with the correct asbestos protocols in place.

# 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: List of Contacts

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# Appendix 3: Summaries of in-Country Visit and Discussions

**Monday 23 February**

A meeting was held between Niue Government representatives (including John Wichman, RCI), EU representatives, Stewart Williams of SPREP and John O'Grady of CEL.

The following matters were discussed:

1. The work done to date by Niue Government (as set out in Appendix 4 below).
2. The EU requirements to be met in order for Niue to be eligible for the $US200,000 loan. This loan had already been promised but the EU needed to be reassured that the work was being done to the correct standard.
3. SPREP's position regarding the work done to date and the ongoing work. SPREP's position was supportive and encouraging and SPREP saw the work as fitting into the context of the overall PacWaste Project (Asbestos Component). SPREP were also supportive of the EU position regarding the need to meet the correct standards in carrying out the work.

**Tuesday 24 February and Wednesday 25 February.**

Stewart Williams and John O'Grady carried out an assessment of asbestos arisings around Alofi North, Alofi South, Taumatatoga and Avatele. This involved meeting numerous people in charge of the locations inspected. They then prepared a list of possible asbestos arisings, quantities and costs of remediation (Niue Baseline Study). Bulk, air and wipe samples were also taken as necessary.

**Thursday 26 February**

Stewart Williams and John O'Grady finalised the Niue Baseline Study in the morning. In the afternoon a further meeting was held between Niue Government representatives (including John Wichman, RCI), EU representatives, Stewart Williams of SPREP and John O'Grady of CEL.

John O'Grady presented the Nuie Baseline Study (including arisings, funding and quantities) in some detail and complimented the Niue Government on their efforts to date. He advised that the Baseline Study was preliminary, pending the receipt of the results of the analyses and that a circuit of the island still needed to be carried out and villages apart from Alofi North, Alofi South, Taumatatoga and Avatele still needed to be visited.

John Wichman detailed some of the aspects of the work to date and expressed a commitment to continue the asbestos removal programme in an effective and positive manner as funds became available.

Jesus Lavina confirmed that the $US200,000 would be made available to the Niue Government although the allocation of the money would need to be accompanied by training and a commitment to carry out the work to acceptable standards.

**Friday 27 February**

A further meeting was held between Niue Government representatives Dr Josie Tamate and Sauni Tongatule and also Stewart Williams and John O'Grady. The matter of the SPREP-funded asbestos training visit by Dirk Catterall was discussed, as was the provision of ongoing support as required. The main findings of the visit to date were also discussed.

The rest of the day was taken up with surveying some of the other villages.

**Saturday 28 February**

The circuit of island was completed and all villages were visited and assessed for asbestos. The circuit of the island also provided an opportunity to assess the incidence of potential asbestos cladding on both occupied and unoccupied houses.

A final meeting was also held with John Wichman regarding the ongoing work to be done and future cooperation.

**Dirk Catterall's Training Visit**

This visit was carried out between 14-21 April 2015. The need for this visit was one of the outputs of the first visit. The training visit is summarised in Appendix 5 below.

## Appendix 4: Annual Report of Niue Asbestos Project Manager (February 2014 – February 2015)

# REPORT FEBRUARY 2014 TO FEBRUARY 2015

## ASBESTOS REMOVAL TO NEW ZEALAND PROJECT

### Introduction:

I was given the project to coordinate as an In-country Project Manager, working in partnership with Mr. John Wichman, the project consultant from Recycle Cook Island (RCI) in February 2014. We both have contracts with Government to undertake what is required to ensure that the asbestos material in Niue are packed and transported to New Zealand for burial.

My contract signed was from February to end of December 2014, but was continue to 2015 due to the volume of work still need to be done.

This report covers the period from February 2014 to February 2015,and the work I have being involved with, to complied with Governments wish, in particularly, the Premier, who have been forthright and keen to get rid of these dangerous and hazardous materials from the island.

### Scoping:

The first part of the project was to carry out the scoping work and this was given to RCI to do and one of its representatives, Mr. John Wichman was asked to come to Niue in February 2014 to do this with me. The following are the work done at that initial stage of the project:

- Familiarization round the island trip on arrival-see asbestos houses
- Assessment of Huihui Site- volume of asbestos to bury
- Meeting with stakeholders
- Workshop with stakeholders
- Draft of Cabinet Submission to officiate Mr. Wichman's contract and commencement of actual work

Outcome of visit:

- Stakeholders able to be advised of the prospect of asbestos materials bury in New Zealand versus bury in Niue,
- Stakeholders, in particularly, HODs and SOG, made well aware of what being appraised as reality, rather than a dream,
- Workshop able to inform stakeholders of the reasons why Cabinet is in favour of taking the materials to bury in New Zealand, and why we should change our mentality towards the contractor's informed expectation,
- RCI able to expressed experience with the Cook Island asbestos already buried in New Zealand,

Application for Disposal in New Zealand:

We are very fortunate to have obtained the service of Mr. John Wichman from RCI to facilitate the transportation of these hazardous materials to New Zealand because of his experience of the same work he has done for the Cook Islands in 2013.

His connection and networking with the relevant agencies in New Zealand responsible for the complete processes up to burial was the key factor to the successful of our operation from the beginning up to now.

The main components of the application for disposal were the Insurance of Guarantee (IOG) for New Zealand Environmental protection Authority (NZEPA) to endorse approval and Tran's boundary movement support letter from Environment Department (NES) certifying safeness of movement at sea from Niue to Auckland wharf.

These processes were included as part of RCI contract with Government because of the license for disposal of hazardous waste into New Zealand was covered under their agreement as importer with NZEPA, which expires in March 2015. The license as at November was extended to cover the rest of the asbestos that we envisaged to send before the end of 2015. We thank Mr. Wichman for his leniency for this as an act of faithfulness to our pledge for an asbestos free Niue at a not too distance future.

The two main documents took quite a while to obtained, but in the end, prior to our first shipment, it came through.

Container Inspection and Procurement:

Containers available at Huihui Site at the commencing of project were inspected with the help of Mr. John Winter and his son from Container Guy Company base in Auckland, New Zealand.

The Container Guy Company was sorted by RCI through the Auckland Yellow Page and hired as a sub-contractor via RCI, to inspect the worthiness of all the containers stationed at Huihui Site before any shipment could be done for overseas.

Because most of these containers were over 10 years stationed at Huihui since they were first loaded with asbestos after Cyclone Heta in 2004, it's only appropriate that they needed to be inspected for safety transportation of asbestos materials to New Zealand, and are properly certified to pass quarantine checks on arrival at Auckland wharf.

After inspection, Mr. Winter was able to certified containers that worth sea transferal and ones need repairs, and from there, knowing the number of new containers to order from his company, to fully transport the asbestos materials to New Zealand.

Total number of containers ordered from Container Guys Company is 30. Twenty was allocated for asbestos and ten was allocated for waste recycling project.

The Loading Team:

The Loading Team was initially contracted under Ricky Makani for the first two months before they were reallocated to be under my control with the on-site supervision by Mr. Lin Lee.

Under Mr. Ricky Makani, they were paid an hourly rate of $20.00 an hour without tax. Mr. Lee disputed the 10% tax applied when I took over, arguing that this was the original arrangement agreed to by Cabinet. There was no document filed to justified Mr. Lees point.

Once I fully had controlled of the Team I arranged their payment via a time sheet including a 10% tax, and informed Mr. Lee that anyone earning an income must deduct tax. It was hard for Mr. Lee to accept initially but in the end he gradually concurs with me and accepted the reality of government policy with regards to taxation.

As a compromise I made a pledge to Cabinet via the Minister of Environment to increase their rate from $20.00 to $23.00 an hour, and also to consider the increase as an allowance for heavy duty and dust. This was decline but the boys continue on working irrespective of this.

The Loading Team was one of the major key components for the successful delivery of the project. I highly commented them for their hard work and endurances in repacking and reloading the asbestos materials stationed at Huihui since 2004 and the work at the villages; taking out corrugated asbestos from the roofs of houses that given consents to do so.

They were supplied with safety gears- boots, masks, disposable overalls, and later with hammers and pinch bars, to effectively carry out their work, at Huihui, and dismantling of asbestos roofs at the villages.

Container Shipment and Processes:

The number of containers sent and already buried at Redvale, West Auckland, New Zealand is 58. They were sent as follows:

| | |
|---|---|
| First shipment: June 2014 | 20 |
| Second shipment: September 2014 | 20 |
| Third shipment: November 2014 | 18 |

Logistics in trying to send the asbestos containers to New Zealand was not a plain sailing process. A lot of negotiation and organizing skills was needed to facilitate all the necessary ground work and documentation requirement are in place before any container is qualified to be at the Niue wharf ready for outbound shipment.

I am pleased to record in this report my utmost appreciation and heart felt thankfulness to Mr. Makasiaki Haimotu Poumale and his Outside Service Team, for helping us out with the cleaning and transporting of the containers to the wharf for all the three shipments. Without their dedication and professionalism in dealing and handling these containers, we would not have been successful with our operation.

It's always difficult to secured the Outside Services Team availability when a boat is due to arrive Niue because they are always busy preparing for their own work schedule for the Boat i.e. shifting barges, petrol containers, empty containers, and any outward bound cargoes to the wharf.

Irrespective of their heavy schedule, Maka always had the asbestos containers in mind as priority cargoes to go out to the Boat first. He has been working with the Environment Team after cyclone Heta stockpiling the materials at Huihui, and very supportive of the move that it's finally taken away and buried in New Zealand.

NUMBER OF CONTAINERS LEFT TO SHIP TO NZ:

Currently, he Loading Team are working in reloading the flat rack supported containers to the newly imported certified ones to be ready for the May Boat. This reshuffle was to avoid the delaying in releasing back the flat racks to Matson once it arrives Auckland. This was mitigated via Mr. Wichman to maintained good and harmonious relationship with the shipping company.

Expected number to ship out and ready before May is 7.

ASBESTOS HOUSES SURVEY AS AT JANUARY 2015:

| VILLAGE | COUNTED SEPT 2014 | ROOF TAKEN OUT | BALANCE |
|---|---|---|---|
| TAMAKAUTONGA | 14 | 7 | 7 |
| AVATELE | 14 | 9 | 5 |
| HAKUPU | 38 | 29 | 9 |
| LIKU | 40 | 10 | 30 |
| LAKEPA | 33 | 14 | 19 |
| MUTALAU | 54 | 17 | 37 |
| TOI | 18 | 4 | 14 |
| HIKUTAVAKE | 16 | 7 | 9 |
| NAMUKULU | 12 | 4 | 8 |
| TUAPA | 30 | 11 | 19 |
| MAKEFU | 21 | 7 | 14 |
| ALOFI NORTH | 14 | 3 | 11 |
| ALOFI SOUTH | 13 | 4 | 9 |

It's a big task trying to convince the owners and custodians of the remaining houses to provide consents so we can take out the roofs and effectively complete this part of the project. We could have easily used the regulation available but we had to respect the wishes of the family first and always tried to maintain a constructive approach for an appropriate end result.

The above data is the result of the work we have done such far and we are still working closely with individual village councils, owners and custodians, to provide more consents so we can continue to work on those remaining houses as we move on through the year.

House owners and custodians much preferred of a deal: asbestos for iron, but Government does not afford to comply with their wish because of fund complication and limitation.

FUTURE ASPIRATIONS:

Government is looking also at getting rid of the flat asbestos materials used for hurricane houses that came together with the corrugated ones in the 1960, so Niue would truly free of asbestos materials once and for all as we move forward to the future.

The survey for the houses with flat asbestos still had to be done but a few of those houses have been dealt with alongside with the work done for the removal of the corrugated roofs.

The Government has also asked individual owners/custodians, and village councils to provide proposal for houses that they see fits at their villages for renovations that it can assist for rental purposes, but none has been forth coming.

Government, as part of its social and economic drive for infrastructure development and tourist attraction is one of main reasons of trying and get rid of asbestos materials and beautify the island accordingly.

We have gone through so much deliberation and argument about this issue and now we have this opportunity through RCI to do it, once and for all. Otherwise we will struggle in the future to finish off the remaining materials at large.

FINANCIAL PARTICULARS:

Treasury and PMU had all the records of what's been spent on this project.

Before embarking on as a Project Co-ordinator, I was led to believe that the balance of the original NZ Aid Fund of NZD$ 600,000 was an opening balance of the Disposal Project i.e. NZD$200,000, and supplemented with other funds from other sources.

Bulk of $400,000 was used to bring asbestos from the villages and stored at Huihui since was commenced in 2004.

It's pleasing to note that we are still working on this project without any major holdup because of funds.

The Financial Secretary has been very helpful and forthright as part of the team that successfully implemented the disposal of these dangerous materials to New Zealand from February 2014, to February 2015.

RECOMMENDATIONS:

Cabinet as see fits;

1. Secure funds to provide corrugated irons to the families of those houses that are still to take out roofs as an incentive to complete the project;
2. Secure funds for the flat asbestos materials to be taken out as well to be shipped to New Zealand, along with the corrugated ones, for burial;
3. Consider increasing wages for the Loading Team from $20.00 to $23.00 an hour to cover allowances for heavy duty and dust;
4. Request RCI for further extension of export permit for asbestos materials to end of 2015;
5. Approval extension of local Project Coordinator contact to end of 2015.

## Appendix 5: Reports from Visit by Dirk Catterall

Morecroft Contractors Ltd

431 Hibiscus Coast Highway,
Orewa

Mobile: 0274-924-135
Email: airborn@xtra.co.nz
www.morecroftcontractors.co.nz

20 April 2015

**Niuean Visit to Monitor Asbestos Removal Progress, Provide Training**

Hi John

Wed 15/4/2015: Met with Sauni to discuss progress of Super 6 ACM removal. Drove to site in Lapeka where Lin Lee was supervising and William Liuaie and Maliatoa Palakua were cleaning up a contaminated site. I arrived during their tea break and noted the following issues:

a) There was no 'dirty zone' marked out with either barrier tape or fencing
b) Masks and gloves had been removed during tea break and placed on top of the Asbestos Containing Materials (ACM)
c) Truck windows were open next to the ACM and food placed on top of the ACM
d) The workers came back from the adjacent meeting house with their overalls on and there were no decontamination procedures
e) All ACM material was being brushed clean (apparently NZ Customs requirement) on to the soil, prior to placing on the truck, contaminating the ground. I discussed the safer method of loading on to a truck and brushing clean in the container, so as to minimize the number of contaminated sites.

Also noted, the silicone masks show high wear and should be replaced as soon as possible. A monitor (#1) was placed at the rear of the cab and run for four hours at 2 l/m. Weather conditions – a light variable wind with light showers passing through.

Thursday 16/4: The new methodology commenced today. Met Lee at the Reef Shipping yard where the ACM is being unloaded into the container. The rear of the truck can be backed right in so no spillage occurs. Once a small pile is unloaded, it is brushed clean and thrown to the rear of the container. A monitor was run for four hours, 2 l/m (#2), just downwind of the container entrance. All brushed debris was collected at the completion of the cleaning and bagged. This is highly contaminated debris and must be disposed of, along

with the AC sheets. As this is the case, there seems little point in brushing it off, as this is the most hazardous part of the process. We are making an inquiry into whether we can just load the containers, as they remain closed and are buried at Redvale Landfill.

Friday 17/4: Set up airborne fibre monitor at the Reef shipping loading area on the back of the truck cab #3. Only 2 guys working today, light winds, dry weather. The new ACM cleaning methodology was working well.

Monday 20/4: Training day at Ministry of the Environment. In attendance:

Dirk Catterall

Fapoi Akesi (Contract Supervisor)

William Luivaie

Maliatoa Palakua

Lin Lee

Presented Powerpoint, as prepared by John O'Grady, along with numerous photographs demonstrating asbestos site set-ups.

Tuesday 21/4 Visited Lakepa school, discussed remediation procedures regarding Taloa Heights School. Asbestos Removal Plan to be completed and forwarded, and generically applied to similar types of clean-ups.

**Sample Taking / Swab Testing**:

Whilst a thorough survey has been completed already, I sampled to reconfirm some earlier surprise results that returned either a high or ambiguous result.

- Honey Processing plant, swab from high shelf/ window sill
- Peta Paints, swab from window sill
- Huihui bitumen tanker insulation, split test (NZ & USA)
- Makatia pit by reservoir, bitumen tanker insulation.

It was noted that there are two different types of insulation on the tanker, a fiberglass layer on the bottom, sides and end; then a suspected asbestos layer at the top. The top of the tanker must require a superior insulation rating, explaining the two different products and also the previous discrepancy between the two tests (one positive and one negative). Photographs taken clearly show the two materials at the end of the tanker.

**Conclusions**

- It is evident that the asbestos removal crew members do need guidance. 466 houses exist and there are 180 left to do. I am assuming that a number of the sites where ACM has been removed will have been contaminated with their methodology.
- Moving forward, all debris will now be cleaned of and bagged in the container, pending advice regarding discarding the cleaning process altogether. The training component completed should assist the guys and give them a bit more confidence in what they are doing.
- There is an urgent need for PPE, Lee's mask is perishing; there is no replacement for that at present. Suits should be replaced every time someone exits and accesses the dirty area. Mask filters should be replaced weekly. Other tools needed are an 'H' class HEPA vacuum cleaner, barrier tape and 'Danger Asbestos' signs.

**Recommendations**

- There are 180 houses left to remediate, along with this, many of them have AC cladding which will need to be removed to achieve an asbestos free Niue.
- An ideal set up for the ongoing work would be a changing/ decontamination are at Reef shipping where the guys can clean themselves at the end of the day. It would not be too expensive to put a cheap shower/ washing machine/ lockers in one of the containers for this work. Shorts and T shirt could be provided for wearing under the suit.
- There needs to be a stockpile of PPE consumables, say 10 silicone masks, boxes of filters, to be changed weekly, enough suits for the guys to change into/ out of without contaminating themselves, which is quite easy when suits are re-used. Also some P2 disposable paper masks, more suitable for when it's very hot.
- They need 'barrier tape' and a 'Danger Asbestos' sign or two. Lee's mask is currently perishing and needs replacement.
- For any work on houses where there are occupants, asbestos dust is most likely to fall down on the interior possessions when it is removed. The guys will need to gather all furnishings into the centre of the room and cover them with plastic sheet, they will also need an 'H' class HEPA vacuum to clean the interior of the house including the roofing timbers prior to the home being reoccupied.
- Lee has told me they have had one instance where someone has fallen through the roof and broken a leg. Working on fragile roofs is dangerous. A harness for the 2 guys who work on the roof would be a big safety plus. Lee might need some training on how to rig a simple rope access system up properly.
- Lee has asked for a couple of heavy duty tarps that can be cleaned, to cover the sheeting on the back of the truck. In NZ we would use 250 micron plastic, then throw it away. Either of these solutions will help keep the ACM safe during transportation to the Reef Shipping site.
- Lee should re-visit some of the sites where a lot of 'brushing' of ACM has occurred and attempt to collect contaminated soil using a shovel and nylon/ asbestos bags.

**At the end of the training, there was a rush to point a number of things:**

- That the current Health and Safety legislation/ Public Service manual is not policed.
- That there is no ACC or any other type of insurance
- That 'danger money' should be paid for work in heat and at height. (I informed Lee that at $25 per hour, he was getting the same as some of my most experienced guys in NZ – this seemed to help )
- That they would like to have a dedicated truck with 4 seats instead of a hire truck, suggested they use an additional car for labour.
- That there is a high turnover of staff, other than Lee, so there is a need for additional PPE such as steel capped boots and tinted safety glasses.

I will forward the rest of the photos tonight once I have good internet access in NZ. Please give me a call if you have any questions.

Regards Dirk Catterall

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Kumeu, Auckland
PO Box 577, Kumeu 0841
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Fax: 09 412 7410
018 x

# Asbestos Removal Plan (AMP) for AC Roof and Sheet Removal, Niue

## 1. Identification:

- The material has been identified as asbestos by several analyses carried out by EMS Laboratories of California. Much of the asbestos cement (AC) roofing and sheeting has been damaged and is considered friable. There are still around 180 roofs to be removed.

## 2. Preparation:

- *Legislative Framework.* There is no legislative frame work in Niue to enforce asbestos removal standards. It is recommended that all AC removal and clean-up is carried out to NZ regulatory standards. Consequently this generic AMP should be applied to all work along with a Standard Operating Procedure used in NZ.

- *Consultation.* Landowner's agreement is needed and neighbours and adjacent residents need to be notified prior to the work being carried out. The notification should include a description of how the work is to be carried out, so that reassurance can be provided that the work is being done safely.

- *Assigned responsibilities for the removal*. The crew currently performing the day-to-day AC removal is headed up by Lee along with a crew of 3 labourers.

- *Programme of commencement and completion dates.* The work is well under way with some 20-30 containers already shipped to NZ for disposal. The work will continue into the foreseeable future with some 180 roofs to complete and a substantial number of buildings that have been constructed with flat AC sheet as cladding.

- *Site Specific Safety Plan.* There may be other Health and Safety precautions and procedures that need to be followed such as working at heights and working around machines. Such relevant procedures also need to be developed. For example, the removal of asbestos from roofs will require suitable edge protection and protection against falling through brittle roofs.

- *Asbestos removal boundaries, including the type and extent of isolation required and the location of any signs and barriers*. An asbestos removal area (dirty area) is to be established using 'danger tape' and posts to mark the boundary. A sign is to be erected indicating that asbestos removal work is taking place and no one should enter. A decontamination area is to be set up at a convenient location on the perimeter with a bag for disposal of dirty suits, gloves and mask filters. There is to be some method of washing hands, cleaning boots, cleaning respirators and cleaning goggles in the decontamination area. Nothing is to leave this area that is contaminated in any way with asbestos fibres.

  *Control of electrical and lighting installations*. There should generally be no issues with electrical and lighting. Power is to be disconnected from houses where roofing and cladding is to be removed. No work is to be carried out at night that would require lighting to see the operations.

  *Personal protective equipment (PPE)*. PPE required for working inside the 'dirty' area will include for each person a disposable overall, a P3 HEPA filtered half mask respirator, sturdy gloves, wrap-around safely goggles and hard steel cap boots. PPE should cover whole body as much possible and the disposable overall hood should be kept on the head.

  *Details of air monitoring programme*. Air monitoring was completed during a recent visit by Dirk Catterall. Monitors were placed on the back of the truck and close to the container entrance where the AC sheet was being brushed clean. All monitoring returned a clearance result indicating a safe methodology. Day to day monitoring is not required, however, some may periodically be performed such as during the visit of a SPREP representative to ensure AC removal procedures are ensuring the required result.

  *Waste storage and disposal programme* All AC sheeting is collected by truck, covered by tarpaulin and transported to the Reef Shipping container yard where the AC sheet is cleaned (within the container) and stacked at the back. Once full, the AC container is transported to Redvale Landfill in NZ where it is buried in its entirety.

**3. Removal**

*Methods for removing the asbestos-contaminated materials.* Roofing sheets are unscrewed wherever possible to minimise breakage. Then they are lowered straight onto a truck covered by a plastic drop sheet or lowered onto a plastic drop sheet on the ground so as to not contaminate the ground. Any large build-up of moss or tree leaves on the roof should be considered as contaminated material, collected and bagged for disposal. The removal method will be a dry process as water makes the roof too slippery to walk on. Minimal breakage is therefore key to minimising dust.

*Asbestos removal equipment*. Roofing sheets will be removed using screw guns, screwdrivers, hammers and demolition bars as required.

*Details of required enclosures and temporary buildings*. A temporary decontamination area will need to be set up for each job. This will be located at a convenient place in the perimeter of the asbestos removal area and can consist of stakes driven into the ground and demarcated with danger tape. There should be a clean and dirty part to the asbestos removal area. The dirty part should contain a large plastic bag for placement of the disposable overalls, gloves, used mask filters and wet cloths used to wipe the masks, goggles and boots. The dirty part also contains a source of water for cleaning non-disposable PPE and exposed skin areas. The clean part is where the clean PPE is put on before entry into the dirty part.

*Other control measures to be used to contain asbestos within the asbestos work area.* Where there are piles of broken asbestos sitting on the ground, the asbestos should be wetted to minimise dust release whilst loading the truck. On completion the ground should be scraped with a shovel to collect any potentially contaminated soil for disposal.

**4. Decontamination:**

Tools will be wet-wiped in the dirty part of the decontamination area on completion of the working day and stored in a plastic bag for the next day's work.

**5. Waste Disposal:**

All asbestos waste is placed in 20 ft shipping containers for transportation to Redvale Landfill in NZ, which is a licensed facility suitable for the disposal of asbestos. This disposal must include all dirty disposable suits and mask filters.

i. PPE as described in the AMP must be worn when removing asbestos
ii. The area must be cordoned off using barrier tape to construct a 'dirty/clean decontamination area established on the perimeter of the cordon. No contaminated material, suits or mask filters should leave the dirty area unless bagged.
iii. AC sheets should be unscrewed where possible and breakage minimised; all moss/ debris accumulated on top of the roofing sheets should be considered as contaminated, and thus bagged and disposed of in the container.
iv. When cleaning the AC sheets the truck should be backed up into the container prior to unloading. All brush down work should happen inside the container and debris collected and bagged. This debris will be highly contaminated.
v. Sheets should be removed directly onto truck and/ or onto a sheet of plastic. This minimises any contaminated material coming into contact with the soil. Should this occur, a small amount of topsoil should be shovelled into a bag and be disposed of as contaminated material.
vi. Manage work at height, ensure roofing framework is secure before working above; wear some type of harness or set up suitable edge protection
vii. Care should be taken when working on asbestos roofs to avoid falling through brittle roofs. Such roofs should not be walked on without planking or similar security.

If you have any questions, please e-mail or phone as required. (airborn@xtra.co.nz, Ph: +64-27-4924135)

Dirk Catterall

NZ Asbestos CoC No.7026

# Appendix 6: Laboratory Reports

## Niue First Bulk Results

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

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

| | | | |
|---|---|---|---|
| CUSTOMER: | Contract Environmental | PAGE #: | 1 of 6 |
| | 119 Johnson Rd. West Melton | REPORT #: | 0165036 |
| | Christchurch NZ | PROJECT: | PLM ANALYSIS |
| CONTACT: | John O'Grady | DATE COLLECTED: | 02/23/2015 |
| REFERENCE: | SPRGP Pac work project | COLLECTED BY: | |
| METHOD: | EPA 600/R-93/116 | DATE RECEIVED: | 03/11/2015 |
| | | ANALYSIS DATE: | 03/13/2015 |

**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 | (%) |
|---|---|---|---|---|---|---|
| 0165036-001 NU1 | Gray, Homogeneous, Granular, crush, non-friable Note: 27°C, Acid | LAYER 1 100% | Chrysotile | 7% | Cellulose Fiber<br>Non-Fibrous Material | 10%<br>83% |
| 0165036-002 NU2 | Gray/White, Non-homogeneous, Granular, crush, non-friable Note: 27°C, 1.55 Oil | LAYER 1 100% | Chrysotile<br>Amosite | 10%<br>7% | Non-Fibrous Material | 83% |
| 0165036-003 NU3 | Gray, Homogeneous, Granular, crush, non-friable Note: 27°C, 1.55 oil | LAYER 1 100% | Chrysotile | 15% | Non-Fibrous Material | 85% |
| 0165036-004 NU4 | Gray, Homogeneous, Granular, crush, non-friable Note: 27°C, 1.55 Oil | LAYER 1 100% | Chrysotile | 10% | Non-Fibrous Material | 90% |
| 0165036-005 NU5 | Gray, Homogeneous, Fibrous, tease, non-friable Note: 27°C, 1.55 Oil | LAYER 1 100% | None Detected | | Cellulose Fiber<br>Non-Fibrous Material | 60%<br>40% |
| 0165036-006 NU6 | Gray, Homogeneous, Granular, crush, non-friable Note: 27°C, 1.55 Oil | LAYER 1 100% | None Detected | | Non-Fibrous Material | 100% |

| | | | |
|---|---|---|---|
| CUSTOMER: | Contract Environmental | PAGE #: | 2 of 6 |
| | 119 Johnson Rd. West Melton | REPORT #: | 0165036 |
| | 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 | (%) |
|---|---|---|---|---|---|---|
| 0165036-007 | | | | | | |
| NU7 | Gray, Homogeneous, Granular, crush, non-friable<br>Note: 27°C, 1.55 Oil | LAYER 1<br>100% | None Detected | | Cellulose Fiber<br>Non-Fibrous Material | 2%<br>98% |
| 0165036-008 | | | | | | |
| NU8 | Gray, Non-homogeneous, Granular, crush, non-friable<br>Note: 27°C, 1.55 Oil | LAYER 1<br>100% | Chrysotile<br>Amosite | 10%<br>7% | Non-Fibrous Material | 83% |
| 0165036-009 | | | | | | |
| NU9 | Gray, Non-homogeneous, Granular, crush, non-friable<br>Note: 27°C, 1.55 Oil | LAYER 1<br>100% | None Detected | | Cellulose Fiber<br>Non-Fibrous Material | 10%<br>90% |
| 0165036-010 | | | | | | |
| NU10 | Gray, Homogeneous, Fibrous, tease, non-friable<br>Note: 27°C, 1.55 Oil | LAYER 1<br>100% | None Detected | | Cellulose Fiber<br>Non-Fibrous Material | 60%<br>40% |
| 0165036-011 | | | | | | |
| NU11 | Gray, Homogeneous, Granular, crush, non-friable<br>Note: 27°C, 1.55 Oil | LAYER 1<br>100% | Chrysotile | 15% | Non-Fibrous Material | 85% |
| 0165036-012 | | | | | | |
| NU12 | Gray, Homogeneous, Granular, crush, non-friable<br>Note: 27°C, 1.55 Oil | LAYER 1<br>100% | Chrysotile<br>Amosite | 10%<br>10% | Non-Fibrous Material | 80% |
| 0165036-013 | | | | | | |
| NU13 | Gray, Homogeneous, Granular, crush, non-friable<br>Note: 27°C, 1.55 Oil | LAYER 1<br>100% | Chrysotile | 7% | Non-Fibrous Material | 93% |
| 0165036-014 | | | | | | |
| NU14 | Gray, Homogeneous, Granular, crush, non-friable<br>Note: 27°C, Acid | LAYER 1<br>100% | None Detected | | Non-Fibrous Material | 100% |
| 0165036-015 | | | | | | |
| NU15 | Gray/Cream, Non-homogeneous, Fibrous, tease, non-friable<br>Note: 27°C, 1.55 Oil | LAYER 1<br>100% | None Detected | | Cellulose Fiber<br>Non-Fibrous Material | 20%<br>80% |

| | | | |
|---|---|---|---|
| CUSTOMER: | Contract Environmental | PAGE #: | 3 of 6 |
| | 119 Johnson Rd. West Melton | REPORT #: | 0165036 |
| | 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 | (%) |
|---|---|---|---|---|---|---|
| 0165036-016 | | | | | | |
| NU16 | Gray/White, Non-homogeneous, Granular, crush, non-friable Note: 27°C, 1.55 Oil | LAYER 1 100% | Chrysotile | 15% | Non-Fibrous Material | 85% |
| 0165036-017 | | | | | | |
| NU17 | Gray, Homogeneous, Granular, crush, non-friable Note: 27°C, 1.55 Oil | LAYER 1 100% | Chrysotile | 15% | Non-Fibrous Material | 85% |
| 0165036-018 | | | | | | |
| NU18 | White/Gray, Homogeneous, Fibrous, tease, non-friable Note: 27°C, 1.55 Oil | LAYER 1 100% | None Detected | | Fibrous Glass<br>Non-Fibrous Material | 95%<br>5% |
| 0165036-019 | | | | | | |
| NU19 | White/Gray, Non-homogeneous, Fibrous, tease, non-friable Note: 27°C, 1.55 oil | LAYER 1 100% | None Detected | | Fibrous Glass<br>Cellulose Fiber<br>Non-Fibrous Material | 95%<br>2%<br>3% |
| 0165036-020 | | | | | | |
| NU20 | Gray, Non-homogeneous, Granular, crush, non-friable Note: 26°C, 1.55 Oil | LAYER 1 100% | Chrysotile<br>Amosite | 10%<br>7% | Non-Fibrous Material | 83% |
| 0165036-021 | | | | | | |
| NU21 | Gray/Blue, Homogeneous, Granular, crush, non-friable Note: 26°C, 1.55 Oil | LAYER 1 100% | None Detected | | Non-Fibrous Material | 100% |
| 0165036-022 | | | | | | |
| NU22 | Gray, Homogeneous, Granular, crush, non-friable Note: 26°C, 1.55 Oil | LAYER 1 100% | Chrysotile<br>Amosite | 10%<br>7% | Non-Fibrous Material | 83% |
| 0165036-023 | | | | | | |
| NU23 | Gray/Green, Non-homogeneous, Granular, crush, non-friable Note: 26°C, 1.55 Oil | LAYER 1 100% | Chrysotile | 2% | Non-Fibrous Material | 98% |
| 0165036-024 | | | | | | |
| NU24 | Gray/Red, Non-homogeneous, Granular, crush, non-friable Note: 26°C, 1.55 Oil | LAYER 1 100% | Chrysotile | 15% | Non-Fibrous Material | 85% |

| | | | |
|---|---|---|---|
| CUSTOMER: | Contract Environmental | PAGE #: | 4 of 6 |
| | 119 Johnson Rd. West Melton | REPORT #: | 0165036 |
| | 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 | (%) |
|---|---|---|---|---|---|---|
| 0165036-025 NU25 | Gray, Homogeneous, Granular, crush, non-friable Note: 26°C, Acid | LAYER 1 100% | Chrysotile | 15% | Non-Fibrous Material | 85% |
| 0165036-026 NU26 | Gray, Homogeneous, Fibrous, tease, non-friable Note: 26°C, 1.55 Oil | LAYER 1 100% | None Detected | | Cellulose Fiber<br>Non-Fibrous Material | 60%<br>40% |
| 0165036-027 NU27 | Gray, Homogeneous, Fibrous, tease, non-friable Note: 26°C, 1.55 Oil | LAYER 1 100% | None Detected | | Cellulose Fiber<br>Non-Fibrous Material | 60%<br>40% |
| 0165036-028 NU28 | Gray, Homogeneous, Granular, crush, non-friable Note: 26°C, 1.55 Oil | LAYER 1 100% | Chrysotile | 20% | Non-Fibrous Material | 80% |
| 0165036-029 NU29 | Gray/Blue, Non-homogeneous, Granular, crush, non-friable | LAYER 1 100% | Chrysotile<br>Amosite | 10%<br>10% | Non-Fibrous Material | 80% |
| 0165036-030 NU30 | Gray, Homogeneous, Granular, crush, non-friable Note: 26°C, 1.55 Oil | LAYER 1 100% | Chrysotile | 20% | Non-Fibrous Material | 80% |
| 0165036-031 NU31 | Tan, Homogeneous, Granular, crush, non-friable Note: 26°C, 1.55 Oil | LAYER 1 100% | None Detected | | Cellulose Fiber<br>Non-Fibrous Material | 10%<br>90% |
| 0165036-032 NU32 | Gray, Homogeneous, Granular, crush, non-friable Note: 27°C, Acid | LAYER 1 100% | None Detected | | Non-Fibrous Material | 100% |
| 0165036-033 NU33 | Gray/Red, Non-homogeneous, Granular, crush, non-friable Note: 27°C, 1.55 Oil | LAYER 1 100% | Chrysotile | 15% | Non-Fibrous Material | 85% |

| | | | |
|---|---|---|---|
| CUSTOMER: | Contract Environmental | PAGE #: | 5 of 6 |
| | 119 Johnson Rd. West Melton | REPORT #: | 0165036 |
| | 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 | (%) |
|---|---|---|---|---|---|---|
| 0165036-034 | | | | | | |
| NU34 | Black/Blue, Homogeneous, Fibrous, tease, non-friable<br>Note: 27°C, 1.55 Oil | LAYER 1<br>100% | None Detected | | Cellulose Fiber<br>Non-Fibrous Material | 80%<br>20% |
| 0165036-035 | | | | | | |
| NU35 | Gray, Homogeneous, Granular, crush, non-friable<br>Note: 27°C, 1.55 Oil | LAYER 1<br>100% | Chrysotile | 15% | Non-Fibrous Material | 85% |
| 0165036-036 | | | | | | |
| NU36 | Gray, Homogeneous, Granular, crush, non-friable<br>Note: 27°C, 1.55 Oil | LAYER 1<br>100% | None Detected | | Non-Fibrous Material | 100% |
| 0165036-037 | | | | | | |
| NU37 | Gray, Homogeneous, Granular, crush, non-friable<br>Note: 27°C, 1.55 Oil | LAYER 1<br>100% | None Detected | | Non-Fibrous Material | 100% |
| 0165036-038 | | | | | | |
| NU38 | Gray, Non-homogeneous, Granular, crush, non-friable<br>Note: 25°C, Acid | LAYER 1<br>100% | Chrysotile<br>Amosite | 7%<br>10% | Non-Fibrous Material | 83% |
| 0165036-039 | | | | | | |
| NU39 | Gray, Granular, crush, non-friable<br>Note: 25°C, 1.55 Oil | LAYER 1<br>100% | Chrysotile<br>Amosite | 5%<br>10% | Non-Fibrous Material | 85% |
| 0165036-040 | | | | | | |
| NU40 | Gray, Non-homogeneous, Granular, crush, non-friable<br>Note: 26°C, 1.55 Oil | LAYER 1<br>100% | Chrysotile | 15% | Non-Fibrous Material | 85% |
| 0165036-041 | | | | | | |
| NU41 | Gray, Homogeneous, Granular, crush, non-friable<br>Note: 26°C, 1.55 Oil | LAYER 1<br>100% | None Detected | | Cellulose Fiber<br>Non-Fibrous Material | 40%<br>60% |
| 0165036-042 | | | | | | |
| NU42 | Gray, Non-homogeneous, Granular, crush, non-friable<br>Note: 26°C, 1.55 Oil | LAYER 1<br>100% | Chrysotile<br>Amosite | 10%<br>3% | Non-Fibrous Material | 87% |

| | | | |
|---|---|---|---|
| CUSTOMER: | Contract Environmental | PAGE #: | 6 of 6 |
| | 119 Johnson Rd. West Melton | REPORT #: | 0165036 |
| | 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 | (%) |
|---|---|---|---|---|---|---|
| 0165036-043 NU43 | Gray, Non-homogeneous, Granular, crush, non-friable Note: 26°C, 1.55 Oil | LAYER 1 100% | Chrysotile<br>Amosite<br>Crocidolite | 8%<br>5%<br>2% | Non-Fibrous Material | 5% |
| 0165036-044 NU44 | Gray/Tan, Non-homogeneous, Granular, crush, non-friable Note: 26°C, 1.55 Oil | LAYER 1 100% | Chrysotile<br>Amosite | 7%<br>7% | Non-Fibrous Material | 86% |
| 0165036-045 NU45 | Gray/White, Non-homogeneous, Rubbery, ash, non-friable Note: 26°C, 1.55 Oil | LAYER 1 100% | None Detected | | Non-Fibrous Material | 100% |
| 0165036-046 NU46 | Gray, Non-homogeneous, Granular, crush, non-friable Note: 27°C, 1.55 Oil | LAYER 1 100% | None Detected | | Non-Fibrous Material | 100% |
| 0165036-047 NU47 | Gray, Homogeneous, Granular, crush, non-friable Note: 27°c, 1.55 Oil | LAYER 1 100% | Chrysotile | 15% | Non-Fibrous Material | 85% |

**Analyst** - Nesene 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.145). 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

NVLAP Lab Code: [illegible]

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

## Niue First Air Results

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



## Phase Contrast Microscopy of Air Samples
## NIOSH Fiber Count (Method 7400, Issue 2, A Rules)
(Aspect ratio >3:1; Fiber length >5µm; Fields counted: 20 to 100 fields)

AIHA LAB. No: 101634
Report No: 165037
Client: Contract Environmental Inc
Address: 119 Johnson Rd. W Melton
Christchurch, NZ 7078

Attention: John O'Grady
Project: NIUE, SPREP
File Name: 165037 Contract.air.lw

Date Sampled: 2-(23-27)-2015
Date Received: 3/11/2015
Date Analyzed: 3/16/2015

Filter Type/Size: MCE/25mm
Filter Area (sqmm): 385
Field Area (sqmm): 0.00785
Mag: 400x

| Sample I.D. | Fields Counted | Fibers Counted | Fiber/sqmm | Fiber/Filter | Vol (Lit.) | Fibers/cc | LOD (f/cc) | LOQ (f/cc) | A. S. (f/cc) |
|---|---|---|---|---|---|---|---|---|---|
| A1 | 100 | 1 | 1 | 490 | 614.0 | < 0.0044 | 0.0044 | 0.0639 | 0.0008 |
| A2 | 100 | 0 | 0 | 0 | 556.0 | < 0.0049 | 0.0049 | 0.0706 | 0.0009 |
| A3 | 100 | 0 | 0 | 0 | 750.0 | < 0.0036 | 0.0036 | 0.0523 | 0.0007 |
| A4 | 100 | 0 | 0 | 0 | 550.0 | < 0.0049 | 0.0049 | 0.0713 | 0.0009 |
| A5 | 100 | 0 | 0 | 0 | 600.0 | < 0.0045 | 0.0045 | 0.0654 | 0.0008 |
| A6 | 100 | 0 | 0 | 0 | 520.0 | < 0.0052 | 0.0052 | 0.0755 | 0.0009 |
| A7 | 100 | 0.5 | 1 | 245 | 550.0 | < 0.0049 | 0.0049 | 0.0713 | 0.0009 |
| A8 | 100 | 0.5 | 1 | 245 | 550.0 | < 0.0049 | 0.0049 | 0.0713 | 0.0009 |
| A9 | 100 | 0.5 | 1 | 245 | 810.0 | < 0.0033 | 0.0033 | 0.0484 | 0.0006 |

N.A. = Not Applicable
N.D. = None Detected
Note: NIOSH 7400 requires 2 field blanks or 10% of the set which ever is greater
Results have been corrected for the field blank or EMS blank if the analyte is detected in the blank
Samples were received in good condition unless otherwise noted.
Result only pertain to items actually tested.

f/cc = Fibers per cubic centimeter
LOD = LIMIT OF DETECTION (5.5 fiber/100 field)
LOQ = LIMIT OF QUANTITATION (80 fiber/100 field)
A. S. = ANALYTICAL SENSITIVITY (1 fiber/100 field)
INTRA-LABORATORY Sr = 0.23

Analyst
Jeff Wan

B. M. Kolk, Laboratory Director



PCM VERSION: 7 (8-2008)

## Niue First Wipe Test Results

# TEM ASBESTOS RESULTS FOR WIPES

ASTM 6480

EMS REPORT 1 165038

| SAMPLE ID | CHRY COUNTED IN TEM | AMPH COUNTED IN TEM | STRUCTURES +Sum COUNTED | ANALYTIC SENSITIVITY STR/CM^2 | CHRY STR/CM^2 | AMPH STR/CM^2 | +Sum STR/CM^2 |
|---|---|---|---|---|---|---|---|
| W1 | 0 | 0 | 0 | 2013 | <2000 | <2000 | <2000 |
| W2 | 0 | 0 | 0 | 10069 | <10000 | <10000 | <10000 |
| W3 | 90 | 5 | 15 | 10069 | 919000 | 51000 | 151000 |
| W4 | 0 | 0 | 0 | 10069 | 60000 | <10000 | <10000 |

CHRY = CHRYSOTILE AMPH = AMPHIBOLE STR = STRUCTURES

Comment: Amphiboles were both amosite and crocidolite

3-25-15
DATE

Bernadine Kolk
Bernadine Kolk - Laboratory Director

EMS LABORATORIES, INC. 117 West Bellevue Drive / Pasadena CA 91105
626-568-6065

## Niue Second Bulk Sample Results

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

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

| | | | |
|---|---|---|---|
| CUSTOMER: | Contract Environmental | PAGE #: | 1 of 2 |
| | 119 Johnson Rd. West Melton | REPORT #: | 0165835 |
| | Christchurch NZ | PROJECT: | PLM ANALYSIS |
| CONTACT: | John O'Grady | DATE COLLECTED: | |
| REFERENCE: | SPREP PACWAST- NIJE | COLLECTED BY: | |
| METHOD: | EPA 600/R-93/116 | DATE RECEIVED: | 05/11/2015 |
| | | ANALYSIS DATE: | 05/19/2015 |

**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 | (%) |
|---|---|---|---|---|---|---|
| 0165835-001 | | | | | | |
| 4 | Brown/Clear, Non-homogeneous, Chalky/Fibrous, crush/tease, friable Note: 21°C, 1.550 | LAYER 1 100% | Amosite | 20% | Non-Fibrous Material | 80% |
| 0165835-002 | | | | | | |
| 5 | Beige/Clear, Non-homogeneous, Chalky/Fibrous, crush/tease, friable Note: 21°C, 1.550 | LAYER 1 100% | Amosite | 20% | Non-Fibrous Material | 80% |
| 0165835-003 | | | | | | |
| 6 | Brown/Clear, Non-homogeneous, Chalky/Fibrous, crush/tease, friable Note: 21°C, 1.550 | LAYER 1 100% | Amosite | 70% | Non-Fibrous Material | 30% |
| 0165835-004 | | | | | | |
| 7 | Tan/Clear, Non-homogeneous, Chalky/Fibrous, crush/tease, friable Note: 21°C, 1.550 | LAYER 1 100% | Amosite | 35% | Non-Fibrous Material | 65% |
| 0165835-005 | | | | | | |
| 8 | White, Homogeneous, Fibrous, tease, friable Note: 21°C, 1.550 | LAYER 1 100% | None Detected | | Fibrous Glass<br>Non-Fibrous Material | 98%<br>2% |

| | | | |
|---|---|---|---|
| CUSTOMER: | Contract Environmental | PAGE #: | 2 of 2 |
| | 119 Johnson Rd. West Melton | REPORT #: | 0165835 |
| | Christchurch NZ | PROJECT: | PLM ANALYSIS |

Analyst: MEGHAN SWEENEY

Approved Signatory: Laboratory Director

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

NVLAP

NVLAP Lab Code: 101219-0



## Niue Second Air Sample Results

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



## Phase Contrast Microscopy of Air Samples
## NIOSH Fiber Count (Method 7400, Issue 2, A Rules)
(Aspect ratio >3:1; Fiber length >5µm; Fields counted: 20 to 100 fields)

AIHA LAB. No: 101634
Report No: 165834
Client: Contract Evironmental
Address: 11- Johnson Rd, W Melton
Christchurch, New Zealand

Attention: John O'Grady
Project: SPREP Pacwaste Project-Niue
File Name: 165834 Contract.air.jw

Date Sampled: N.A.
Date Received: 5/11/2015
Date Analyzed: 5/19/2015

Filter Type/Size: MCE/25mm
Filter Area (sqmm): 385
Field Area (sqmm): 0.00785
Mag: 400x

| Sample I.D. | Fields Counted | Fibers Counted | Fiber/sqmm | Fiber/Filter | Vol (Lit.) | Fibers/cc | LOD (f/cc) | LOQ (f/cc) | A. S. (f/cc) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 100 | 5.5 | 7 | 2697 | 240.0 | **0.0112** | 0.0112 | 0.1635 | 0.0020 |
| 2 | 100 | 7 | 9 | 3433 | 240.0 | **0.0143** | 0.0112 | 0.1635 | 0.0020 |
| 3* | 100 | 17.5 | 22 | 8583 | 240.0 | **0.0358** | 0.0112 | 0.1635 | 0.0020 |

* sample contain fungal hyphae which were not counted as fibers

N.A. = Not Applicable
N.D. = None Detected
Note: NIOSH 7400 requires 2 field blanks or 10% of the set which ever is greater
Results have been corrected for the field blank or EMS blank if the analyte is detected in the blank
Samples were received in good condition unless otherwise noted.
Result only pertain to items actually tested.

f/cc = Fibers per cubic centimeter
LOD = LIMIT OF DETECTION (5.5 fiber/100 field)
LOQ = LIMIT OF QUANTITATION (80 fiber/100 field)
A. S. = ANALYTICAL SENSITIVITY (1 fiber/100 field)
INTRA-LABORATORY Sr = 0.16

Analyst
JEFF WAN

B. M. Kolk, Laboratory Director

PCM VERSION: 7 (9-2008)



## Niue Air TEM Results for Second Air Samples

## RESULTS OF AIR FILTER ANALYSIS *by TEM for Asbestos Structures*

| | | | | | |
|---|---|---|---|---|---|
| ► EMS Laboratory No. | 166195 | | | | |
| ► Client | Contract Environmental | ►Date Received | 6/16/2015 | ► Verbal Results | |
| ► Location | SPREP Pacwaste Project-Nine | ►Date Analyzed | 6/22/2015 | ► Email Results | 6/29/2015 |

**METHOD**

___ EPA Level II
___ AHERA Rules
_X_ NIOSH 7402 M(PCM Range)
___ ISO
___ Other
_X_ Direct Preparation
___ Indirect Preparation
___ Other Preparation

**STRUCTURE / FIBER SIZE**

All Sizes (EPA) __ PCM Range _X_
≥ 0.5 microns length __ > 0.25 microns width
> 5.0 microns length

**ASPECT RATIO 3:1**

### ASBESTOS STRUCTURES

| Sample Identification | Volume | Number of fibers | Fibers / mm² | Fibers / cc | Analytical Sensitivity Fibers / cc | 95% CONFIDENCE LEVELS Lower Limit Structures | Upper Limit / cc |
|---|---|---|---|---|---|---|---|
| 1 | 480 | 3 | 7 | 0.0057 | 0.0019 | 0 | 0.007 |
| 2 | 480 | 10.5 | 25 | 0.0199 | 0.0019 | 0 | 0.007 |
| 3 | 480 | 8.5 | 20 | 0.0161 | 0.0019 | 0 | 0.007 |

☐ "Asbestos - Containing Materials in School", U.S. EPA Final Rule, 40 CFR Part 763, October 30, 1987 (AHERA) counting rules.
☐ "Methodology for the Measurement of Airborne Asbestos by Electron Microscopy," USEPA 1984 (Yamate, et.al.)
X PCM equivalent range by the method described in NIOSH 7402, Issue # 2 15 August, 1994, Modified
Comments:

BK 6/24/15 VK
Analyst QC

*N.D. No asbestos structures detected

TEM -1A (10/12)

EMS Laboratories Inc. / 117 W. Bellevue Drive Ste. 3 / Pasadena, California 91105-2503

## Dowdells Bitumen Tanker Results

# DOWDELL & ASSOCIATES LTD

**OCCUPATIONAL HEALTH ANALYSTS & CONSULTANTS**

4 Cain Rd, Penrose. PO Box 112-017 Auckland 1642. Phone (09) 5260-246. Fax (09) 5795-389.

27th October 2011

Morecroft Asbestos
1183 Kaipara Coast Highway
RD3
Kaukapakapa
**Auckland**

Attention: Dirk Catterall

Dear Sir,

Re: Bulk Fibre Analysis -

| | |
|---|---|
| Sampled by | : Client |
| Date Sample Received | : 27th October 2011 |
| Laboratory No. | : 26155 |
| Location/Description | : Nuie Island – Top of bitumen tanker truck |
| Works Order | : |
| Method | : AS 4964 (2004) - Method for the Qualitative Identification of Asbestos in Bulk Samples. |

The following sample was examined using Low Powered Stereomicroscopy followed by 'Polarised Light Microscopy' including Dispersion Staining Techniques.
The following result applies to the sample as received.

**Reg No:** 90683 **Description**: Insulation **Sample Size:** ≈2x2cm

**Result: Amosite (Brown asbestos)** detected

Yours Faithfully
**DOWDELL & ASSOCIATES LTD**

Michael Sullivan
**Analyst/Consultant**

R.Nicholson
**Analyst/Consultant**

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

DOWDELL ASSOCIATES LTD
OCCUPATIONAL HEALTH ANALYSTS CONSULTANTS
4 Cain Rd, Penrose, PO Box 112-017 Auckland 1642, Phone (09) 5260-246. Fax (09) 5795-389.

DOWDELL & ASSOCIATES LTD

# BULK SAMPLE IDENTIFICATION CERTIFICATE

| | | | |
|---|---|---|---|
| Job Number: | 15-008304 | Certificate Issue Date: | 20/05/2015 |

| | |
|---|---|
| Date Samples Received: | 20/05/2015 |
| No of Samples: | 1 |
| Sampled By: | Client |
| Obtained: | Submitted by client |
| Date Analysed: | 20/05/2015 |
| Analyst: | Adam Ngawati |
| Method: | AS 4964 (2004) - Method for the Qualitative Identification of Asbestos in Bulk Samples |
| Client: | Contract Environmental Ltd |
| Client Address: | 119 Johnson Road, West Melton, Christchurch |
| Client Ref No: | - |
| Contact: | John O'Grady |
| Site Address: | Hui Hui Tanker, Niue |

We examined the following sample(s) using Low Powered Stereomicroscopy followed by 'Polarised Light Microscopy' including Dispersion Staining Techniques. The result(s) in this certificate relate(s) to the sample(s) as received.

GLOSSARY

CHRYSOTILE (WHITE ASBESTOS) - CROCIDOLITE (BLUE ASBESTOS) - AMOSITE (BROWN ASBESTOS) - TREMOLITE, ANTHOPHYLLITE & ACTINOLITE (LESS COMMON ASBESTOS FIBRE TYPES)

Where non-asbestos fibres and the product type are listed, this is to help in the interpretation of results and are the opinion of the analyst only.

Where the sampling is not conducted by Dowdell & Associates Ltd, the information indicated is that supplied by the client. Dowdell & Associates Ltd cannot be held responsible for sampling errors where the sample is taken by others.

For soil samples, note that New Zealand has no specific guidelines with regard to asbestos content in soils. However, we recommend that the Australian Government's enHealth Council's Document 'Management of Asbestos in the Non-Occupational Environment' – 2005 and the (DOH) WA's 'Guidelines for the Assessment, Remediation and Management of Asbestos Contaminated Sites in Western Australia – May 2009 be consulted.



| | | |
|---|---|---|
| Analyst: | | Name: Adam Ngawati |

| | | |
|---|---|---|
| Approved By: | | Name: Rob Nicholson |

DOWDELL ASSOCIATES LTD
OCCUPATIONAL HEALTH ANALYSTS CONSULTANTS
4 Cain Rd, Penrose, PO Box 112-017 Auckland 1642, Phone (09) 5260-246. Fax (09) 5795-389.

DOWDELL & ASSOCIATES LTD

**15-008304 Results**

| Laboratory Reference | Sample Ref / Description | Sample size as received | Sample Weight Analysed | Result | Comments |
|---|---|---|---|---|---|
| 35124 | 1. Insulation - | 1 g | As recieved | No Asbestos detected | SMF present |



## Niue Second Wipe Sample Results

Page 2 of 2

TEM ASBESTOS RESULTS FOR WIPES
ASTM 6480

EMS REPORT 1 165836

| SAMPLE ID | CHRY COUNTED IN TEM | AMPH* COUNTED IN TEM | STRUCTURES >5um COUNTED | ANALYTIC SENSITIVITY STR/CM^2 | CHRY STR/CM^2 | AMPH* STR/CM^2 | >5um STR/CM^2 |
|---|---|---|---|---|---|---|---|
| 9 | 37 | 3 | 11 | 1919 | 71000 | 5800 | 21000 |
| 10 | 111 | 4 | 45 | 3198 | 350000 | 13000 | 140000 |

CHRY = CHRYSOTILE AMPH = AMPHIBOLE STR = STRUCTURES

*Amphibole identified as amosite.

27-May-15
DATE

Bernadine Kolk - Laboratory Director

EMS LABORATORIES, INC. 117 West Bellevue Drive / Pasadena CA 91105
626-568-4648

# Appendix 7: Build Up to Costs for Remediation Options

Four scenarios have been costed:

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

4. Remove and replace asbestos exterior wall cladding

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

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

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

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

## Central Meridian Quote

02.12.14

**Quotation: 6814**

Mr John O'Grady
Contract Environmental Ltd.

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

**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 sealed containment for correct removal and disposal to local landfill. | 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 suitable nearby local disposal. | 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 asbestos contaminated materials will be transported to suitable nearby local disposal. | 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. | 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. Transport asbestos contaminated materials to suitable nearby local disposal. | 6,697.50 | 5,358.00 | 4,870.91 |
| Vacuum clean the existing wall cavities with a vacuum cleaner with a HEPA filter. | 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 |