Baseline Study for the Pacific Hazardous Waste Management Project - Healthcare Waste

The collection, collation and review of data on the management of healthcare waste and best-practice options for its disposal in participating Pacific Island Countries

Timor Leste

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Executive Summary

Introduction

The Secretariat of the Pacific Regional Environment Programme (SPREP) is the Pacific region's major intergovernmental organisation charged with protecting and managing the environment and natural resources. SPREP works with and on behalf of its 21 member countries and territories to promote cooperation in the Pacific islands region, providing assistance to protect and improve the Pacific environment and to ensure sustainable development for present and future generations.

SPREP is implementing the Pacific Hazardous Waste Management (PacWaste) Project, a four year, €7,850,000 (2013 – 2017) project funded by the European Union and administered through SPREP. The project will provide fundamental on-ground improvement in the way priority high risk wastes are managed in Pacific island countries to help build a healthy, economically and environmentally sustainable Pacific for future generations. The PacWaste project is funded by the European Union under its 10th European Development Fund (EDF 10). The project focuses on three priority hazardous waste streams including asbestos, E-waste and healthcare waste.

ENVIRON was engaged by SPREP to collect and collate information on the regional management of healthcare waste and its disposal, as part of their broader strategy of improving waste management in Pacific Island countries, and specifically to assist in establishing sustainable healthcare waste management. This report presents the findings of the assessment conducted for Timor Leste.

Current Healthcare Waste Management in Timor Leste

Five referral hospitals were assessed in Timor Leste in five separate provinces. Information regarding the waste management process occurring, from ward-level waste generation through to ultimate treatment and disposal, was collected during audits for each hospital conducted between 10-16 April 2014.

A minimum standards framework has been developed to set a benchmark for the sustainable management of healthcare waste in the Pacific Island region. This framework is drawn from the *Industry code of practice for the management of biohazardous waste (including clinical and related) wastes*, Waste Management Association of Australia (2014), Draft 7th edition, taking into account the Pacific Island hospital and environmental context.

Using information obtained from the audit, the healthcare facilities in Timor Leste were assessed against this framework. Table ES1 highlights the key areas of concern in terms of health services delivery by the hospital, as part of this assessment.

A full description and definitions of minimum standards applicable for healthcare waste management, as well as a comprehensive assessment against each of the criteria is presented in **Appendix C**.

Target areas have been rated as follows:

	Meets minimum standards assessment criteria
	Partially meets minimum standards assessment criteria.
	Does not meet minimum standards assessment criteria.

Table ES1: Healthcare waste – Key Issues for Timore Leste

Scale	Category	Item	Minimum Standard Criterion	Guido Valadares National Hospital (Dili)	Baucau Referral Hospital	Maliana Referral Hospital	Suai Referral Hospital	Maubisse Referral Hospital	Timor Leste Overall
Healthcare Facility	Policy	Infection Control	Infection control policy incorporates principles of waste management within it						
Healthcare Facility	Policy	Waste Management Plan	Has been developed by the hospital and is based on a review of healthcare waste management and is current (within 5 years)						
Healthcare Facility	Management Committee		A waste management committee has been formed that has representatives from a broad range of departments and meets at least twice per year. A clear set of objectives has been developed for this committee. It reports to the senior management of the hospital.						
Healthcare Facility	Signage		Signs are located in all wards/department areas where waste bins are located indicating the correct container for the various waste types						
Healthcare Facility	Segregation		Waste are correctly segregated in all wards/departments with use of containers that are colour coded for the different waste types						
Healthcare Facility	Storage	Storage before treatment	Meets the standards stated in Appendix E, Recommendation 2, *Correct Storage*.						
Healthcare Facility	Training	Planning and implementation	A structured waste management education program has been developed with a clear delivery structure						
Healthcare Facility	Training	Curricula	A structured waste management training program has been developed that targets the different roles within the hospitals.						
Healthcare Facility	Training	Follow-up & refresher courses	All staff receive waste management education during induction. All staff receive refresher training annually. Waste management training is delivered following an adverse incident to the relevant staff/ward/department.						

Table ES1: Healthcare waste – Key Issues for Timore Leste

Healthcare Facility	Training	Training responsibility	A hospital officer has responsibility for ensuring all training occurs as required and that records are maintained of all training and attendance.						
Healthcare Facility	Waste Audits		A program has been implemented to ensure waste audits are conducted of all waste materials/systems in all wards/departments on an annual basis and reports are provided to the waste management committee. Effective systems are in place to ensure that any non-conformances (with the hospital waste management strategy) are remedied.						
Healthcare Facility	Transport - External		A dedicated vehicle is used to transport untreated healthcare waste. This load carrying area of the vehicle is enclosed and constructed so that any spilt material is contained within this area. A split kit is provided.	N/A	N/A	N/A			
Healthcare Facility	Treatment	Suitability of treatment for healthcare waste	The method for treating healthcare waste is in accord with required standards - this includes operating parameters and location of the treatment unit.						
Healthcare Facility	Economics	Cost Effectiveness	A process has been developed that cost all aspects of waste management and these costs are reported annually to the waste management committee.						
Healthcare Facility	Occupational Health and Safety	Staff risk	Waste containers, locations, storage and management procedures for healthcare waste incorporate identified risks to staff in accessing the waste and/or having needle-stick injuries.						
Healthcare Facility	Occupational Health and Safety	Patient/Visitor risk	Waste containers, locations, storage and management procedures for healthcare waste incorporate identified risks to patients and visitors in accessing the waste and/or having needle-stick injuries.						
Healthcare Facility	Healthcare waste management emergencies	Spill Prevention and Control	Spill kits are provided or all types of healthcare waste in all wards/departments, storage areas and on trolleys and vehicles. Staff are trained on the use of spill kits. All incidents of spills of healthcare waste are investigated and where appropriate remedial actions implemented.						

Table ES1: Healthcare waste – Key Issues for Timore Leste									
Healthcare Facility	Future Planning	Planning for change	Hospitals have developed a process to benchmark waste generation so as to (amongst other requirements), plan of future hospital development in terms of services and numbers of patients.						
Local Council	Waste Treatment Facility	Landfill	Healthcare waste is disposed of at a dedicated location and covered immediately on arrival. Scavengers cannot access untreated healthcare waste.						

Key Issues

Common issues observed in Timor Leste were:

- Incinerators had broken down at three of the five hospitals visited (Bacuau, Suai and Maubisse). Factors for breaking down included no incinerator operation training and no skilled hospital staff to repair the incinerators. Also, hospital staff were no aware of any contractor with the capabilities to repair incinerators in Timor Leste.
- There is no documented waste management planning system in place and limited evidence of waste management committees.
- Segregation and containment practices are generally below minimum standard in that there is virtually no signage present, the only segregation regularly practiced is for sharps, colour coded bags (liners) and bins were limited in supplies and storage at some of the hospital (Dili, Bacuau and Suai) is not adequate.
- There is no structured training or waste segregation auditing program in place

Analysis of Options for Sustainable Healthcare Waste Management in Timor Leste

Where non-treatment waste management aspects were observed to be performing below the Minimum Standards Framework, this framework is referenced for recommended actions.

For treatment of healthcare waste, various options used around the world were considered in the Pacific Islands context, via a two stage process:

- Stage 1: High-level costs and benefits (cost, lifespan, technical feasibility and how that relates to the Pacific Island regional context); and
- Stage 2: A Timor Leste -specific feasibility assessment, using an analysis of 10 criteria (**Appendix D**)

Treatment options that rated best for Timor Leste were:

- ***High Temperature Incineration*** is the promoted disinfection practice where units are modern, maintained, have sufficient waste volumes and locked in supplier maintenance and training contracts.
- ***Medium Temperature Incineration*** is acceptable to remedy current unacceptable practices at sites too small to justify costs of expensive equipment.
- ***Low temperature burning*** is a borderline practice which can only be acceptable in the short term, in low population density environments, to remedy current unacceptable practices.
- ***Autoclaving*** is an acceptable disinfection practice where units with shredder are affordable and locked in supplier maintenance and training contracts are in place, but borderline beyond Port Vila due to lack of lined landfills and increased complexity of machinery.

Recommendations

Table ES2 provides a summary of the recommendations for Timor Leste

Table ES2: Recommendations for Timor Leste Applicable to	Guido Valadares National Hospital	Baucau Referral Hospital	Maliana Referral Hospital	Suai Referral Hospital	Maubisse Referral Hospital
Recommendation 1: Develop a Waste Management Framework					
Description	• A *Healthcare Waste Management Plan*, specific to each healthcare facility • Appoint an *officer responsible* for the development and implementation of the Healthcare Waste Management Plan. The referral hospitals visited had a Quality Control Officer or an environmental officer who would be suitable candidates for the responsibility of the implementation of the Healthcare Waste Management Plan • A *waste management committee*, appropriate to the scale of each facility and across all the hospitals nationwide.				
Output	• An agreed *Healthcare Waste Management Plan*, specific to each healthcare facility outlining procedures and guidelines, waste definitions and characterisation, segregation techniques, containment specifications and storage practices, collection and transport, treatment and disposal and emergency procedures • Accountability for healthcare waste management through clearly defined roles and responsibilities				
Monitoring & Evaluation Indicators	• Plan approved by Ministry of Health (all facilities) • Approved budget for implementation of Healthcare Waste Management Plan • The Plan should be regularly monitored, reviewed, revised and updated. • Annual assessment of 'Responsible Officer's' or Waste Management Committees' performance against key healthcare waste management competencies.				
Costs ($US)	• Establishment – Low, if existing systems (such as those for Fiji) are used as a starting points and document drafting assistance is provided • Ongoing – Low				
Recommendation 2: Procurement of Consumables (Segregation & Storage)					
Description	• Supply of colour-coded **waste bins** and **plastic liners** in quantities sufficient to serve all wards/departments for a period of time sufficient to allow bedding down of the segregation process. • Supply of small number of colour-coded **wheelie bins** (where required) per hospital to act as both in-ward/department storage and internal transport trolleys. • Supply of **signage** to explain the colour-coded segregation system as well as **posters** to promote it.				
Output	Adequate supply of consumables to bed down more rigorous segregation practices				
Monitoring & Evaluation Indicators	• Wastes are segregated at their place of production. • Infection wastes, general wastes and used sharps are stored in separate colour coded				

Table ES2: Recommendations for Timor Leste Applicable to	Guido Valadares National Hospital	Baucau Referral Hospital	Maliana Referral Hospital	Suai Referral Hospital	Maubisse Referral Hospital
	containers and locations within medical areas. • Zero Needle Stick Injuries.				
Costs ($US)	Establishment – Low; Ongoing - Low, sustainably funded by country				
Recommendation 3: Provide a Sustainable Training Program					
Description	• Development and delivery of a structured healthcare waste training program to all hospital personnel as well as personnel from other stakeholders (e.g., government health and environment agencies) • This could be facilitated/ delivered by SPREP staff, or outside trainers, or a combination of both, as no competent healthcare waste management training capability exists in Timor Leste. • The Quality Control Officer at Guido Valadares National Hospital (Paulina Pinto) has had training and sufficient work experience in Australia in relation to infection control to assist in leading the training program. • Training should be coordinated with other countries' needs in the region.				
Output	• Improvement of personnel skills and competency in managing healthcare waste • Promotion of the advantages of sustainable segregation and storage techniques for the different waste streams and an understanding of the health and safety risks resulting from the mismanagement risks of healthcare waste.				
Monitoring & Evaluation Indicators	• Competency Assessments • Refresher Training • No/very little cross contamination between waste streams demonstrated by waste audits.				
Costs ($US)	• Establishment – Low-medium per facility if regional synergies are utilised • Ongoing – Low-medium per facility if regional synergies are utilised				
Recommendation 4: Repair and Maintain Treatment Infrastructure *U2H*					
Description	• **Repair** of existing incinerator for Baucau, Suai and Maubisse referral hospitals. • **Identify contractor** that is able repair the incinerators as well as offer training to incinerator operators on proper use and maintenance of incinerators. • Establish maintenance support contract. • Develop incinerator operation and maintenance procedure specific to each incinerator.				
Output	All incinerator working that the referral hospitals; relevant staff are trained to operate and maintain the incinerator; an maintenance support contract established.				

Table ES2: Recommendations for Timor Leste Applicable to	Guido Valadares National Hospital	Baucau Referral Hospital	Maliana Referral Hospital	Suai Referral Hospital	Maubisse Referral Hospital
Monitoring & Evaluation Indicators	Assessment of the following should be regularly undertaken for new and existing incinerators: • Operations and construction (e.g. pre-heating and not overloading the incinerator and incinerating at temperatures above 800ºC only) • Maintenance program – are maintenance issues dealt with promptly? • Ensure burn times are sufficient to reduce waste ash volumes				
Costs ($US)	• Establishment – Repairs (low-medium) • Ongoing –maintenance and support contract (medium)				
Recommendation 5: Appropriate Storage Facilities *U2H*					
Description	• Procure contractors to design and develop a healthcare waste storage facility as per Appendix C and Appendix E at the Guido Valadares National Hospital. • Ensure appropriate waste storage facility is incorporated into construction on the new Baucau Hospital. Potential funding may be required.				
Output	A disposal system that reduces the potential hazard posed by health-care waste, while endeavoring to protect the environment (**meet minimum standards outlined in** Appendix C and Appendix E).				
Monitoring & Evaluation Indicators	Suitability of storage areas regularly assessed by 'responsible officer' of waste management committee.				
Costs ($US)	• Establishment – Medium $US10,000. • Ongoing – low – monitoring and maintenance.				

U2H - Unique to hospital

Implementation actions are suggested for each recommendation, classified as short, medium and long-term priorities.

1 Introduction and Background

The Secretariat of the Pacific Regional Environment Programme (SPREP) is the Pacific region's major intergovernmental organisation charged with protecting and managing the environment and natural resources. SPREP works with and on behalf of its 21 member countries and territories to promote cooperation in the Pacific islands region, providing assistance to protect and improve the Pacific environment and to ensure sustainable development for present and future generations.

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ENVIRON was engaged by SPREP to collect and collate information on the regional management of healthcare waste and its disposal, as part of their broader strategy of improving waste management in Pacific Island countries, and specifically to assist in establishing sustainable healthcare waste management. This report presents the findings of the assessment conducted for Timor Leste.

1.1 Project Scope

This report covers the approach specified in the Request for Tender AP 6/5/6/2 '*The collection, collation and review of data on the management of healthcare waste and best practice options for its disposal in selected Pacific Island communities'* as it specifically relates to Timor Leste and includes:

- Collection and collation of data on the current practice(s) used to dispose of hazardous healthcare waste in Timor Leste. Data collected includes:
  - Basic background data on the operation of the site (number of beds, population served, current and projected rates of hazardous healthcare waste generation;
  - Healthcare waste separation and infection control practices;
  - Adequacy of supply of hazardous healthcare waste collection equipment;
  - Hazardous healthcare waste storage;
  - Hazardous healthcare waste transportation;
  - Hazardous healthcare waste disposal practice and annual operating costs;
  - Frequency and adequacy of infection control training;
  - Frequency and adequacy of waste disposal training;
  - Adequacy of supply of personnel protective equipment.
- Consultation with national authorities to review and identify best-practice option(s) and preferences for national hazardous healthcare waste management by considering

technical feasibility within the existing health infrastructure (including review of existing local institutional, policy and regulatory arrangements).

- Identification of local contractors who may have the expertise and capacity to potentially partner with regional or international expert's in future hazardous healthcare waste management including infection control training.

1.2 Report Structure

This report is structured as follows:

- an introduction to the project (**section 1**)
- discussion of current healthcare waste management in Timor Leste, including the current regulatory framework and hospital details (**section 2**)
- a summary of existing waste management practices, waste streams and quantities, waste management and infection control framework, the waste management process that were reviewed, training and education programs and identified healthcare waste management issues (**section 3)**
- key healthcare waste management issues and any county-wide or regional themes that were identified (**section 4**)
- a summary of hospital and national authority consultation outcomes (**section 5**)
- an assessment of contractor roles and their capacity to sustainably manage and treat healthcare waste, including any training or education capacity (**section 6)**
- an analysis of the healthcare waste management and treatment options available, both regionally and specific to Timor Leste, to address the key issues identified (**section 7**)
- recommendations and prioritization of actions necessary to enable sustainable hazardous healthcare waste management and disposal in Timor Leste (**section 8**)

2 Healthcare Waste Management in Timor Leste

2.1 National Regulatory Framework

The Ministry of Health is responsible for the regulation of healthcare however the generally the management of healthcare lies with the individual hospitals at this stage with little regulation or assistance from the MoH.

Timor Leste Government is still in the early stages of development of its new Government (2002) and very little information regarding the national regulatory framework was available online (the language barrier of Portuguese and/or Tetum also restricted searches).

From the people interviewed during ENVIRON's audits (refer to Section 5) no one was able to identify any specific legislation or guidelines relating to healthcare waste management.

Therefore no national legislation summary is provided for this report.

2.2 Hospitals Assessed

This section summarises the hospitals that were assessed in Timor Leste, key contact personnel and key hospital administrative statistics.

There are six referral hospitals in Timor Leste covering 13 districts. ENVIRON visited five of the six referral hospitals. ENVIRON was not able to visit Oecusse Referral hospital within an exclave district on the western part of the Island of Timor. Difficulty in visas and transportation to reach Oecusse were the main reasons for not being able to make the hospital visit.

2.2.1 Guido Valadares National Hospital, Dili

Guido Valadares is national referral hospital and the largest hospital in Timor Leste. The hospital is located within Dili and is limited in space with building, roads and parking occupying most of the site. The area is surrounded by residential and commercial shops.

The construction date of the hospital was not known as many attritional building and renovations have been made in the last ten years.

Wards at the hospital include: Paediatric ward; medical ward; gynaecology ward; anti-malaria ward; post natal ward; pre natal ward; maternity ward; surgical wards (male and female); emergency ward; TB ward; rehabilitation ward; orthopaedic ward; medicine wards (male and female); standby Isolation ward and outpatient ward.

2.2.2 Baucau Referral Hospital, Baucau

Bacuau Referral Hospital is located in the Timor Leste second largest city of Baucau. The hospital receives referral from the eastern district of Lautem as well. The hospital is believed to have been built in the mid 1990's but many of the buildings are now run down. Construction is underway for a new Referral Hospital in Baucau which was due to be completed at the end 2013. Due to a series of financial issues the planned date of completion is now at the end of 2014.

Wards at the hospital include: medical ward; paediatric ward; surgical ward and maternity ward.

2.2.3 Maliana Referral Hospital, Maliana

Maliana was built in late 2000's and is located on the outskirts of the Maliana main shopping precinct. It services the neighboring Bobonaro district in addition to the Maliana District. Hospital buildings, roads and car parking only occupy around 50% of the hospital. A police station and other government buildings surround the hospital.

Wards at the hospital include: out-patients ward; accidents and emergency ward; surgical/operating theatre ward; in-patients ward; pathology ward and TB ward.

2.2.4 Suai Referral Hospital, Suai

Suai was built in late 2000's and is located on the outskirts of the Maliana main shopping precinct. It services the Cova Lima District.

Wards at the hospital include: emergency ward; maternity ward; out-patients ward and in-patients ward.

2.2.5 Maubisse Referral Hospital, Suai

Maubisse Referral Hospital was built in late 2000's and is located on the outskirts of the Maubisse township.

Wards at the hospital include: medical ward; paediatric ward; emergency ward and maternity ward.

Table 1: Hospital Details – Timor Leste					
Hospital/Region	**Guido Valadares National Hospital, Dili, Dili District**	**Baucau Referral Hospital, Baucau, Baucau District**	**Maliana Referral Hospital, Maliana, Bobonaro District (sub district Maliana)**	**Suai Referral Hospital, Suai, Cova Lima District**	**Maubisse Referral Hospital, Maubisse. Ainaro District**
Contact Name **Position**	Paulina Pinto, Quality Control Manager	Mr Simone, Quality Control Officer	Dr Bourdaloue Moniz Hospital Director	Dr Hormausigifdo, Hospital Director	Gabriela Pereira, Quality Control Officer
Pop Served	200,000	16,000 (Baucau); 111,486 (Baucau District)	22,000 (Maliana), 97,000 (Bobonaro District)	23,000 (Suai); 60,063 (Cova Lima District)	4,949 (Maubisse); 59,382 (Ainaro District)
No. of Beds	260	114	45	24	24
Annual Average Occupancy Rate (%)	80%	70%	50%	40%	40%
Occupied Bed Days (OBD)	75,920	29,127	8,212	3,504	4,380
No. Operations	Not provided	Not provided	Not provided	Not provided	-
No. of Births	3,600	1,068	660	350	242
Emergency Patients Attended	Not provided	8,752	10,950	6,000	4,000
Out-Patients Attended	Not provided	49,116	45,625	30,000	6,000
No. of staff	427	190	103	88	62
No. of staff per function					
Nursing/ Medical	374	139	100	86	27
Infection Control	2	1	1	0	1
Dedicated Waste Management – Internal Management	4	50	2	1	20
Dedicated Waste Management – Treatment Operation	As above	0	0	0	0
Administration	49	Included in nursing/medical	Included in nursing/medical	1	1
Other	0	0	0	0	13

3 Existing Waste Management Practices

This section describes waste management practices observed during hospital audits carried out at each of the hospitals introduced in Section 2. Information regarding the waste management process occurring, from ward-level waste generation through to ultimate treatment and disposal is described for each of the five hospitals in Table 3.

Audit observations are elaborated upon further for each hospital individually in sections 3.1 – 3.4 for the remaining issue headings:

- Wastestreams, Treatment Constraints and Costs
- Waste Management and Infection Control Framework and
- Training.

A comprehensive list of all data collected from the site audits of each hospital is located in **Appendix B**.

Table 2: Waste Management Process - Observations

	Hospital Name	Guido Valadares National Hospital (Dili)			Baucau Referral Hospital			Maliana Referral Hospital			Suai Referral Hospital			Maubisse Referral Hospital		
Generation & Segregation	Dedicated Containers/ Bags	Y			N			Y			Y			Y		
	Colour Coding	N			N			Y			Y			N		
	Sharps segregated & secure	Y			Y			Y			Y			Y		
	Signage Present	N			N			Y			N			N		
Internal Handling	Degree of manual handling of bags	Medium			High			Medium			High			Medium		
	Internal Transport Mode	Trolley			Manual			Wheelie Bin			Manual			Trolley		
	Spill Kit Present	N			N			N			N			N		
Storage	Dedicated & Appropriate Area	N			N			Y			N			Y		
	Loading/unloading acceptable	N			N			Y			N			Y		
	Spill Kits Present	N			N			Y			N			N		
	Monitoring & record keeping occurs	N			N			N			N			N		
Treatment	Treatment per Waste Stream		Tech. Type	Volumes (kg/wk)		Tech. Type	Volumes (kg/wk)		Tech. Type	Volumes (kg/wk)		Tech. Type	Volumes (kg/wk)			Volumes (kg/wk)
	Healthcare Waste	✓	Incinerate	500[1]	✓	Burn on site	~250[2]	✓	Incinerate	100[3]	✓		75[4]	✓	Landfill	35[5]

[1] Based on the incinerator burning once daily (weekdays only) holding approximately 100kg.
[2] No data available. Estimate based on comparison with Guido Valadares and Maliana as hospitals of similar scale and practices
[3] Not weighed as no scale at hospital – based on estimates of weekly use of the incinerator of about a 100kg load
[4] Not weighed as no scale at hospital – based on estimates of weekly use of the incinerator of about a 75kg load

Table 2: Waste Management Process - Observations

	Hospital Name	Guido Valadares National Hospital (Dili)			Baucau Referral Hospital			Maliana Referral Hospital			Suai Referral Hospital			Maubisse Referral Hospital		
			(internal)						(internal)						(without treatment)	
	Sharps	✓	Incinerate (internal)	Included above	✓	Burn on site	Not known Not known	✓	Incinerate (internal)	Included above	✓	As above	Included above	✓	Landfill (without treatment)	40[6]
	Pharmaceutical	✓	Dilution	Not known	✓	Burn on site	Not known	✓	Incinerate (internal)	Not known	✓	Dump off site	Not known	✓	Chemical/ Maceration	Not known
	Cytotoxic	×	NA	NA	×	NA	NA	×	NA	NA	×	NA	NA	×	NA	NA
	General	✓	Landfill (without treatment)	Not known	✓	Landfill (without treatment)	Not known	✓	Landfill (without treatment)	Not known	✓	Dump off site	Not known	✓	Landfill (without treatment)	Not known
	If incinerator present															
	Make, Model, Year commissioned	Nu-Way, Nol 133, Sept 2001			Nu-Way, Nol 19S Sept 2001			Kato Burner Co. Ltd, 2008			Not known			Kato Burner Co. Ltd, 2007		
	Operating Temp (^{0}C)	1,000+			1,000+			1,000+			Not known			1,000+		
	No. chambers	2			2			1			1			1		
	Condition	Reasonable			Broken down			Reasonable			Broken down			Broken down		
	Comments				Yes but not in use since 2004						Currently storing healthcare waste on site as the internal incinerator is not working (refer to Photo 21 of Appendix A).			Yes (not operated since Jan 2014)		

[5] Not weighed as no scale at hospital – based on estimates of previous use of the incinerator three times per month and approximately a 100kg load (minus the sharps quantities estimate).
[6] Estimated 10 Sharps boxes (20 litre) per week weighing approximately 4kg

Table 2: Waste Management Process - Observations

	Hospital Name	Guido Valadares National Hospital (Dili)	Baucau Referral Hospital	Maliana Referral Hospital	Suai Referral Hospital	Maubisse Referral Hospital
	Operational statistics	Per year				
	Waste Throughput (kg)	100kg/per load	Not known	100kg/per load	Not known	100kg/per load
	Operating Hours (hr)	Approx 2 hours	Not known	Approx 2 hours	Not known	Approx 2 hours
	Fuel	Diesel	Diesel	Electric	Diesel	Electric
	Fuel use (kg/litres)	Not known	Not known	Not known	Not known	Not known
	Fuel use per kg waste burnt	Not known	Not known	Not known	Not known	Not known
	Technology siting and operation issues	Neighbouring residents have previously complained about the fumes.	No local contractions identified to have the capabilities to repair the incinerator.	None to report	No local contractions identified to have the capabilities to repair the incinerator.	No local contractions identified to have the capabilities to repair the incinerator.
	Offsite transport assessment	Fair	Poor	N/A	Fair	Fair

3.1 Guido Valadares National Hospital (Dili)

3.1.1 Wastestreams, Treatment Constraints and Costs

Guido Valadares National Hospital generates general wastes and healthcare wastes (including, infectious waste, sharps and pharmaceutical wastes) in the approximate quantities described in Table 3.

Quantities of waste were not measured by the hospital and records were not kept. General waste is picked up twice daily in a 3 tonne truck and taken to the landfill by a local contractor. Plastic bags are loaded onto the truck which the hospital cleaning staff were not able to estimate number of bags offloaded.

No costs information was obtained; since waste disposal costs are internally borne by the hospital it is not directly measured. General cost would be for diesel and staffing.

3.1.2 Waste Management and Infection Control Framework

The following summarises the waste management and infection control framework at Guido Valadares National Hospital:

- There is no waste management policy, plan or formalised waste management procedure. The Hospital Quality Officer oversees waste management and infection control and uses the WHO Guidelines as a reference.
- There is no formal waste auditing or inspections.
- There are plans to start a Nation-wide infection control committee which will be headed by the Quality Control Officer at Guido Valadares National Hospital. However, availability of time is delaying the set-up of this committee as well as the difficulty of operating remotely of each another.

3.1.3 Training

- There are no known training courses within Timor Leste which specifically relate to infection control or healthcare waste management.
- None of the hospitals audited in Timor Leste have a formal training program in place for infection control, waste segregation and/or incinerator use/maintenance. The following training has taken place:
- The Quality Control Officer (Mrs Paulina Pinto) at the Guido Valadares National Hospital (Dili) has recently commenced undertaking infection control training to all nursing staff as well as inviting the Quality Control Officers from the Baucau Referral Hospital to attend. The training summarised some of the key lesson learned from Mrs. Pinto work experience in Infection Control undertaken at Sydney's North Shore Hospital (the training was funded by AusAid).
- Mrs. Pinto has also previously completed such summaries for a quality control training course she undertook in Jakarta in 2009 however there is no regular schedule as yet.
- Mrs. Pinto is currently looking to develop a training course relating to quality control that will incorporate medical waste which can be rolled out to the other referral hospital. Key constraints of this will be time and cost allowances for travel.

- Registered nurses receive basic training on waste segregation and infection control during the three year training course to be a registered nurse which is undertaken in Dili or abroad (typically Indonesia).
- Anecdotally, waste management training and incinerator operation is communicated informally upon new staff employment at a hospital.

3.2 Baucau Referral Hospital, Baucau

3.2.1 Wastestreams, Treatment Constraints and Costs

Baucau Referral Hospital generates general wastes and healthcare wastes (including, infectious waste, sharps and pharmaceutical wastes) in the approximate quantities described in Table 3. Quantities of waste were not measured by the hospital and records were not kept. Waste is un-segregated and dumped at the on-site landfill from small 20-50 litre plastic bins, making it difficult to provide volume estimates for each waste type.

No costs information was obtained; since waste disposal costs are internally borne by the hospital it is not directly measured.

3.2.2 Waste Management and Infection Control Framework

The following summarises the waste management and infection control framework at Baucau Referral Hospital:

- There is no waste management policy, plan or formalised waste management procedure. The Hospital Quality Officer oversees waste management and infection control and receives come direction from Guido Valadares National Hospital and Ministry of Health however this is infrequent.
- There is no formal waste auditing or inspections.

3.2.3 Training

There are no known training courses within Timor Leste which specifically relate to infection control or healthcare waste management.

None of the hospitals audited in Timor Leste have a formal training program in place for infection control, waste segregation and/or incinerator use/maintenance. The following training has taken place:

- Registered nurses receive basic training on waste segregation and infection control during the three year training course to be a registered nurse which is undertaken in Dili or abroad (typically Indonesia).
- Anecdotally, waste management training and incinerator operation is communicated informally upon new staff employment at a hospital.
- The incinerator is no longer is use as no one at the hospital was trained to maintain to repair the incinerator. The hospital does not know who to contact in regards to fixing the incinerator.

3.3 Maliana Referral Hospital, Maliana

3.3.1 Wastestreams, Treatment Constraints and Costs

Malinana Referral Hospital generates general wastes and healthcare wastes (including, infectious waste, sharps and pharmaceutical wastes) in the approximate quantities described in Table 3. Quantities of waste were not measured by the hospital and records were not kept. Waste is un-segregated and dumped at the on-site landfill, making it difficult to provide volume estimates for each waste type.

No costs information was obtained; since waste disposal costs are internally borne by the hospital it is not directly measured.

3.3.2 Waste Management and Infection Control Framework

The following summarises the waste management and infection control framework at Maliana Referral Hospital:

- There is no waste management policy, plan or formalised waste management procedure. The Hospital Quality Officer oversees waste management and infection control and receives direction from Guido Valadares National Hospital and Ministry of Health however this is infrequent.
- There is no formal waste auditing or inspections.
- The hospital keeps a needle stick injury (NSI) register and has a procedure was developed by the on-site Doctor for any NSI in relation to ongoing testing. There have been two cases in the past 12 months.

3.3.3 Training

There are no known training courses within Timor Leste which specifically relate to infection control or healthcare waste management.

None of the hospitals audited in Timor Leste have a formal training program in place for infection control, waste segregation and/or incinerator use/maintenance. The following training has taken place:

- Registered nurses receive basic training on waste segregation and infection control during the three year training course to be a registered nurse which is undertaken in Dili or abroad (typically Indonesia).
- Anecdotally, waste management training and incinerator operation is communicated informally upon new staff employment at a hospital.

3.4 Suai Referral Hospital, Suai

3.4.1 Wastestreams, Treatment Constraints and Costs

Suai Referral Hospital generates general wastes and healthcare wastes (including infectious waste, sharps and pharmaceutical wastes) in the approximate quantities described in Table 3. Quantities of waste were not measured by the hospital and records were not kept. Currently the incinerator is not in use however hospital staff estimated that the incinerator was formerly used one a week with the incinerator usually being three quarters full. Hospital staff were not able to provide estimates on quantities of waste going to landfill.

No costs information was obtained; since waste disposal costs are internally borne by the hospital and it is not directly measured.

3.4.2 Waste Management and Infection Control Framework

The following summarises the waste management and infection control framework at Suai Referral Hospital:

- There is no waste management policy, plan or formalised waste management procedure. The Hospital Quality Officer oversees waste management and infection control and receives direction from Guido Valadares National Hospital and Ministry of Health however this is infrequent.
- There is no formal waste auditing or inspections.

3.4.3 Training

There are no known training courses within Timor Leste which specifically relate to infection control or healthcare waste management.

None of the hospitals audited in Timor Leste have a formal training program in place for infection control, waste segregation and/or incinerator use/maintenance. The following training has taken place:

- Registered nurses receive basic training on waste segregation and infection control during the three year training course to be a registered nurse which is undertaken in Dili or abroad (typically Indonesia).
- Anecdotally, waste management training and incinerator operation is communicated informally upon new staff employment at a hospital.

3.5 Maubisse Referral Hospital, Maliana

3.5.1 Wastestreams, Treatment Constraints and Costs

Maubisse Referral Hospital generates general wastes and healthcare wastes (including infectious waste, sharps and pharmaceutical wastes) in the approximate quantities described in Table 3. Quantities of waste were not measured by the hospital and records were not kept. Estimates are made based on interviews with hospital staff.

No costs information was obtained; since waste disposal costs are internally borne by the hospital it is not directly measured.

3.5.2 Waste Management and Infection Control Framework

The following summarises the waste management and infection control framework at Maubisse Referral Hospital:

- There is no waste management policy, plan or formalised waste management procedure. The Hospital Quality Officer oversees waste management and infection control and receives direction from Guido Valadares National Hospital and Ministry of Health however this is infrequent.
- There is no formal waste auditing or inspections.

3.5.3 Training

There are no known training courses within Timor Leste which specifically relate to infection control or healthcare waste management.

None of the hospitals audited in Timor Leste have a formal training program in place for infection control, waste segregation and/or incinerator use/maintenance. The following training has taken place:

- The resident Doctor from Cuba performed a one off staining session on Infection Control for the Hospital which was completed in January 2014.
- Registered nurses receive basic training on waste segregation and infection control during the three year training course to be a registered nurse which is undertaken in Dili or abroad (typically Indonesia).
- Anecdotally, waste management training and incinerator operation is communicated informally upon new staff employment at a hospital.

The incinerator is no longer is use as no one at the hospital was trained to maintain to repair the incinerator. In addition to hospital does not know who to contact in regards to fixing the incinerator. .

4 Key Healthcare Waste Management Issues in Timor Leste

This section takes the collected information from Section 3 and summarises and critically assesses it, for each hospital surveyed, in the context of a Minimum Standards Framework.

A key issues summary is also provided.

4.1 Minimum Standards Framework

A minimum standards framework has been developed to set a benchmark for the sustainable management of healthcare waste in the Pacific Island region. This framework is drawn from the *Industry code of practice for the management of biohazardous waste (including clinical and related) wastes*, Waste Management Association of Australia (2014), Draft 7th edition, taking into account the Pacific Island hospital and environmental context.

A full description and definitions of minimum standards applicable for healthcare waste management, as well as a comprehensive assessment against each of the criteria is presented in **Appendix C**. Target areas have been rated as follows:

Table 3: Assessment criteria rating system	
	Meets minimum standards assessment criteria
	Partially meets minimum standards assessment criteria.
	Does not meet minimum standards assessment criteria.

Table 4 highlights the key areas of concern, both per hospital, and in terms of health services delivery across Timor Leste's hospitals, as part of this assessment.

The sub-sections below discuss these key areas of concern further.

Table 4: Healthcare waste – Key Issues for Timor Leste

Scale	Category	Item	Minimum Standard Criterion	Guido Valadares National Hospital (Dili)	Baucau Referral Hospital	Maliana Referral Hospital	Suai Referral Hospital	Maubisse Referral Hospital	Timor Leste Overall
Healthcare Facility	Policy	Infection Control	Infection control policy incorporates principles of waste management within it						
Healthcare Facility	Policy	Waste Management Plan	Has been developed by the hospital and is based on a review of healthcare waste management and is current (within 5 years)						
Healthcare Facility	Management Committee		A waste management committee has been formed that has representatives from a broad range of departments and meets at least twice per year. A clear set of objectives has been developed for this committee. It reports to the senior management of the hospital.						
Healthcare Facility	Signage		Signs are located in all wards/department areas where waste bins are located indicating the correct container for the various waste types						
Healthcare Facility	Segregation		Waste are correctly segregated in all wards/departments with use of containers that are colour coded for the different waste types						
Healthcare Facility	Storage	Storage before treatment	Meets the standards stated in Appendix E, Recommendation 2, *Correct Storage*.						
Healthcare Facility	Training	Planning and implementation	A structured waste management education program has been developed with a clear delivery structure						
Healthcare Facility	Training	Curricula	A structured waste management training program has been developed that targets the different roles within the hospitals.						
Healthcare Facility	Training	Follow-up & refresher courses	All staff receive waste management education during induction. All staff receive refresher training annually. Waste management training is delivered following an adverse incident to the relevant staff/ward/department.						
Healthcare Facility	Training	Training responsibility	A hospital officer has responsibility for ensuring all training occurs as required and that records are maintained of all training and attendance.						

Table 4: Healthcare waste – Key Issues for Timor Leste

Scale	Category	Item	Minimum Standard Criterion	Guido Valadares National Hospital (Dili)	Baucau Referral Hospital	Maliana Referral Hospital	Suai Referral Hospital	Maubisse Referral Hospital	Timor Leste Overall
Healthcare Facility	Waste Audits		A program has been implemented to ensure waste audits are conducted of all waste materials/systems in all wards/departments on an annual basis and reports are provided to the waste management committee. Effective systems are in place to ensure that any non-conformances (with the hospital waste management strategy) are remedied.						
Healthcare Facility	Transport - External		A dedicated vehicle is used to transport untreated healthcare waste. This load carrying area of the vehicle is enclosed and constructed so that any spilt material is contained within this area. A split kit is provided.	N/A	N/A	N/A			
Healthcare Facility	Treatment	Suitability of treatment for healthcare waste	The method for treating healthcare waste is in accord with required standards - this includes operating parameters and location of the treatment unit.						
Healthcare Facility	Economics	Cost Effectiveness	A process has been developed that cost all aspects of waste management and these costs are reported annually to the waste management committee.						
Healthcare Facility	Occupational Health and Safety	Staff risk	Waste containers, locations, storage and management procedures for healthcare waste incorporate identified risks to staff in accessing the waste and/or having needle-stick injuries.						
Healthcare Facility	Occupational Health and Safety	Patient/Visitor risk	Waste containers, locations, storage and management procedures for healthcare waste incorporate identified risks to patients and visitors in accessing the waste and/or having needle-stick injuries.						
Healthcare Facility	Healthcare waste management emergencies	Spill Prevention and Control	Spill kits are provided or all types of healthcare waste in all wards/departments, storage areas and on trolleys and vehicles. Staff are trained on the use of spill kits. All incidents of spills of healthcare waste are investigated and where appropriate remedial actions implemented.						

Table 4: Healthcare waste – Key Issues for Timor Leste

Scale	Category	Item	Minimum Standard Criterion	Guido Valadares National Hospital (Dili)	Baucau Referral Hospital	Maliana Referral Hospital	Suai Referral Hospital	Maubisse Referral Hospital	Timor Leste Overall
Healthcare Facility	Future Planning	Planning for change	Hospitals have developed a process to benchmark waste generation so as to (amongst other requirements), plan of future hospital development in terms of services and numbers of patients.						
Local Council	Waste Treatment Facility	Landfill	Healthcare waste is disposed of at a dedicated location and covered immediately on arrival. Scavengers cannot access untreated healthcare waste.						

4.1.1 Guido Valadares National Hospital (Dili) – Key Issues

The most significant healthcare waste management issues observed at Guido Valadares National Hospital (Dili) were:

- Shortage of colour coded waste disposal bins as well as yellow bags supplied for the hospital.
- No adequate waste storage facility. General waste is dumped and burnt at the rear of the incinerator when there is an overload for waste going to landfill (**Photos 1-2**).
- Healthcare waste ash from the incinerator is disposed of at the rear of the facility (not buried).
- Residential properties neighbour the facility and in particular are adjacent to the incinerator and on-site landfill. Neighbours have previously complained about the fumes. There is no other suitable location at the hospital site for the incinerator. From the site audit, ENVIRON observed the incinerator to working efficiently.
- Dili Hospital has constraints that would be typically expected to be found in a hospital located in a developing country. These include limited funding (especially to waste management); time available for qualified staff to focus on waste management; training; and at times a low importance put on medical waste management.

4.1.2 Baucau Referral Hospital – Key Issues

The most significant healthcare waste management issues observed at Baucau Referral Hospital were:

- Healthcare waste and general waste is not segregated and disposed of untreated in an onsite dump site (**Photos 9-10**).).
- Shortage of colour coded waste disposal bins as well as yellow baggage supplied for the hospital.
- Diesel Incinerator has not been operating since 2004 due to breaking down and no local contractor skilled to repair the incinerator (**Photo 8**).
- There is a new hospital planned to be completed in Baucau at the end of 2014. At this hospital there is no planning for an incinerator or a waste storage facility.

4.1.3 Maliana Referral Hospital – Key Issues

The most significant healthcare waste management issues observed at Maliana Hospital were:

- The ash from the incinerator is not buried (**Photo 16**).
- Shortage of colour coded waste disposal bins as well as yellow baggage supplied for the hospital.
- Limited training is available to nursing staff in relation to infection control and medical waste management.
- There is no documented waste management planning system in place.
- There is no structured training or waste segregation auditing program in place.

4.1.4 Suai Referral Hospital – Key Issues

The most significant healthcare waste management issues observed at Suai Referral Hospital were:

- Incinerator has not been operating since mid-2013 due to breaking down and no local contractor skilled to repair the incinerator (**Photo 20**).
- There is a stockpile of healthcare waste including sharps stored in the incinerator caged area which needs to be treated and disposed of (**Photo 21**).
- Healthcare waste and general waste is generally poorly segregated.
- Shortage of colour coded waste disposal bins as well as yellow bags supplied for the hospital.
- Limited training is available to nursing staff in relation to infection control and healthcare waste management.
- There is no documented waste management planning system in place.
- There is no structured training or waste segregation auditing program in place.

4.1.5 Maubisse Referral Hospital – Key Issues

The most significant healthcare waste management issues observed at Maubisse Referral Hospital were:

- Healthcare waste and general waste is generally poorly segregated and disposed of untreated in an offsite dump site.
- Shortage of colour coded waste disposal bins as well as yellow baggage supplied for the hospital.
- Incinerator has not been operating since January 2014 due to breaking down and no local contractor skilled to repair the incinerator.
- Limited training is available to nursing staff in relation to infection control and medical waste management.
- There is no documented waste management planning system in place.
- There is no structured training or waste segregation auditing program in place.

5 Consultation

Apart from hospital staff across all five hospitals, no other discussions were held with any of the government departments. ENVIRON made contact with the Ministry of Health however, responses were limited.

6 Contractor Roles and Capacity

Currently, all healthcare waste management services are managed by the hospital and Ministry of Health with no in-country contractors identified as providing or having the capacity to provide healthcare waste management support services.

Dili has a reasonable service industry and although no specific incinerator service contractor were known by hospital staff or identified during the visit, there are electrician, mechanics and general engineers that may be able to service to perform repair work on electronic/diesel/gas incinerators.

No waste contractor were identified that treat healthcare waste to the minimum standard.

In terms of educational and consulting services, no locally based services were known to occur. Training is often provided aid agencies (both government and non-government). However this appears to be informal in scheduling and no directional planning in relation to healthcare waste.

7 Analysis of Options for Sustainable Healthcare Waste Management in Timor Leste

Section 4 identifies key issues that need to be addressed in improving healthcare waste management in Timor Leste. This section evaluates the potential options that could be employed to respond to these key issues.

Table 5 categorizes these key issues (A – F) against potential options that could be adopted to tackle them, as a collated list of high-level responses

Table 5: Options for Sustainable Healthcare Waste Management in Timor Leste

Key Issue Category	Key Issue	Options to address the issue
A. Waste Management Framework	There is no documented **waste management** planning system in place and limited evidence of waste management committees.	Establish a waste management framework including: • Waste Management Plan • Responsible officer for implementation of waste management plan • Waste management committee, appropriate to the scale of each facility and to work between other hospitals in Timor Leste.
B. Signage, Segregation & Containers	**Segregation and containment** practices are generally below minimum standard in that: • There is virtually no wall signage present. Signage is limited to bins and not always present. • Waste segregation is intended however is generally poorly implemented. • Colour coded bags (liners) were rarely available. • Some colour coded bin were available but usually there was a shortage which prevented consistency across the individual hospital.	Improve segregation practices by: • Supply of colour-coded waste bins and plastic liners in quantities sufficient to serve all wards/departments for a period of time sufficient to allow bedding down of the segregation process. • Supply of small number of colour-coded wheelie bins (where required) per hospital to act as both in-ward/department storage and internal transport trolleys. • Supply of signage to explain in words and illustrations the colour-coded segregation system as well as posters to promote it.
C. Training & Audit	There is no structured **training** or waste segregation **auditing** program in place	Development and delivery of a structured healthcare waste training program to all hospital personnel as well as personnel from other stakeholders (e.g., government health and environment agencies). This could be facilitated/ delivered by: 1. SPREP staff, **or** 2. International technical training providers (or a combination of both), - as no competent healthcare waste management training capability were identified in Timor Leste.
D. Healthcare Waste Storage Facility	Healthcare waste storage facilities generally did not meet minimum standard (except for Maliana and Maubisse). However in the case of Suai, the facilities are available but not	• Ensure there is a waste storage facility that meets the requirements detailed in Appendix E. • Regular checks and maintenance of waste storage facilities.

	used properly.	
E. Treatment	**Treatment** is intended to be done at the hospitals visited however with the exception of Dili and Maliana the hospital incinerators have broken down.	Treatment using one (or a combination) of the following for each hospital: 1. Rotary kiln (highest temperature) 2. Incineration (high, medium temperature) 3. Low temperature burning (single chamber incinerator/ pit/ drum/ brick enclosure/ land) 4. Autoclave 5. Chemical 6. Microwave 7. Encapsulation 8. Landfill (without disinfection) 9. Onsite burial 10. Shredding
F. Occupational Health and Safety	Waste handlers generally wore appropriate **PPE** including, gloves and face masks. Generally overalls /protective clothing and eye protection was not worn. **Spill control kits** were not observed anywhere.	Procurement of Consumables (PPE): • Supply spill kits and appropriate PPE including overalls/protective clothing, gloves and eye protection for all waste handlers. • Incinerator staff are provided with additional PPE such as face masks and noise protection.

7.1 Options for (Non-Treatment) Waste Management Aspects

Those options that do not relate directly to the waste treatment process tend to have limited alternatives that can address their respective key issue, given they typically relate to the fundamentals of hazardous waste management. These are:

- The waste management (and infection control) framework, including policies, plans, procedures, responsibility for implementation and audit of the functioning of the framework (A in Table 5)
- The waste management process, from generation to transport up to the treatment location (B in Table 5)
- Training systems for sustainable healthcare waste management (C in Table 5)
- Healthcare Waste Storage Facility (D in Table 5)
- OHS related protection for waste handlers (F in Table 5)

These areas have not been subjected to an options analysis, because the minimum standards framework has clear requirements with limited variation options.

7.2 Options for Treatment of Healthcare Waste

Healthcare waste treatment (key issue category E) has a range of alternative approaches, as summarized in Table 5. These have strengths and weaknesses that need to be considered in the context of criteria such as performance and cost of the technology itself, the waste types and volumes it is required to process, the environment it would be operating

in and a range of factors specific to the Pacific Islands region and in some cases an individual country's circumstances.

Treatment solutions may involve a single technology, more than one technology for sub-categories of healthcare waste or combination of the technologies listed in Table 5. These alternatives have been assessed using a two stage process:

Stage 1: High-level costs and benefits

- Cost (capital, operating, maintenance)*
- Lifespan
- Technical feasibility (advantages and disadvantages) and how that relates to the Pacific Island regional context

* Costs are estimated at a high level for relative comparison purposes. Detailed quotations, particularly for equipment purchase and associated operating and maintenance costs will be required as part of any future procurement process to be managed by SPREP.

Stage 2: Local feasibility assessment (per country)

- comparative cost to implement
- comparative effectiveness across all HCWs
- health and safety considerations
- sustainability
- institutional and policy fit
- cultural fit
- barriers to implementation
- environmental impact
- durability and
- ease of operator use.

The stage 1 treatment technology options assessment is generic to the Pacific region so is included in the *Whole of Project – Summary Report*, Appendix E. This analysis highlights the following technologies as worthy of consideration for Timor Leste's Stage 2 assessment:

1. Incineration (high temperature: >1,000^{0}C [7])
2. Incineration (medium temperature: 800 – 1,000^{0}C [4])
3. Low temperature burning (single chamber incinerator/ pit/ drum/ brick enclosure/ land: <400^{0}C [4])
4. Autoclave
5. Encapsulation (of sharps only, in combination with a form of disinfection).

[7] As defined in *Management of Solid Health-Care Waste at Primary Health-Care Centres - A Decision-Making Guide*, WHO (2005)

7.2.1 Waste Treatment Systems Relevant for Timor Leste

The Stage 2 local feasibility assessment (for Timor Leste) took these first 4[8] technologies and assessed them against the ten dot point criteria listed in 7.2. These criteria are explored qualitatively in **Appendix D**. Table 6 takes these qualitative descriptions and assigns a quantitative score from 1 – 5, to prioritise local applicability of technology options to the Timor Leste context, on a relative basis as follows:

1. Very low
2. Low
3. Moderate
4. High
5. Very High.

The treatment technologies suitable for the Timor Leste context are ranked in order of preference in Table 6:

Table 6: QUANTITATIVE Treatment Technology Options Assessment (Stage 2) - Local Feasibility Assessment (Timor Leste)

Stage 1- Approved Technology Options	Comparatively low cost to implement	Comparative effectiveness across all HCWs	Local Feasibility								Total Score out of 50	Rank
			Health & safety to workers & community	Sustainability of solution	Institutional and policy fit	Cultural fit	Implementation barriers can be overcome?	Receiving environment protected	Durability	Ease of operation		
Incineration at high temperature (>1000^{0}C)	1	5	4	4	3	4	3	3	3	3	33	1
Incineration at med. temperature (800 - 1000^{0}C)	4	4	3	3	3	4	4	2	2	4	33	1
Low temperature burning (<400^{0}C)	5	3	1	2	2	3	4	1	5	5	31	2
Autoclave with shredder	2	4	4	3	3	3	3	4	2	2	30	3

Notes:
- Scored on a scale of 1-5, where 1= very low; 2 = low; 3= moderate; 4 = high and 5 = very high
- Criteria given equal weighting
- Possible maximum score: 50

[8] Encapsulation is assessed separately as its potential applicability is only for sharps that have already been treated to remove the infection risk, whereas all other technologies have a wider application and are fundamentally standalone options.

In support of Table 6's ranking:

- ***High Temperature Incineration*** is the promoted disinfection practice where units are modern, maintained, have sufficient waste volumes and locked in supplier maintenance and training contracts.
- ***Medium Temperature Incineration*** is acceptable to remedy current unacceptable practices at sites too small to justify costs of expensive equipment.
- ***Low temperature burning*** is a borderline practice which can only be acceptable in the short term, in low population density environments, to remedy current unacceptable practices.
- ***Autoclaving*** is an acceptable disinfection practice where units with shredder are affordable and locked in supplier maintenance and training contracts are in place, but borderline beyond Port Vila due to lack of lined landfills and increased complexity of machinery.

Based on the qualitative assessment in **Appendix D**, ***encapsulation*** ranks as an effective way to deal with the residual risk from already disinfected sharps: i.e., the risk of needle stick injury by healthcare workers or the community (waste disposal area) due to the fact that sharps are disinfected but not physically destroyed by the low-medium temperature of open burning (or non-destruction of autoclaving). Encapsulation is never recommended as an isolated form of treatment, as it does not disinfect or otherwise treat the hazard of the waste.

A substantial amount of data exists on the emissions generated from incinerators, but conversely, little studies have been conducted on all aspects of alternate technologies performance. While the literature is inconclusive on the requirements needed to effectively manage the blood and body fluid contaminated and infectious components of the waste streams, there does seem to be consensus that hazardous components such as pharmaceuticals and cytotoxic wastes do need to be treated prior to final disposal to ensure there is no risks to the environment or health of humans and other species. No publication from a government environmental or health agency, or any article reviewed advocated any other preferred form of treatment for pharmaceuticals and cytotoxic wastes than incineration. In most instances the preference for anatomical waste was also incineration.

Since Timor Leste does not currently generate cytotoxic wastes and typically returns anatomical waste to the family of the patient for cultural reasons, limitations regarding these wastes are not particularly relevant for healthcare waste treatment choices in Timor Leste.

7.2.1 Treatment Investment Options for individual Timor Leste Hospitals

Wastes should be treated and disposed of accordingly to ensure the infectious hazard is destroyed. Three out of the five referral hospitals in Timor Leste require some investment in either replacement or maintenance of infrastructure to achieve this, as described by their respective treatment weaknesses in sections 4.1.1 – 4.1.5.

Table 7 determines 'intervention' options that are suggested to improve treatment of healthcare waste in each Timor Leste hospitals visited. Shading in green indicates where investment is proposed, while orange shading shows where a technology consideration is also relevant.

Table 7: Technology Options Applicable for Each Hospital in Timor Leste	
Remaining Technology Options	**Technology Applicability**
Guido Valadares National Hospital	
Disinfection & Encapsulation (only sharps assessed)	Not applicable when incinerator is operating.
Incineration at high temperature (>1000^{0}C)	Currently available and suitable.
Incineration at med. temperature (800 - 1000^{0}C)	Not applicable to Guido Valadares National Hospital as it is large enough to justify a better performing larger option that runs at a higher temperature.
Autoclave with shredder	Not applicable when incinerator is operating.
Low temperature burning (<400^{0}C)	Not applicable to Guido Valadares National Hospital as it is large enough to justify a better performing larger option that runs at a higher temperature.
Baucau Referral Hospital	
Disinfection & Encapsulation (only sharps assessed)	Autoclave and encapsulation of sharps should be an option employed in the short term until the incinerator is repaired.
Incineration at high temperature (>1000^{0}C)	Current incinerator is not working and requires repair. The incinerator is a Nu-Way, Nol 19S (commissioned in Sept 2001) and is the same type of incinerator used at Guido Valadares National Hospital. The existing incinerator should be repaired urgently to provide the hospital with a functional treatment option.
Incineration at med. temperature (800 - 1000^{0}C)	The existing incinerator, when working, is a functional treatment option.
Autoclave with shredder	The existing incinerator, when working, is a functional treatment option.
Low temperature burning (<400^{0}C)	The existing incinerator, when working, is a functional treatment option.
Maliana Referral Hospital	
Disinfection & Encapsulation (only sharps assessed)	Not applicable when incinerator is operating.
Incineration at high temperature (>1000^{0}C)	Currently available and suitable.
Incineration at med. temperature (800 - 1000^{0}C)	Not applicable when the current incinerator is operating.
Autoclave with shredder	Not applicable when the current incinerator is operating.
Low temperature burning (<400^{0}C)	Not applicable when the current incinerator is operating.
Suai Referral Hospital	
Disinfection & Encapsulation (only sharps assessed)	Autoclave and encapsulation of sharps should be an option employed in the short term until the incinerator is repaired.
Incineration at high temperature (>1000^{0}C)	Current incinerator is not working and requires repair. The incinerator is a Kato Burner Co. Ltd and is the same type of incinerator used at Maliana and Maubisse Referral hospitals. The existing incinerator should be repaired urgently. When repaired, the incinerator will provide the hospital with a functional treatment option.
Incineration at med. temperature (800 - 1000^{0}C)	The existing incinerator, when working, is a functional treatment option.

Autoclave with shredder	The existing incinerator, when working, is a functional treatment option.
Low temperature burning (<400^{0}C)	The existing incinerator, when working, is a functional treatment option.
Maubisse Referral Hospital	
Disinfection & Encapsulation (only sharps assessed)	Autoclave and encapsulation of sharps should be an option employed in the short term until the incinerator is repaired.
Incineration at high temperature (>1000^{0}C)	Current in incinerator is not working and requires repair. The incinerator is a Kato Burner Co. Ltd and is the same type of incinerator used at Maliana and Suai Referral hospitals. The existing incinerator should be repaired urgently. When repaired, the incinerator will provide the hospital with a functional treatment option.
Incineration at med. temperature (800 - 1000^{0}C)	The existing incinerator, when working, is a functional treatment option.
Autoclave with shredder	The existing incinerator, when working, is a functional treatment option.
Low temperature burning (<400^{0}C)	The existing incinerator, when working, is a functional treatment option.

Timing considerations for these options, in the context of other (non-treatment) options, is provided in the Section 8 (Recommendations).

8 Recommendations

The following section outlines recommendations and a proposed implementation plan for each recommendation to achieve sustainable management of healthcare waste in Timor Leste. Further details and guidance on each recommendation are provided in **Appendix E**.

Table 8 provides a summary of the recommendations for Timor Leste. A colour coding system is used to describe the degree of applicability of each recommendation to each hospital as follows:

	Fully Applicable
	Partially applicable
	Not applicable

In terms of relative priorities of the five recommendations, they are all high, based on the deficiencies addressed against the minimum standards framework. They are also highly inter-related, for example: segregation practices cannot be sustainably improved without the requirements and responsibility of the waste management framework; which in turn cannot be turned into active policies and procedures without the understanding and reinforcement that comes from training. Effective treatment and use of PPE cannot be sustained without the reinforcement of training, effective segregation and the procedures and monitoring spelled out in the waste management framework.

However, the staggered timing of actions required to implement the recommendations, as outlined for each hospital in section 8.1, and their different short, medium and long term approaches give an indication of priority of the recommendation actions themselves.

*Where a recommendation is **unique** to the circumstances of a particular hospital, because of issues identified that are **unique** to that hospital, the recommendation (and associated implementation action) is appended with the annotation* ***U2H***

Table 8: Recommendations for Timor Leste Applicable to	Guido Valadares National Hospital	Baucau Referral Hospital	Maliana Referral Hospital	Suai Referral Hospital	Maubisse Referral Hospital
Recommendation 1: Develop a Waste Management Framework					
Description	• A *Healthcare Waste Management Plan*, specific to each healthcare facility • Appoint an *officer responsible* for the development and implementation of the Healthcare Waste Management Plan. The referral hospitals visited had a Quality Control Officer or an environmental officer who would be suitable candidates for the responsibility of the implementation of the Healthcare Waste Management Plan • A *waste management committee*, appropriate to the scale of each facility and across all the hospitals nationwide.				
Output	• An agreed *Healthcare Waste Management Plan*, specific to each healthcare facility outlining procedures and guidelines, waste definitions and characterisation, segregation techniques, containment specifications and storage practices, collection and transport, treatment and disposal and emergency procedures • Accountability for healthcare waste management through clearly defined roles and responsibilities				
Monitoring & Evaluation Indicators	• Plan approved by Ministry of Health (all facilities) • Approved budget for implementation of Healthcare Waste Management Plan • The Plan should be regularly monitored, reviewed, revised and updated. • Annual assessment of 'Responsible Officer's' or Waste Management Committees' performance against key healthcare waste management competencies.				
Costs ($US)	• Establishment – Low, if existing systems (such as those for Fiji) are used as a starting points and document drafting assistance is provided • Ongoing – Low				
Recommendation 2: Procurement of Consumables (Segregation & Storage)					
Description	• Supply of colour-coded **waste bins** and **plastic liners** in quantities sufficient to serve all wards/departments for a period of time sufficient to allow bedding down of the segregation process. • Supply of small number of colour-coded **wheelie bins** (where required) per hospital to act as both in-ward/department storage and internal transport trolleys. • Supply of **signage** to explain the colour-coded segregation system as well as **posters** to promote it.				
Output	Adequate supply of consumables to bed down more rigorous segregation practices				
Monitoring & Evaluation	• Wastes are segregated at their place of production.				

Table 8: Recommendations for Timor Leste Applicable to	Guido Valadares National Hospital	Baucau Referral Hospital	Maliana Referral Hospital	Suai Referral Hospital	Maubisse Referral Hospital
Indicators	• Infection wastes, general wastes and used sharps are stored in separate colour coded containers and locations within medical areas. • Zero Needle Stick Injuries.				
Costs ($US)	Establishment – Low; Ongoing - Low, sustainably funded by country				
Recommendation 3: Provide a Sustainable Training Program					
Description	• Development and delivery of a structured healthcare waste training program to all hospital personnel as well as personnel from other stakeholders (e.g., government health and environment agencies) • This could be facilitated/ delivered by SPREP staff, or outside trainers, or a combination of both, as no competent healthcare waste management training capability exists in Timor Leste. • The Quality Control Officer at Guido Valadares National Hospital (Paulina Pinto) has had training and sufficient work experience in Australia in relation to infection control to assist in leading the training program. • Training should be coordinated with other countries' needs in the region.				
Output	• Improvement of personnel skills and competency in managing healthcare waste • Promotion of the advantages of sustainable segregation and storage techniques for the different waste streams and an understanding of the health and safety risks resulting from the mismanagement risks of healthcare waste.				
Monitoring & Evaluation Indicators	• Competency Assessments • Refresher Training • No/very little cross contamination between waste streams demonstrated by waste audits.				
Costs ($US)	• Establishment – Low-medium per facility if regional synergies are utilised • Ongoing – Low-medium per facility if regional synergies are utilised				
Recommendation 4: Repair and Maintain Treatment Infrastructure *U2H*					
Description	• **Repair** of existing incinerator for Baucau, Suai and Maubisse referral hospitals. • **Identify contractor** that is able repair the incinerators as well as offer training to incinerator operators on proper use and maintenance of incinerators. • Establish maintenance support contract. • Develop incinerator operation and maintenance procedure specific to each incinerator.				
Output	All incinerator working that the referral hospitals; relevant staff are trained to operate and				

Table 8: Recommendations for Timor Leste Applicable to	Guido Valadares National Hospital	Baucau Referral Hospital	Maliana Referral Hospital	Suai Referral Hospital	Maubisse Referral Hospital
	maintain the incinerator; an maintenance support contract established.				
Monitoring & Evaluation Indicators	Assessment of the following should be regularly undertaken for new and existing incinerators: • Operations and construction (e.g. pre-heating and not overloading the incinerator and incinerating at temperatures above 800ºC only) • Maintenance program – are maintenance issues dealt with promptly? • Ensure burn times are sufficient to reduce waste ash volumes				
Costs ($US)	• Establishment – Repairs (low-medium) • Ongoing –maintenance and support contract (medium)				
Recommendation 5: Appropriate Storage Facilities *U2H*					
Description	• Procure contractors to design and develop a healthcare waste storage facility as per Appendix C and Appendix E at the Guido Valadares National Hospital. • Ensure appropriate waste storage facility is incorporated into construction on the new Baucau Hospital. Potential funding may be required.				
Output	A disposal system that reduces the potential hazard posed by health-care waste, while endeavoring to protect the environment (**meet minimum standards outlined in** Appendix C and Appendix E).				
Monitoring & Evaluation Indicators	Suitability of storage areas regularly assessed by 'responsible officer' of waste management committee.				
Costs ($US)	• Establishment – Medium $US10,000. • Ongoing – low – monitoring and maintenance.				
Recommendation 6: Procurement of Consumables (PPE)					
Description	• Supply appropriate PPE including overalls/protective clothing, gloves and eye protection for all waste handlers. • Incinerator staff are provided with additional PPE such as face masks and noise protection.				
Output	Adequate supply of PPE for protection of waste handlers				
Monitoring & Evaluation Indicators	• PPE is provided to all staff and staff are aware on how to protect themselves from injuries and infectious wastes • Zero Needle Stick Injuries.				
Costs ($US)	Establishment – Low; Ongoing - Low, sustainably funded by country				

Recommendation 6: Procurement of Consumables (PPE)						
Monitoring & Evaluation Indicators	• Plan approved by Ministry of Health (all facilities) • Approved budget for implementation of Healthcare Waste Management Plan • The Plan should be regularly monitored, reviewed, revised and updated. • Annual assessment of 'Responsible Officer's' or Waste Management Committees' performance against key healthcare waste management competencies.					

U2H - Unique to hospital Implementation Priorities

8.1.1 Recommendation 1: Develop a Waste Management Framework

1. Develop a **Healthcare Waste Management Plan** specific to each hospital, including technical guidelines and procedures relating to waste management and if not already present, infection control.

2. Appoint an **officer responsible** for the development and implementation of the Healthcare Waste Management Plan

3. Establish a **waste management committee**, appropriate to the scale of the facility.

A **Healthcare Waste Management Plan**, specific to each healthcare facility outlining waste definitions and characterisation, segregation techniques, containment specifications and storage practices, collection and transport, treatment and disposal and emergency procedures should be developed as an overarching document to guide healthcare waste management processes and procedures at each healthcare facility.

The Management Plan should be developed in accordance with any waste strategies the Timor Leste government has developed or is planning to develop. Ministry of Commerce, Industry and Environment and the Ministry of Health (MoH) should be consulted on the drafting of the waste management plan, to ensure policy and legislative needs are considered.

A responsible officer or **waste management officer** would be responsible for the day-to-day operations and monitoring of the waste management system and is usually established as a separate post in larger hospitals (however, one appointee could be responsible for the waste management performance for a number of hospitals with a stated time fraction allocated to each hospital). It is important that the waste management officer be adequately resourced to enable them to undertake their role as well as supported by hospital management to ensure that all staff recognise the importance of adopting waste management practices that are in accord with all requirements.

A **waste management committee** has representatives from a broad range of departments and meets at least twice per year. A clear set of objectives has been developed for this committee. It reports to the senior management of the hospital.

8.1.1.1 Short Term (0-6 months)

- Identify existing documents and systems that may have been used in the past
- Responsible officer or healthcare waste management committee set up as part of infection control.
- Definitions of responsibilities and key accountabilities of responsible officers and Waste Management Committee developed for inclusion in Waste Management Plan.

8.1.1.2 Medium Term (6 months-1 year)

- Formulate a Draft Waste Management Plan drawing on the results of this 'Baseline Assessment' (i.e. present situation, quantities of waste generated, possibilities for

waste minimization, identification of treatment options, identification and evaluation of waste-treatment and disposal options, identification and evaluation of record keeping and documentation and estimations of costs relating to waste management)

- The draft discussion document would be prepared in consultation with hospital staff, and officials from the relevant government agencies.

8.1.1.3 Long Term (1 year-3 years)

- Finalise the Waste Management Framework
- Continually improve the mandatory standards of healthcare waste management
- Implement a program to ensure waste audits are conducted of all waste materials/systems in all wards/departments on an annual basis and reports are provided to the waste management committee. Effective systems are in place to ensure that any non-conformances (with the hospital waste management strategy) are remedied.

8.1.2 Recommendation 2: Procurement of Consumables (Segregation & Storage)

Waste should be collected in accordance with the schedules specified in the Waste Management Plan (Recommendation One).The correct segregation of healthcare waste is the responsibility of the person who produces each waste item, whatever their position in the organisation. The healthcare facility is responsible for making sure there is a suitable segregation, transport and storage system, and that all staff adhere to the correct procedures. Labeling of waste containers is used to identify the source, record their type and quantities of waste produced in each area, and allow problems with waste segregation to be traced back to a medical area.

8.1.2.1 Short Term (0-6 months)

- Procurement of in-hospital healthcare waste management consumables including:
    - Colour coded bins and bin liners
    - Wheelie bins
    - Classification and segregation signage as well as instructional posters to promote good healthcare waste management practices (all hospitals)
- Procurement plan developed to ensure the sustainable supply of healthcare waste management resources.

8.1.2.2 Medium Term (6 months-1 year)

As per short term above.

8.1.2.3 Long Term (1-3 years)

Consumables to be supplied from in-country health agency budgets.

8.1.3 Recommendation 3: Provide a Sustainable Training Program

Development and delivery of a structured healthcare waste training program to all hospital personnel as well as personnel from other stakeholders (e.g., government health and environment agencies).

This could be facilitated/ delivered by SPREP staff, or outside trainers, or a combination of both, as no competent healthcare waste management training capability exists in Timor Leste.

Training should be coordinated with other countries' needs in the region.

All waste management strategies rely on all staff to participate and co-operate in order to ensure that objectives are at least met. Staff therefore must receive appropriate training/education or else they are not going to know what to do. The following is an outline of a Staff Waste Management Education Program that could be developed:

- Introduction to the session.
- Importance of good waste/environment management.
- Waste management hierarchy.
- Waste minimisation principles.
- Brief overview of legislation pertaining to waste management.
- Hospital policies on environment/waste management.
- Overview of waste types.
- Issues relating to waste reduction.
- Management responsibilities.
- Identification of, and hazards associated with the different types of wastes generated Importance of effective waste segregation.
- Waste, handling, packaging and disposal routes for the different types of wastes generated.

All staff and contractors should attend a waste management training session. This is to be conducted during all induction programs in the first instance. For those staff and contractors currently employed on-site, they will be required to attend a dedicated training session so that they are fully aware of their roles and responsibilities in respect to waste management. Records shall be maintained of all staff and contractors attendance at a training session to ensure that all personnel attend.

8.1.3.1 Short Term (0-6 months)

- Identify potential trainers and build training skills
- Develop a budget for long term training delivery
- Identification and prioritization of employees that need to be trained
- Defining the specific learning objectives for each target audience

- Develop a detailed curriculum specifying the training plan for each session.

8.1.3.2 Medium Term (6 months-1 year)

- Explore incentives for training (e.g. training in collaboration with a health professional society or university that can award certificates or professional credentials)

8.1.3.3 Long Term (1 year-3 years)

- Continually improve the mandatory standards of healthcare waste management
- A continuing audit program be implemented to identify incorrect waste management practices and results of such audits communicated to staff in all wards/departments. Results from these audits and corrective actions to be reported to the facility waste management committee

8.1.4 Recommendation 4: Improved Treatment Infrastructure [U2H]

Wastes should be treated and disposed of accordingly to ensure the infectious hazard is destroyed. All five hospitals in Timor Leste have incinerators on site however at three of the five the incinerators were broken down. None of the hospital staff at the hospitals visited had received training on proper use and maintenance of the incinerators.

Suai, Maubisse and Baucau Referral Hospital - Repair of existing incinerators

All Hospitals – Provide training, maintenance contracts and operation procedures for all incinerators.

8.1.4.1 Short Term (0-6 months)

- Identify contractor to repair existing incinerators at Suai, Maubisse and Baucau Referral Hospital (high priority).
- Preferably completed parallel to the repair work of existing incinerators is to educate relevant hospital staff on the proper use and maintenance of exiting incinerators.
- *Using appropriate PPE*, immediately gather up and treat backlog of sharps and medical waste at the Suai Referral Hospital:

8.1.4.2 Medium Term (6 months-1 year)

- Develop procedure for the training, maintenance and operation of the incinerator as well as contacts should a problem occur.

8.1.4.3 Long Term (1-3 years)

- Ongoing incineration system maintenance support
- Recording of waste treatment quantities and operating conditions (e.g. burn temperatures per batch)
- Maintain training of operators as required.

8.1.5 Recommendation 5: Appropriate Storage Facilities [U2H]

Storage areas for healthcare waste should be designated within the healthcare facility. Storage facilities should be labeled in accordance with the hazard level of the stored waste and should be designed to prevent the risk of infection risk and environmental harm. Spill Kits for healthcare waste should also be located in the storage areas.

At the newly constructed hospitals (Maliana, Suai and Maubisse constructed in the 2000's) appropriate waste storage facilities were built. However Dili and Baucau, two the largest serving population hospitals did not have appropriate waste storage facilities.

The storage areas are fenced, lockable, paved and suitably designed and isolated from patients, public and animals (as described in **Appendix E**).

8.1.5.1 Short Term (0 – 6 months)

- Procure contractors to design and develop a healthcare waste storage facility at the Guido Valadares National Hospital (Dili), and Baucau Referral Hospital.
- Upgrade central storage areas to meet minimum standards outlined in **Appendix C** to eliminate the risk of ongoing public risk and environmental harm.

8.1.5.2 Medium Term (6 months – 1 year)

- Procure spill kits for each central storage area.

8.1.5.3 Long Term (1 year – 3 years)

- Implement an ongoing healthcare waste facilities audit program to monitor the condition of central storage areas

8.1.6 Recommendation 6: Procurement of Consumables (PPE)

All waste handlers are provided with and use appropriate PPE including overalls/protective clothing, gloves and eye protection. Incinerator staff are provided with additional PPE such as face masks and noise protection.

8.1.6.1 Short Term (0-6 months)

- Procurement of in-hospital healthcare waste management PPE including overalls/protective clothing, gloves and eye protection
- Incinerator staff are provided with additional PPE such as face masks and noise protection
- Procurement plan developed to ensure the sustainable supply of healthcare waste management resources.

8.1.6.2 Medium Term (6 months-1 year)

- A system is set up to monitor correct use of PPE.

8.1.6.3 Long Term (1-3 years)

Nil.

Appendix A

Photo Log

Appendix B

Collected Data from Hospital Audits in Timor Leste

Table B1: Collected Data from Hospital Audits in Timor Leste

HOSPITAL DETAILS	Region		Dili, Dili District		Baucau, Baucau District		Maliana, Bobonaro District (subdistrict Malinana)		Suai, Cova Lima district		Maubisse. Ainaro District	
	Facility Name & Contact Information	Hospital Name	Guido Valadares National Hospital (Dili)		Baucau Referral Hospital		Maliana Referral Hospital		Suai Referral Hospital		Maubisse Referral Hospital	
		Contact Name & Position	Paulina Pinto	Quality Control	Mr Simone	Quality Control	Dr Bourdaloue Moniz	Hospital Director	Dr Hormausigifdo	Director of Suai	Gabriela Pereira	Hospital Director
		Email	paula_pinto@gmail.com				bfmoniz@yahoo.co.id				hospmbs@yahoo.com	
		Phone	77363508		77263670		+670 23 30008		'+67078239847		78239845	
	Key Services Data	Summary of Services Provided	Paediatric ward; medical ward; gynaecology ward; anti-malaria ward; post natal ward; pre natal ward; maternity ward; surgical wards (male and female); emergency ward; TB ward; rehabilitation ward; orthopaedic ward; medicine wards (male and female); standby Isolation ward; outpatient ward.		Medical ward; paediatric ward; surgical ward; and maternity ward		Out-Patients ward; accidents and emgency ward; surgical/operating theater ward; in-patients ward; pathology ward; TB ward.		Emergency ward; maternity ward; out-Patients ward; in-patients.		Medical ward; paediatric ward; emergency ward; and maturnity ward	
		Pop Served	200,000		16,000 (Baucau); 111,486 (Baicai District)		22,000 (Maliana), 97,000 (Bobonaro District)		23,000 (Suai); 60,063 (Cova Lima District)		4,949 (Maubisse); 59,382 (Ainaro District)	
		No. of Beds	260		114		45		24		24	
		OBD's [1]	80%		70%		50%		40%		50%	
		No. Operations										

Table B1: Collected Data from Hospital Audits in Timor Leste

		No. of Births[2]	3,600		1,068		660		350		242	
		Emergency Patients Attended[2]			8,752		10,950		6,000		4,000	
		Out-Patients Attended[2]	Not measured		49,116		45,625		30,000		6,000	
		No of Staff	427		190		103		88		62	
WASTE MANAGEMENT PROCESS	Waste Steams Managed	Estimates	Volumes (kg/wk)	Cost ext. ($US)	Volumes (kg/wk)	Cost ext. ($US)	Volumes (kg/wk)	Volumes (kg/wk)	Cost ext. ($US)	Volumes (kg/wk)	Volumes (kg/wk)	Cost ext. ($US)
		Healthcare Waste	Not measured		Not measured		Not measured		Not measured		Not measured	
		Sharps	Not measured		Not measured		Not measured		Not measured		Not measured	
		Pharmaceutical	Not measured		Not measured		Not measured		Not measured		Not measured	
		Cytotoxic	Small quantities		None		None		None		None	
		General	Not measured		Not measured		Not measured		Not measured		Not measured	
		Recycling	Not separated		Not separated		Not separated		Not separated		Not separated	
		TOTAL	0	$ -	0	$ -	0	$ -	0	$ -	0	$ -
	Generation & Segregation	Dedicated Containers/ Bags	Y		N		Y		Y		Y	
		Colour Coding	N		N		Y		Y		N	
		Sharps segregated & secure	Y		Y		Y		Y		Y	
		Signage Present	N		N		Y		N		N	

Table B1: Collected Data from Hospital Audits in Timor Leste

	Internal Handling	Degree of manual handling of bags	Medium		High		Medium		High		Medium	
		Internal Transport Mode	Trolley		Manual		Wheelie Bin		Manual		Trolley	
		Spill Kit Present	N		N		N		N		N	
	Storage	Dedicated & Appropriate Area	N		N		Y		N		Y	
		Loading/unloading acceptable	N		N		Y		N		Y	
		Spill Kits Present	N		N		Y		N		N	
		Monitoring & record keeping occurs	N		N		N		N		N	
	Treatment	Treatment per Waste Stream	Tech. Type	Int/Ext	Tech. Type	Int/Ext	Tech. Type	Tech. Type	Int/Ext	Tech. Type	Tech. Type	Int/Ext
		Healthcare Waste										
		Sharps										
		Pharmaceutical										
		Cytotoxic										
		General										
		If incinerator present	Yes		Yes but not in use since 2004		Yes		Yes		Yes (not operated since Jan 2014)	
		Make, Model, Year commissioned	Nu-Way, Nol 133, Sept 2001		Nu-Way, Nol 19S Sept 2001		Not known - commissioned 2008		N		Kato Burner Co. Ltd, 2007	
		Operating Temp (^{0}C)	1,000+		1,000+		1,000+		Not known		1,000+	
		No. chambers	2		2		1		1		1	
		Condition	Reasonable		Broken down		Reasonable		Broken down		Broken down	
			Per week	Per year	Per week	Per year	Per week	Per week	Per year	Per week	Per week	Per year
		Waste Throughput (tonnes)										
		Operating Hours (hr)										

Table B1: Collected Data from Hospital Audits in Timor Leste

WASTE MANAGEMENT FRAMEWORK		Fuel															
		Fuel use (kg/litres)															
		Fuel use per kg waste burnt															
		Technology siting and operation issues															
		Offsite transport assessment	Fair		Fair		Fair		Fair			Fair					
	Waste Management Documents	Waste Management Policy	N		N		N		N			N					
		Waste Management Plan	N		N		N		N			N					
		Waste Management Procedure	N		N		N		N			N					
		Waste Management Committee	Y		N		Y		N			Y					
	Infection Control	Infection Control Policy	N		N		N		N			N					
		Infection Control Procedures	N		N		N		N			N					
	Auditing and Record Keeping	Audit Program	N		N		Y		N			N					
		What is audited	Segregation	N	Segregation	N	Segregation	Y	N		Segregation	Segregation	N				
			Compliance P&P	N	Compliance P&P	N	Compliance P&P	Y	N		Compliance P&P	Compliance P&P	N				
			Int. transport	N	Int. transport	N	Int. transport	Y	N		Int. transport	Int. transport	N				
			Storage	N	Storage	N	Storage	Y	N		Storage	Storage	N				
			Treatment/ disposal	N	Treatment/ disposal	N	Treatment/ disposal	N	N		Treatment/ disposal	Treatment/ disposal	N				
		Frequency	N/A				N/A					N/A					
	Training	Training Program															
		Curricula	Infection Control	N	Infection Control	N	Infection Control	N	N		Infection Control	Infection Control	N				

Table B1: Collected Data from Hospital Audits in Timor Leste

			Waste Mgt	N	Waste Mgt	N	Waste Mgt	N	N	Waste Mgt	Waste Mgt	N
			PPE	N	PPE	N	PPE	N	N	PPE	PPE	N
			Treat. Tech operation	N	Treat. Tech operation	N	Treat. Tech operation	N	N	Treat. Tech operation	Treat. Tech operation	N
		Duration / frequency of training	N	N	N	N	N	N	N	N	N	N
		Records of who has been trained	N		N		N		N		N	
		Monitoring or refresher courses	N		N		N		N		N	
PROJECTED ISSUES	Forecasting	10 year projections for waste management	Skilled people in training. Time. Resources		New hospital is planned to be finished at the end of 2014. The hospital plans to have an incinerator but no order has been made and costings have been included.		No major plans					
		Barriers to change	Staff time.		Expertise in repairing and maintaining incinerators							
		Other issues	Space on the site and not enough supplies from the MOH		No adequate municipal landfill.							
LOCAL CONTRACTORS		Potential in-country contractors	Who	Key Capability	Who	Key Capability	Who	Who	Key Capability	Who	Who	Key Capability
			-		-		-	-		-	-	
			-		-		-	-		-	-	
			-		-		-	-		-	-	
			-		-		-	-		-	-	

[1] *Occupied Bed Days (previous 12 months) annual average occupancy rate (as %)*

[2] *Previous 12 months*

Appendix C

Minimum Standards Assessment

HEALTHCARE WASTE - MINIMUM STANDARDS FRAMEWORK & ASSESSMENT FOR Timor Leste								
Scale	**Category**	**Item**	**Minimum Standard Criterion**	**Guido Valadares National Hospital (Dili)**	**Baucau Referral Hospital**	**Maliana Referral Hospital**	**Suai Referral Hospital**	**Maubisse Referral Hospital**
National Authority	National Legislation	Definitions	A clear definition of hazardous healthcare wastes and its various categories has been developed and used by generators.					
National Authority	National Legislation	Annual Compliance Reporting	Hospitals required to annually report on waste generation and management					
	National Legislation	Technical Guidelines	Practical and directly applicable technical guidelines					
National Authority	Regulations	Annual Compliance Reporting						
National Authority	Policy	National healthcare waste management plan	A national strategy for management of healthcare waste has been published and is up to date (ie., within 5 years) and hospitals required to adhere to its requirements					
Healthcare Facility	Policy	Infection Control	Infection control policy incorporates principles of waste management within it					
Healthcare Facility	Policy	Waste Management Plan	Has been developed by the hospital and is based on a review of healthcare waste management and is current (within 5 years)					
Healthcare Facility	Responsible Person		An officer has been appointed to assume responsibility for waste management within the hospital, and has been allocated sufficient time and resources - this person could have waste management as part of other duties					
Healthcare Facility	Management Committee		A waste management committee has been formed that has representatives from a broad range of departments and meets at least twice per year. A clear set of objectives has been developed for this committee. It reports to the senior management of the hospital.					
Healthcare Facility	Signage		Signs are located in all wards/department areas where waste bins are located indicating the correct container for the various waste types					
Healthcare Facility	Segregation		Waste are correctly segregated in all wards/departments with use of containers that are colour coded for the different waste types					

Healthcare Facility	Containers		All areas have dedicated waste containers are suitable for the types of waste generated. All waste containers are colour coded and have correct wording on them. Sharps are deposited into containers that reduce potential for needle-stick injury					
Healthcare Facility	Storage	Interim storage in healthcare facility	Storage areas at ward/department level should be secure and located away from public areas. Storage areas should be sufficient in size to allow waste to be segregated and so as to avoid waste of different classifications being stored together.					
		Storage before treatment	Meets the standards stated in Appendix E, Recommendation 2, *Correct Storage*.					
Healthcare Facility	Internal Handling	Transport Trolley	A dedicated trolley is used for waste transport. The trolley is designed so that any spills are contained.					
	Internal Handling	Routing	Healthcare waste is not transported where clean linen and/or food are transported					
Healthcare Facility	Training	Planning and implementation	A structured waste management education program has been developed with a clear delivery structure					
Healthcare Facility	Training	Curricula	A structured waste management training program has been developed that targets the different roles within the hospitals.					
Healthcare Facility	Training	Follow-up & refresher courses	All staff receive waste management education during induction. All staff receive refresher training annually. Waste management training is delivered following an adverse incident to the relevant staff/ward/department.					
Healthcare Facility	Training	Training responsibility	A hospital officer has responsibility for ensuring all training occurs as required and that records are maintained of all training and attendance.					
Healthcare Facility	Waste Audits		A program has been implemented to ensure waste audits are conducted of all waste materials/systems in all wards/departments on an annual basis and reports are provided to the waste management committee. Effective systems are in place to ensure that any non-conformances (with the hospital waste management strategy) are remedied.					
Healthcare Facility	Transport - External		A dedicated vehicle is used to transport untreated healthcare waste. This load carrying area of the vehicle is enclosed and constructed so that any spilt material is contained within this area. A split kit is provided.	N/A	N/A	N/A		

Healthcare Facility	Treatment	Suitability of treatment for healthcare waste	The method for treating healthcare waste is in accord with required standards - this includes operating parameters and location of the treatment unit.					
Healthcare Facility	Economics	Cost Effectiveness	A process has been developed that cost all aspects of waste management and these costs are reported annually to the waste management committee.					
Healthcare Facility	Occupational Health and Safety	PPE	All waste handlers are provided with and use appropriate PPE including overalls/protective clothing, gloves and eye protection. Incinerator staff are provided with additional PPE such as face masks and noise protection. A system is in place to monitor correct use of PPE.					
Healthcare Facility	Occupational Health and Safety	Staff risk	Waste containers, locations, storage and management procedures for healthcare waste incorporate identified risks to staff in accessing the waste and/or having needle-stick injuries.					
Healthcare Facility	Occupational Health and Safety	Patient/Visitor risk	Waste containers, locations, storage and management procedures for healthcare waste incorporate identified risks to patients and visitors in accessing the waste and/or having needle-stick injuries.					
Healthcare Facility	Healthcare waste management emergencies	Spill Prevention and Control	Spill kits are provided or all types of healthcare waste in all wards/departments, storage areas and on trolleys and vehicles. Staff are trained on the use of spill kits. All incidents of spills of healthcare waste are investigated and where appropriate remedial actions implemented.					
Healthcare Facility	Future Planning	Planning for change	Hospitals have developed a process to benchmark waste generation so as to (amongst other requirements), plan of future hospital development in terms of services and numbers of patients.					
Local Council	Waste Treatment Facility	Landfill	Healthcare waste is disposed of at a dedicated location and covered immediately on arrival. Scavengers cannot access untreated healthcare waste.					

* The minimum standard is drawn from the *Industry code of practice for the management of biohazardous waste (including clinical and related) wastes*, Waste Management Association of Australia (2014), Draft 7th edition, taking into account the Pacific Island hospital and environmental context

Appendix D

Qualitative Local Feasibility Assessment – Treatment Technology

Table D1: QUALITATIVE Treatment Technology Options Assessment - Local Feasibility (Timor Leste)

Remaining Technology Options	Comparatively low cost to implement	Comparative effectiveness across all HCWs	Local Feasibility							
			Health & safety to workers & community	Sustainability of solution	Institutional and policy fit	Cultural fit	Implementation barriers can be overcome?	Receiving environment not impacted	Durability	Ease of operation
Incineration at high temperature (>1000^{0}C)	$211,460 USD over 10 years (ref Whole of Project – Summary Report, Appendix E)	Most effective – can treat all waste types and achieves complete sterilization, complete combustion and destroys waste	Some issues for operators (requires training & PPE); some potential issues for community (potential for smoke, some controlled emissions)	Equipment lifespan ~ 10 years plus; sustainability dependant on maintaining operator skills plus proper operation and maintenance	No legal barriers to incineration and Timor is not a signatory to Stockholm. 'Moderate' score based on lack of any policy context in Timor at all.	Burning of rubbish is historically accepted & widely practised in Timor Leste. Incinerators are/ have been previously used in hospitals	Equipment breakdown and lack of local skills to maintain equipment – real barrier but can be managed through skills training & supplier support	Emissions of air pollutants and leaching from ash disposal to receiving environment are potential impacts. High temp operation minimises pollution & proper landfilling of ash restricts leaching.	Equipment lifespan ~ 10 years plus but will only last if maintained. High temperature equipment is prone to require a moderate level of maintenance	Requires skilled operators but modern equipment combined with training simplify operation
Incineration at med. temperature (800 - 1000^{0}C)	$69,820 USD over 10 years (ref Whole of Project – Summary Report, Appendix E)	Can treat all waste types, achieves complete sterilization, incomplete combustion, may not destroy needles	Some issues for operators (requires training & PPE); potential issues for community (smoke, emissions not fully controlled)	Equipment lifespan ~ 5 years; sustainability dependant on maintaining operator skills plus proper operation and maintenance	No legal barriers to incineration and Timor is not a signatory to Stockholm. 'Moderate' score based on lack of any policy context in Timor at all.	Burning of rubbish is historically accepted & widely practised in Timor Leste. Incinerators are/ have been previously used in hospitals	Equipment breakdown and lack of local skills to maintain equipment – real barrier but can be managed through skills training & supplier support. Simpler infrastructure.	Emissions of air pollutants/ smoke and leaching from ash disposal to receiving environment are potential impacts. Med. temperature operation increases risks of air pollution, but not likely to be an issue in isolated	Equipment lifespan typically less ~ 5 years but will only last if maintained. Equipment is prone to require a moderate level of maintenance	Requires less skilled operators than high temperature equipment - training simplifies operation

Table D1: QUALITATIVE Treatment Technology Options Assessment - Local Feasibility (Timor Leste)										
Remaining Technology Options	**Comparatively low cost to implement**	**Comparative effectiveness across all HCWs**	**Local Feasibility**							
			Health & safety to workers & community	**Sustainability of solution**	**Institutional and policy fit**	**Cultural fit**	**Implementation barriers can be overcome?**	**Receiving environment not impacted**	**Durability**	**Ease of operation**
								small communities.		
Low temperature burning (<400^{0}C)	$6,485 USD over 10 years (ref Whole of Project – Summary Report, Appendix E)	Not applicable for all waste types, relatively high disinfection efficiency, incomplete combustion, will not destroy needles	Some issues for operators (requires training & PPE); issues for community (smoke, emissions not controlled at all)	No equipment; sustainability dependant government & community acceptance which would be expected to decline with time	Potential for smoke nuisance is very high and the potential for contribution to combustion derived POPs & broader range of other pollutants is very high .	Burning of rubbish is historically accepted & widely practised in Timor Leste.	No equipment operation reliability barrier; burning rubbish common practice in Timor Leste	Emissions of air pollutants/ smoke and leaching from ash disposal to receiving environment are potential impacts. Low temperature operation provides no controls on air pollution. Risk of fire impact.	Simple, zero technology so there is nothing that can break down	Simple, zero technology so there is nothing that can break down and no specific training is required other than health and safety.
Autoclave with shredder	$158,000 USD over 10 years (ref Whole of Project – Summary Report, Appendix E)	Cannot treat all waste types, achieves complete sterilization when correctly operated, no combustion required, shredder destroys	Some issues for operators (requires training & PPE); small potential for odours and wastewater discharge (community)	Equipment lifespan ~ 10 years; sustainability dependant on maintaining operator skills plus longevity of equipment use given technology	No legal barriers; no potential for smoke nuisance; some potential for odour nuisance; no air pollution (no combustion-	Not familiar with use of sterilisers for waste – potential community issue with waste appearance if steriliser not operated	Equipment breakdown and lack of local skills to maintain equipment – real barrier but can be managed through skills training & supplier support. Increased complexity of	No emissions of air pollutants/ smoke; some potential for odour impacts; still requires landfill or dump disposal so some potential for leaching on burial; some	Equipment will only last if maintained. Adding shredder to autoclave technology increases mechanical parts that can go wrong.	Requires skilled operators to achieve best level of disinfection.

Table D1: QUALITATIVE Treatment Technology Options Assessment - Local Feasibility (Timor Leste)										
Remaining Technology Options	**Comparatively low cost to implement**	**Comparative effectiveness across all HCWs**	**Local Feasibility**							
			Health & safety to workers & community	**Sustainability of solution**	**Institutional and policy fit**	**Cultural fit**	**Implementation barriers can be overcome?**	**Receiving environment not impacted**	**Durability**	**Ease of operation**
		needles		complexity	POPs) and some potential for waste water management issues	correctly or shredder not used	equipment (compared to incineration) increases barrier	potential for waste water management issues. Larger residual waste compared to burning – only engineered landfill is in Port Vila.	May require moderate level of maintenance	
Encapsulation (only post-disinfection sharps assessed)	Virtually zero additional cost to disinfection system costs	Not applicable to non-sharps waste. In the context of pre-sterilised sharps only: no combustion required and completely removes downstream needle injury risk	Encapsulation has handling issues for operators (requires training & PPE) and no community issues	No equipment; sustainability dependant burial space available. Only engineered landfill is in Port Vila so increases waste volume that requires burial.	No legal barriers; no smoke nuisance; no odour nuisance; no air pollution and some potential for leachate to groundwater, although limited inherent hazard	No particular cultural fit concerns	New practice proposed – may face some inertia barrier. Lack of new 'shiny' machinery may imply the change is not that important.	Encapsulation itself poses no smoke nuisance; no odour nuisance; no air pollution and some potential for leachate to groundwater, although limited inherent hazard.	Highly durable due to its simplicity.	Simple procedure once operator understands and manages the risk of sharps handling and knows how to mix cement correctly.

Legend: Descriptions equate to the following scores:

	1. very low agreement with feasibility criteria
	2. low agreement with feasibility criteria
	3. moderate agreement with feasibility criteria
	4. high agreement with feasibility criteria
	5. very high agreement with feasibility criteria

Appendix E

Recommendation Guidelines

Recommendation 1: Develop a Waste Management Framework

Healthcare Waste Management Plan

Hospital waste management plans should incorporate strategic objectives of the national medical waste management strategy as well as the following information:

- Location and organisation of collection and storage facilities
- Overview of the purpose of, and design specifications:
  - Drawing showing the type of waste container to be used in the wards and departments (eg., sizes, colours and wording)
  - Drawing illustrating the type of trolley or wheeled container to be used for bag collection
  - Minimum specifications of sharps containers
- Required Material and human resources
- Responsibilities:
  - Including definitions of responsibilities, duties and codes of practice for each of the different categories of personnel of the hospital who, through their daily work, will generate waste and be involved in the segregation, storage and handling of the waste.
  - Definitions of responsibilities of hospital attendants and ancillary staff in collecting and handling wastes, for each ward and department.
- Procedures and practices
- Training
  - Description of the training courses and programs to be set up and the personnel who should participate in each.
- Implementation Strategy

It is important that it also is compatible with any National Waste Management Strategies to ensure consistency of approaches such as with external transport and disposal of treated residues.

Appointment of a Responsible Officer

A responsible officer or waste management officer would be responsible for the day-to-day operations and monitoring of the waste-management system and is usually established as a separate post in larger hospitals (however, one appointee could be responsible for the waste management performance for a number of hospitals with a stated time fraction allocated to each hospital).

It is important that the waste management officer be adequately resourced to enable them to undertake their role as well as supported by Hospital management to ensure that all staff recognise the importance of adopting waste management practices that are in accord with all requirements.

Appointment of a Waste Management Committee

A waste management committee should also be established to provide guidance and support to the waste management officer and assist in implementation of developed actions. In larger hospitals, a separate waste management committee should be formed. For smaller hospitals, such a committee could be either part of the responsibility of another related committee (eg., infection control or quality assurance), or a sub-committee reporting back to this related committee.

This Committee should not necessarily undertake all activities themselves, but by the nature of the members and the professions/departments represented will ensure that there is a balanced approach to the investigations and analysis to ensure that patient and staff safety will not be compromised.

In addition, the Committee approach will enable advocates for such factors as environmental and economic performance to be heard in a balanced manner.

Waste Management Committee Members should serve for a minimum period of 2 years, with the option of reappointment.

The Waste Management Committee will work with hospital staff, stakeholders and the wider community to develop a culture of environmentally responsible waste management through information sharing and education.

Its members will ensure that waste management issues are considered on committees that deal with product evaluation, infection control and occupational health and safety, and in user groups such as Unit/Department Managers.

The Waste Management Committee should:

- Develop a waste management policy that meets current environmental legislation “due diligence” requirements. This policy is to include strategic directions for correct waste minimisation and management.
- Ensure that the hospital is meeting due-diligence requirements as specified by the Waste Management Team.
- Develop and implement a system to document waste and recyclable quantities on a spreadsheet to evaluate these quantities and therefore the waste minimisation programs that have been implemented, ensuring the results are circulated to all Unit managers/department managers on a regular basis.
- Review and submit subsequent reporting to Unit managers/department managers of the results of all implemented programs and trials.
- Work on implementing the most appropriate waste minimisation/management recommendations as agreed with hospital management and the Waste Management Team.

- Target in order the waste items that are contributing the most significant quantities of waste being generated and in particular waste segregation methods.
- Agree on the Waste Reduction targets for the hospital and outline the key objectives of the committee
- Review current work and waste management practices and develop waste management/minimisation initiatives.
- Conduct mini audits to review progress.
- Visually inspect waste and recycling containers to ascertain if staff are depositing appropriate items into them.

Recommendation 2: Procurement of Consumables (Segregation & Storage)

The correct segregation of healthcare waste is the responsibility of the person who produces each waste item, regardless of their position in the organisation. The healthcare facility is responsible for making sure there is a suitable segregation, transport and storage system, and that all staff adheres to the correct procedures.

Ideally, the same system of segregation should be in force throughout a country, and many countries have national legislation that prescribes the waste segregation categories to be used and a system of colour coding for waste containers. Colour coding makes it easier for medical staff and hospital workers to put waste items into the correct container, and to maintain segregation of the wastes during transport, storage, treatment and disposal. Colour coding also provides visual identification of the potential risk posed by the waste in that container.

Labeling of waste containers is used to identify the source, record they type and quantities of waste produces in each area, and allow problems with waste segregation to be traced back to a medical area.

Waste containers specification and siting

Containers should have well-fitting lids, either removable by hand or preferably operated by a foot pedal. Both the containers and the bags should be of the correct colour for the waste they are intended to receive and labeled clearly.

All containers should be able to adequately contain the wastes deposited into it – to prevent the possibility of spills.

Sharps should be collected in puncture proof and impermeable containers that are difficult to open after closure.

The appropriate waste receptacle (bags, bins, sharps containers) should be available to staff in each medical and other waste-producing area in a healthcare facility. This permits staff to segregate and dispose of waste at the point of generation, and reduces the need for staff to carry waste through a medical area. Posters showing the type of waste that should be disposed of in each container should be displayed on the walls to guide staff and reinforce good habits.

Segregation success can be improved by making sure that the containers are large enough for the quantities of waste generated at the location during the period between collections, as well as a collection frequency that ensures no container is overfilled.

Setting and Maintaining Segregation Standards

Segregation requirements and methods should be clearly set out in the waste-management policy of a healthcare facility. It is important that the waste-management policy is supported and enforced by senior staff and managers. Managers and medical supervisors should know the relevant legislation and understand how to implement waste audits.

The 'Responsible Person' or Waste Management Committee should be responsible for seeing that segregation rules are enforced and waste audits are carried out to quantify the amount of waste produced.

Correct Signage

Signage indicating correct waste segregation practices is a valuable tool to provide ongoing guidance to staff. The success of the waste/recycling system will depend on having a clearly identified container for each type of material. This is achieved by the use of colour coded containers, symbols and wording. In addition, signage must be placed so that those wanting to dispose of materials can clearly and readily identify which container to deposit such materials into.
Once designed, signs should be located on walls above all waste containers as well as on the container itself.

Correct Storage

The storage area should be signposted with the bio-hazard symbol and other labeling appropriate to the types of waste stored in the area (eg healthcare) and includes the following:

- The base should be an impervious surface (eg. concrete) surrounded by a bund appropriate to contain any spill.
- All loading/ unloading takes place within the bunded area in such a manner to ensure any spills are appropriately managed.
- The base and walls of bunded areas are free of gaps or cracks.
- No liquid waste, wash down waters or stormwater contaminated with biohazardous wastes are disposed of via the stormwater drainage system; and
- The bunded area drains to a sump or sewer to collect spills and wash waters. Cut-off drains, which drain to a sump, should be used instead of bunds if approved by the relevant authority.
- Loading/ unloading of waste is carried out in accordance with designated safe procedures, and relevant records are completed and maintained.
- Containers in which biohazardous waste are stored secured when loading/unloading is not taking place.

- Spill Kits for biohazardous waste located in the storage areas.

Storage for larger generators may involve a dedicated room that is constructed specifically for waste management, or could be via the use of appropriately sized mobile garbage bins (eg., 240 or 660 litre).

Conditions related to security of healthcare waste include the following:

(a) The operator shall ensure that loading/ unloading of waste is carried out in accordance with designated safe procedures, and relevant records are completed and maintained.

(b) Containers in which healthcare waste are stored shall be secured when loading/unloading is not taking place.

Spill Kits for healthcare and cytotoxic waste shall be located in the storage areas.

Recommendation 3: Provide a Sustainable Training Program

All waste management strategies (particularly resource management programs), rely on all staff to participate and co-operate in order to ensure that objectives are met. Staff therefore should receive appropriate training/education to understand the inherent hazard and risks posed of healthcare waste, and the importance of its management from generation to final treatment and disposal.

The Waste Management Committee (apart from ensuring staff education programs are developed and implemented), should also address other methodologies in order to ensure that staff receive information on waste reduction programs (eg., signage, information sheets and flow charts).

One of the initial steps for developing a structured training program is to gain management support from hospital administration. The development of a training program can be facilitated by establishing core competencies related to healthcare waste management.

In the development of a training program, the following should be considered:

- Conduct of a training needs analysis
- Identification and prioritisation of employees that need to be trained.
- Defining the specific learning objectives for each target audience.
- Develop a detailed curriculum specifying the training plan for each session.
- Incorporate pre-evaluation and post evaluation of learners, evaluation of trainers, follow-up activities, and documentation into the training program.
- Develop training content or adapt available training materials, tailor training content to specific target audiences.
- Identify potential trainers and build training skills
- Develop a budget and secure funding

- Explore incentives for training (e.g. training in collaboration with a health professional society or university that can award certificates or professional credentials)

The following is an outline of a Staff Waste Management Education Program that could be developed:

- Introduction to the session
- Importance of good waste/environment management/ infection control
- Waste management hierarchy
- Waste minimisation principles
- Brief overview of legislation pertaining to waste management
- Hospital policies on environment/waste management/ infection control/ needle stick injuries
- Overview of waste types
- Issues relating to waste reduction
- Management responsibilities
- Identification of, and hazards associated with the different types of wastes generated Importance of effective waste segregation
- Infection control and sharps management
- Waste, handling, packaging and disposal routes for the different types of wastes generated
- Questions

All staff and contractors should attend a waste management training session. This should be conducted during all induction programs in the first instance.
For those staff and contractors currently employed on-site, they should attend a dedicated training session so that they are fully aware of their roles and responsibilities in respect to waste management. Records should be maintained of all staff and contractors attendance at a training session to ensure that all personnel attend.

At a national and regional level, training programs could be in the form of train the trainer. The training of trainers approach allows rapid capacity building and widespread training outreach.

Training of Waste Disposal Treatment Operators

Incinerator/ healthcare waste treatment system operators should receive training in the following:

- Overview of healthcare waste management including risks and management approaches
- General functioning of the incinerator, including basic maintenance and repair training.

- Health, safety and environmental implications of treatment operations
- PPE, its correct use and removal and cleaning (if appropriate)
- Technical procedures for operation of the plant.
- Recognition of abnormal or unusual conditions
- Emergency response, in case of equipment failures.
- Maintenance of the facility and record keeping
- Surveillance of the quality of ash and emissions.
- Disposal of residues

Recommendation 4: Improved Treatment Infrastructure

The healthcare waste stream is diverse in that it contains a variety of chemical substances, organic materials, plastics, metals and materials that are potentially contaminated with pathogenic substances. The primary aim of treating this waste stream is to ensure that there is no potential negative impact to human health or the environment as a consequence of the components of this waste not being treated adequately.

This means that the treatment process should render the waste material so that there are no pathogens likely to cause harm as well as be conducted in a manner that reduces any environmental consequences.

There are a number of treatment processes for healthcare waste. However, not all of these are able to treat all types of healthcare wastes. Materials such as pharmaceuticals, cytotoxic and anatomical wastes can only currently be treated by incineration. Therefore, when selecting a process to treat healthcare wastes, the generator must be aware of the capabilities and limitations of each of the various treatment processes and ensure that only those wastes that can be thus treated are actually sent to such a facility, and the remainder sent to an incineration facility. This is part of any facilities due diligence process.

There are a number of means of treating healthcare waste that are in commercial use around the globe. The question arises as to what type of technology is best suited to meet the various waste categories/quantities generated, environmental requirements and that treatment is done safely and in a cost-effective manner. Treatment of healthcare wastes should achieve a change in the wastes biological or chemical hazard so as to reduce or eliminate its potential to cause disease or other adverse consequences, by meeting acceptable biological standards and to ensure that there is minimal adverse environmental impact in respect to water, soil, air and noise.

Management of wastes should be based on the **precautionary principle** in that a lack of data should not mean that options be undertaken when there is still a perceivable risk of damage (to human health or the environment). The literature and other sources of information have clearly demonstrated a need for maintaining incineration as the most preferred option for at least the treatment of pharmaceutical and cytotoxic wastes – if not other components such as microbiological specimens and body parts. Only one technology has been demonstrated to be able to effectively treat all categories of healthcare waste.

This technology is incineration (at high temperature, with sufficient residence time and appropriate air pollution control equipment).

A substantial amount of data exists on the emission generated from incinerators, but conversely, little studies have been conducted on all aspects of alternate technologies performance. While the literature is inconclusive on the requirements needed to effectively manage the blood and body fluid contaminated and infectious components of the waste streams, there does seem to be consensus that these hazardous components such as pharmaceuticals and cytotoxic wastes do need to be treated prior to final disposal to ensure there is no risks to the environment or health of humans and other species.

It is also very clear that there is little work been undertaken on the consequences of landfilling untreated healthcare waste, and in particular pharmaceuticals and cytotoxic wastes. The literature does relate to impacts resulting from untreated pharmaceuticals being discharged into the environment from hospital sewers and wastewater treatment plants and does indicate that there are potential negative environmental and health consequences. The implications of these studies could legitimately be applied to discharge of waters such as leachate or surface water runoff from landfills should these wastes be deposited untreated. According to the World Health Organization[9, 10], incineration is the preferred method for treating pharmaceutical and cytotoxic wastes. This is further supported by the United Nations[11, 12] in that they have also recommended incineration as the preferred method for treatment prior to disposal of pharmaceuticals and cytotoxic wastes. These recommendations are generally standard throughout the world in relation to these two specific waste types[13, 14].

There are other studies that have been conducted on what is referred to as “alternate treatment technologies”, and these have demonstrated that all of these technologies cannot effectively treat pharmaceutical and cytotoxic waste, with many also unable to treat anatomical waste.. Some jurisdictions do allow alternative means of treating anatomical waste prior to disposal to landfill, but these are by far in the minority and mostly related to ethical or religious rationales.

In Australia as an example where there is allowed a variety of treatment technologies for the range of clinical and related wastes, without exception, jurisdictions do not allow treatment

[9] World Health Organization Regional Office for Europe, EURO Reports and Studies 97, Management of Wastes from Hospitals and other Health Care Establishments, 1983.
[10] World Health Organization, Safe management of Wastes from healthcare Facilities, Geneva, 1999.
[11] United Nations Environment Programme – Technical Working Group on the Basel Convention, Draft Technical Guidelines on Biomedical and Health Care Wastes, 1999.
[12] Environment Australia, Basel Convention – Draft Technical Guidelines on Hazardous Waste: Clinical and Related Waste (Y1), March 1998.
[13] Health care Without Harm, Non-Incineration Treatment Technologies, August 2001.
[14] London Waste Regulation Authority, Guidelines for the Segregation, Handling, Transport and Disposal of Clinical Waste, 2nd Edition, 1994.

other than incineration for anatomical waste, pharmaceuticals and cytotoxic wastes[15, 16, 17, 18, 19, 20]. This is also quite evident in a review of Australian State/Territory environmental agency licence conditions for approved clinical and related waste treatment technologies. In countries that do allow landfilling of clinical and related wastes, often these two specific waste categories are specifically excluded from this option[21].

In summary, no publication from a government environmental or health agency, or any article reviewed advocated any other preferred form of treatment for pharmaceuticals and cytotoxic wastes than incineration. In most instances the preference for anatomical waste was also incineration.

Recommendation 5: Appropriate Storage Facilities

The following guiding principles should be applied for healthcare waste storage facility:

- Minimises the threat to health, safety or the environment. In particular preventing public and wildlife access and prevention and containment of any spills.

Specifically the following measures should be implemented

- Storage areas prior to disposal or treatment should be secure, lockable, hygienic and appropriately sign posted.
- Storage area is paved and bunded.
- Weather elements such as rain is prevented from making contact with healthcare waste. This could be in the form of a roofed facility or bins with lids.
- Siting is strategically selected to minimize any health risks. I.e. away from patients, the general public and healthcare activities such as laundry and the kitchen.
- Ensure all necessary equipment required to clean and disinfect the area in case of accidental spillage is easily available and accessible.

Recommendation 6: Procurement of Consumables (PPE)

Personnel Protective Equipment

The use of Personal Protective Equipment (PPE) should be a condition of employment for employees with waste management responsibilities. PPE is one aspect of a multifaceted

[15] National Health & Medical Research Council, National Guidelines for Waste Management in the Health Industry, Commonwealth of Australia, 1999.
[16] EPA Victoria, Draft Guidelines for the Management of Clinical and Related Waste, July 2003.
[17] NSW Department of Health, Waste Management Guidelines for Health care Facilities, August 1998.
[18] Queensland Government, Environmental Protection (Waste Management) Regulation, 2000.
[19] Australian/New Zealand Standard 3816:1998, Management of Clinical and Related Wastes.
[20] Australian and New Zealand Clinical Waste Management Industry Group, Industry Code of Practice for the Management of Clinical and Related Wastes, 3rd edition July 2000.
[21] Provincial Government of Gauteng (South Africa), Draft Health Care Waste Regulations, 11 September 2003.

program, designed to protect employees from injuries and unnecessary exposure to hazardous substances.

Other aspects of this program are:

- employee training
- engineering controls to reduce or eliminate known hazards
- administrative controls

The following is a list of the personal protective equipment that should as a minimum to be supplied for all waste handlers:

- Gloves
- Masks
- Safety glasses/eye shields
- Overalls/aprons
- Safety boots