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

Fiji

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This document is issued in confidence to Secretariat of the Pacific Regional Environment Programme (SPREP) for the purposes of collection and collation of information on the regional management of healthcare waste and its disposal, as part of their broader strategy of improving hazardous waste management in Pacific Island countries, and specifically to assist in establishing sustainable healthcare waste management. This report presents the findings of this assessment. It should not be used for any other purpose.

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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 Fiji.

Current Healthcare Waste Management in Fiji

Information regarding the waste management process occurring in Fiji hospitals, from ward-level waste generation through to ultimate treatment and disposal was collected during audits of all three divisional hospitals, plus two sub-divisional hospitals. These hospitals were:

- Colonial War Memorial Hospital (CWMH) Suva, Central Division on 26/3/2014
- Lautoka Divisional Hospital, Western Division on 24/3/2014
- Labasa Hospital, Northern Division on 27/3/2014
- Nadi Sub-Divisional Hospital, Western Division on 24/3/2014
- Sigatoka Sub-Divisional Hospital, Western Division on 25/3/2014.

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 audits, the hospitals were assessed against this framework. Table ES1 highlights the key areas of concern in terms of health services delivery by the hospitals, 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 FIJI

Scale	Category	Item	Minimum Standard Criterion	CWMH	Lautoka	Labasa	Nadi	Sigatoka	Fiji overall
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	Segregation	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	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	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.						

Key Issues

The key issues observed were:

- There is no documented waste management planning system in place and limited evidence of waste management committees in some sub-divisional hospitals.
- Signage is below minimum standard in the two sub-divisional hospitals since there is virtually no signage present
- There is no structured training program in the two sub-divisional hospitals and no waste segregation auditing program in Nadi.
- The method for treatment of healthcare waste is typically in accord with required standards but, given stresses on the current infrastructure, improvements should be made.
- Spill control kits were not observed anywhere.
- Storage before disposal areas is not locked or signed and does not meet minimum standards

Key Issue Overall

Fiji's approach to healthcare waste management and infection control is more mature than most in the region. There are good waste management systems and procedures in place and staff in Infection Control roles that are generally more aware of the risk posed by healthcare waste than in some other Pacific countries. However, like some of the incinerators within their control, this good system is showing signs of wear and tear, and appears to be working in some cases only because of the commitment of a very small group of individuals.

It seems that the 'machinery' of a good and workable waste management framework exists in Fiji but not beyond the divisional level, and even there it seems under-prioritised and possibly under-resourced, which makes it vulnerable rather than sustainable.

There is an opportunity to take a working framework (divisional level) and the potential of one (the sub-divisional level) and bring it to life with the injection of some short-term resourcing effort, focused on organizing and coordinating, rejuvenating and prioritizing the existing system and rolling this into the sub-divisional hospital structure. The infection control/ waste management capacity in Fiji could benefit from help and assistance to band it together, as it appears to have been in the recent past, so they can operate a more coherent health care waste management system throughout the country's health care delivery facilities.

Analysis of Options for Sustainable Healthcare Waste Management in Fiji

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 Fiji-specific feasibility assessment, using an analysis of 10 criteria (**Appendix D**)

The results of the feasibility assessment for Fiji 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 in the medium term to remedy current unacceptable practices at sites too small to justify costs of expensive equipment.
- ***Low temperature burning*** is not acceptable in Fiji, due to the requirement to incinerate all healthcare waste.
- ***Autoclaving*** is a potentially acceptable disinfection practice (where units with shredder are affordable and locked in supplier maintenance and training contracts are in place), but is not acceptable in Fiji due to the requirement to incinerate all healthcare waste.

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). *However, for Fiji, encapsulation is not acceptable due to the requirement to incinerate all healthcare waste*. Encapsulation is never recommended as an isolated form of treatment, as it does not disinfect or otherwise treat the hazard of the waste.

Recommendations

Table ES2 provides a summary of the recommendations for Fiji.

*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 ES2: Recommendations for Fiji — Applicable to	CWMH Suva	Lautoka Hospital	Labasa Hospital	Nadi Hospital	Sigatoka Hospital
Recommendation 1: Develop a Waste Management Framework for sub-divisional hospitals					
Description	For Nadi and Sigatoka (and for sharing with other sub-divisional hospitals as appropriate) develop: • 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 • A *waste management committee*, appropriate to the scale of each facility.				
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 • 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 ($US)	• Establishment – Low, if existing system used across Fiji Divisional Hospitals is used as starting point and document drafting assistance is provided • Ongoing – Low				
Recommendation 2: Procurement of Segregation Signage for sub-divisional hospitals					
Description	Supply of **signage** to explain the colour-coded segregation system as well as **posters** to promote it.				
Output	Signs above waste locations in hospitals				
Monitoring & Evaluation Indicators	• Wastes are segregated at their place of production. • Infection wastes, general wastes and used sharps are stored in separate colour coded containers and locations within medical areas. • Zero Needle Stick Injuries.				
Costs ($US)	Establishment – Low; Ongoing - Low				
Recommendation 3: Roll Existing Divisional Training Program out to sub-divisional hospitals[UTH]					

Table ES2: Recommendations for Fiji	**Applicable to**	**CWMH Suva**	**Lautoka Hospital**	**Labasa Hospital**	**Nadi Hospital**	**Sigatoka Hospital**
Description	• Delivery of the existing structured healthcare waste training program that is common to all divisional hospitals to all sub-divisional hospital infection control officers in Fiji • This could be facilitated/ co-delivered by SPREP staff, or outside trainers, or a combination of both, supporting and **financing** existing trainers in divisional hospitals. • 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: Improved Treatment Infrastructure[U2H]						
Description	Conduct **repairs** and improvements on incinerators: • **CWMH Suva:** 1. The incinerator should have maintenance carried out to fix and replace the broken third burner and blower. Operating without this will be at reduced efficiency and temperature the latter leading to bouts of black smoke which cause problems (see below) 2. Once repairs are complete and the unit is running effectively, an air quality assessment should be carried out to determine the preferred design height for the stack, so as to avoid impacts to the administration building 3. Depending on the results of '2', works should be done on the stack to raise its height • **Lautoka:** 1. The large older incinerator should have urgent maintenance carried out to get it operational (if it isn't already). The back-up MediBurn unit is not large enough to sustainably manage Lautoka's needs. • **Labasa**: 1. The MediBurn unit stack has not been located correctly in relation to the roof structure of the building it is housed in. (Photo #) shows that structural roofing timber has been burnt, indicating that the stack flue is too close to the rafters. This needs to be remedied by rebuilding the roof structure to provide more clearance.					
Output	A disposal system that reduces the potential hazard posed by healthcare waste, while endeavoring					

Table ES2: Recommendations for Fiji	Applicable to	CWMH Suva	Lautoka Hospital	Labasa Hospital	Nadi Hospital	Sigatoka Hospital
	to protect the environment.					
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 – Medium to high for Suva, low for Lautoka and low-medium for Labasa • Ongoing – None in direct relation to these recommendations					
Recommendation 5: Upgrade of Storage Areas						
Description	The storage areas of healthcare waste before disposal does not meet minimum standards for storage; it can be accessed by members of the public. This is most simply remedied by: • **CWMH Suva**: o Purchase of two or more 660L wheel-able bins for storage outside the incineration building, which is more cost-effective and flexible than building a roofing structure. The bins should have the ability to be padlocked. Also procure spill kits for waste handling areas. o Immediately stop the use of the waste transfer chute, as this substantially increases infection risk. o Replace it with a more effective structure, such as something with a more forgiving horizontal slope (like that of a playground slide) or better still a simple pneumatic lowering lift • **Lautoka**: Purchase of two 660L wheel-able bins for storage in front of the incineration building, which is more cost-effective and flexible than building an additional building or roofing structure, even though there is ample room to do so. The bins should have the ability to be padlocked. Also procure spill kits for waste handling areas. • **Labasa**: No action required • **Nadi**: Purchase of one 660L wheel-able bins for storage awaiting weekly transport to Lautoka. The bin should have the ability to be padlocked. Also procure spill kits for waste handling areas. • **Sigatoka**: Purchase of one 660L wheel-able bins for storage awaiting weekly transport to Lautoka. The bin should have the ability to be padlocked. This is a simpler solution that building a roof over the existing raised storage structure. Also procure spill kits for waste handling areas.					
Output	• Storage areas are fenced, lockable, suitably designed and isolated from patients and the public.					

Table ES2: Recommendations for Fiji	Applicable to	CWMH Suva	Lautoka Hospital	Labasa Hospital	Nadi Hospital	Sigatoka Hospital
Monitoring & Evaluation Indicators	• Suitability of storage areas frequently assessed by the 'responsible officer' to ensure that it is locked and appropriately signed.					
Costs ($US)	• Establishment – Low (procurement of actual storage structures/ bins, signage for them and spill kits) • Ongoing – Low					
Recommendation 6: A Short-term Whole of Fiji Co-ordination Resource[U2H]						
Description	• A dedicated person responsible for inter-hospital co-ordination, setting work programs, prioritising project actions (as they relate to Fiji) and monitoring progress towards improved waste management • This person could be supplied by SPREP as part of the implementation stage of this project or assistance could be provided to the Ministry of Health to house this part-time role • This position is designed to be short-term, and serve as a kick-starter and rejuvenator of an existing system that is dormant in some facilities • Fiji has been highlighted for this recommendation because it has mature systems in place – with only moderate effort this can be made more operational and widespread					
Output	• The 'push' and direction required to establish a coordinated and functioning waste management policy, training, auditing and delivery system throughout divisional and sub-divisional hospitals, in conjunction with a uniform waste management framework (Recommendation 1) and training program (Recommendation 3). • This is a model that could be applied elsewhere in the region					
Monitoring & Evaluation Indicators	• Improved communication between hospitals • Improved segregation performance of sub-divisional hospitals • Lowered waste volumes (assuming all other factors unchanged) from sub-divisional hospitals to divisional incinerators					
Costs ($US)	• Establishment – Medium to High: Travel and expenses budget, 0.5 FTE for one year (approx.. $100,000) • Ongoing – Low, monitoring and follow up role reinserted back into general project implementation (SPREP)					

U2H - Unique to hospital

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

1 Introduction and Background

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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 Fiji and includes:

- Collection and collation of data on the current practice(s) used to dispose of hazardous healthcare waste in Fiji. Data collected includes:
  - Basic background data on the operation of the hospital sites assessed (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 Fiji, 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 was 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 Fiji, to address the key issues identified (**section 7**)
- recommendations and prioritization of actions necessary to enable sustainable hazardous healthcare waste management and disposal in Fiji (**section 8**)

2 Healthcare Waste Management in Fiji

2.1 National Regulatory Framework

Fiji is an island nation in the south-west Pacific Ocean, located between Vanuatu and Tonga. Fiji's Exclusive Economic Zone covers about 1.3 million square kilometers of the Pacific Ocean with 330 islands, of which a third are inhabited. The total population was 837,271 in the 2007 census.

Health services in Fiji are tax funded, provided manly at public facilities and primarily free of charge. The Ministry of Health operates via a system of four decentralised divisional offices, geographically based:

- Central and Eastern (often combined) in Suva
- Western in Lautoka, and
- Northern in Labasa.

The divisional offices are responsible for provision of public health services, operation of the sub-divisional hospitals, health centres and nursing stations, and are led by a Divisional Medical Officer, reporting to the Deputy Secretary Public Health.

Fiji faces challenges in health service delivery, with many public health facilities in deteriorating condition and shortages of pharmaceutical and medical supplies a regular occurrence[1].

A summary of relevant legislation is provided in Table 1.

[1] Roberts G, Sutton R, Lingam D (2008) Situational Analysis of the Fiji Health Sector. Proceedings of Health Systems Research Workshop, Ministry of Health, Suva, Fiji

Table 1: National Environmental Legislation Summary			
Legislation	**Type**	**Summary**	**Regulator/ Agency**
Environmental Management Act 2005	Act	Part 5 of the Environmental Management Act 2005 sets out the framework for Waste Management and Pollution Control in the Fiji Islands.	Department of Environment
Environmental Management (Waste Disposal and Recycling) (Amendment) Regulations 2011	Reg.	The purpose is to prevent environmental pollution by controlling the discharge and disposal of solid wastes, air emissions, and hazardous substances. It also prescribes permitting conditions for landfills, waste dumps, waste transport, waste recycling facilities, importing/manufacturing plastic bottles, and lead acid battery handling.	Department of Environment
Environmental Management (Container Deposit) Regulation 2011	Reg.	Provides the legal framework for the establishment of the Container Deposit and Refund Recycling System.	Department of Environment
National Solid Waste Management Strategy 2011 - 2014	Strategy	Key objectives of this strategy: reduces the amount of waste that each community generates make best use of the waste that is generated develop and implement economic and social incentive mechanisms to change wasteful behaviour improve and upgrade existing waste management and disposal systems encourage /provide waste management practices, which minimise the environmental risk and harm to human health provide a guideline template for rural or community level solid waste management practices.	Department of Environment
Public Health Act 2005	Act	Requires persons engaged in carrying or removing garbage to apply for a permit from the local authority - Allows local authorities to formulate bylaws in respect of the storage, collection and disposal of garbage, and prescribing the fees to be paid for removal of garbage - Regulates (i.e., garbage dumps, and incineration of garbage or refuse) - Health Care management Policy and Guidelines	Fiji Ministry of Health
Draft Health-care Waste Management Policy 2011	Policy	Not located but reference from National Solid Waste Management Strategy 2011 – 2014 indicates that all health care waste (including from small clinics) must be incinerated in Fiji.	Fiji Ministry of Health

2.2 Hospitals Assessed

All divisional and 2 sub-divisional hospitals were assessed as part of this project, to get a good representation of how wastes are managed within the hospital system in Fiji. These hospitals were:

- Colonial War Memorial Hospital (CWMH) Suva, Central Division
- Lautoka Divisional Hospital, Western Division
- Labasa Hospital, Northern Division
- Nadi Sub-Divisional Hospital, Western Division
- Sigatoka Sub-Divisional Hospital, Western Division

This section summarises these hospitals, key contact personnel and key hospital administrative statistics.

2.2.1 Colonial War Memorial Hospital (CWMH) Suva, Central Division

Apart from being the national referral hospital, CWMH is also Fiji's major teaching hospital. It has 481 beds, 1239 nursing/ medical staff and 1370 staff in all. The hospital services include accident and emergency, medical, surgical, orthopaedic, ophthalmology, obstetrics, gynaecology and paediatrics services and outpatient clinics. More complex services are also provided including: critical care services (intensive care/high dependency and coronary), dialysis unit, laboratory services, oral surgery and dental services, radiology services, acute psychiatric admissions, oncology/ chemotherapy and palliative care.

CWMH services are also accessed by other Pacific Island Countries.

2.2.2 Lautoka Divisional Hospital, Western Division

Lautoka Hospital has 340 beds and approximately 44 doctors and 328 nurses, with a total staffing of 680. The hospital services include accident and emergency, medical, surgical, orthopaedic, ophthalmology, obstetrics, gynaecology and paediatrics services, radiology and outpatient clinics. More complex services are also provided including: dialysis, laboratory services, dental services, cancer treatment and district nursing.

2.2.3 Labasa Hospital, Northern Division

Labasa Hospital has 182 beds. The hospital services include accident and emergency, medical, surgical, orthopaedic, ophthalmology, obstetrics, gynaecology and paediatrics services, radiology, an outpatient clinic, laboratory services, dental services and radiology services.

2.2.4 Nadi Sub-Divisional Hospital, Western Division

Nadi Hospital has 71 beds, 12 doctors and 59 nurses, with a total staffing of 82. The hospital services are limited to accident & emergency services, general inpatient care, routine obstetrics, dental services, limited diagnostic services (laboratory and radiology) and facilitate the provision of outreach services to the nursing stations within the sub-division.

Referrals are to Lautoka hospital

2.2.5 Sigatoka Sub-Divisional Hospital, Western Division

Sigatoka Hospital has 68 beds, 4 doctors and 43 nurses, with a total staffing of approximately 100. The hospital services are limited to accident & emergency services, general inpatient care, routine obstetrics, dental services, limited diagnostic services (laboratory and radiology) and facilitate the provision of outreach services to the nursing stations within the sub-division.

Referrals are to Lautoka hospital

2.2.6 Hospital Statistics

Detailed operational statistics for each of these hospitals are described in Table 2 overleaf.

Table 2: Hospital Details – Fiji									
Hospital/Region	**CWMH Suva**		**Lautoka Hospital**		**Labasa Hospital**		**Nadi Hospital**		**Sigatoka Hospital**
Contact Name **Position**	Sr. Sarita Goundar I/C Officer	Sr. Miriama Vakaloloma , Risk Mgr	Sr. Ana Radolo I/C Officer	Dr. Luisa Cikamatana Rauto, Acting Med Superintendent	Sr. Sera Lasakula Senior urse	Sr. Losavati Vakatalai Infection Control Officer	Dr. Susana Nakalevu, I/C Officer Sr. Munesh[3]	Dr. Josaia Tiko, Sub Divisional Medical Officer	Sr. Kelera Vosailagi, I/C Officer
Pop Served	243,594		238,547		103,122		~50,000		~20,000
No. of Beds	481		340		182		71		68
Annual Average Occupancy Rate (%)	113%		73%		77%		48%		57%
OBD's	158,008		90,593		51,151		12,439		13,651
No. Operations	5,000		Not supplied		Not supplied		Not supplied		Not supplied
No. of Births	8,717		4012		Not supplied		Not supplied		600
Emergency Patients Attended	8,138		36,625		Not supplied		Not supplied		Not supplied
Out-Patients Attended	99,932		138,370		148,252		72,340		20,776
No. of staff	1,370		786		Not supplied		82		~100
No. of staff per function									
Nursing/ Medical	1,239		591		Not supplied		71		46
Infection Control	3		1		Not supplied		1		1
Dedicated Waste Management – Internal Management	2		0		Not supplied		Not supplied		0
Dedicated Waste Management – Treatment Operation	2		1		Not supplied		Not supplied		3
Administration	14		33		Not supplied		Not supplied		3
Other	125		160		Not supplied		10		47

Notes:

1. OBDs = Occupied Bed Days (previous 12 months)
2. Infection Control staff are also included in Nursing/ Medical numbers
3. Escorted us for the audit

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.

Waste volumes and estimates of costs per waste stream (where this information is available) are provided separately in Table 4.

Table 4 also provides a critical analysis of waste treatment capacity available versus actual volumes treated, at those hospitals that operate incinerators. This demonstrates that if the large incinerators present at CWMH and Lautoka are maintained and operating they have significant excess capacity.

Audit observations are elaborated upon further for each hospital individually in sections 3.1 – 3.5 for the remaining issue headings:

- 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 3: Waste Management Process - Observations

	Hospital Name	CWMH Suva		Lautoka		Labasa		Nadi		Sigatoka	
Generation & Segregation	Dedicated Containers/ Bags	Y		Y		Y		Y		Y	
	Colour Coding	Y		Y		Y		Y		Y	
	Sharps segregated & secure	Y		Y		Y		Y		Y	
	Signage Present	Y		Y		Y		N		Y	
Internal Handling	Degree of manual handling of bags	Low		Low		Low		High		Medium	
	Internal Transport Mode	Trolley		Trolley		Trolley		Wheelie Bin		Trolley	
	Spill Kit Present	Y		Y		N		N		N	
Storage	Dedicated & Appropriate Area	N		N		N		N		N	
	Loading/unloading acceptable	N		Y		Y		N		Y	
	Spill Kits Present	N		N		N		N		N	
	Monitoring & record keeping occurs	Y		Y		Y		N		N	
Treatment	Treatment per Waste Stream		Tech. Type		Tech. Type		Tech. Type		Tech. Type		Tech. Type
	Healthcare Waste	✓	Incinerate (int.)	✓	Incinerate (int.)	✓	Incinerate (int.)	✓	Incinerate (ext.)	✓	Incinerate (ext.)
	Sharps	✓	Incinerate (int.)	✓	Incinerate (int.)	✓	Incinerate (int.)	✓	Incinerate (ext.)	✓	Incinerate (ext.)
	Pharmaceutical	✓	Incinerate (int.)	✓	Incinerate (int.)	✓	Incinerate (int.)	✓	Incinerate (ext.)	✓	Incinerate (ext.)
	Cytotoxic	✓	Incinerate (int.)	✓	Incinerate (int.)	×	Incinerate (int.)	×	NA	×	NA
	General	✓	Landfill (w/o treat)	✓	Landfill (w/o treat)	✓	Landfill (w/o treat)	✓	Landfill (w/o treat)	✓	Landfill (w/o treat)
	If incinerator present	Yes		Two incinerators - main larger older unit		Two incinerators present – original unit and new incinerator (yet to be commissioned)		Yes, but not used. HCW sent to Lautoka		Yes, but not used. HCW sent to Lautoka	

Table 3: Waste Management Process - Observations

	Hospital Name	CWMH Suva		Lautoka		Labasa		Nadi		Sigatoka	
Treatment	Make, Model, Year commissioned	McDonald Industries New Zealand		1. McLaren Hastings, NZ, 2004 2. Elastec American Marine, MediBurn 20, recent		1. McLaren Hastings, NZ, 1998 2. Elastec American Marine, MediBurn 20, recent		Thermtec, S-18, 2003		Thermtec, S-18, 2003	
	Operating Temp (^{0}C)	900-1200		1. 900 C 2. 1000 C		1. 800 – 1200 C 2. 1000 C		800		800	
	No. chambers	2		Both have 2		Both have 2		2		2	
	Condition	Good		1. Temporarily broken down 2. Good		1. Good 2. New		Broken down		Broken down	
	Comments	-		Below waste/ fuel stats for reported for main unit only		-		-		-	
	Operational statistics	Per week	Per year	Per week	Per year	Per week	Per year	Per week	Per year	Per week	Per year
	Waste Throughput (tonnes)	2.9	148	1.6	81	Not available	Not available	N/A	N/A	N/A	N/A
	Operating Hours (hr)	42	2184	48	2496	Not available	Not available	N/A	N/A	N/A	N/A
	Fuel	Diesel		Diesel		Diesel		Diesel		Diesel	
	Fuel use (kg/litres)	700	36400	360	18720	Not available	Not available	N/A	N/A	N/A	N/A
	Fuel use per kg waste burnt	0.25		0.23		Not available		N/A		N/A	

Table 3: Waste Management Process - Observations

	Hospital Name	CWMH Suva	Lautoka	Labasa	Nadi	Sigatoka
Treatment	Technology siting and operation issues	Key issue - stack discharge is close to the top storey of the admin building (additional levels added after incineratot stack originally designed). Soot was evident on glass windows and staff in admin building complain from time to time about smoke	Siting – not ideal. Clear of hospital buildings but close to residential neighbour	Both incinerators well sited away from hospital buildings. Old incinerator building kept in clean condition and appears to be operating effectively. New incinerator shelter building poorly designed as roofing beams are in close proximity to exhaust ductwork - heat from this could cause fire. Commissioning of new incinerator held up while shelter roof is rebuilt.	There is an incinerator onsite, although it is not operational and according to a previous inspection of healthcare facility incinerators done for the Fiji Department of Environment in 2005, the incinerator had been reported to have an electrical problem. It is likely to have rarely been used since it was installed. Unit appears in reasonable order because it is housed in a roofed and caged enclosure.	Incinerator is broken down and has not been used for 6 years - suggested a "fuel supply" problem which could mean the fuel delivery line or tank but might simply be the cost of the fuel to run it was unaffordable. Unit appears in reasonable order because it is housed in a roofed and caged enclosure, although plenty of vines growing throughout. Siting poor - upwind of main building and only 60m away. Room for alternative siting right at front NW corner of the property downwind from the new nurses quarters.
	Offsite transport assessment	Good	Fair	Good	Fair	Good

Table 4: Wastestream Quantities, Costs and Treatment Constraints (Fiji)										
Waste Stream	**CWMH Suva**		**Lautoka**		**Labasa**		**Nadi**		**Sigatoka**	
	Volumes (kg/week)	**Estimated costs ($US p.a.)**	**Volumes (kg/week)**	**Estimated costs ($US p.a.)**	**Volumes (kg/week)**	**Estimated costs ($US p.a.)**	**Volumes (kg/week)**	**Estimated costs ($US p.a.)**	**Volumes (kg/week)**	**Estimated costs ($US p.a.)**
Healthcare Waste	2,290[2]	34,600	1,100[2]	NM	700[3]	NM	200[3]	NM	150	NM
Sharps	250[2]	7,940	60[2]						5	
Pharmaceutical	NM	NM	NM		NM		NM		NM	
Cytotoxic	315	45,900	10		NA		NA		NA	
General	1,000	49,600	NM		NM		NM		NM	
Waste Treatment Parameter										
Incin. Design Capacity (kg/ batch)	1,000		500		80		NA		NA	
No. batches/ day possible	3		3		3		NA		NA	
	Per week*	Per year	Per week*	Per year	Per week*	Per year	Per week*	Per year	Per week*	Per year
Available Incinerator Capacity (kg)	15,000	780,000	7,500	390,000	1,200	62,000	NA	NA	NA	NA
Actual Incinerated Waste Throughput (kg)	2,900	151,000	1,600	83,200	930	48,000	NA	NA	NA	NA
Spare Capacity (kg) **	12,100	629,000	5,900	306,800	270	14,000	NA	NA	NA	NA

NM = Not measured

NA = Not Applicable

* Based on a 5 day week

** Theoretical spare capacity does not take into account other factors such as increased downtime maintenance that could be required under higher loads

[2] Based on weighed quantities of healthcare waste.

[3] Not provided. Estimated based on kg per occupied bed figures obtained from weighing records at CWMH and Lautoka

3.1 CWMH, Suva

3.1.1 Waste Management and Infection Control Framework

The following summarises the waste management and infection control framework at CWMH:

Non-sharps health care waste generated in wards and departments is placed in proper yellow foot-operated bins (with hazard labeling signs and symbols on the bins/ bags). Sharps are separated from syringes and placed in dedicated but often “home-made” sharps boxes/ pails (usually with handwritten labels), which have been provided with a small opening but are not necessarily puncture-proof (**Photo #1**). General waste is placed in clear bags secured over standard plastic bins. Cytotoxic waste is carefully managed within the National Cytology Centre at the hospital and is well managed with purple coloured (with hazard symbols) signage, bags and bins in controlled-access storage areas.

- There is a waste management policy, plan and formalised waste management procedures. The Risk Manager, with support of the Infection Control Unit and Waste Management Team, oversees waste management.
- There is an infection control policy which includes waste management procedures.
- There is formal waste auditing inspections conducted quarterly, and there is a waste management committee.
- CWMH’s waste management and infection control framework is well-documented and thorough, although there is evidence that it is not being implemented as well as it may have been in the past, since there were a couple of cases where general wastes/ recycling was seen in the yellow bins.

3.1.2 Training

CWMH has a formal training program in place that covers infection control, waste segregation, sharps management, spills management, use of PPE but not specifically incinerator operation, since this is performed by a small dedicated maintenance team. Responsibility for its delivery sits with the Infection Control Unit in conjunction with the In-service training department.

Waste management training is covered during induction training and is provided to all staff and although records of attendance have historically been kept, it was not clear whether this was currently occurring. Frequency of the training program was another issue that was unclear.

The systems in place suggest a strong historical focus on waste management and infection control but advice from relevant staff is that the hospital’s broader performance in these areas may have slipped a little in the last 12 months as previously responsible staff had been moved taken off to focus on other matters. Given that this is a very large hospital with new staff cycling through as part of the hospital’s teaching role, it is foreseeable that standards could slip relatively quickly without close and continued attention.

There were no barriers evident in discussions with onsite personnel regarding training being provided by an external organisation. Quite the contrary in fact – there was new recruitment

into the infection control team and a desire within this group to bring standards back to where they had previously been.

Around 2007/ 2008 there were some Infection Control staff from the divisional hospitals trained via 6 week placements at John Hunter training hospital in Newcastle, Australia. This appears to have been the launching pad for the current disciplines and practices in Fiji regarding infection control and related waste management.

3.2 Lautoka Hospital

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

3.2.1 Waste Management and Infection Control Framework

The following summarises the waste management and infection control framework at Lautoka:

Health care waste is categorised and sorted into colour-coded bags/ bins as follows:

- General waste – clear garbage bags (previously black but changed upon staff suggestion to make it easier to spot sharps and other contamination)
- Infectious/ pathological waste – yellow garbage bags
- Used sharps – placed into yellow rigid puncture resistant containers (rigid plastic 'jerry can' style 20L fuel drums used – see **Photo #2**)
- Pharmaceutical/ Cytotoxic waste – placed in dedicated purple bags
- Empty vials - cardboard boxes.

Once ¾ full, bags are tied with string and labelled with department name and date. Otherwise this tying and labelling occurs daily upon bag collection at 7am by waste management staff. Infectious and non-infectious bags are collected separately and transported on separate trolleys. Infectious wastes are taken by waste management staff by trolley to the storage area, located in front of the incinerator.

All yellow bags, sharps containers (once ¾ full and sealed), pharmaceutical and cytotoxic waste bags are treated by incineration onsite. Highly infectious wastes such as lab cultures and stocks of infectious agents from the laboratory are autoclaved before incineration.

- There is a waste management policy, plan and formalised waste management procedures. The Infection Control Officer oversees all infection control and waste management practices with the support of the treatment engineer and his team.
- There is an infection control policy which includes waste management procedures.
- There are formal waste auditing inspections conducted monthly by the infection control officer, and there is a waste management committee.
    - The audit process consists of checking all waste bins in all wards and departments to ensure they only store the right type of waste. The bins are checked for the presence of colour coded garbage bags placed inside the bin which determines the type of waste that should be disposed in them. The

management of sharps is also audited and the recommended amount of waste storage.

- An audit checklist and 12 months of audit records were sighted.

- Lautoka's waste management and infection control framework is well-documented and thorough, like CWMH, although there is heavy reliance on the Infection Control Officer to maintain its implementation.
- Observations and review of waste audit records indicates a high rate of segregation is being achieved at Lautoka.

3.2.2 Training

Lautoka has a formal training program in place that covers infection control, waste segregation, sharps management, spills management, use of PPE and incinerator operation (where applicable). Responsibility for its delivery sits with the Infection Control Officer.

Training topics include:

- Waste segregation, standard precautions (including PPEs), blood borne viruses and transmissions, hand hygiene, occupational exposures and risk assessment and management, cleaning hospital environment and equipment.

Waste management training is covered during induction training and is provided to all staff. Short training sessions are of 30 minutes to one hour duration and are conducted frequently at ward levels. More in-depth training takes the form of a two day infection control training workshop (and refresher opportunity) carried out 3 times per year, which covers all of the topics in the training manual.

Records of attendance are kept.

All training is delivered by the Infection Control Officer. Her experience is gained from historical knowledge and on-line training with also some information (and documents) sharing between other infection control functions across the other divisional hospitals.

As a means of assessing the effectiveness of training, results of monthly audits that are below 100% are followed up individually with ward/ department nurses as a feedback loop to correct unacceptable segregation or other management practices.

The training systems in place suggest a strong historical and current focus on waste management and infection control.

Around 2007/ 2008 there were some Infection Control staff from the divisional hospitals trained via 6 week placements at John Hunter training hospital in Newcastle, Australia. This appears to have been the launching pad for the current disciplines and practices in Fiji regarding infection control and related waste management.

There were no barriers evident in discussions with onsite personnel regarding training being provided by an external organisation. Quite the contrary in fact – Lautoka appears to have one of the best training, auditing and management programs in place to manage infection

risks but it appears to have an unhealthy reliance on the commitment of the Infection Control Officer.

3.3 Labasa Hospital

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

3.3.1 Waste Management and Infection Control Framework

The following summarises the waste management and infection control framework at Labasa:

Health care waste is categorised and sorted into colour-coded bags/ bins as follows:

- General waste – black garbage bags and bins
- Infectious/ pathological waste – yellow garbage bags and bins
- Used sharps – placed into yellow rigid puncture resistant containers (rigid plastic 'jerry can' style 20L fuel drums used)
- Empty vials - cardboard boxes.

Once ¾ full, bags are tied with string and labelled with department name and date. Infectious and non-infectious bags are collected separately in the morning every day and transported on separate trolleys. Infectious wastes are taken by waste management staff by trolley to the storage area, located within the old incinerator building.

All yellow bags, sharps containers (once ¾ full and sealed) and pharmaceutical waste (in boxes) are treated by incineration onsite.

- There is a waste management policy, plan and formalised waste management procedures. The Infection Control Officer oversees all infection control and waste management practices with the support of an infection control nurse.
- There is an infection control policy which includes waste management procedures. There is an infection control committee but no waste management committee, although it is noted that the functions the infection control committee carries out are similar to what a Waste Management Committee would do.
- There is a detailed and formal waste auditing inspection program conducted DAILY by the waste collection staff, and documented daily checklist results (in the form of comments on specific locations where segregation was found to be inadequate) are reconciled on a monthly basis.
    - An audit checklist and audit checklist records were sighted.
- Labasa's waste management and infection control framework is well-documented and thorough, like CWMH.
- Observations and review of waste audit records indicates a high rate of segregation is being achieved at Labasa.

3.3.2 Training

Labasa has a formal training program in place that covers infection control, waste segregation, sharps management, spills management, use of PPE and incinerator operation (where applicable). Responsibility for its delivery sits with the Infection Control Officer.

Training topics include:

- Waste segregation, standard precautions (including PPEs), blood borne viruses and transmissions, hand hygiene, occupational exposures and risk assessment and management, cleaning hospital environment and equipment.

Waste management training is conducted twice a year as a two day infection control training workshop (and refresher opportunity), run by the Infection Control Team, which covers all of the topics in the training manual. Training is also conducted for new inductees and records of both the structured workshop attendance and inductee attendance are signed and kept (sighted).

This program has a high degree of consistency with that run in Lautoka and CWMH, indicating the shared development of the Waste Management and Infection Control regime between the divisional hospitals in Fiji.

As a means of assessing the effectiveness of training, results of daily audits that are unsatisfactory are followed up individually with ward/ department nurses as a feedback loop to correct unacceptable segregation or other management practices.

The training systems in place suggest a strong historical and current focus on waste management and infection control.

Around 2007/ 2008 there were some Infection Control staff from the divisional hospitals trained via 6 week placements at John Hunter training hospital in Newcastle, Australia. This appears to have been the launching pad for the current disciplines and practices in Fiji regarding infection control and related waste management.

There were no barriers evident in discussions with onsite personnel regarding training being provided by an external organisation.

3.4 Nadi Hospital

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

3.4.1 Waste Management and Infection Control Framework

The following summarises the waste management and infection control framework at the Nadi Hospital. It is noted however that the most appropriate staff we not present on the day of the audit, so there was less detail collected from Nadi than other hospitals visited in Fiji:

- There is no evidence of a waste management policy, plan or formalised waste management procedure.
- There may be a documented infection control policy but none was indicated as known and operational on the day.

- There are no formal waste auditing or inspections conducted at Nadi.
- Waste generated in hospital wards is placed in standard plastic bins with yellow bags for infectious waste (non-sharps), rigid plastic 'jerry can' style 20L fuel drums (sharps), bins with black bags (general waste) and cardboard boxes for empty vials.
- Yellow bags are collected from the 5 wards and placed in the blue wheelie bin. This is collected by Council on a weekly basis and taken to Lautoka hospital for incineration.
- There is no dedicated storage area.

3.4.2 Training

There was no evidence of a training program at Nadi.

3.5 Sigatoka Hospital

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

3.5.1 Waste Management and Infection Control Framework

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

- There is no waste management policy or plan but simple waste management procedures exist that have likely been based on those developed in more detail in the divisional hospitals.
- There is a documented infection control policy
- Waste segregation audits are carried out monthly by the Infection Control Officer, which measure percent compliance of segregation across all wards/ departments. Underperformance is addressed through discussion with relevant staff on the ward in question and this is reported to the monthly infection control committee meeting.
- Waste generated in hospital wards is placed in standard plastic bins with yellow bags for infectious waste (non-sharps), rigid plastic 'jerry can' style 20L fuel drums (sharps), bins with black bags (general waste) and cardboard boxes for empty vials. Segregation appears to be good.
- Yellow bags are collected from the 7 wards daily via a dedicated trolley, stored in the above ground outside (uncovered) storage enclosure (**Photo #3**) and collected by Council on a weekly basis (Fridays) for incineration at Lautoka hospital

3.5.2 Training

There was no training program at Sigatoka.

4 Key Healthcare Waste Management Issues in Fiji

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

Table 6 highlights the key areas of concern, both per hospital, and in terms of health services delivery across Fijian hospitals, as part of this assessment.

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

Table 6: HEALTHCARE WASTE – KEY ISSUES FOR FIJI

Scale	Category	Item	Minimum Standard Criterion	CWMH	Lautoka	Labasa	Nadi	Sigatoka	Fiji overall
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	Segregation	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	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	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.						

4.2 CWMH Suva – Key Issues

CWMH Suva's size as both a medical and teaching hospital means maintaining a strong culture around waste segregation and handling practices is challenging; which puts pressure on the risk management and infection control teams charged with upholding the waste management and infection control systems that have been in place for some years now. Despite this, the documented systems and procedures are as sound as anywhere surveyed across the Pacific.

Colour-coded segregation practices are generally well-adhered to with containers appropriate for task. Labeling, measuring, handling, routing and auditing practices are generally good (with an exception noted below), as is the provision and use of PPE.

Training at CWMH is based on a strong and structured program, closely related to the Waste Management Framework, although discussion with key staff suggests the hospital's commitment (and therefore resourcing) for the continued implementation of this had weakened over the last 12 months.

However there were still significant areas that could be improved. The most significant healthcare waste management issues observed at CWMH Suva were:

- The large incinerator (**Photo #4**) is coping, although it has significant performance issues:
    - The third burner is not operational and the blower has also broken down (**Photo #5**). This is reducing the temperature of the burning process, which sometimes leads to visible black smoky emissions.
    - The administrative wing of the hospital has been constructed in more recent years as extended 3-storey building on top of the original. The incinerator is sited on lower ground on what is quite a hilly overall hospital site, and this location is quite close to the administration building. The incinerator's stack is relatively tall but this would clearly have been designed and built for conditions before the new admin block as built. Consequently there are smoke impacts directly to those in the administration building on some days and some wind conditions. In fact, black sooty droplets were evident on some windows of the admin building when inspected from the inside.
    - In addition to the healthcare waste quantities generated by CWMH, the incinerator is also required to treat waste from the sub-divisional hospitals in the region plus all private hospitals, clinics, pathology laboratories and other small businesses that generate healthcare waste. There is no back up treatment option on site to assist in the management of this large treatment task if and when breakdowns occur.
- There is a corrugated iron "slide" structure (**Photo #6**) that has been design to transport healthcare waste bags from the building level above down to the level of the incinerator area, direct from the internal routing trolley without the need for carrying of the bags

- This is a good idea in theory but in practice it is excessively steep which leads to bags splitting and healthcare waste contents spilling out all over the open ground at the base of it (**Photo #7**)
- The pre-treatment storage area is limited to a concreted area immediately adjacent to the entry of the incinerator building. This is uncovered and un-bunded so any residue from broken or poorly sealed bags stored there can wash straight in to the open stormwater drain (**Photo #8**)

4.3 Lautoka Hospital – Key Issues

There appears to be quite a strong waste management framework system in place at Lautoka Hospital, with particular attention to segregation auditing and structured training. This has led to good segregation performance, as evidenced by the audit compliance results observed for the last 12 months and the areas inspected on the day of the audit.

Colour-coded segregation practices are generally well-adhered to with containers appropriate for task. Labeling, measuring, handling, routing and auditing practices are generally good, as is the provision and use of PPE. There is reasonable undercover storage within the main incinerator building.

There are some areas that could be improved however:

- While the treatment system of one large (older) incinerator (the unit attached to the smaller of the 2 stacks in **Photo #9**) and one smaller (and newer) MediBurn incinerator (**Photo #10**) is typically adequate, this was not the case on the day of the visit – the main incinerator was broken down and had been for 3 weeks.
- The consequence of this was that the Mediburn could not keep up with waste supply and the old incinerator compound was being used to store a mounting pile of untreated yellow bags (**Photo #11**). This area was quite full and consequently bags were also being kept immediately outside the area, unsecured (**Photo #12**).
- Because of the breakdown of the main incinerator the MediBurn was overloaded, in an attempt to treat more waste, which caused thicker smoke than usual to emitted (**Photo #13**). There is a residence less than 100m away and complaints do occur.

4.4 Labasa Hospital – Key Issues

There appears to be structured waste management framework in place at Labasa Hospital, with good segregation and handling practices. Labasa appears to have the most extensive segregation auditing program and well-structured and documented training and record-keeping system across the hospitals audited in Fiji.

This has led to good segregation performance, as evidenced by the audit compliance results observed for the last 12 months and the areas inspected on the day of the audit.

Colour-coded segregation practices are well-adhered to with containers appropriate for task. Labeling, measuring, handling, routing and auditing practices are generally good, as is the provision and use of PPE.

The main issue identified at Labasa, like the other divisional hospitals, concerns the treatment system infrastructure:

- Labasa has a large incinerator which is operating effectively (**Photo #14**). The second incinerator (MediBurn 20 – **Photo #15**)) is present effectively as back-up for now and additional capacity in the event of any future expansion. However, the MediBurn unit's stack has not been located correctly in relation to the roof structure of the building it is housed in. (**Photo #16**) shows that structural roofing timber has been burnt, indicating that the stack flue is too close to the rafters.

4.5 Nadi Hospital – Key Issues

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

- Yellow and black bags (both in general plastic rubbish bins) are used for general and healthcare waste respectively. Sharps are placed in jerry can style puncture-proof plastic, similar to other Western Division hospitals.
- General waste was often evident in yellow bags while there was some evidence of healthcare waste contaminating black bags. The use of the same bins for both types of waste (**Photo #17**), limited signage above or on the bins and the regular use of yellow bags in what looked to be general waste bins (**Photo #18**) probably created more confusion than clarity for staff disposing of waste in the hospital
- There is no documented waste management planning system in place.
- There is no structured training or waste segregation auditing program in place.
- There is no dedicated storage area.

4.6 Sigatoka Hospital – Key Issues

Sigatoka appears to good colour-coded segregation practices and does have an auditing program in place. The most significant healthcare waste management issues observed at Sigatoka were:

- There is no documented waste management planning system in place.
- There is no structured training program in place.
- There is a dedicated storage area, raised off the ground and caged, but is is open to the elements.
- There is some signage present (on bin lids only) but it was solely handwritten, not throughout all areas and there were no promotional posters.

4.7 Key Issue Overall

Fiji's approach to healthcare waste management and infection control is more mature than most in the region. There are good waste management systems and procedures in place and staff in Infection Control roles that are generally more aware of the risk posed by healthcare waste than in some other Pacific countries. However, like some of the incinerators within their control, this good system is showing signs of wear and tear, and appears to be working in some cases only because of the commitment of a very small group of individuals. The key issues highlighted above focus on improvements to treatment

infrastructure for the divisional hospitals, while sub-divisional hospitals have a much broader level of non-compliance against the minimum standards framework.

It seems that the 'machinery' of a good and workable waste management framework exists in Fiji but not beyond the divisional level, and even there it seems under-prioritised and possibly under-resourced, which makes it vulnerable rather than sustainable.

There is an opportunity to take a working framework (divisional level) and the potential of one (the sub-divisional level) and bring it to life with the injection of some short-term resourcing effort, focused on organizing and coordinating, rejuvenating and prioritizing the existing system and rolling this into the sub-divisional hospital structure. The infection control/ waste management capacity in Fiji could benefit from help and assistance to band it together, as it appears to have been in the recent past, so they can operate a more coherent health care waste management system throughout the country's health care delivery facilities.

5 Consultation

Apart from hospital staff across all four hospitals, discussions were also held with various Ministry of Health officials.

6 Contractor Roles and Capacity

No potential in-country contractors (private or public sector) were identified as providing or having the capacity to provide healthcare waste management support services. This includes training (in areas like waste management, infection control, technology operation and maintenance) and risk management.

However, in relation to the training recommendation discussed in section 8 for sub-divisional hospitals, with appropriate support, existing infection control staff in the three divisional hospitals (who have relevant training programs in place) could help with this delivery.

7 Analysis of Options for Sustainable Healthcare Waste Management in Fiji

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

Table 7 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 7: Options for Sustainable Healthcare Waste Management in Fiji

Key Issue Category	Key Issue	Options to address the issue
A. Waste Management Framework	There is no documented **waste management plan**ning system in place and limited evidence of waste management committees in some sub-divisional hospitals.	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.
B. Signage, Segregation & Containers	**Signage is** below minimum standard in the two sub-divisional hospitals since there is virtually no signage present	Improve segregation practices by supplying signage to explain the colour-coded segregation system as well as posters to promote it.
C. Training & Audit	There is no structured **training** program in the two sub-divisional hospitals and no waste segregation **auditing** program in Nadi.	Delivery of the existing structured healthcare waste training program that exists in the divisional hospitals out to sub-divisional hospitals in Fiji. This could be facilitated/ co-delivered by: 1. SPREP staff, or 2. International technical training providers (or a combination of both), supporting and financing existing trainers in divisional hospitals.
D. Treatment	The method for **treatment** of healthcare waste is typically in accord with required standards, but improvements could be made.	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
E. Health and Safety	**Spill control kits** were not observed anywhere.	Procurement of Consumables (PPE): • Supply spill kits
F. Suitable Storage	Storage before disposal areas is not locked or signed and does not meet minimum standards	Upgrades to various hospital's storage (before disposal) areas to prevent access to the public and protect from weather.

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 7)
- The waste management process, from generation to transport up to the treatment location (B and F in Table 7)
- Training systems for sustainable healthcare waste management (C in Table 7)
- OHS related protection for waste handlers (E in Table 7)

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 D) has a range of alternative approaches, as summarized in Table 7. 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 7. 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 Fiji's Stage 2 assessment:

1. Incineration (high temperature: >1,000^{0}C [4])
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).

7.2.1 Waste Treatment Systems Relevant for Fiji

The Stage 2 local feasibility assessment (for Fiji) took these first four[5] technologies and assessed them against the ten dot point criteria listed in 7.2. These criteria are explored qualitatively in **Appendix D**. Table 7 takes these qualitative descriptions and assigns a quantitative score from 1 – 5, to prioritise local applicability of technology options to the Fijian 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 Fijian context are ranked in order of preference in Table 8:

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

[5] 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.

Table 8: QUANTITATIVE **Treatment Technology Options Assessment - Local Feasibility (Fiji)**

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	5	5	3	3	3	3	36	1
Incineration at med. temperature (800 - 1000^{0}C)	4	4	3	3	3	5	4	2	2	4	34	2
Low temperature burning (<400^{0}C)	5	3	1	2	1	2	2	1	5	5	27	3
Autoclave with shredder	2	4	4	3	3	2	2	3	2	2	27	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

In support of Table 8'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 in the medium term to remedy current unacceptable practices at sites too small to justify costs of expensive equipment.
- ***Low temperature burning*** is not acceptable in Fiji, due to the requirement to incinerate all healthcare waste.
- ***Autoclaving*** is a potentially acceptable disinfection practice (where units with shredder are affordable and locked in supplier maintenance and training contracts are in place), but is not acceptable in Fiji due to the requirement to incinerate all healthcare waste.

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). *However, for Fiji, encapsulation is not acceptable due to the requirement to incinerate all healthcare waste*. 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.

7.2.1 Waste Treatment Systems Relevant for individual Fijian Hospitals

Wastes should be treated and disposed of accordingly to ensure the infectious hazard is destroyed. All three divisional hospitals in Fiji have incineration systems in place, which in addition are set up to serve sub-divisional hospital and smaller clinics' needs as well.

However, there are some repair-related improvements that could be made to existing infrastructure in these three hospitals as outlined in Table 9, and indicated by shading in green.

Table 9: Technology Options Applicable for Each Hospital in Fiji

Remaining Technology Options	Technology Applicability
CWMH Suva Hospital	
Incineration at high temperature (>1000^{0}C)	The existing large capacity incinerator is sufficient for current needs, if it is maintained in good condition. There are however a number of improvements or repairs that could be made: 1. The incinerator should have maintenance carried out to fix and replace the broken third burner and blower. Operating without this will be at reduced efficiency and temperature the latter leading to bouts of black smoke which cause problems (see below) 2. Once repairs are complete and the unit is running effectively, an air quality assessment should be carried out to determine the preferred design height for the stack, so as to avoid impacts to the administration building 3. Depending on the results of '2', works should be done on the stack to raise its height 4. Should the incinerator be unavailable for periods of time during maintenance, avenues should be explored with Quarantine Authorities to treat the health care waste at Suva Port Authority's large incinerator as a back-up.
Incineration at med. temperature (800 - 1000^{0}C)	Not applicable to CWMH as it is large enough to justify a better performing larger option that runs at a higher temperature.
Low temperature burning (<400^{0}C)	Not applicable to CWMH as it is large enough to justify a better performing larger option.
Lautoka Hospital	
Incineration at high temperature (>1000^{0}C)	The existing large capacity incinerator is sufficient for current needs, if it is operating: 1. The large older incinerator should have **urgent** maintenance carried out to get it operational (if it isn't already). The back-up MediBurn unit is not large enough to sustainably manage Lautoka's needs 2. Avenues should be explored with Quarantine Authorities to treat the health care waste

Table 9: Technology Options Applicable for Each Hospital in Fiji	
Remaining Technology Options	**Technology Applicability**
	at Nadi Port's incinerator as a back-up in the event of future malfunction.
Incineration at med. temperature (800 - 1000^{0}C)	Not applicable to Lautoka as it is large enough to justify a better performing larger option that runs at a higher temperature.
Low temperature burning (<400^{0}C)	Not applicable to Lautoka as it is large enough to justify a better performing larger option that runs at a higher temperature.
Labasa Hospital	
Incineration at high temperature (>1000^{0}C)	The existing large capacity incinerator is sufficient for current needs, especially with the MediBurn unit as a back-up. However: • The MediBurn unit stack has not been located correctly in relation to the roof structure of the building it is housed in. (**Photo #16**) shows that structural roofing timber has been burnt, indicating that the stack flue is too close to the rafters. This needs to be remedied by rebuilding the roof structure to provide more clearance
Incineration at med. temperature (800 - 1000^{0}C)	Not applicable to Labasa as it is large enough to justify a better performing larger option that runs at a higher temperature.
Low temperature burning (<400^{0}C)	Not applicable to Labasa as it is large enough to justify a better performing larger option that runs at a higher temperature.

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 Fiji. Further details and guidance on each recommendation are provided in **Appendix E**.

Table 10 provides a summary of the recommendations for Fiji. 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 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, because all sub-divisional hospitals in Fiji are dependent on the incineration capability of three divisional hospitals, effective performance of the latters' treatment infrastructure (Recommendation 4) must take highest priority over all others.

Also, 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 10: Recommendations for Fiji — Applicable to	CWMH Suva	Lautoka Hospital	Labasa Hospital	Nadi Hospital	Sigatoka Hospital
Recommendation 1: Develop a Waste Management Framework for sub-divisional hospitals					
Description	For Nadi and Sigatoka (and for sharing with other sub-divisional hospitals as appropriate) develop: • 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 • A *waste management committee*, appropriate to the scale of each facility.				
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 • 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 ($US)	• Establishment – Low, if existing system used across Fiji Divisional Hospitals is used as starting point and document drafting assistance is provided • Ongoing – Low				
Recommendation 2: Procurement of Segregation Signage for sub-divisional hospitals					
Description	Supply of **signage** to explain the colour-coded segregation system as well as **posters** to promote it.				
Output	Signs above waste locations in hospitals				
Monitoring & Evaluation Indicators	• Wastes are segregated at their place of production. • Infection wastes, general wastes and used sharps are stored in separate colour coded containers and locations within medical areas. • Zero Needle Stick Injuries.				
Costs ($US)	Establishment – Low; Ongoing - Low				

Recommendation 3: Roll Existing Divisional Training Program out to sub-divisional hospitals[UTH]	
Description	• Delivery of the existing structured healthcare waste training program that is common to all divisional hospitals to all sub-divisional hospital infection control officers in Fiji • This could be facilitated/ co-delivered by SPREP staff, or outside trainers, or a combination of both, supporting and **financing** existing trainers in divisional hospitals. • 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: Improved Treatment Infrastructure[U2H]	
Description	Conduct **repairs** and improvements on incinerators: • **CWMH Suva:** 4. The incinerator should have maintenance carried out to fix and replace the broken third burner and blower. Operating without this will be at reduced efficiency and temperature the latter leading to bouts of black smoke which cause problems (see below) 5. Once repairs are complete and the unit is running effectively, an air quality assessment should be carried out to determine the preferred design height for the stack, so as to avoid impacts to the administration building 6. Depending on the results of '2', works should be done on the stack to raise its height • **Lautoka:** 2. The large older incinerator should have urgent maintenance carried out to get it operational (if it isn't already). The back-up MediBurn unit is not large enough to sustainably manage Lautoka's needs. • **Labasa**: 2. The MediBurn unit stack has not been located correctly in relation to the roof structure of the building it is housed in. (Photo #) shows that structural roofing timber has been burnt, indicating that the stack flue is too close to the rafters. This needs to be remedied by rebuilding the roof structure to provide more clearance.

Table 10: Recommendations for Fiji	Applicable to	CWMH Suva	Lautoka Hospital	Labasa Hospital	Nadi Hospital	Sigatoka Hospital
Output	A disposal system that reduces the potential hazard posed by healthcare waste, while endeavoring to protect the environment.					
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 – Medium to high for Suva, low for Lautoka and low-medium for Labasa • Ongoing – None in direct relation to these recommendations					
Recommendation 5: Upgrade of Storage Areas						
Description	The storage areas of healthcare waste before disposal does not meet minimum standards for storage; it can be accessed by members of the public. This is most simply remedied by: • **CWMH Suva**: o Purchase of two or more 660L wheel-able bins for storage outside the incineration building, which is more cost-effective and flexible than building a roofing structure. The bins should have the ability to be padlocked. Also procure spill kits for waste handling areas. o Immediately stop the use of the waste transfer chute, as this substantially increases infection risk. o Replace it with a more effective structure, such as something with a more forgiving horizontal slope (like that of a playground slide) or better still a simple pneumatic lowering lift • **Lautoka**: Purchase of two 660L wheel-able bins for storage in front of the incineration building, which is more cost-effective and flexible than building an additional building or roofing structure, even though there is ample room to do so. The bins should have the ability to be padlocked. Also procure spill kits for waste handling areas. • **Labasa**: No action required • **Nadi**: Purchase of one 660L wheel-able bins for storage awaiting weekly transport to Lautoka. The bin should have the ability to be padlocked. Also procure spill kits for waste handling areas. • **Sigatoka**: Purchase of one 660L wheel-able bins for storage awaiting weekly transport to Lautoka. The bin should have the ability to be padlocked. This is a simpler solution that building a roof over the existing raised storage structure. Also procure spill kits for waste handling areas.					

Table 10: Recommendations for Fiji — Applicable to	CWMH Suva	Lautoka Hospital	Labasa Hospital	Nadi Hospital	Sigatoka Hospital
Output	• Storage areas are fenced, lockable, suitably designed and isolated from patients and the public.				
Monitoring & Evaluation Indicators	• Suitability of storage areas frequently assessed by the 'responsible officer' to ensure that it is locked and appropriately signed.				
Costs ($US)	• Establishment – Low (procurement of actual storage structures/ bins, signage for them and spill kits) • Ongoing – Low				
Recommendation 6: A Short-term Whole of Fiji Co-ordination Resource[U2H]					
Description	• A dedicated person responsible for inter-hospital co-ordination, setting work programs, prioritising project actions (as they relate to Fiji) and monitoring progress towards improved waste management • This person could be supplied by SPREP as part of the implementation stage of this project or assistance could be provided to the Ministry of Health to house this part-time role • This position is designed to be short-term, and serve as a kick-starter and rejuvenator of an existing system that is dormant in some facilities • Fiji has been highlighted for this recommendation because it has mature systems in place – with only moderate effort this can be made more operational and widespread				
Output	• The 'push' and direction required to establish a coordinated and functioning waste management policy, training, auditing and delivery system throughout divisional and sub-divisional hospitals, in conjunction with a uniform waste management framework (Recommendation 1) and training program (Recommendation 3). • This is a model that could be applied elsewhere in the region				
Monitoring & Evaluation Indicators	• Improved communication between hospitals • Improved segregation performance of sub-divisional hospitals • Lowered waste volumes (assuming all other factors unchanged) from sub-divisional hospitals to divisional incinerators				
Costs ($US)	• Establishment – Medium to High: Travel and expenses budget, 0.5 FTE for one year (approx.. $100,000) • Ongoing – Low, monitoring and follow up role reinserted back into general project implementation (SPREP)				

U2H - Unique to hospital

8.1 Implementation Priorities

8.1.1 Recommendation 1: Develop a Waste Management Framework for <u>sub-divisional hospitals</u>

For **Nadi** and **Sigatoka** (and for sharing with other sub-divisional hospitals as appropriate) develop:

- 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
- A *waste management committee*, appropriate to the scale of each 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 the draft *National Solid Waste Management Strategy* and representatives from the Ministry of Environment and Climate Change (MECC) 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)

- Model the framework on those used by the Fiji Divisional Hospitals
- 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 (1year-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 Segregation Signage

Supply **signage** to explain the colour-coded segregation system as well as **posters** to promote it.

8.1.2.1 Short Term (0-6 months)

- Procurement of classification and segregation signage as well as instructional posters to promote good healthcare waste management practices (all hospitals)

8.1.2.2 Medium Term (6 months-1 year)

Nil.

8.1.2.3 Long Term (1-3 years)

Nil.

8.1.3 Recommendation 3: Roll Existing Divisional Training Program out to sub-divisional hospitals [U2H]

Delivery of the existing structured healthcare waste training program that is common to all divisional hospitals to all sub-divisional hospital infection control officers in Fiji.

This could be facilitated/ co-delivered by SPREP staff, or outside trainers, or a combination of both, supporting and ***financing*** existing trainers in divisional hospitals.

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

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.

Conduct **repairs** and improvements on incinerators at CWMH, Lautoka and Labasa:

8.1.4.1 CWMH Suva

The existing large capacity incinerator is sufficient for current needs, if it is maintained in good condition. There are however a number of improvements or repairs that could be made:

(a) Short Term (0-6 months)

1. The incinerator should have maintenance carried out to fix and replace the broken third burner and blower. Operating without this will be at reduced efficiency and temperature the latter leading to bouts of black smoke which cause problems (see below)

(b) Medium Term (6 months-1 year)

2. Once repairs are complete and the unit is running effectively, an air quality assessment should be carried out to determine the preferred design height for the stack, so as to avoid impacts to the administration building.
3. Depending on the results of '2', works should be done on the stack to raise its height.
4. Should the incinerator be unavailable for periods of time during maintenance, avenues should be explored with Quarantine Authorities to treat the health care waste at Suva Port Authority's large incinerator as a back-up.

(c) Long Term (1-3 years)

5. Ongoing incineration system maintenance support

6. Recording of waste treatment quantities and operating conditions (e.g. burn temperatures per batch)
7. Maintain training of operators as required

8.1.4.2 Lautoka Hospital

(a) Short Term (0-6 months)

The large older incinerator should have urgent maintenance carried out to get it operational (if it isn't already). The back-up MediBurn unit is not large enough to sustainably manage Lautoka's needs.

(b) Medium Term (6 months-1 year)

Avenues should be explored with Quarantine Authorities to treat the health care waste at Nadi Port's incinerator as a back-up in the event of future malfunction.

(c) Long Term (1-3 years)

Maintain training of operators as required..

8.1.4.3 Labasa Hospital

(a) Short Term (0-6 months)

Nil.

(b) Medium Term (6 months-1 year)

The MediBurn unit's exhaust stack has not been located correctly in relation to the roof structure of the building it is housed in. (**Photo #16**) shows that structural roofing timber has been burnt, indicating that the stack flue is too close to the rafters. This needs to be remedied by rebuilding the roof structure to provide more clearance.

(c) Long Term (1-3 years)

Maintain training of operators as required.

8.1.5 Recommendation 5: Upgrade of Storage Areas

The storage areas of healthcare waste before disposal does not meet minimum standards for storage; it can be accessed by members of the public.

This is most simply remedied by the following short term purchases:

8.1.5.1 Short Term (0-6 months)

CWMH Suva:

- Purchase of two or more 660L wheel-able bins for storage outside the incineration building, which is more cost-effective and flexible than building a roofing structure. The bins should have the ability to be padlocked. Also procure spill kits for waste handling areas.
- Immediately stop the use of the waste transfer chute, as this substantially increases infection risk.
- Replace it with a more effective structure, such as something with a more forgiving horizontal slope (like that of a playground slide) or better still a simple pneumatic lowering lift.

Lautoka:

- Purchase of two 660L wheel-able bins for storage in front of the incineration building, which is more cost-effective and flexible than building an additional building or roofing structure, even though there is ample room to do so. The bins should have the ability to be padlocked. Also procure spill kits for waste handling areas.

Labasa:

- No action required.

Nadi:

- Purchase of one 660L wheel-able bins for storage awaiting weekly transport to Lautoka. The bin should have the ability to be padlocked. Also procure spill kits for waste handling areas

Sigatoka

- Purchase of one 660L wheel-able bins for storage awaiting weekly transport to Lautoka. The bin should have the ability to be padlocked. This is a simpler solution that building a roof over the existing raised storage structure. Also procure spill kits for waste handling areas.

8.1.5.2 Medium Term (6 months-1 year)

Nil.

8.1.5.3 Long Term (1-3 years)

Nil.

8.1.6 A Short-term Whole of Fiji Co-ordination Resource [U2H]

A dedicated person responsible for inter-hospital co-ordination, setting work programs, prioritising project actions (as they relate to Fiji) and monitoring progress towards improved waste management. This would provide the 'push' and direction required to establish a coordinated and functioning waste management system throughout divisional and sub-divisional hospitals.

Fiji has been highlighted for this recommendation because it has mature systems in place – with only moderate effort this can be made more operational and widespread.

There is an opportunity to take a working framework (divisional level) and the potential of one (the sub-divisional level) and bring it to life with the injection of some short-term resourcing effort, focused on organizing and coordinating, rejuvenating and prioritizing the existing system and rolling this into the sub-divisional hospital structure. The infection control/ waste management capacity in Fiji could benefit from help and assistance to band it together, as it appears to have been in the recent past, so they can operate a more coherent health care waste management system throughout the country's health care delivery facilities.

(a) Short Term (0-6 months)

- Establish position description, operational boundaries, duration, expected outcomes and budget for this initiative
- Discuss delivery options with Ministry of Health officials and senior hospital staff

(b) Medium Term (6 months-1 year)

- Recruit to and establish position.
- Maintain for approximately one year, at a reduced FTE rate (0.5FTE for example)

(c) Long Term (1-3 years)

- Withdraw position with enough momentum, transferred knowledge and resource commitment for a more sustainable healthcare waste management in Fiji.

Appendix A

Photo Log

Photo 1: Sharps pail, CWMH Suva, Fiji (taken 26/03/2014 by Geoff Latimer ref:DSC03709)

Photo 2: Yellow 'Jerry can' style sharps container, Lautoka Hospital, Fiji (taken 24/03/2014 by Geoff Latimer ref:DSC03618)

Photo 3: Storage enclosure for healthcare waste bags prior to collection for incineration, Sigatoka Hospital, Fiji (taken 25/03/2014 by Geoff Latimer ref:DSC03659)

Photo 4: Incinerator, CWMH Suva, Fiji (taken 26/3/2014 by Geoff Latimer ref:DSC03696)

Photo 5: Uncommissioned 3rd burner (left) and broken-down blower (right) on incinerator, CWMH Suva, Fiji (taken 26/03/2014 by Geoff Latimer ref:DSC03698)

Photo 6: Slide structure for transfer of healthcare waste bags, CWMH Suva, Fiji (taken 26/3/2014 by Geoff Latimer ref:DSC03694)

Photo 7: Base of slide structure showing fresh blood from split bags, CWMH Suva, Fiji (taken 26/3/2014 by Geoff Latimer ref:DSC03704)

Photo 8: Pre-treatment storage area at incinerator building entrance, with open drain (left), CWMH Suva, Fiji (taken 26/3/2014 by Geoff Latimer ref:DSC03702)

Photo 9: Main incinerator and boiler building, Lautoka Hospital, Fiji (taken 24/3/2014 by Geoff Latimer ref:DSC03600)

Photo 10: Second incinerator (MediBurn 20), Lautoka Hospital, Fiji (taken 24/3/2014 by Geoff Latimer ref:DSC03594)

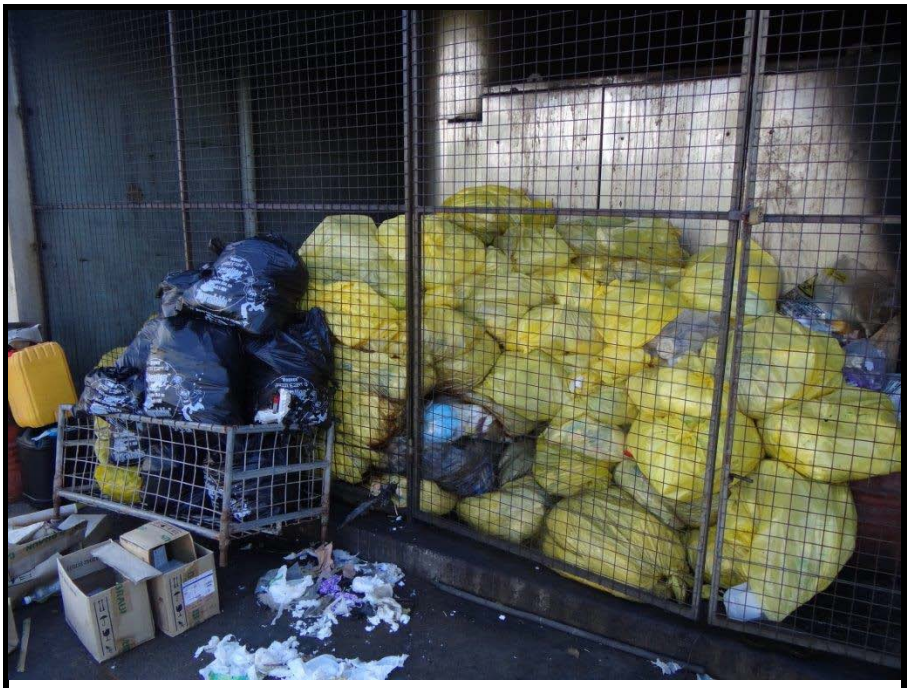

Photo 11: Temporary storage of waste prior to treatment – overflowing from main incinerator enclosure, Lautoka Hospital, Fiji (taken 24/3/2014 by Geoff Latimer ref:DSC03602)

Photo 12: Unsecured waste outside temporary storage area, Lautoka Hospital, Fiji (taken 24/3/2014 by Geoff Latimer ref:DSC03604)

Photo 13: MediBurn 20 incinerator in operation, Lautoka Hospital, Fiji (taken 24/3/2014 by Geoff Latimer ref:DSC03607A)

Photo 14: Main incinerator at Labasa Hospital, Fiji (taken 27/3/2014 by Geoff Latimer ref:DSC03758)

Photo 15: MediBurn 20 incinerator in enclosure at Labasa Hospital, Fiji (taken 27/3/2014 by Geoff Latimer ref:DSC03749)

Photo 16: MediBurn 20 incinerator at Labasa Hospital, Fiji (taken 27/3/2014 by Geoff Latimer ref:DSC03750)

Photo 17: Unlabelled general and healthcare waste bins, Nadi Hospital, Fiji (taken 24/3/2014 by Geoff Latimer ref:DSC03633)

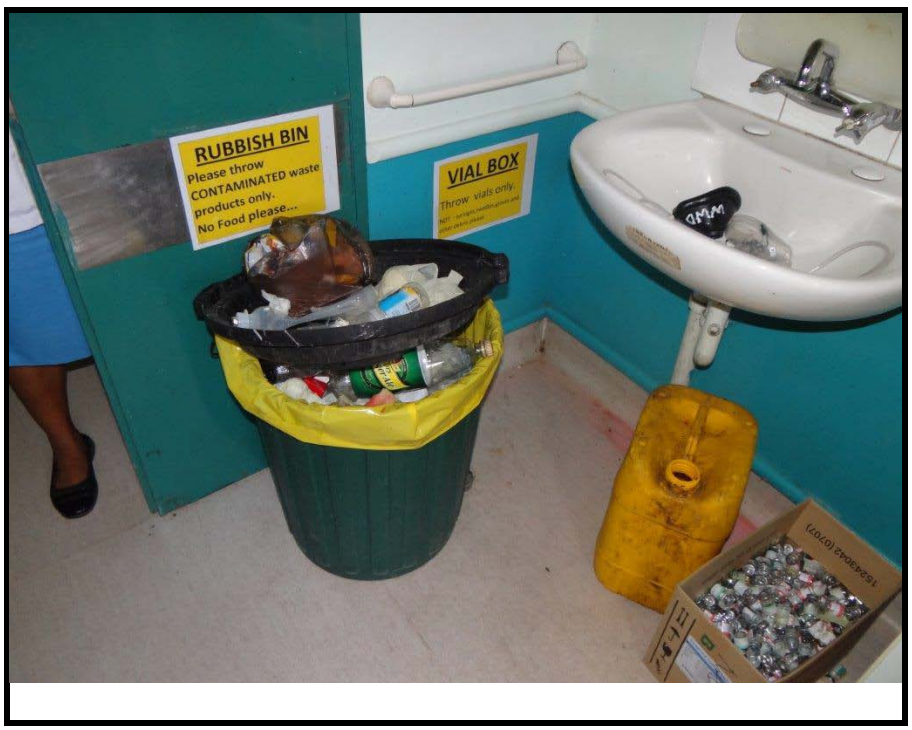

Photo 18: General waste bin with yellow liner bag, Nadi Hospital, Fiji (taken 24/3/2014 by Geoff Latimer ref:DSC03635)

Appendix B

Collected Data from Hospital Audits in Fiji

Table B1: Collected Data from Hospital Audits in Fiji

	Hospital Name	CWMH Suva		Lautoka		Labasa		Nadi		Sigatoka
Facility Name & Contact Information	Hospital Name	Colonial War Memorial Hospital (Divisional)		Lautoka Divisional Hospital		Labasa Divisional Hospital		Nadi Sub-divisional Hospital		Sigatoka Sub-divisional Hospital
	Contact Name & Position	Sr. Sarita Goundar- Infection Control Officer	Sr Miriama Vakaloloma, Risk Manager	Sister Ana Radolo Infection Control Officer	Dr Luisa Cikamatana Rauto Acting Medical Superintendent	Sera Lasakula Senior Nurse	Sr Losavati Vakatalai Infection Control Officer	Dr. Josaia Tiko, Sub Divisional Medical Officer	Dr. Susana M. Nakalevu, Infection Control Officer Nurse Munesh (escorted us for the audit)	Kelera Vosailagi, Infection Control Officer
	Email	sarita.goundar@govnet.gov.fj	miriama.vakaloloma@health.gov.fj	Ana.radolo@govnet.gov.fj	lcikamatana@health.gov.fj	lelavosailagi@gmail.com	lelavosailagi@gmail.com	josaia.tiko@health.gov.fj	susana.nakalevu@govnet.gov.fj	lelavosailagi@gmail.com
	Phone	3313444 (ext: 1244/ 1262 - Infection Control Unit)		666 0399	Phone: 6660 399 ext 641349 Mobile: 9943865 or 9906947	9435 050				6500 455

Key Services Data	Summary of Services Provided	Emergency care-A&E dept/Peads ER Outpatients: CHOP/SOPD/ANC/Gynae Outpatient/Diabetic Centre/HITH/Urology Clinic/Endoscopy/Oxfam Clinic/Dental Dept./Outpatient Blood Services/Physio/Radiology dept. Cancer Treatment: Oncology (Paediatrics/Adult/Gynaecology) Dialysis: ICU Pathology: Microbiology/Blood Bank/Haematology/Serology/Biochem Etc Wards: 22 Wards –(East Wing/West Wing/Maternity /Paediatrics Unit) +Operating theatre Other Dept: Kitchen /CSSD/stores/laundry/boiler	emergency care, district nursing, outpatients, cancer treatment, dialysis, pathology	Emergency, operating theatre, laboratory, 10 general wards (including a tuberculosis ward), radiology	Small hospital with limited capability. No laboratory or operating theatre with referrals to Lautoka hospital.	Emergency care, outpatients, maternity, operating theatre, general wards
	Pop Served	238,	238547	103122	50000	20000
	No. of Beds	481	340	182	71	68
	OBD's [1]	158008.5	90593	51151.1	12439.2	13651
	No. Operations	5000	Not supplied	Not supplied	Not supplied	Not supplied
	No. of Births[2]	8717	4012	Not supplied	Not supplied	600

	Emergency Patients Attended[2]	8138		36625		Not supplied		Not supplied		Not supplied	
	Out-Patients Attended[2]	99932		138370		148252		72340		20776	
	No of Staff	1370		786							
Waste Steams Managed	Estimates	Volumes (kg/wk)	Cost ext. ($US)	Volumes (kg/wk)	Cost ext. ($US)	Volumes (kg/wk)	Cost ext. ($US)	Volumes (kg/wk)	Cost ext. ($US)	Volumes (kg/wk)	Cost ext. ($US)
	Healthcare Waste	2290	$ 34,607.52	1100						150	$ 2,600.00
	Sharps	250	$ 7,938.00	60						5	
	Pharmaceutical										
	Cytotoxic	315	$ 45,900.00	10							
	General	1000	$ 49,619.52	Not tracked							
	Recycling	20	$ -								
	TOTAL	**3875**		**1170**						**115**	**2,600**
Generation & Segregation	Dedicated Containers/ Bags	Y		Y		Y		Y		Y	
	Colour Coding	Y		Y		Y		Y		Y	
	Sharps segregated & secure	Y		Y		Y		Y		Y	
	Signage Present	Y		Y		Y		N		Y	
Internal Handling	Degree of manual handling of bags	Low		Low		Low		High		Medium	

	Internal Transport Mode	Trolley	Trolley	Trolley	Wheelie Bin	Trolley
	Spill Kit Present	Y	Y	N	N	N
Storage	Dedicated & Appropriate Area	N	N	N	N	N
	Loading/unloading acceptable	N	Y	Y	N	Y
	Spill Kits Present	N	N	N	N	N
	Monitoring & record keeping occurs	Y	Y	Y	N	N
Treatment	Treatment per Waste Stream	Tech. Type	Tech. Type	Tech. Type	Tech. Type	Tech. Type
	Healthcare Waste	Incinerate (internal)	Incinerate (internal)	Incinerate (internal)	Incinerate (external)	Incinerate (external)
	Sharps	Incinerate (internal)	Incinerate (internal)	Incinerate (internal)	Incinerate (external)	Incinerate (external)
	Pharmaceutical	Incinerate (internal)	Incinerate (internal)	Incinerate (internal)	Incinerate (external)	Incinerate (external)
	Cytotoxic	Incinerate (internal)	Incinerate (internal)	NA		
	General	Landfill (without treatment)	Landfill (without treatment)	Landfill (without treatment)	Landfill (without treatment)	Landfill (without treatment)
	If incinerator present	Yes	Two incinerators - main larger older unit	Two incinerators present – original unit and new incinerator (yet to be commissioned)	Yes, but not used. HCW sent to Lautoka	Yes, but not used. HCW sent to Lautoka
	Make, Model, Year commissioned	McDonald Industries New Zealand	1. McLaren Hastings, NZ, 2004 2. Elastec American Marine, MediBurn 20, recent	1. McLaren Hastings, NZ, 1998 2. Elastec American Marine, MediBurn 20, recent	Thermtec, S-18, 2003	Thermtec, S-18, 2003

	Operating Temp (^{0}C)	900-1200		1. 900 C 2. 1000 C		1. 800 – 1200 C 2. 1000 C		800		800	
	No. chambers	2		Both have 2		Both have 2		2		2	
	Condition	Good		1. Temporarily broken down 2. Good		1. Good 2. New		Broken down		Broken down	
	Comments	-		Below waste/ fuel stats for reported for main unit only		-		-		-	
		Per week	Per year	Per week	Per year	Per week	Per year	Per week	Per year	Per week	Per year
	Waste Throughput (tonnes)	2.9	148	1.6	81					NA	NA
	Operating Hours (hr)	42	2184	48	2496						
	Fuel	Diesel		Diesel						Diesel	
	Fuel use (kg/litres)	700	36400	360	18720	NA				NA	
	Fuel use per kg waste burnt	0.25		0.23						NA	

	Technology siting and operation issues	Key issue - stack discharge is close to the top story of the admin building (additional levels added after incinerator stack originally designed). Soot was evident on glass windows and staff in admin building complain from time to time about smoke	Siting – not ideal. Clear of hospital buildings but close to residential neighbour	Both incinerators well sited away from hospital buildings. Old incinerator building kept in clean condition and appears to be operating effectively. New incinerator shelter building poorly designed as roofing beams are in close proximity to exhaust ductwork - heat from this could cause fire. Commissioning of new incinerator held up while shelter roof is rebuilt.	There is an incinerator onsite, although it is not operational and according to a previous inspection of healthcare facility incinerators done for the Fiji Department of Environment in 2005, the incinerator had been reported to have an electrical problem. It is likely to have rarely been used since it was installed. Unit appears in reasonable order because it is housed in a roofed and caged enclosure.	Incinerator is broken down and has not been used for 6 years - suggested a "fuel supply" problem which could mean the fuel delivery line or tank but might simply be the cost of the fuel to run it was unaffordable. Unit appears in reasonable order because it is housed in a roofed and caged enclosure, although plenty of vines growing throughout. Siting poor - upwind of main building and only 60m away. Room for alternative siting right at front NW corner of the property downwind from the new nurses quarters.
	Offsite transport assessment	Good	Fair	Good	Fair	Good
Waste Management Framework	Waste Management Policy	Y	Y	Y	N	N
	Waste Management Plan	Y	Y	Y	N	N
	Waste Management Procedure	Y	Y	Y	N	N
	Waste Management Committee	Y	Y	Y	N	N
	Infection Control Policy	Y	Y	Y	N	N

	Infection Control Procedures	Y		Y		Y		N		Y	
	Audit Program	Y		Y		Y		N		Y	
	What is audited	Segregation	Y	Segregation		Segregation	Y	Segregation	N	Segregation	Y
		Compliance P&P	N	Compliance P&P	N	Compliance P&P	Y	Compliance P&P	N	Compliance P&P	Y
		Int. transport	N	Int. transport		Int. transport	Y	Int. transport	N	Int. transport	N
		Storage	N	Storage		Storage	N	Storage	N	Storage	N
		Treatment/ disposal	N	Treatment/ disposal	Y	Treatment/ disposal	Y	Treatment/ disposal	N	Treatment/ disposal	N
	Frequency	Quarterly				Daily				Monthly	
	Training Program	Y		Y		Y		Y		N	
	Curricula	Infection Control	Y	Infection Control	Y	Infection Control	Y	Infection Control	Y	Infection Control	Y
		Waste Mgt	Y	Waste Mgt	Y	Waste Mgt	Y	Waste Mgt	Y	Waste Mgt	Y
		PPE	Y	PPE	Y	PPE	Y	PPE	Y	PPE	Y
		Treat. Tech operation	N	Treat. Tech operation	N	Treat. Tech operation	N	Treat. Tech operation	N	Treat. Tech operation	N
	Duration / frequency of training	Quarterly				-2 days -Induction annually per staff member					
	Records of who has been trained	Y		N		Y		N		N	
	Monitoring or refresher courses	Y		Y		Y		N		N	

Projected Issues	10 year projections for waste management	No expansion plans			Hospital appears to be stretched for space and resources although no extension plans are known to us	Currently building an extension to the hospital
	Barriers to change	Resources available and prioritised			training, awareness and resources	training, awareness and resources

	Other issues				Significant volumes of general waste were observed in most of the infectious waste (yellow bag) bins One yellow bag was observed to be overflowing with what appeared to be all general waste One sharps container was observed to have dried blood stains on the top of it and broken pieces of several glass syringes The identified contact people (Dr. Josaia Tiko, Sub Divisional Medical Officer and Dr. Susana M. Nakalevu, Infection Control Officer) were not present as arranged for the audit. Senior nurse Munesh showed around the hospital but was not able to answer some of our questions. However, it was evident from our observations that the hospital does not place a high priority on infection control and good healthcare waste practice.	

Local	Potential in-country contractors	Who	Key Capability	Who	Key Capability	Who	Key Capability	Who	Key Capability	Who	Key Capability
		None identified		None identified		Rentakil?		None identified		None identified	
Contractors											

Appendix C

Minimum Standards Assessment

Table C1: HEALTHCARE WASTE - MINIMUM STANDARDS FRAMEWORK & ASSESSMENT FOR FIJI

Scale	Category	Item	Minimum Standard Criterion	CWMH Suva	Lautoka Hospital	Labasa Hospital	Nadi Hospital	Sigatoka Hospital	Fiji - overall
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 that 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.				N/A	N/A		

* The minimum standards 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

Appendix D

Qualitative Local Feasibility Assessment – Treatment Technology

Table D1: QUALITATIVE **Treatment Technology Options Assessment - Local Feasibility (Fiji)**										
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	Incineration is required for all healthcare waste generated in Fiji. Fiji is a party to Stockholm so HTI is favoured over MTI to reduce contribution to combustion derived POPs.	Incineration has been practised in Fijian divisional hospitals for at least 15 years	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	Equipment lifespan ~ 5 years; sustainability dependant on maintaining operator skills plus proper operation and maintenance	Incineration is required for all healthcare waste generated in Fiji. However, Fiji is a party to Stockholm so MTI will contribute	Incineration has been practised in Fijian divisional hospitals for at least 15 years	Equipment breakdown and lack of local skills to maintain equipment – real barrier but can be managed through skills training & supplier support. Simpler	Emissions of air pollutants/ smoke and leaching from ash disposal to receiving environment are potential impacts. Med. temperature	Equipment lifespan typically ~ 5 years but will only last if maintained. Equipment is prone to require a moderate	Requires less skilled operators than high temperature equipment - training simplifies operation

			controlled)		more to combustion derived POPs than HTI.		infrastructure than HTI.	operation increases risks of air pollution, but not likely to be an issue in isolated small communities.	level of maintenance	
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 – Fiji is a party to Stockholm	Burning of rubbish was historically practised in Fiji but Incineration is required for all healthcare waste generated in Fiji.	No equipment operation reliability barrier; however would expect Dept Env barrier due to requirement to incinerate HCW	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	Some issues for operators (requires training & PPE); small potential for odours and wastewater discharge	Equipment lifespan ~ 10 years; sustainability dependant on maintaining operator skills plus longevity of equipment	Incineration is required for all healthcare waste generated in Fiji.; but no potential for smoke nuisance;	Not familiar with use of sterilisers for waste – potential community issue with waste appearance	Equipment breakdown and lack of local skills to maintain equipment – real barrier but can be managed through skills training & supplier support.	No emissions of air pollutants/ smoke; some potential for odour impacts; still requires landfill or dump disposal so some potential	Equipment will only last if maintained. Adding shredder to autoclave technology increases mechanical	Requires skilled operators to achieve best level of disinfection.

		required, shredder destroys needles	(community)	use given technology complexity	some potential for odour nuisance; no air pollution (no combustion-POPs) and some potential for waste water management issues	if steriliser not operated correctly or shredder not used	Increased complexity of equipment (compared to incineration) increases barrier	for leaching on burial; some potential for waste water management issues. Larger residual waste compared to burning – landfills are not generally lined and groundwater is shallow	parts that can go wrong. 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. Landfills are not generally lined & groundwater is shallow - increases waste volume that requires burial.	Incineration is required for all healthcare waste generated in Fiji; some potential for leachate to groundwater, although limited inherent hazard	No particular cultural fit concerns	No equipment operation reliability barrier; however would expect Dept Env barrier due to requirement to incinerate HCW	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[6, 7], incineration is the preferred method for treating pharmaceutical and cytotoxic wastes. This is further supported by the United Nations[8, 9] 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[10, 11].

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

[6] World Health Organization Regional Office for Europe, EURO Reports and Studies 97, Management of Wastes from Hospitals and other Health Care Establishments, 1983.
[7] World Health Organization, Safe management of Wastes from healthcare Facilities, Geneva, 1999.
[8] United Nations Environment Programme – Technical Working Group on the Basel Convention, Draft Technical Guidelines on Biomedical and Health Care Wastes, 1999.
[9] Environment Australia, Basel Convention – Draft Technical Guidelines on Hazardous Waste: Clinical and Related Waste (Y1), March 1998.
[10] Health care Without Harm, Non-Incineration Treatment Technologies, August 2001.
[11] 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[12, 13, 14, 15, 16, 17]. 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[18].

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.

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