



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

Federated States of Micronesia (FSM)

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

Prepared by:
ENVIRON Australia Pty Ltd

Date:
July 2014

Project Number:
AS140211



Prepared by:		Authorised by:	
Name:	Natalie Stella	Name:	Geoff Latimer
Title:	Senior Consultant	Title:	Senior Manager
Phone:	9606 1503	Phone:	9606 1508
Email:	nstella@environcorp.com	Email:	glatimer@environcorp.com
Signature:	Date:	Signature:	Date:

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.

The report must not be reproduced in whole or in part except with the prior consent of SPREP and subject to inclusion of an acknowledgement of the source.

© ENVIRON Australia Pty Ltd

This has been produced with the assistance of the European Union. Its contents are the sole responsibility of Environ and can in no way be taken to reflect the views of the European Union.

VERSION CONTROL RECORD

Document File Name	Date Issued	Version	Author	Reviewer
AS140211_SPREP_Health care Waste Report_FSM_Draft rev0	13 June 2014	Draft 1	Natalie Stella	Geoff Latimer Trevor Thornton
AS140211_SPREP_Health care Waste Report_FSM_Final rev0	10 July 2014	Final 1	Natalie Stella	Geoff Latimer Trevor Thornton
PacWaste_HCW_Baseline_Report_FSM_v1.1	10 & 23 Oct 2014	Final 1.1	J. Tavane	EU emblem & disclaimer added

Contents

	Page
Executive Summary	5
1 Introduction and Background	11
1.1 Project Scope	11
1.2 Report Structure	12
2 Healthcare Waste Management in FSM	13
2.1 National Regulatory Framework	13
2.2 Hospitals Assessed	15
2.2.1 Yap Memorial Hospital	15
2.2.2 Chuuk State Hospital	15
2.2.3 Pohnpei State Hospital	16
2.2.4 Kosrae State Hospital	16
2.2.5 Hospital Statistics	16
3 Existing Waste Management Practices	18
3.1 Yap Memorial Hospital	22
3.1.1 Wastestreams, Treatment Constraints and Costs	22
3.1.2 Waste Management and Infection Control Framework	22
3.1.3 Training	22
3.2 Chuuk State Hospital	22
3.2.1 Wastestreams, Treatment Constraints and Costs	22
3.2.2 Waste Management and Infection Control Framework	22
3.2.3 Training	23
3.3 Pohnpei State Hospital	24
3.3.1 Wastestreams, Treatment Constraints and Costs	24
3.3.2 Waste Management and Infection Control Framework	24
3.3.3 Training	24
3.4 Kosrae State Hospital	25
3.4.1 Wastestreams, Treatment Constraints and Costs	25
3.4.2 Waste Management and Infection Control Framework	25
3.4.3 Training	25
4 Key Healthcare Waste Management Issues in FSM	26
4.1 Minimum Standards Framework	26
4.1.1 Yap Memorial Hospital – Key Issues	27
4.1.2 Chuuk State Hospital – Key Issues	28
4.1.3 Pohnpei State Hospital – Key Issues	28
4.1.4 Kosrae State Hospital – Key Issues	29
5 Consultation	30
6 Contractor Roles and Capacity	30
7 Analysis of Options for Sustainable Healthcare Waste Management in FSM	31
7.1 Options for (Non-Treatment) Waste Management Aspects	32

7.2	Options for Treatment of Healthcare Waste	32
7.2.1	Waste Treatment Systems Relevant for FSM	34
7.3	Treatment Investment Options for individual FSM Hospitals	35
8	Recommendations	37
8.1	Implementation Priorities	41
8.1.1	Recommendation 1: Develop a Waste Management Framework	41
8.1.2	Recommendation 2: Procurement of Consumables (Segregation & Storage)	42
8.1.3	Recommendation 3: Provide a Sustainable Training Program	43
8.1.4	Recommendation 4: Improved Treatment Infrastructure	43
8.1.5	Recommendation 5: Procurement of Consumables (PPE)	45
8.1.6	Recommendation 6: Upgrade Storage Facility (Chuuk)	45

List of Tables

Table 1:	National Environmental Legislation Summary
Table 2:	Hospital Details – FSM
Table 3:	Waste Management Process - Observations
Table 4:	Assessment criteria rating system
Table 5:	HEALTHCARE WASTE – KEY ISSUES FOR FSM
Table 6:	Options for Sustainable Healthcare Waste Management in FSM
Table 7:	<u>QUANTITATIVE</u> Treatment Technology Options Assessment - Local Feasibility (FSM)
Table 8:	Technology Options Applicable for Each Hospital in FSM
Table 9:	Recommendations for FSM

List of Photographs

Photo 1:	Example of healthcare waste disposal at Yap Memorial Hospital.
Photo 2:	Type of sharps containers used at Yap Memorial Hospital.
Photo 3:	Incinerator used at Yap Memorial Hospital
Photo 4:	Example of healthcare waste disposal at Chuuk State Hospital
Photo 5:	Solids and unburnt sharps in residual ash material at Chuuk State Hospital
Photo 6:	Second incinerator at Chuuk State Hospital
Photo 7:	Second incinerator at Chuuk State Hospital
Photo 8:	Example of healthcare waste disposal at Pohnpei State Hospital
Photo 9:	Types of sharps container used at Pohnpei State Hospital
Photo 10:	Incinerator used at Pohnpei State Hospital
Photo 11:	Unburnt solids and sharps in residual ash material at Pohnpei State Hospital
Photo 12:	Example of healthcare waste disposal at Kosrae State Hospital
Photo 13:	Example of healthcare waste disposal at Kosrae State Hospital
Photo 14:	Exposed, dumped residue ash from old incinerator at Kosrae State Hospital

List of Appendices

- Appendix A: Photo Log
- Appendix B: Collected Data from Hospital Audits in FSM
- Appendix C: Minimum Standard Assessment
- Appendix D: Qualitative Local Feasibility Assessment – Treatment Technology
- Appendix E: Recommendation Guidelines

Executive Summary

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 FSM.

Current Healthcare Waste Management in FSM

The Ministry of Health operates healthcare facilities in FSM. Information regarding the waste management process occurring, from ward-level waste generation through to ultimate treatment and disposal was collected during audits of the four largest hospitals as follows:

- Yap State Hospital, Yap – 1/4/2014
- Chuuk State Hospital, Chuuk – 4/4/2014
- Pohnpei State Hospital, Pohnpei – 7/4/2014
- Kosrae State Hospital, Kosrae – 8/4/2014

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 FSM								
Scale	Category	Item	Minimum Standard Criterion	YAP	CHUUK	POHNPEI	KOSRAE	FSM - Overall
Health care 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					
Health care 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)					
Health care Facility	Signage		Signs are located in all wards/department areas where waste bins are located indicating the correct container for the various waste types					
Health care Facility	Segregation		Waste are correctly segregated in all wards/departments with use of containers that are colour coded for the different waste types					
Health care Facility	Containers		All areas have dedicated waste containers are suitable for the types of waste generated. All waste containers are colour coded and have correct wording on them. Sharps are deposited into containers that reduce potential for needle-stick injury					
Health care Facility	Storage	Storage before treatment	Meets the stated standards					
Health care Facility	Training	Planning and implementation	A structured waste management education program has been developed with a clear delivery structure					
Health care 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.					
Health care 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.					
Health care 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.					
Health care 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 most significant healthcare waste management issues observed in FSM were:

- There was no documented waste management planning systems in place at any of the hospitals.
- The segregation and containment practices are generally below minimum standards, there was virtually no signage present at any of the hospitals (some in Pohnpei and Kosrae) the only segregation regularly practices was for sharps.
- There is no structured training program in place. Waste segregation auditing only takes place in Pohnpei and Kosrae.
- No PPE such as gloves, protective clothing, eye protection or covered footwear was observed for waste management staff and spill control kits were not observed anywhere throughout the facility.
- The method for treatment of healthcare waste is not in accord with required standards at Pohnpei and needs improvement in Yap and Chuuk.

Analysis of Options for Sustainable Healthcare Waste Management in FSM

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

Treatment options that rated best for FSM 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 a borderline practice which can only be acceptable in the short term, in low population density environments, to remedy current unacceptable practices.
- **Autoclaving** is an acceptable disinfection practice where units with shredder are affordable and locked in supplier maintenance and training contracts are in place.

Encapsulation ranks as an effective way to deal with the residual risk from already disinfected sharps: i.e., the risk of needle stick injury by healthcare workers or the community (waste disposal area) due to the fact that sharps are disinfected but not physically destroyed by the low-medium temperature of open burning (or non-destruction of

autoclaving). Encapsulation is never recommended as an isolated form of treatment, as it does not disinfect or otherwise treat the hazard of the waste.

Recommendations

Table ES2 provides a summary of the recommendations for FSM.

Table ES2: Recommendations for FSM		Applicable to	Yap Hospital	Chuuk Hospital	Pohnpei Hospital	Kosrae Hospital	FSM Overall
Recommendation 1: Develop a Waste Management Framework							
Description	<ul style="list-style-type: none"> A <i>Healthcare Waste Management Plan</i>, specific to each healthcare facility Appoint an <i>officer responsible</i> for the development and implementation of the Healthcare Waste Management Plan (likely to be a more senior person than the one nominated in response to recommendation 6) A <i>waste management committee</i>, appropriate to the scale of each facility. 						
Output	<ul style="list-style-type: none"> An agreed <i>Healthcare Waste Management Plan</i>, 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	<ul style="list-style-type: none"> Plan approved by Department of Health (all facilities) Approved budget for implementation of Healthcare Waste Management Plan The Plan should be regularly monitored, reviewed, revised and updated. Annual assessment of 'Responsible Officer's' or Waste Management Committees' performance against key healthcare waste management competencies. 						
Costs (\$US)	<ul style="list-style-type: none"> Establishment – Low, if existing systems (such as those for Fiji) are used as a starting points and document drafting assistance is provided Ongoing – Low 						
Recommendation 2: Procurement of Consumables (Segregation)							
Description	<ul style="list-style-type: none"> Supply of colour-coded waste bins and plastic liners in quantities sufficient to serve all wards/departments for a period of time sufficient to allow bedding down of the segregation process. Supply of small number of colour-coded wheelie bins (where required) per hospital to act as both in-ward/department storage and internal transport trolleys. Supply of signage to explain the colour-coded segregation system as well as posters to promote it. 						
Output	Adequate supply of consumables to bed down more rigorous segregation practices						

Table ES2: Recommendations for FSM		Applicable to	Yap Hospital	Chuuk Hospital	Pohnpei Hospital	Kosrae Hospital	FSM Overall
Monitoring & Evaluation Indicators	<ul style="list-style-type: none"> 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, sustainably funded by country						
Recommendation 3: Provide a Sustainable Training Program							
Description	<ul style="list-style-type: none"> Development and delivery of a structured healthcare waste training program to all hospital personnel as well as personnel from other stakeholders (e.g., government health and environment agencies) This could be facilitated/ delivered by SPREP staff, or outside trainers, or a combination of both, as no competent health care waste management training capability exists in FSM Training should be coordinated with other countries’ needs in the region 						
Output	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> Competency Assessments Refresher Training No/very little cross contamination between waste streams demonstrated by waste audits. 						
Costs (\$US)	<ul style="list-style-type: none"> 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							
Description	<ul style="list-style-type: none"> Procurement of a new, high temperature incinerator for Pohnpei Hospital, within existing building that houses the waste treatment system, with maintenance support contract Repair of existing incinerator for Yap Memorial Hospital, to replace fix the upper chamber. Establish maintenance support contract Repair of existing incinerator for Chuuk State Hospital, to replace fix the upper chamber. A stack outlet should also be created for the second incinerator so this incinerator can be used as a back-up. 						
Output	A disposal system that reduces the potential hazard posed by health-care waste, while endeavoring to protect the environment.						
Monitoring &	Assessment of the following should be regularly undertaken for new and existing incinerators:						

Table ES2: Recommendations for FSM		Applicable to	Yap Hospital	Chuuk Hospital	Pohnpei Hospital	Kosrae Hospital	FSM Overall
Evaluation Indicators	<ul style="list-style-type: none"> Operations and construction (e.g. pre-heating and not overloading the incinerator and incinerating at temperatures above 800°C only) Maintenance program – are maintenance issues dealt with promptly? Ensure burn times are sufficient to reduce waste ash volumes 						
Costs (\$US)	<ul style="list-style-type: none"> Establishment – High (approx.. \$50,000 per unit (average) including housing and commissioning costs; Ongoing – medium (fuel and maintenance) 						
Recommendation 5: Procurement of Consumables (PPE)							
Description	<ul style="list-style-type: none"> Supply appropriate PPE including overalls/protective clothing, gloves and eye protection for all waste handlers. Incinerator staff are provided with additional PPE such as face masks and noise protection. 						
Output	Adequate supply of PPE for protection of waste handlers						
Monitoring & Evaluation Indicators	<ul style="list-style-type: none"> PPE is provided to all staff and staff are aware on how to protect themselves from injuries and infectious wastes Zero Needle Stick Injuries. 						
Costs (\$US)	Establishment – Low; Ongoing - Low, sustainably funded by country						
Recommendation 6 Upgrade of Healthcare Waste Storage Area (Before Treatment)							
Description	<ul style="list-style-type: none"> The storage area of healthcare waste before disposal is not locked or adequately signed; it can be accessed by members of the public. 						
Output	<ul style="list-style-type: none"> Storage area is fenced, lockable, suitably designed and isolated from patients and the public. 						
Monitoring & Evaluation Indicators	<ul style="list-style-type: none"> Suitability of storage areas frequently assessed by the ‘responsible officer’ to ensure that it is locked and appropriately signed. 						
Costs (\$US)	<ul style="list-style-type: none"> Establishment – Low (procurement of signage and lock for door and spill kit) Ongoing – Low 						

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

1 Introduction and Background

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

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 the FSM.

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 FSM and includes:

- Collection and collation of data on the current practice(s) used to dispose of hazardous healthcare waste in FSM. 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 FSM, 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 FSM, to address the key issues identified (**section 7**)
- recommendations and prioritization of actions necessary to enable sustainable hazardous healthcare waste management and disposal in the FSM (**section 8**)

2 Healthcare Waste Management in FSM

2.1 National Regulatory Framework

The Federated States of Micronesia are governed by the 1979 constitution which guarantees fundamental human rights and established a separation of governmental powers. The Congress is unicameral and has fourteen members elected by popular vote. Four senators – one from each state, serve four year terms; the remaining ten senators represent single-member districts based on population, and serve two year terms. Prior to 2008, responsibility for solid waste management at the national level was split between the Department of Health & Social Affairs and the Department of Transportation and Infrastructure. The enactment of FSM Public Law 15-19, supplemented by Presidential Order No 1, established the Office of Environment and Emergency Management (OEEM), which now bears responsibility for implementing the FSM Environmental Protection Act at the national level.

Responsibility for medical waste at the national level lies with the Division of Health Services.

A summary of relevant legislation is provided in **Table 1**.

Legislation	Type	Summary	References to Solid/HCW	Regulator/ Agency
Federated States of Micronesia Environmental Protection Act (FSMEPA) 1984	Act	Provides for the protection and enhancement of the environmental quality of the air, land and water of FSM. The Act declares a continuing policy to work in close cooperation with State and municipal governments to <i>"foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social and economic and other requirements of present and future generations"</i>	-	OEEM Environment & Sustainable Development Division
FSM National Solid Waste Strategy	Strategy	A strategic vision and direction for solid waste management over the five year period 2010-2014	<u>Strategy Vision for HCW</u> <i>Develop a national medical waste management strategy, which may be a stand-alone strategy, or which may be ultimately incorporated as an element in the national waste management strategy'</i>	

Kosrae State – Environmental Legislation Summary				
Kosrae State Constitution	Const.	Every person has the right to a healthful, clean and stable environment, while providing for the orderly development and use of natural resources, the state government shall by law protect the states environment, ecology, and natural resources from impairment from the public interest.	-	Kosrae Island Resource Management Authority (KIRMA)
Kosrae State Code	Code	Designates pollution of air, land and water as an offence.	-> Establishes KIRMA with responsibilities for protecting the environment, human welfare and safety, and controlling and preventing pollution of air, land and water -> Designates pollution of air, land and water as an offence	KIRMA
Pollution Regulations 2013	Reg	The purposes of these Regulations is to prohibit the discharge and release of pollutants into air, land and water	<i>‘Solid Waste’ defined as any waste composed of metal, paper, plastic, other synthetic material or any other solid substance deemed unsafe for the health of humans or the environment</i>	KIRMA
Yap State - Environmental Legislation Summary				
Yap State Code 2000	Code	<i>Chapter 15 – Environmental Quality Protection</i> <i>Enforcement Actions will take place if:</i> <i>Waste collection, treatment or disposal facilities of a discharger are approaching capacity, the Agency shall require the discharger to submit for approval by the Agency a detailed time schedule of specific action to be taken by the discharger to prevent a violation of the requirements as to discharges, and the Agency may approve the schedule subject to such modifications as it considers reasonably necessary’</i>		

Chuuk State - Environmental Legislation Summary				
Chuuk State Code 2001 (Draft)	Code	Title 22. Environmental Protection & Preservation	Chuuk State Code 2001 (Draft)	
Pohnpei State - Environmental Legislation Summary				
State Law No 3L-26-92, Pohnpei Environmental Protection Act	Law	Established the Pohnpei Environmental Protection Agency	State Law No 3L-26-92, Pohnpei Environmental Protection Act	Law
Pohnpei State Law No 6L-66-06	Law	Provides for litter abatement and solid waste disposal, shipping container and motor vehicle waste disposal fee, and established Environmental Quality Fund and Litter Reward Fund	Pohnpei State Law No 6L-66-06	Law

2.2 Hospitals Assessed

The Department of Health operates healthcare facilities in FSM, and there are some private hospital and dispensaries located across the outer islands.

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

2.2.1 Yap Memorial Hospital

Yap Memorial Hospital (also known as the Department of Health Services), located in Colonia is the only hospital in Yap and is directly accessible only to those residents who live in Yap. Residents who live on the outer islands find access difficult due to limited transportation. Yap Memorial Hospital has 43 beds. The hospital has an emergency room; outpatient clinics inpatient wards surgical suits, a dental clinic, pharmacy, laboratory, x-ray services, physical therapy services and health administration offices, including data and statistics offices. Yap has 17 outer islands dispensaries, of which two (on Ulithi and Woleai) have been designated 'super dispensaries.'

2.2.2 Chuuk State Hospital

Chuuk State Hospital is the only inpatient facility on the island. The hospital has 140 beds and is staffed by 20 doctors and 80 clinical nurses, and has over 4000 admissions a year. There are also three private clinics in Weno and 80 dispensaries throughout Chuuk with complex healthcare cases referred to Chuuk State Hospital. The hospital has an emergency room, outpatient clinics; inpatient wards surgical suits, a dental clinic, pharmacy, laboratory, x-ray services, physical therapy services and health administration offices. Many of the hospital facilities are deteriorating and lacking in basic supplies and equipment. The interior of the hospital is unsanitary with ants on desks and working areas and unclean walls. There were reports of rats within the wall spaces of the operating theatre.

2.2.3 Pohnpei State Hospital

Pohnpei is a 43 bed hospital with approximately 100 staff. The hospital has an emergency room, outpatient clinic; inpatient wards, a surgical suit, a dental clinic, pharmacy, laboratory, a pediatrics unit, obstetrics was a neonatal and newborn ward and an intensive care unit. Pohnpei State Hospital generates general wastes, healthcare wastes (including pathological waste, infectious waste, sharps and pharmaceutical wastes) and although there are no formal quantification of waste volumes the following has been based on anecdotal evidence and visual quantification.

2.2.4 Kosrae State Hospital

Kosrae State Hospital is located in Tofol, the capital. It is a 45 bed hospital with 100 staff. The hospital has an emergency room, outpatient clinic; inpatient wards, a surgical suit, a dental clinic, pharmacy, laboratory, a pediatrics unit, obstetrics was a neonatal and newborn ward, an intensive care unit and a mental health ward. Kosrae State Hospital generates general wastes, healthcare wastes (including pathological waste, infectious waste, sharps and pharmaceutical wastes) since March 2014 healthcare waste has been weighed prior to incineration however no records were available at the time of the audit, the following quantities are therefore based on anecdotal evidence and visual quantification.

2.2.5 Hospital Statistics

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

Table 2: Hospital Details – FSM				
Hospital/Region	Yap Memorial Hospital, Yap FSM	Chuuk State Hospital Chuuk - FSM	Pohnpei State Hospital Pohnpei - FSM	Kosrae State Hospital Hospital - FSM
Contact Name	Laurence Yug	Mr. Boone Raine	Mrs. Dolori Hadley	Mr Kun Mongkeya
Position	Environmental Health & Safety (EHS) Coordinator	Hospital Administrator	Hospital Administrator	Hospital Administrator
Pop Served	11,000	48,651	34,000	7,600
No. of Beds	43	140	100	45
Annual Average Occupancy Rate (%)	-	-	56	62
OBD's	-	-	20,440	10,184
No. Operations	-	-	-	24
No. of Births	100	-	545	34
Emergency Patients Attended	125	-	10,205	1,609
Out-Patients Attended	-	54,595	25,127	4,857
No. of staff	125	229	242	100
No. of staff per function				
Nursing/ Medical		18 physicians 211 general medical		
Infection Control	1	1	1	1
Dedicated Waste Management – Internal Management	2	0	1	3
Dedicated Waste Management – Treatment Operation		2	1	1
Administration		5	-	-
Other	-	-	-	-

Notes: OBDs = Occupied Bed Days (previous 12 months) – “ - ” = data not provided by the hospital

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 four hospitals in Table 3.

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

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

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

	Hospital Name	Yap Memorial Hospital	Chuuk State Hospital	Pohnpei State Hospital	Kosrae State Hospital								
Generation & Segregation	Dedicated Containers/ Bags	Y	Y - Limited	Y - Limited	Y - Limited								
	Colour Coding	Y	Y – Very Limited	Y - Limited	Y - Limited								
	Sharps segregated & secure	Y	Y - Limited	Y	Y								
	Signage Present	Y – Very Limited	N	Y - Very Limited	Y - Very Limited								
Internal Handling	Degree of manual handling of bags	Medium	High	Medium	Medium								
	Internal Transport Mode	Trolley	Manual	Trolley	Trolley								
	Spill Kit Present	N	N	N	N								
Storage	Dedicated & Appropriate Area	Y	N	Y	Y Very Good – Signage outside storage room indicating HCW present								
	Loading/unloading acceptable	Y	Y	Y	Y								
	Spill Kits Present	N	N	N	N								
	Monitoring & record keeping occurs	Y (Since Jan 2014)	N	N	Y (Anecdotally since March 2014, however no data was available at the time of the audit.)								
Treatment	Treatment per Waste Stream		Tech. Type	Volumes (kg/wk)		Tech. Type	Volumes (kg/wk)		Tech. Type	Volumes (kg/wk)			
	Healthcare Waste	✓	Incinerate (internal)	170*	✓	Incinerate (internal)	560*	✓	Incinerate (internal)	180*	✓	Incinerate (internal)	330*
	Sharps	✓	Incinerate (internal)		✓	Incinerate (internal)		✓	Incinerate (internal)		✓	Incinerate (internal)	
	Pharmaceutical	✓	Incinerate (internal)	NM	✓	Landfill (without treatment)	NM	✓	Incinerate (internal)	NM	✓	Incinerate (internal)	NM
	Cytotoxic	×	NA	NA	×	NA	NA	×	NA	NA	×	NA	NA
	General	✓	Landfill (without treatment)	NM	✓	Landfill (without treatment)	NM	✓	Landfill (without treatment)	NM	✓	Landfill (without treatment)	NM

Table 3: Waste Management Process - Observations

Hospital Name	Yap Memorial Hospital		Chuuk State Hospital		Pohnpei State Hospital		Kosrae State Hospital	
If incinerator present								
Make, Model, Year commissioned	Shenandoah FireLake A200X Commissioned: 2011		YD-50 (CLOVER) Commissioned: 2012		UHT (300) II Commissioned: 2009		PyroStar NU-100B Commissioned: 2014	
Operating Temp (°C)	870		800 - 1000		Not known		800 +	
No. chambers	2		2		1		1	
Condition	Average		Poor - Reasonable		Poor		V. Good - New	
Comments	Upper chamber often fails High amount of solid, unburnt material in the remnant ash material. Often get complaints from hospital staff/patients and near-by residents. Use twice a week only (Monday – Thursday) but dependant on number of operations performed.		Upper chamber often fails High amount of solid, unburnt material in the remnant ash material. Waiting for a new part to repair upper chamber. Often get complaints from hospital staff/patients and near-by residents. Used approx. 3 times every day. A second incinerator is present at the hospital, donated by JICA in 2010 – has never been used as there is no outlet for exhaust stack.		Incinerator has stopped functioning so using wood as a fuel source. A second incinerator is located at the hospital but is not functioning at all. Details about this incinerator were not available.		Commissioned in March 2014, donated by JICA.	
Operational statistics	Per week	Per year	Per week	Per year	Per week	Per year	Per week	Per year
Waste Throughput (kg)	172**	9632**	560**	31360**	400**	22400**	180**	10080**
Operating Hours (hr)	2	2 (including cooling time)	2	1				
Fuel	Diesel		Diesel		Wood		Kerosene	

Hospital Name	Yap Memorial Hospital	Chuuk State Hospital	Pohnpei State Hospital	Kosrae State Hospital
				A 120W solar panel is also mounted to the roof however not connected.
Fuel use (kg/litres)	1kg/0.3L	10kg/hour	NA	Not known
Fuel use per kg waste burnt	121 L/ week	208 L / week	NA	30 L/ week
Technology siting and operation issues	Poor	Poor	Reasonable	Good
Offsite transport assessment	Good	Goog	Good	Good

- a. **Quantities provided appear to be incorrect and overinflated a correction factor applied to healthcare waste quantities at approximately 4kg/person based on long-term weighed and audited regional averages (Lautoka Hospital, Fiji & Suva Hospital, Fiji)
- b. NA = Not Applicable
- c. NM = Not Measured
- d. ~ = estimation based on estimates of weekly bin loads

3.1 Yap Memorial Hospital

3.1.1 Wastestreams, Treatment Constraints and Costs

Yap Memorial Hospital general waste and healthcare wastes (including, infectious waste, sharps and pharmaceutical wastes) in the approximate quantities described in Table 3. They do not generate cytotoxic waste. They have an incinerator that was donated by the Japanese International Cooperation Agency (JICA) in 2011. The incinerator has been operating reasonably however, the upper chamber offer fails resulting in smoke emissions.

Hospital personnel estimate average waste management expenditure at \$ US 204/ week for diesel and transportation costs.

3.1.2 Waste Management and Infection Control Framework

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

- There is no waste management policy, plan or formalised waste management procedure. The Environmental Health & Safety officer oversees waste management and a maintenance team is responsible for waste disposal.
- There is an infection control policy but it does not include waste management procedures. This was not sighted at the time of the audit.
- There is no formal waste auditing or inspections.

3.1.3 Training

Yap Memorial Hospital does not have a formal training program in place that covers infection control, waste segregation, incinerator (or other treatment infrastructure) operation or any other topic related to healthcare waste management.

There were no records of historical training sessions having taken place. Anecdotally, waste management training is communicated informally upon new staff employment at a hospital.

3.2 Chuuk State Hospital

3.2.1 Wastestreams, Treatment Constraints and Costs

Chuuk State Hospital generates general waste and healthcare wastes (including, infectious waste, sharps and pharmaceutical wastes) in the approximate quantities described in Table 3. There are currently two incinerators at the Chuuk State Hospital. Only one of them is utilised, it operates sufficiently however requires maintenance. The second incinerator was donated in 2010 by JICA but reportedly has never been used.

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

3.2.2 Waste Management and Infection Control Framework

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

- There is no waste management policy, plan or formalised waste management procedure. There is no dedicated person who oversees waste management and disposal.
- There is no documented infection control policy.
- There is no formal waste auditing or inspections.

3.2.3 Training

Chuuk State Hospital does not have a formal training program in place that covers infection control, waste segregation, incinerator (or other treatment infrastructure) operation or any other topic related to healthcare waste management. There were no records of historical training sessions having taken place. Anecdotally, waste management training is communicated informally upon new staff employment at a hospital.

3.3 Pohnpei State Hospital

3.3.1 Wastestreams, Treatment Constraints and Costs

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

The incinerator has stopped functioning so wood is used as a fuel source in the chamber. A second broken down incinerator is also located at the Pohnpei State Hospital. No costs information was obtained; since waste disposal costs are internally borne by the hospital it is not directly measured.

3.3.2 Waste Management and Infection Control Framework

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

- There is no waste management policy, plan or formalised waste management procedure. The Health Administrator oversees waste management and a maintenance manager is responsible for day-to-day waste disposal and operation of the incinerator waste disposal.
- There is an infection control manual which was sighted at the time of the audit; it does not include waste management procedures.
- Waste audits (visual observations of segregation only) are undertaken as part of a fortnightly Quality Assurance (QA) audit by the Quality Assurance Officer, no documented records were available at the time of the audit.

3.3.3 Training

Pohnpei State Hospital does not have a formal training program in place that covers infection control, waste segregation, incinerator (or other treatment infrastructure) operation or any other topic related to healthcare waste management.

There were no records of historical training sessions having taken place. Anecdotally, waste management training is communicated informally upon new staff employment at a hospital.

3.4 Kosrae State Hospital

3.4.1 Wastestreams, Treatment Constraints and Costs

Kosrae State Hospital generates general waste and healthcare wastes (including, infectious waste, sharps and pharmaceutical wastes) in the approximate quantities described in Table 3. Kosrae State Hospital operates an incinerator donated by JICA in March 2014.

According to Hospital Administration internal waste management and treatment costs amount to approximately \$ US 10,000/ year.

3.4.2 Waste Management and Infection Control Framework

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

- There is no waste management policy, plan or formalised waste management. The Environmental Health Officer oversees waste management with his team (3 people) and responsible for waste disposal and maintenance of the incinerator.
- There is an infection control manual (sighted at the time of the audit but it does not include waste management procedures.
- Waste audits are carried out monthly and focus on storage and correct segregation by the QA officer or the Environmental Health Officer. Recommendations and actions are circulated electronically in the form of a report to all hospital staff. There was no evidence of actions being followed up.

3.4.3 Training

Kosrae State Hospital does not have a formal training program in place that covers infection control, waste segregation, incinerator (or other treatment infrastructure) operation or any other topic related to healthcare waste management.

There were no records of historical training sessions having taken place. Anecdotally, waste management training is communicated informally upon new staff employment at a hospital.

The current Environmental Health Office; Norlin Livaie, undertook healthcare waste management training facilitated by JICA. The training involved proper healthcare waste segregation, separation, safe disposal and how to carry out a waste audit. The training was conducted in 2011.

4 Key Healthcare Waste Management Issues in FSM

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

Table 5 highlights the key areas of concern, both per hospital, and in terms of health services delivery across FSM hospitals, as part of this assessment.

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

Table 5: HEALTHCARE WASTE – KEY ISSUES FOR FSM

Scale	Category	Item	Minimum Standard Criterion	YAP	CHUUK	POHNPEI	KOSRAE	FSM - Overall
Health care 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					
Health care 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)					
Health care Facility	Signage		Signs are located in all wards/department areas where waste bins are located indicating the correct container for the various waste types					
Health care Facility	Segregation		Waste are correctly segregated in all wards/departments with use of containers that are colour coded for the different waste types					
Health care Facility	Containers		All areas have dedicated waste containers are suitable for the types of waste generated. All waste containers are colour coded and have correct wording on them. Sharps are deposited into containers that reduce potential for needle-stick injury					
Health care Facility	Storage	Storage before treatment	Meets the stated standards					
Health care Facility	Training	Planning and implementation	A structured waste management education program has been developed with a clear delivery structure					
Health care 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.					
Health care 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.					
Health care 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.					
Health care 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.					

4.1.1 Yap Memorial Hospital – Key Issues

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

- There is very limited signage, but there was good segregation at Yap Memorial Hospital with red bags used in most instances and some red bins used throughout for non-sharps healthcare waste (**Photo 1**). Sharps segregation is also good, with dedicated red sharps containers used throughout the hospital. (**Photo 2**).

- There is no documented waste management planning system in place.
- There is no structured training or waste segregation auditing program in place.
- No PPE such as gloves, protective clothing, eye protection or covered footwear was observed for waste management staff and spill control kits were not observed anywhere throughout the facility.
- The incineration requires maintenance. According to the Environmental Health and Safety Officer, the upper chamber often 'fails' emitting thick, black smoke (**Photo 3**) resulting in frequent complaints from neighboring residents and hospital staff.

4.1.2 Chuuk State Hospital – Key Issues

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

- There is no signage and poor segregation – only sharps are separated into sharps containers (in most cases plastic bottles). Healthcare waste and general waste was often combined in the same bins with red bin liners only used in some instances (**Photo 4**)
- There is no 'responsible person' who looks after managing of healthcare waste at the hospital.
- There is no structured training or waste segregation auditing program in place.
- No PPE such as gloves, protective clothing, eye protection or covered footwear was observed for waste management staff and spill control kits were not observed anywhere throughout the facility.
- The incineration requires maintenance. According to the Incinerator Operator, the upper chamber needs repair and has been emitting thick, black smoke. Visual observation of the ash indicates that incinerated material isn't fully combusted. There is a high degree of unburnt solids and sharps in the remnant ash material. (**Photo 5**).
- A second incinerator is at the hospital and was donated by JICA in 2010. According to maintenance personnel the second incinerator has not been used as there is no stack exhaust point in the incinerator's housing structure (**Photo 6 & Photo 7**).

4.1.3 Pohnpei State Hospital – Key Issues

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

- There is very limited signage, where it is present it has been hand written. Segregation is poor with red bags used in some instances for non-sharps healthcare waste (**Photo 8**). Sharps segregation was good, with a combination of dedicated red sharps containers and disposable containers used throughout (**Photo 9**).
- The existing incinerator has failed and wood is now used as a fuel source to burn healthcare waste in the chamber. There is a high degree of unburnt solids and sharps in the remnant ash material (**Photo 10 & Photo 11**)

- There is no documented waste management planning system in place.
- There is no structured training.
- No PPE such as gloves, protective clothing, eye protection or covered footwear was observed for waste management staff and spill control kits were not observed anywhere.

4.1.4 Kosrae State Hospital – Key Issues

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

- There is very limited signage, where it is present it has been hand written. Segregation is generally good; however dedicated red containers and red bags are only used in some instances. Sharps segregation is also good, with dedicated red sharps containers used throughout the hospital (**Photo 12**).
- Historically, ash was dumped adjacent to the incinerator site, the ash is exposed and there is a high degree of unburnt solids and sharps in the remnant ash material (**Photo 13**).
- There is no documented waste management planning system in place.
- There is no structured training program in place.
- Spill control kits were not observed anywhere.

5 Consultation

Apart from hospital staff across all four hospitals, discussions were also held with a representative from the Directors of Health in each state who were supportive of the project and provided high level information on the hospital including medium and long term projections for the hospital.

A representative from the Office of Environment and Emergency Management (Sustainable Development Planner Division of Environment and Sustainable Development) Ms. Patricia Pedrus was the PacWaste Focal Point; she was supportive of the project and the need for sustainable healthcare management for FSM. Ms. Pedrus was extremely helpful in arranging all meetings at the four hospitals, as well as the collection of operational statistics and information from each.

6 Contractor Roles and Capacity

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

All States across FSM, nominated the Japanese International Cooperation Agency (JICA) as having provided either technical or material support with all healthcare waste incineration systems donated by JICA. In Kosrae, the Environmental Health Officer, Norlin Livaie, undertook healthcare waste management training facilitated by JICA. The training involved proper healthcare waste segregation, separation, safe disposal and how to carry out a waste audit.

7 Analysis of Options for Sustainable Healthcare Waste Management in FSM

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

Table 6 categorizes these key issues (A – G) against potential options that could be adopted to tackle them, as a collated list of high-level responses.

Key Issue Category	Key Issue	Options to address the issue
A. Waste Management Framework	There is no documented waste management planning system in place and limited evidence of waste management committees.	Establish a waste management framework including: <ul style="list-style-type: none"> • 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	Segregation and containment practices are generally below minimum standard in that: <ul style="list-style-type: none"> • There is virtually no signage present • There is room for improvement in segregation practices in all hospitals. • Segregation is particularly poor in Chuuk. 	Improve segregation practices by: <ul style="list-style-type: none"> • Supply of colour-coded waste bins and plastic liners in quantities sufficient to serve all wards/departments for a period of time sufficient to allow bedding down of the segregation process. • Supply of small number of colour-coded wheelie bins (where required) per hospital to act as both in-ward/department storage and internal transport trolleys. • Supply of signage to explain the colour-coded segregation system as well as posters to promote it.
C. Training & Audit	There is no structured training program in place.	Development and delivery of a structured healthcare waste training program to all hospital personnel as well as personnel from other stakeholders (e.g., government health and environment agencies). This could be facilitated/ delivered by: <ol style="list-style-type: none"> 1. SPREP staff, or 2. International technical training providers (or a combination of both), - as no competent healthcare waste management training capability exists in FSM
D. Treatment	The method for treatment of healthcare waste is typically <u>not</u> in accord with required standards in Pohnpei. Incinerators in Chuuk and Yap are in need of maintenance to operate efficiently.	Treatment using one (or a combination) of the following for each hospital: <ol style="list-style-type: none"> 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

Table 6: Options for Sustainable Healthcare Waste Management in FSM		
Key Issue Category	Key Issue	Options to address the issue
		7. Encapsulation 8. Landfill (without disinfection) 9. Onsite burial 10. Shredding
E. Occupational Health and Safety	Waste handlers regularly do not use appropriate PPE including overalls /protective clothing, gloves and eye protection. Spill control kits were not observed anywhere.	Procurement of Consumables (PPE): <ul style="list-style-type: none"> • Supply spill kits and appropriate PPE including overalls/protective clothing, gloves and eye protection for all waste handlers. • Incinerator staff are provided with additional PPE such as face masks and noise protection.
F. Responsible Person	There is no one person who has accountability of healthcare waste management at the hospital through a clearly defined role. <ul style="list-style-type: none"> • Chuuk Only 	Appoint a responsible officer and defined their role and key accountabilities for the management of healthcare waste at the hospital
G. Suitable Storage	Storage before treatment area is not locked, signed or fenced. <ul style="list-style-type: none"> • Chuuk Only 	Upgrade storage before disposal area to prevent access to the public and procure spill kits for the storage area

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 and F in Table 6)
- The waste management process, from generation to transport up to the treatment location (B and G in Table 6)
- Training systems for sustainable healthcare waste management (C in Table 6)
- OHS related protection for waste handlers (E in Table 6)

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 FSM's Stage 2 assessment:

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

¹ As defined in *Management of Solid Health-Care Waste at Primary Health-Care Centres - A Decision-Making Guide*, WHO (2005)

7.2.1 Waste Treatment Systems Relevant for FSM

The Stage 2 local feasibility assessment (for FSM) took these first four² 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 FSM 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 FSM context are ranked in order of preference in Table 7:

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°C)	1	5	4	4	4	4	3	3	3	3	34	1
Incineration at med. temperature (800 - 1000°C)	4	4	3	3	2	4	4	2	2	4	32	2
Low temperature burning (<400°C)	5	3	1	2	1	3	5	1	5	5	31	3
Autoclave with shredder	2	4	4	3	5	2	2	3	2	2	29	4

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 7'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.

² 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.

- **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 a borderline practice which can only be acceptable in the short term, in low population density environments, to remedy current unacceptable practices.
- **Autoclaving** is an acceptable disinfection practice where units with shredder are affordable and locked in supplier maintenance and training contracts are in place and increased complexity of machinery.

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

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

Since FSM does not currently generate cytotoxic wastes, limitations regarding these wastes are not particularly relevant for healthcare waste treatment choices in FSM.

7.3 Treatment Investment Options for individual FSM Hospitals

Wastes should be treated and disposed of accordingly to ensure the infectious hazard is destroyed. Three of the four hospitals audited require some investment in either replacement or maintenance of infrastructure to achieve this as described by their respective treatment weaknesses in sections 4.1.1 – 4.1.4.

Treatment choices from Table 7 have been applied to Pohnpei only, as described in Table 8 below. This is because incinerators existing in Yap and Chuuk require maintenance only and a new incinerator was donated to the Kosrae State Hospital by JICA in March 2014 and is operating efficiently. Shading in green indicates where investment is proposed for Pohnpei.

Table 8: Technology Options Applicable for Pohnpei	
Remaining Technology Options	Technology Applicability
Pohnpei	
Disinfection & Encapsulation (only sharps assessed)	A short term solution before a new incinerator is procured. Disinfected sharps should be placed within high-density plastic containers or metal drums and when full an immobilising material such as plastic foam, sand, cement or clay is added and could then be disposed of at the Pohnpei Landfill.
Incineration at high temperature (>1000°C)	Healthcare waste volumes at Pohnpei appear to be underestimated therefore quantities were recalculated based of regional averages. Adjusting healthcare waste generation to approximately 400kg/ week, this would be sufficient to consider a small high temperature incinerator. <ul style="list-style-type: none"> Procure a new incinerator – a MediBurn 30 model has a manufacturer’s claimed throughput of 200 kg/day of healthcare waste. At an estimated rate of 400 kg healthcare waste per week (10% of which is sharps) this unit is theoretically large enough.
Incineration at med. temperature (800 - 1000°C)	Not applicable to Pohnpei as it is large enough to justify a better perfoFSMng larger option that runs at a higher temperature.
Autoclave with shredder	Not applicable to Pohnpei on the grounds of waste volume justification, cost, complexity and ease of operation.
Low temperature burning (<400°C)	Not applicable to Pohnpei as it has sufficient waste volumes to justify a better perfoFSMng disinfection technology choice.

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

Table 9 provides a summary of the recommendations for FSM. 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 six recommendations, they are all high, based on the deficiencies addressed against the minimum standards framework. They are also highly inter-related, for example: segregation practices cannot be sustainably improved without the requirements and responsibility of the waste management framework; which in turn cannot be turned into active policies and procedures without the understanding and reinforcement that comes from training. Effective treatment and use of PPE cannot be sustained without the reinforcement of training, effective segregation and the procedures and monitoring spelled out in the waste management framework.

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

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

Table 9: Recommendations for FSM		Applicable to	Yap Hospital	Chuuk Hospital	Pohnpei Hospital	Kosrae Hospital	FSM Overall
Recommendation 1: Develop a Waste Management Framework							
Description	<ul style="list-style-type: none"> • A <i>Healthcare Waste Management Plan</i>, specific to each healthcare facility • Appoint an <i>officer responsible</i> for the development and implementation of the Healthcare Waste Management Plan (likely to be a more senior person than the one nominated in response to recommendation 6) • A <i>waste management committee</i>, appropriate to the scale of each facility. 						
Output	<ul style="list-style-type: none"> • An agreed <i>Healthcare Waste Management Plan</i>, 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	<ul style="list-style-type: none"> • Plan approved by Department of Health (all facilities) • Approved budget for implementation of Healthcare Waste Management Plan • The Plan should be regularly monitored, reviewed, revised and updated. • Annual assessment of 'Responsible Officer's' or Waste Management Committees' performance against key healthcare waste management competencies. 						
Costs (\$US)	<ul style="list-style-type: none"> • Establishment – Low, if existing systems (such as those for Fiji) are used as a starting points and document drafting assistance is provided • Ongoing – Low 						
Recommendation 2: Procurement of Consumables (Segregation)							
Description	<ul style="list-style-type: none"> • Supply of colour-coded waste bins and plastic liners in quantities sufficient to serve all wards/departments for a period of time sufficient to allow bedding down of the segregation process. • Supply of small number of colour-coded wheelie bins (where required) per hospital to act as both in-ward/department storage and internal transport trolleys. • Supply of signage to explain the colour-coded segregation system as well as posters to promote it. 						
Output	Adequate supply of consumables to bed down more rigorous segregation practices						
Monitoring & Evaluation Indicators	<ul style="list-style-type: none"> • 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. 						

Table 9: Recommendations for FSM		Applicable to	Yap Hospital	Chuuk Hospital	Pohnpei Hospital	Kosrae Hospital	FSM Overall
Costs (\$US)	Establishment – Low; Ongoing - Low, sustainably funded by country						
Recommendation 3: Provide a Sustainable Training Program							
Description	<ul style="list-style-type: none"> Development and delivery of a structured healthcare waste training program to all hospital personnel as well as personnel from other stakeholders (e.g., government health and environment agencies) This could be facilitated/ delivered by SPREP staff, or outside trainers, or a combination of both, as no competent health care waste management training capability exists in FSM Training should be coordinated with other countries' needs in the region 						
Output	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> Competency Assessments Refresher Training No/very little cross contamination between waste streams demonstrated by waste audits. 						
Costs (\$US)	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> Procurement of a new, high temperature incinerator for Pohnpei Hospital, within existing building that houses the waste treatment system, with maintenance support contract Repair of existing incinerator for Yap Memorial Hospital, to replace fix the upper chamber. Establish maintenance support contract Repair of existing incinerator for Chuuk State Hospital, to replace fix the upper chamber. A stack outlet should also be created for the second incinerator so this incinerator can be used as a back-up. 						
Output	A disposal system that reduces the potential hazard posed by health-care waste, while endeavoring to protect the environment.						
Monitoring & Evaluation Indicators	<p>Assessment of the following should be regularly undertaken for new and existing incinerators:</p> <ul style="list-style-type: none"> Operations and construction (e.g. pre-heating and not overloading the incinerator and incinerating at temperatures above 800°C only) Maintenance program – are maintenance issues dealt with promptly? Ensure burn times are sufficient to reduce waste ash volumes 						

Table 9: Recommendations for FSM		Applicable to	Yap Hospital	Chuuk Hospital	Pohnpei Hospital	Kosrae Hospital	FSM Overall
Costs (\$US)	<ul style="list-style-type: none"> Establishment – High (approx.. \$50,000 per unit (average) including housing and commissioning costs; Ongoing – medium (fuel and maintenance) 						
Recommendation 5: Procurement of Consumables (PPE)							
Description	<ul style="list-style-type: none"> Supply appropriate PPE including overalls/protective clothing, gloves and eye protection for all waste handlers. Incinerator staff are provided with additional PPE such as face masks and noise protection. 						
Output	Adequate supply of PPE for protection of waste handlers						
Monitoring & Evaluation Indicators	<ul style="list-style-type: none"> PPE is provided to all staff and staff are aware on how to protect themselves from injuries and infectious wastes Zero Needle Stick Injuries. 						
Costs (\$US)	Establishment – Low; Ongoing - Low, sustainably funded by country						
Recommendation 6 Upgrade of Healthcare Waste Storage Area (Before Treatment)							
Description	<ul style="list-style-type: none"> The storage area of healthcare waste before disposal is not locked or adequately signed; it can be accessed by members of the public. 						
Output	<ul style="list-style-type: none"> Storage area is fenced, lockable, suitably designed and isolated from patients and the public. 						
Monitoring & Evaluation Indicators	<ul style="list-style-type: none"> Suitability of storage areas frequently assessed by the ‘responsible officer’ to ensure that it is locked and appropriately signed. 						
Costs (\$US)	<ul style="list-style-type: none"> Establishment – Low (procurement of signage and lock for door and spill kit) Ongoing – Low 						

8.1 Implementation Priorities

8.1.1 Recommendation 1: Develop a Waste Management Framework

1. Develop a **Healthcare Waste Management Plan** specific to each hospital, including technical guidelines and procedures relating to waste management and if not already present, infection control.
2. Appoint an **officer responsible** for the development and implementation of the Healthcare Waste Management Plan
3. Establish a **waste management committee**, appropriate to the scale of the facility.

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

The Management Plan should be developed in accordance with 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)

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

8.1.1.2 Medium Term (6 months-1 year)

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

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

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

8.1.1.3 Long Term (1year-3 years)

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

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

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

8.1.2.1 Short Term (0-6 months)

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

8.1.2.2 Medium Term (6 months-1 year)

As per short term above.

8.1.2.3 Long Term (1-3 years)

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

8.1.3 Recommendation 3: Provide a Sustainable Training Program

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

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

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 (1year-3 years)

- Continually improve the mandatory standards of health-care 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

Wastes should be treated and disposed of accordingly to ensure the infectious hazard is destroyed. All four hospitals in FSM require some investment in either replacement or maintenance of infrastructure:

Pohnpei Hospital - Procurement of a new incinerator and encapsulation of unburnt sharps. (high priority)

Yap Memorial - Repair of existing incinerator to fix the upper chamber (high priority).

Chuuk Hospital - Repair of existing incinerator to fix the upper chamber (high priority).
Provide maintenance support to construct stack outlet for second incinerator (medium priority)

Kosrae – No infrastructure required

8.1.4.1 Pohnpei State Hospital

(a) Short Term (0-6 months)

The existing wood-fueled has insufficient capacity to treat all healthcare waste. It is recommended to:

- A low cost, short term option for sharps could involve concrete encapsulation of disinfected sharps in a metal drum. The drum could then be buried at the Pohnpei Landfill.
- *Start process of procurement of a new incinerator* – a MediBurn 30 model has a manufacturer's claimed throughput of 200 kg/day of healthcare waste. At Pohnpei Hospital estimated rate of 400 kg healthcare waste per week (approx.10% of which is sharps) this unit is theoretically large enough.

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

- Dispose of ash at Dekehtik Landfill.

(c) Long Term (1-3 years)

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

8.1.4.2 Yap Memorial Hospital

(a) Short Term (0-6 months)

- Repair existing incinerator to fix the upper chamber (high priority)

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

- Procure supplier support and maintenance contract, possibly packaged together with other incinerator purchases, even if the incinerator make and model is different to those procured elsewhere.

(c) Long Term (1-3 years)

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

8.1.4.3 Chuuk State Hospital

(a) Short Term (0-6 months)

- Repair existing incinerator to fix the upper chamber (high priority)

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

- Procure supplier support and maintenance contract, possibly packaged together with other incinerator purchases, even if the incinerator make and model is different to those procured elsewhere.

(c) Long Term (1-3 years)

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

8.1.5 Recommendation 5: Procurement of Consumables (PPE)

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

8.1.5.1 Short Term (0-6 months)

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

8.1.5.2 Medium Term (6 months-1 year)

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

8.1.5.3 Long Term (1-3 years)

Nil.

8.1.6 Recommendation 6: Upgrade Storage Facility (Chuuk)

The healthcare waste storage area should be locked, and isolated from patients and the public.

8.1.6.1 Short Term (0-6 months)

- Upgrade the storage area to include appropriate signage, fencing and a lockable door.

8.1.6.2 Medium Term (6 months-1 year)

- Procure a spill containment kit for the storage area.

8.1.6.3 Long Term (1-3 years)

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

Appendix A

Photo Log



Photo 1: Example of healthcare waste disposal at Yap Memorial Hospital. Red bag used throughout, no signage present. (taken 1/04/2014 by Natalie Stella ref:DSC0063)



Photo 2: Type of sharps container used at Yap Memorial Hospital. (taken 1/04/2014 by Natalie Stella ref:DSC0068)



Photo 3: Incinerator used at Yap Memorial Hospital (taken 1/04/2014 by Natalie Stella ref:DSC0101)

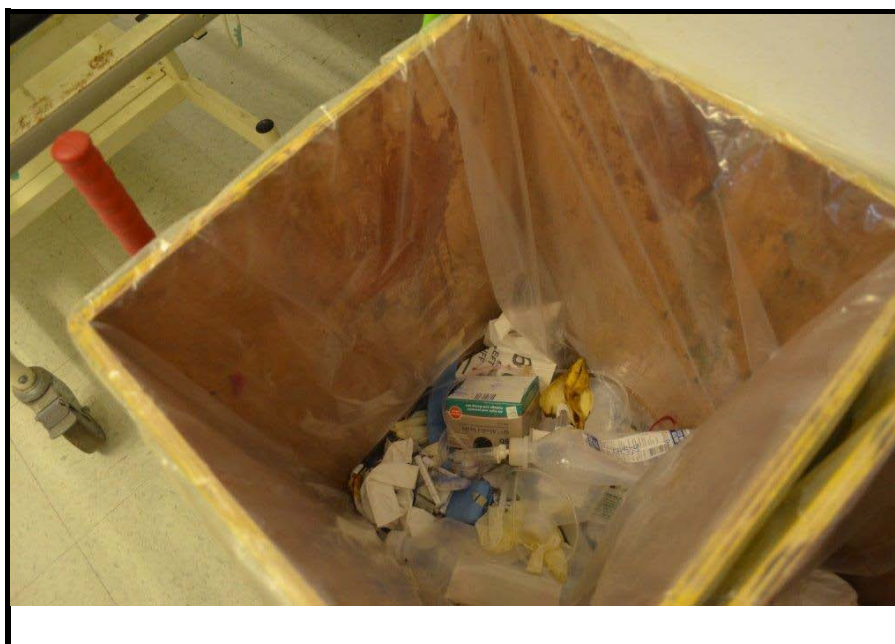


Photo 4: Example of healthcare waste disposal at Chuuk General Hospital, healthcare waste mixed with normal waste (taken 4/04/2014 by Natalie Stella ref:DSC03918)



Photo 5: Solids and unburnt sharps in ash material from the Chuuk incinerator (taken 4/04/2014 by Natalie Stella ref:DSC03909)



Photo 6: Second incinerator donated by JICA in 2010 at Chuuk Hospital – not used. (taken 4/04/2014 by Natalie Stella ref:DSC00135)



Photo 7: Second incinerator visible in photo no outlet for stack exhaust (taken 4/04/2014 by Natalie Stella ref:DSC0139)



Photo 8: Example of healthcare waste disposal at Pohnpei State Hospital. Red bag seldom used, signage rarely present. (taken 7/04/2014 by Natalie Stella ref:DSC0063)



Photo 9: Type of sharps container used at Pohnpei State Hospital. (taken 07/04/2014 by Natalie Stella ref:DSC0068)



Photo 10: Incinerator used at Pohnpei State Hospital – wood used as a fuel source. (taken 7/04/2014 by Natalie Stella ref:DSC0101)



Photo 11: Unburnt solids and sharps in the remnant ash material at Pohnpei State Hospital (taken 07/04/2014 by Natalie Stella ref: DSC0345)



Photo 12: Example of healthcare waste disposal at Kosrae Hospital, signage is limited however where it is present in is handwritten. Dedicated red containers used in some instances. (taken 8/04/2014 by Natalie Stella ref:DSC0413)



Photo 13: Example of healthcare waste disposal at Kosrae State Hospital – moderate level of cross contamination observed.
(taken 8/04/2014 by Natalie Stella ref:DSC0412)



Photo 14: Exposed, dumped ash material from old incinerator at Kosrae State Hospital (taken 8/04/2014 by Natalie Stella ref:DSC0455)

Appendix B

Collected Data from Hospital Audits in FSM

Region		Yap		Chuuk		Pohnpei		Kosrae	
Facility Name & Contact Information	Hospital Name	<u>Yap General Hospital</u>		<u>Chuuk General Hospital</u>		Pohnpei General Hospital		Kosrae General Hospital	
	Contact Name & Position	Laurence Yug EHS Coordinator		Mr Boone Raine Hospital Administrator		Mrs. Dolori Hadley Hospital Administrator		Mr. Kun Mongkeya Administrator,, Div. of Administrative Services	
	Email	lyug@fsmhealth.fm		brain@fsmhealth.fm		dhadley@fsmhealth.fm		kkilafwa@fsmhealth.fm	
	Phone	(691) 350-4274							
Key Services Data	Summary of Services Provided	Emergency, patient care, outpatients, pharmacy, laboratory, dental, maternal, paediatrics		Emergency, patient care, outpatients, pharmacy, laboratory, dental, maternal, paediatrics		Emergency, patient care, outpatients, pharmacy, laboratory, dental, maternal, paediatrics		Emergency, patient care, outpatients, pharmacy, laboratory, dental, maternal, paediatrics	
	Pop Served	11,000		48,651		34000		7,600	
	No. of Beds	43		140		100		45	
	OBD's ¹	-		-		56		62	
	No. Operations	-		-		-		24	
	No. of Births ²	100		-		545		24	
	Emergency Patients Attended ²	125		-		10205		34	
	Out-Patients Attended ²	-		54,595		25127		4,857	
No of Staff	125		229		242		100		
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)
	Healthcare Waste	680 Correction:172**	\$ 204.60	1850 Correction:560**	\$ 340.00	(180)	no data provided	330 Correction:180**	180****
	Sharps					Correction:400**	no data provided		
	Pharmaceutical					-		-	
	Cytotoxic	none produced		none produced		none produced		none produced	
	General	no data provided		no data provided		no data provided		no data provided	
	Recycling	no data provided		no data provided		no data provided		no data provided	
	TOTAL	680	\$ 204.60	1850	\$340.00	0	\$ -	0	\$ -
Generation &	Dedicated Containers/ Bags	Y		Y - Very Limited		Y - Limited		Y - Limited	

Segregation	Colour Coding	Y		Y - Limited		Y - Limited		Y - Limited	
	Sharps segregated & secure	Y		Y-Limited		Y		Y	
	Signage Present	Y - Limited		N		Y - Limited		Y - Limited	
Internal Handling	Degree of manual handling of bags	High		High		High		High	
	Internal Transport Mode	Trolley		Manual		Trolley		Trolley	
	Spill Kit Present	N		N		N		N	
Storage	Dedicated & Appropriate Area	Y		N		Y		Y	
	Loading/unloading acceptable	Y		Y		Y		Y	
	Spill Kits Present	N		N		N		N	
	Monitoring & record keeping occurs	Y		N		N		Y	
Treatment	Treatment per Waste Stream	Tech. Type	Int/Ext	Tech. Type	Int/Ext	Tech. Type	Int/Ext	Tech. Type	Int/Ext
	Healthcare Waste	Incinerate (internal)	Internal	Incinerate (internal)	Internal	Incinerate (internal)	Internal	Incinerate (internal)	Internal
	Sharps	Incinerate (internal)	Internal	Incinerate (internal)	Internal	Incinerate (internal)	Internal	Incinerate (internal)	Internal
	Pharmaceutical	NA	NA	NA	NA	NA	NA	NA	NA
	Cytotoxic	NA	NA	NA	NA	NA	NA	NA	NA
	General	Landfill (without treatment)	External	Landfill (without treatment)	External	Landfill (without treatment)	External	Landfill (without treatment)	External
	If incinerator present								
	Make, Model, Year commissioned	Shenandoah FireLake A200X Commissioned: 2011		YD-50 (CLOVER) Commissioned: 2012		UHT (300) II: Commissioned: 2009		PyroStar NU-100B Commissioned 2014	
	Operating Temp (°C)	870		800 - 1000		not known		800	
	No. chambers	2		2		1		1	
	Condition	Reasonable		Reasonable		Poor		New	
	Comments	Upper chamber often fails Ash material looks in incompletely		Upper chamber often fails		Incinerator has stopped functioning so using wood as a fuel source		Commissioned in March 2014, donated by JICA	

		combusted. JICA donated incinerator. JICA used to monitor the incinerator periodically, after donation.						
Comments	Complaints from neighbouring residents		Frequent complaints about smell/smoke from patients and hospital staff		Complaints from neighbouring residents			
	Per week	Per year	Per week	Per year	Per week	Per year	Per week	Per year
Waste Throughput (kg)	680 172**	38080 9632**	1850 560**	103600 31360**	180 400**	77400 22400**	330 180**	18480 10080**
Operating Hours (hr)	2		2-5 hours/feed (incl cooling time)		2		1	
Fuel	Diesel		Diesel		Wood		Kerosene	
Fuel use (kg/litres)	1kg/0.3L *		10kg/hour		-			
Fuel use per kg waste burnt	121 L/week		208L/ week		-			
Technology siting and operation issues	Often get complaints from hospital staff/patients and near-by residents. Use twice a week only		Used three times a day to capacity		wood-fired, single-chamber incinerator donated by the Government of Japan in 2009. This incinerator is operated by hospital staff, once or twice per week on a 2-hour cycle. The resulting ash is then taken to the Dekehtik dumpsite. Prior to this incinerator, medical waste was often burnt at the dumpsite under controlled conditions.		Issues with old incinerator but no smoke emissions with this incinerator so far.	
Offsite transport assessment	Good		Poor		Good		Good	
Waste Management Documents	Waste Management Policy	N	N		N		N	
	Waste Management Plan	N	N		N		N	
	Waste Management Procedure	N	N		N		N	
	Waste Management Committee	N	N		N		Y - Limited	
Infection Control	Infection Control Policy	Y	N		Y		Y	
	Infection Control Procedures	Y	N		Y		Y	

Auditing and Record Keeping	Audit Program	N		N		Y - Limited		Y	
	What is audited	Segregation	NA	Segregation	NA	Segregation	NA	Segregation	Y
		Compliance P&P	NA	Compliance P&P	NA	Compliance P&P	NA	Compliance P&P	Y
		Int. transport	NA	Int. transport	NA	Int. transport	NA	Int. transport	N
		Storage	NA	Storage	NA	Storage	NA	Storage	Y
		Treatment/ disposal	NA	Treatment/ disposal	NA	Treatment/ disposal	NA	Treatment/ disposal	N
Frequency	NA		NA		Fortnightly - no records		Monthly – records sighted from 2010		
Training	Training Program	N		No training in approx. 2 years		N		N	
	Curricula	Infection Control	NA	Infection Control	NA	Infection Control	NA	Infection Control	NA
		Waste Mgt	NA	Waste Mgt	NA	Waste Mgt	NA	Waste Mgt	NA
		PPE	NA	PPE	NA	PPE	NA	PPE	NA
		Treat. Tech operation	NA	Treat. Tech operation	NA	Treat. Tech operation	NA	Treat. Tech operation	NA
	Duration / frequency of training	NA		NA		NA		NA	
	Records of who has been trained	NA		NA		NA		NA	
Monitoring or refresher courses	NA		NA		NA		NA		
Forecasting	10 year projections for waste management	NA		Hospital redevelopment and infrastructure upgrade planned		NA		Hospital redevelopment and infrastructure upgrade planned	
	Barriers to change	None noted		Limited budgeted, complacency		Cleaning contractors are changed every year, this may present a continuity challenge		None noted	
	Other issues	No other incinerators on Yap		Another JICA incinerator exists at the facility but has not been used due to lack of vent for stack exhaust/		Ash taken to Dekehtik Dump Site		An open pit filled with ash was observed during the audit.	

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

² *Previous 12 months*

** based on the information provided during the site audit that
30/90kg*

***Quantities provided appear to be incorrect and overinflated a
correction factor applied to healthcare waste quantities at
approximately 4kg/person based on long-term weighed and audited
regional averages (Lautoka Hospital , Fiji & Suva Hospital, Fiji)*

**** hospital is confiFSMng this figure*

***** based on a 10,000 year estimate*

Appendix C
Minimum Standards Assessment

HEALTHCARE WASTE - MINIMUM STANDARDS FRAMEWORK & ASSESSMENT FOR FSM								
Scale	Category	Item	Minimum Standard Criterion	YAP	CHUUK	POHNPEI	KOSRAE	FSM - 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 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	Waste is stored in a hygienic and safe manner in all wards/departments						
		Storage before treatment	Meets the standards stated in Appendix E, Recommendation 6, <i>Correct Storage</i> .						
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.					
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.		Not known	Not known	Not known	-

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

Appendix D

Detailed Options Assessment (Scored)

Table D1: <u>QUALITATIVE</u> Treatment Technology Options Assessment - Local Feasibility (FSM)										
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°C)	\$211,460 USD over 10 years (ref Whole of Project – Summary Report, Appendix E)	Most effective – can treat all waste types and achieves complete sterilization, complete combustion and destroys waste	Some issues for operators (requires training & PPE); some potential issues for community (potential for smoke, some controlled emissions)	Equipment lifespan ~ 10 years plus; sustainability dependant on maintaining operator skills plus proper operation and maintenance	No legal barriers to incineration; loses a point for potential for smoke nuisance and the potential for minor contribution to combustion derived POPs – FSM is a party to Stockholm	Burning of rubbish is historically accepted & widely practised in FSM. Incinerators are/ have been previously used in hospitals	Equipment breakdown and lack of local skills to maintain equipment – real barrier but can be managed through skills training & supplier support	Emissions of air pollutants and leaching from ash disposal to receiving environment are potential impacts. High temp operation minimises pollution & proper landfilling of ash restricts leaching.	Equipment lifespan ~ 10 years plus but will only last if maintained. High temperature equipment is prone to require a moderate level of maintenance	Requires skilled operators but modern equipment combined with training simplify operation
Incineration at med. temperature (800 - 1000°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	Some issues for operators (requires training & PPE); potential issues for community (smoke, emissions not	Equipment lifespan ~ 5 years; sustainability dependant on maintaining operator skills plus proper operation and	No legal barriers to incineration; potential for smoke nuisance is med - high and the potential for contribution	Burning of rubbish is historically accepted & widely practised in FSM. Incinerators are/ have	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/ smoke and leaching from ash disposal to receiving environment are potential impacts. Med. temperature operation	Equipment lifespan typically less ~ 5 years but will only last if maintained. Equipment is prone to require a	Requires less skilled operators than high temperature equipment - training simplifies operation

Table D1: <u>QUALITATIVE</u> Treatment Technology Options Assessment - Local Feasibility (FSM)										
Remaining Technology Options	Comparatively low cost to implement	Comparative effectiveness across all HCWs	Local Feasibility							
			Health & safety to workers & community	Sustainability of solution	Institutional and policy fit	Cultural fit	Implementation barriers can be overcome?	Receiving environment not impacted	Durability	Ease of operation
		needles	fully controlled)	maintenance	to combustion derived POPs & other pollutants is high – FSM is a party to Stockholm	been previously used in hospitals	Simpler infrastructure.	increases risks of air pollution, but not likely to be an issue in isolated small communities.	moderate level of maintenance	
Low temperature burning (<400°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 – FSM is a party to Stockholm	Burning of rubbish is historically accepted & widely practised in FSM.	No equipment operation reliability barrier; burning rubbish common practice in FSM	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 –	Cannot treat all waste types, achieves complete	Some issues for operators (requires training &	Equipment lifespan ~ 10 years; sustainability	No legal barriers; no potential for smoke	Not familiar with use of sterilisers for waste –	Equipment breakdown and lack of local skills to maintain	No emissions of air pollutants/ smoke; some potential for	Equipment will only last if maintained. Adding	Requires skilled operators to achieve best

Table D1: <u>QUALITATIVE</u> Treatment Technology Options Assessment - Local Feasibility (FSM)											
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	
	Summary Report, Appendix E)	sterilization when correctly operated, no combustion required, shredder destroys needles	PPE); small potential for odours and wastewater discharge (community)	dependant on maintaining operator skills plus longevity of equipment use given technology complexity	nuisance; some potential for odour nuisance; no air pollution (no combustion-POPs) and some potential for waste water management issues		potential community issue with waste appearance if steriliser not operated correctly or shredder not used	equipment – real barrier but can be managed through skills training & supplier support. Increased complexity of equipment (compared to incineration) increases barrier	odour impacts; still requires landfill or dump disposal so some potential for leaching on burial; some potential for waste water management issues. Larger residual waste compared to burning – only engineered landfill is in Pohnpei & Kosrae	shredder to autoclave technology increases mechanical parts that can go wrong. May require moderate level of maintenance	level of disinfection.
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	Encapsulation has handling issues for operators (requires training & PPE) and no	No equipment; sustainability dependant burial space available. Only engineered landfill is in Poh	No legal barriers; no smoke nuisance; no odour nuisance; no air pollution	No particular cultural fit concerns	New practice proposed – may face some inertia barrier. Lack of new 'shiny' machinery may imply the change is	Encapsulation itself poses no smoke nuisance; no odour nuisance; no air pollution and some potential	Highly durable due to its simplicity.	Simple procedure once operator understands and manages the risk of sharps	

Table D1: <u>QUALITATIVE</u> Treatment Technology Options Assessment - Local Feasibility (FSM)										
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
		required and completely removes downstream needle injury risk	community issues	so increases waste volume that requires burial.	and some potential for leachate to groundwater, although limited inherent hazard		not that important.	for leachate to groundwater, although limited inherent hazard.		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.

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

ENVIRON

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

ENVIRON

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^{3, 4}, incineration is the preferred method for treating pharmaceutical and cytotoxic wastes. This is further supported by the United

³ World Health Organization Regional Office for Europe, EURO Reports and Studies 97, Management of Wastes from Hospitals and other Health Care Establishments, 1983.

⁴ World Health Organization, Safe management of Wastes from healthcare Facilities, Geneva, 1999.

Nations^{5, 6} 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^{7, 8}.

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 other than incineration for anatomical waste, pharmaceuticals and cytotoxic wastes^{9, 10, 11, 12, 13, 14}. 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 option¹⁵.

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

Recommendation 5: Procurement of Consumables (PPE)

Personnel Protective Equipment

⁵ United Nations Environment Programme – Technical Working Group on the Basel Convention, Draft Technical Guidelines on Biomedical and Health Care Wastes, 1999.

⁶ Environment Australia, Basel Convention – Draft Technical Guidelines on Hazardous Waste: Clinical and Related Waste (Y1), March 1998.

⁷ Health care Without Harm, Non-Incineration Treatment Technologies, August 2001.

⁸ London Waste Regulation Authority, Guidelines for the Segregation, Handling, Transport and Disposal of Clinical Waste, 2nd Edition, 1994.

⁹ National Health & Medical Research Council, National Guidelines for Waste Management in the Health Industry, Commonwealth of Australia, 1999.

¹⁰ EPA Victoria, Draft Guidelines for the Management of Clinical and Related Waste, July 2003.

¹¹ NSW Department of Health, Waste Management Guidelines for Health care Facilities, August 1998.

¹² Queensland Government, Environmental Protection (Waste Management) Regulation, 2000.

¹³ Australian/New Zealand Standard 3816:1998, Management of Clinical and Related Wastes.

¹⁴ 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.

¹⁵ Provincial Government of Gauteng (South Africa), Draft Health Care Waste Regulations, 11 September 2003.

The use of Personal Protective Equipment (PPE) should be a condition of employment for employees with waste management responsibilities. PPE is one aspect of a multifaceted program, designed to protect employees from injuries and unnecessary exposure to hazardous substances.

Other aspects of this program are:

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

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

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

Recommendation 6: Improved Storage Infrastructure (Chuuk)

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.