# 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

**Vanuatu**

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

Prepared by:
**ENVIRON Australia Pty Ltd**

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| **Prepared by:** | | | **Authorised by:** | | |
|---|---|---|---|---|---|
| Name: | Dean Osmond | | Name: | Geoff Latimer | |
| Title: | Senior Consultant | | Title: | Senior Manager | |
| Phone: | +61 2 9954 8117 | | Phone: | +61 3 9606 1505 | |
| Email: | dosmond@environcorp.com | | Email: | glatimer@environcorp.com | |
| Signature: | Date: | 3/07/2014 | Signature: | Date: | 3/7/2014 |




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# Executive Summary

## *Introduction*

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

SPREP is implementing the Pacific Hazardous Waste Management (PacWaste) Project, a four year, €7,850,000 (2013 – 2017) project funded by the European Union and administered through SPREP. The project will provide fundamental on-ground improvement in the way priority high risk wastes are managed in Pacific island countries to help build a healthy, economically and environmentally sustainable Pacific for future generations. The PacWaste project is funded by the European Union under its 10$^{th}$ 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 Vanuatu.

## *Current Healthcare Waste Management in Vanuatu*

Five healthcare facilities were assessed in Vanuatu on four separate provinces. Information regarding the waste management process occurring, from ward-level waste generation through to ultimate treatment and disposal was collected during an audit of the hospital conducted between 28 March and 1 April 2014.

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

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

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

Target areas have been rated as follows:

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

**Table ES1: Health care waste – Key Issues for Vanuatu**

| Scale | Category | Item | Minimum Standard Criterion | Port Vila Central Hospital | Northern Districts Hospital | Lenakel Hospital | Norsup Hospital | Panunagis Health Centre | Vanuatu Overall |
|---|---|---|---|---|---|---|---|---|---|
| Healthcare Facility | Policy | Infection Control | Infection control policy incorporates principles of waste management within it | | | | | | |
| Healthcare Facility | Policy | Waste Management Plan | Has been developed by the hospital and is based on a review of healthcare waste management and is current (within 5 years) | | | | | | |
| Healthcare Facility | 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 | Storage before treatment | Meets the standards stated in Appendix E, Recommendation 2, *Correct Storage*. | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Healthcare Facility | Training | Planning and implementation | A structured waste management education program has been developed with a clear delivery structure | | | | | | |
| Healthcare Facility | Training | Curricula | A structured waste management training program has been developed that targets the different roles within the hospitals. | | | | | | |
| Healthcare Facility | Training | Follow-up & refresher courses | All staff receive waste management education during induction. All staff receive refresher training annually. Waste management training is delivered following an adverse incident to the relevant staff/ward/department. | | | | | | |
| Healthcare Facility | 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 | 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 | 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. | | | | | | |
| Local Council | Waste Treatment Facility | Landfill | Healthcare waste is disposed of at a dedicated location and covered immediately on arrival. Scavengers cannot access untreated healthcare waste. | | N/A | N/A | N/A | | |

### *Key Issues*

Common key issues observed in Vanuatu were:

- There is no documented waste management planning system in place and limited evidence of waste management committees.
- Segregation and containment practices are generally below minimum standard in that there is virtually no signage present, the only segregation regularly practiced is for sharps, colour coded bags (liners) and bins were limited in supplies and storage is not adequate.
- There is no structured training or waste segregation auditing program in place
- The method for treatment of healthcare waste is not in accord with required standards at any of the hospitals visited.
- The wood-fired incinerators (Northern Districts, Lekakel and Norsup hospitals) do not get to the temperature required to adequately burn the healthcare waste.

### *Analysis of Options for Sustainable Healthcare Waste Management in Vanuatu*

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

Treatment options that rated best for Vanuatu 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, but borderline beyond Port Vila due to lack of lined landfills and increased complexity of machinery.

### *Recommendations*

Table ES2 provides a summary of the recommendations for Vanuatu.

| Table ES2: Recommendations for Vanuatu | Applicable to | Port Vila Central Hospital | Northern Districts General Hospital | Lenakel Hospital | Norsup Hospital | Panunagis Health Centre |
|---|---|---|---|---|---|---|
| **Recommendation 1: Develop a Waste Management Framework** | | | | | | |
| **Description** | • A *Healthcare Waste Management Plan*, specific to each healthcare facility<br>• Appoint an *officer's from each hospital responsible* for the development and implementation of the Healthcare Waste Management Plan<br>• A *waste management committee*, appropriate to the scale of each facility. | | | | | |
| **Output** | • An agreed *Healthcare Waste Management Plan*, specific to each healthcare facility outlining procedures and guidelines, waste definitions and characterisation, segregation techniques, containment specifications and storage practices, collection and transport, treatment and disposal and emergency procedures<br>• Accountability for healthcare waste management through clearly defined roles and responsibilities | | | | | |
| **Monitoring & Evaluation Indicators** | • Plan approved by Ministry of Health (all facilities)<br>• Approved budget for implementation of Healthcare Waste Management Plan<br>• The Plan is to include an auditing component to that the WMP can be routinely monitored, reviewed, revised and updated.<br>• Annual assessment of 'Responsible Officer's' or Waste Management Committees' performance against key healthcare waste management competencies. | | | | | |
| **Costs ($US)** | • Establishment – medium - Waste management consultant: $US15,000<br>• Establishment – Low - Travel costs for hospital staff and government departments: $US5,000<br>• Ongoing – Low – intention to incorporate the cost into hospital and MoH budgets. | | | | | |
| **Recommendation 2: Procurement of Consumables (Segregation & Storage)** | | | | | | |
| **Description** | • Supply of colour-coded **waste bins** and **plastic liners** in quantities sufficient to serve all wards/departments for a period of time sufficient to allow bedding down of the segregation process.<br>• 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.<br>• 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 &** | • Wastes are segregated at their place of production. | | | | | |

| Table ES2: Recommendations for Vanuatu | Applicable to | Port Vila Central Hospital | Northern Districts General Hospital | Lenakel Hospital | Norsup Hospital | Panunagis Health Centre |
|---|---|---|---|---|---|---|
| **Evaluation Indicators** | • Infection wastes, general wastes and used sharps are stored in separate colour coded containers and locations within medical areas.<br>• Zero Needle Stick Injuries. | | | | | |
| **Costs ($US)** | Establishment – Low; Ongoing - Low, sustainably funded by country | | | | | |
| **Recommendation 3: Provide a Sustainable Training Program** | | | | | | |
| **Description** | • Development and delivery of a structured healthcare waste training program to all hospital personnel as well as personnel from other stakeholders (e.g., government health and environment agencies)<br>• This could be facilitated/ delivered by SPREP staff, or outside trainers, or a combination of both, as no competent health care waste management training capability exists in Vanuatu<br>• Training should be coordinated with other countries' needs in the region | | | | | |
| **Output** | • Improvement of personnel skills and competency in managing healthcare waste<br>• Promotion of the advantages of sustainable segregation and storage techniques for the different waste streams and an understanding of the health and safety risks resulting from the mismanagement risks of healthcare waste. | | | | | |
| **Monitoring & Evaluation Indicators** | • Competency Assessments<br>• Refresher Training<br>• No/very little cross contamination between waste streams demonstrated by waste audits. | | | | | |
| **Costs ($US)** | • Establishment – Low-medium per facility if regional synergies are utilised<br>• Ongoing – Low-medium per facility if regional synergies are utilised | | | | | |
| **Recommendation 4: Appropriate Storage Facilities** | | | | | | |
| **Description** | **<u>Short Term (0 – 6 months)</u>**<br>• Procure contractors to design and develop a healthcare waste storage facility at the Port Vila Central Hospital and Lenakel Hospital.<br>• Procure contractors to design and develop an upgrade to the waste storage facility at Northern Districts Hospital.<br>• Upgrade central storage areas to meet minimum standards outlined in **Appendix C and Appendix E** to eliminate the risk of ongoing public risk and environmental harm. | | | | | |
| **Output** | A disposal system that reduces the potential hazard posed by health-care waste, while endeavoring to protect the environment (**meet minimum standards outlined in** Appendix C and Appendix E). | | | | | |
| **Monitoring & Evaluation** | Suitability of storage areas regularly assessed by 'responsible officer' of waste management committee. | | | | | |

| Table ES2: Recommendations for Vanuatu | Applicable to | Port Vila Central Hospital | Northern Districts General Hospital | Lenakel Hospital | Norsup Hospital | Panunagis Health Centre |
|---|---|---|---|---|---|---|
| **Indicators** | | | | | | |
| **Costs ($US)** | • Establishment - Medium$US15,000 ($10,000 for Port Vila and $5,000 for Northern Districts Hospital).<br>• Ongoing – low – monitoring and maintenance. | | | | | |
| **Recommendation 5: Improved Treatment Infrastructure** | | | | | | |
| **Description** | • Feasibility study into the following two options for healthcare waste treatment at the Port Vila Central Hospital:<br>- Procure a new incinerator and construct an enclosure at the Bouffa landfill.<br>- Procure the option of a new fumeless incinerator for the Port Vila Central Hospital and large scale autoclave and shredder.<br>• Procurement of new incinerator at the Northern Districts Hospital.<br>• Procurement contractor for incinerator and upgrade/maintenance at Lenakel Hospital and Norsup hospitals which includes increasing the stack height and building an enclosure.<br>• Procure woodfired incinerator for Panunagis Health Centre. | | | | | |
| **Output** | A disposal system that reduces the potential hazard posed by health-care waste, while endeavoring to protect the environment. | | | | | |
| **Monitoring & Evaluation Indicators** | Assessment of the following should be regularly undertaken for new and existing incinerators:<br>Operations and construction (e.g. pre-heating and not overloading the incinerator and incinerating at temperatures above 800ºC only)<br>Maintenance program.<br><br>Ensuring lowest emissions, materials containing chlorine such as polyvinyl chloride products (e.g. some blood bags, IV bags, IV tubes, etc.,) or heavy metals such as mercury (e.g. broken thermometers) should never be incinerated. | | | | | |
| **Costs ($US)** | • Establishment (incinerators) – High (approx. $50-70,000 per unit (average) including housing and commissioning costs;<br>• Establishment (maintenance) – Low (approx. $2,000 per hospital).<br>• Ongoing – medium (fuel and maintenance) | | | | | |
| **Recommendation 6: Procurement of Consumables (PPE)** | | | | | | |
| **Description** | • Supply appropriate PPE, in particular overalls/protective clothing, and eye protection for all waste handlers.<br>• Incinerator staff are provided with additional PPE such as face masks and noise | | | | | |

| Table ES2: Recommendations for Vanuatu | Applicable to | Port Vila Central Hospital | Northern Districts General Hospital | Lenakel Hospital | Norsup Hospital | Panunagis Health Centre |
|---|---|---|---|---|---|---|
| | protection. | | | | | |
| **Output** | Adequate supply of PPE for protection of waste handlers | | | | | |
| **Monitoring & Evaluation Indicators** | • PPE is provided to all staff and staff are aware on how to protect themselves from injuries and infectious wastes<br>• Zero Needle Stick Injuries. | | | | | |
| **Costs ($US)** | Establishment – Low; Ongoing - Low, sustainably funded by country | | | | | |
| **Monitoring & Evaluation Indicators** | • Plan approved by Ministry of Health (all facilities)<br>• Approved budget for implementation of Healthcare Waste Management Plan<br>• The Plan should be regularly monitored, reviewed, revised and updated.<br>• Annual assessment of 'Responsible Officer's' or Waste Management Committees' performance against key healthcare waste management competencies. | | | | | |
| **Costs ($US)** | • Establishment – Low, if existing systems (such as those for Fiji) are used as a starting points and document drafting assistance is provided<br>• 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.

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

## 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 Vanuatu and includes:

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

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

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

## 1.2 Report Structure

This report is structured as follows:

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

# 2 Health Care Waste Management in Vanuatu

## 2.1 Regulatory Framework

The regulatory and policy development of the management, handling, treatment and disposal of health care waste in Vanuatu is the responsibility of the Ministry of Health (MoH). The MoH has a sub-unit that overseas healthcare waste called the National Environmental Health Unit.

To the knowledge of National Environmental Health Unit; hospital staff interviewed; and desktop research, there is no specific legislation, guidelines, polices and/or management plans that have been developed by the Vanuatu government that specifically relates to healthcare waste. The overarching legislation which relate to protection of the environment and public health are described in the table below.

**Table 1: National Environmental Legislation Summary**

| Legislation | Type | Summary | References to Solid/HCW | Regulator/ Agency |
|---|---|---|---|---|
| Environmental Management and Conservation Act (Cap 283) 2002 | Act | Provides for the conservation, sustainable development and management of the environment of Vanuatu, and the regulation of related activities. | Minister can regulate the environmental effects of waste management | Ministry of Lands and Natural Resources |
| Public Health Act [Cap 296] | Act | Prescribes rules relative, among other things, prevention of nuisance, and prevention of poisoning by food, prevention of mosquitoes and vermin, water supply, waste disposal and waste water discharge and control of baby food. It also establishes the Vanuatu Public Health Fund and provides for the appointment of environmental health officers and the Principal Environmental Health Officer for the purposes of this Act. | - | Ministry of Health |

## 2.2 Hospitals Assessed

This section summarises the key statistic and key personnel regarding the hospitals that were assessed in Vanuatu.

### 2.2.1 Port Vila Central Hospital

Port Vila Central Hospital is located in the township of Port Vila and is a national referral hospital for Vanuatu. It is one of two hospitals on Efate Island (and Shefa Province) however the other hospital is private. There are a number of health clinics which refer patients to the hospital.

The hospital is old and run down with hospital wards spaced out across the hospital. Residential properties surround the hospital which can be accessed from two separate ends. There is minimal space for further development.

Ward at the hospital include: TB ward; maternity/paediatric ward; medical ward; and surgical ward. In addition there is an emergency room, intensive care unit (ICU) and mental illness room.

### 2.2.2 Northern Districts Hospital

Northern Districts Hospital is Vanuatu's second largest hospital. The hospital is the only hospital in the Sanma Province and is also a referral hospital for some of the nearby provinces due to its size. The hospital is in Espiritu Santo Island largest town of Luganville.

The hospital opened in 1998 however its facilities appear run down. The hospital is on a large space of land with room for development, especially at the rear of the facility. Residential properties to surround the facility but there is adequate buffer from land space and vegetation.

Ward at the hospital include: medical ward; children's ward; TB ward; maternity ward; and surgical ward. In addition there is an emergency room, pharmacy and a blood bank.

### 2.2.3 Lenakel Hospital

Lenakel Hospital is in main town on Tanna Island (Lenakel) and serves the six surrounding islands as well as the 12 health care clinics on the island. The island is remote and roads are generally well worn. The hospital is quite run down and requires more public waiting room area which there are plans for. The hospital is in a residential area however there is some buffer from land space and vegetation.

Ward at the hospital include: maternity/paediatric ward; medical and surgical ward; TB ward; Men's ward. In addition there is an emergency room and health clinic.

### 2.2.4 Norsup Hospital

Norsup Hospital services the remote Malakula Island as well as other surround Islands. The hospital is in reasonable condition and adjacent to a school and some residents properties as well as dense vegetation. There is limited space for further development on the hospital land.

Ward at the hospital include: Maternity ward; surgical/medical/paediatric ward. In addition there is an operating theatre; laboratory; pharmacy; radiology room and a health clinic.

### 2.2.5 Panunagis Health Centre

Panunagis Health Centre provides medical services to the population of the northern coast of North Efate. The Health Centre buildings are small but in reasonable condition. There are plans for the Health Centre to become a mini-hospital which will require expansion on available space at the Centre.

| Table 2: Hospital Details – Vanuatu | | | | | |
|---|---|---|---|---|---|
| **Hospital/Region** | **Port Vila General Hospital, Efate Island, Shefa Province.** | **Northern Districts Hospital, Espiritu Santo Island, Sanma Province** | **Lenakel Hospital, Tanna Island, Tafea Province** | **Norsup Hospital, Malakula Island - Malampa Province** | **Panunagis Health Centre, North Efate Efate Island, Shefa Province** |
| **Contact Name**<br>**Position** | Leipakoa Matarika, Nurses Manager | Dr Sam Ailo, Hospital Director | Simon Saika, Hospital Director | Noal Nathan, Hospital Director | Kalwad Poilapa, Manager |
| **Pop Served** | 65,000 | 40,000 | 32,000 | 36,000 | 12,000 |
| **No. of Beds** | 146 | 43 | 43 | 54 | 4 |
| **Annual Average Occupancy Rate (%)** | 80-90% | 60-70% | 60-70% | 33% | 10% |
| **Occupied Bed Days (OBD)** | 45,296 | 10,202 | 10,202 | 6,504 | 146 |
| **No. Operations** | Not known | Not known | Not known | Not known | Not known |
| **No. of Births** | 3,000 | 1,200 | 589 | 344 | 120 |
| **Emergency Patients Attended** | 480 | Not known | 85 | 85 | 72 |
| **Out-Patients Attended** | 121,340 | 146,000 | 4,200 | 4,869 | 3,600 |
| **No. of staff** | 102 | 107 | 50 | 33 | 4 |
| **No. of staff per function** | | | | | |
| **Nursing/ Medical** | 81 | Not provided | 40 | 25 | 4 |
| **Infection Control** | 2 | Not provided | 0 | 1 | 0 |
| **Dedicated Waste Management – Internal Management** | 7 | Not provided | 1 | 3 | 0 |
| **Dedicated Waste Management – Treatment Operation** | 0 | 1 | 1 | Included above. | 0 |
| **Administration** | 7 | Not provided | 5 | 4 | 0 |
| **Other** | 98 | 34 | 3 | 0 | 0 |

# 3 Existing Waste Management Practices

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

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

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

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

**Table 3: Waste Management Process - Observations**

| | Hospital Name | Port Vila Central Hospital | | | Northern Districts Hospital | | | Lenakel Hospital | | | Norsup Hospital | | | Panunagis Health Centre | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Generation & Segregation | Dedicated Containers/ Bags | N | | | Y | | | N | | | Y | | | N | | |
| | Colour Coding | N | | | N | | | N | | | Y | | | Y | | |
| | Sharps segregated & secure | Y | | | Y | | | Y | | | Y | | | Y | | |
| | Signage Present | N | | | N | | | N | | | Y | | | N | | |
| Internal Handling | Degree of manual handling of bags | High | | | High | | | High | | | Medium | | | High | | |
| | Internal Transport Mode | Manual | | | Manual | | | Manual | | | Wheelie Bin | | | Manual | | |
| | Spill Kit Present | N | | | N | | | N | | | N | | | N | | |
| Storage | Dedicated & Appropriate Area | N | | | Y | | | N | | | Y | | | Y | | |
| | Loading/unloading acceptable | N | | | Y | | | Y | | | Y | | | Y | | |
| | Spill Kits Present | N | | | N | | | N | | | N | | | N | | |
| | Monitoring & record keeping occurs | N | | | N | | | N | | | N | | | N | | |
| Treatment | Treatment per Waste Stream | | Tech. Type | Volumes (kg/wk) | | Tech. Type | Volumes (kg/wk) | | Tech. Type | Volumes (kg/wk) | | Tech. Type | Volumes (kg/wk) | | | Volumes (kg/wk) |
| | Healthcare Waste | ✓ | Landfill (w/o treatment) | ~750[1] | ✓ | Incinerate (internal) | ~250[2] | ✓ | Incinerate (internal) | ~250[3] | ✓ | Incinerate (internal) | ~100[4] | ✓ | landfill (internal) w/o | ~10[5] |

[1] Very little information was available to make waste estimates. Estimates are based on the size of the hospital comparable to the other hospitals in Vanuatu.
[2] Based on estimated incinerator size and number of times it is used a week (3 times)
[3] Based on estimated incinerator size and number of times it is used a week (3 times)
[4] Based on estimated incinerator size and number of times it is used a week (once a week).
[5] Based on sharps boxes and healthcare waste buckets filled each week.

**Table 3: Waste Management Process - Observations**

| | Hospital Name | Port Vila Central Hospital | | | Northern Districts Hospital | | | Lenakel Hospital | | | Norsup Hospital | | | Panunagis Health Centre | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | treatment | |
| | Sharps | ✓ | Landfill (w/o treatment) | Included above | ✓ | Incinerate (internal) | Included above | ✓ | Incinerate (internal) | Included above | ✓ | Incinerate (internal) | Included above | ✓ | Landfill (w/o treatment) | Included above |
| | Pharmaceutical | ✓ | Landfill (w/o treatment) | Not known | ✓ | Incinerate (internal) | Not known | ✓ | Incinerate (internal) | Not known | ✓ | Incinerate (internal) | Not known | ✓ | Landfill (w/o treatment) | Not known |
| | Cytotoxic | × | NA | NA | × | NA | NA | × | NA | NA | × | NA | NA | × | NA | NA |
| | General | ✓ | Landfill (w/o treatment) | Not known | ✓ | Landfill (w/o treatment) | 500[6] | ✓ | Landfill (w/o treat) | 300[7] | ✓ | landfill (internal) w/o treatment | 500[8] | ✓ | landfill (internal) w/o treatment | 15[9] |
| | If incinerator present | | | | | | | | | | | | | | | |
| | Make, Model, Year commissioned | UHT-300 II 0 UCHIMURAGUM CO. LTD (Made in Japan. March 2007 | | | Simple iron wood fired incinerator - no branding | | | Simple iron wood fired incinerators - no branding | | | Simple iron wood fired incinerator - no branding | | | N/A | | |
| | Operating Temp ($^0$C) | Not known | | | Not known | | | Not known | | | Not known | | | N/A | | |
| | No. chambers | 1 | | | 1 | | | 1 | | | 1 | | | N/A | | |
| | Condition | Reasonable | | | Reasonable | | | Poor | | | Reasonable | | | N/A | | |
| | Comments | Ceased operation in 2013 due to fumes impacting the nearby residents (refer to Photo 2 in Appendix A). | | | Good location away from hospital and residents (refer to Photo 8 in Appendix A). | | | Two incinerators. The first is used for sharps and vials and the second is used for all other healthcare waste. One | | | Refer to Photo 22 in Appendix A). | | | NA | | |

[6] General waste estimates are based on visual assessment and hospital staff interviews and general waste is approximately double healthcare waste
[7] General waste estimates are based on visual assessment and hospital staff interviews.
[8] General waste estimates are based on visual assessment and hospital staff interviews
[9] General waste estimates are based on visual assessment and hospital staff interviews.

| Table 3: Waste Management Process - Observations | | | | | | |
|---|---|---|---|---|---|---|
| | Hospital Name | **Port Vila Central Hospital** | **Northern Districts Hospital** | **Lenakel Hospital** | **Norsup Hospital** | **Panunagis Health Centre** |
| | | | | incinerator does not have a stack (refer to Photo 14, Appendix A). | | |
| | Operational statistics | Per year | | | | |
| | Waste Throughput (kg) | Not known | Not known | Not known | Not known | NA |
| | Operating Hours (hr) | Currently not in use. | Not specified – one load takes between 2-4 hours | Not specified – one load takes between 2-4 hours | Not specified – one load takes between 2-4 hours | NA |
| | Fuel | Diesel | Wood | Wood | Wood | Wood |
| | Fuel use (kg/litres) | Not known | Not known | Not known | Not known | NA |
| | Fuel use per kg waste burnt | Not known | Not known | Not known | Not known | NA |
| | Technology siting and operation issues | Low stack (approx 5-6 m) and in close vicinity to residents and the hospital due to lack of hospital space. Additionally, the incinerator may not be properly used and consequently generate high fume mass around the hospital. | The incinerator does not reach high enough temperatures to adequately burn sharps and vials. Basic incinerator, green wood and wet conditions (no roof cover) are the main factors. | The incinerator does not reach high enough temperatures to adequately burn sharps and vials. Basic incinerator, green wood and wet conditions (no roof cover) are the main factors. | The incinerator does not reach high enough temperatures to adequately burn sharps and vials. Basic incinerator, green wood and wet conditions (no roof cover) are the main factors. | N/A |
| | Offsite transport assessment | Fair | Fair | N/A | Fair | Good |

## 3.1 Port Vila Central Hospital

### 3.1.1 Wastestreams, Treatment Constraints and Costs

The Port Vila Central Hospital generates general wastes and healthcare wastes (including pathological waste, infectious waste, sharps and pharmaceutical wastes) in the approximate quantities described in Table 3. Volumes of waste generated are not measured and at the time of the site visit it was difficult to estimate due to lack of waste data gathered by staff and staff unable to make estimates on bins taken to the landfill each day. Estimates are based on the size of the hospital comparable to the other hospitals in Vanuatu.

Port Vila Hospital stated they have a flat rate fee levy of ~$US64,000 annually to be paid to the municipal waste dump for all waste generated from the hospital.

### 3.1.2 Waste Management and Infection Control Framework

The following summarises the waste management and infection control framework at the Port Vila General Hospital:

- There is no waste management policy, plan or formalised waste management procedures. The newly appointed (February 2014) Quality Officer has goals to develop a management framework. The grounds team is responsible for waste disposal and operation of the incinerator when it was previously working.
- There is no infection control policy or procedures known to occur at the hospital.
- There is no formal waste auditing or inspections.

### 3.1.3 Training

Port Vila General Hospital has no formal training program in place in relation to health care waste and infection control. There were no records of historical training session having taken place. Anecdotally, waste management training is communicated informally upon new staff employment by senior nurses at a hospital as well as training received during the three year registered nurses university courses which includes units on infection control and waste management.

## 3.2 Northern Districts Hospital

### 3.2.1 Wastestreams, Treatment Constraints and Costs

The Northern Districts Hospital generates general wastes and healthcare wastes (including pathological waste, infectious waste, sharps and pharmaceutical wastes) in the approximate quantities described in Table 3. Volumes of waste generated are not formally measured and were estimated based on incinerator volumes and interviews with hospital staff.

The incinerator is wood-fired and there is no cost for this wood.

### 3.2.2 Waste Management and Infection Control Framework

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

- There is no waste management policy, plan or formalised waste management procedures. The grounds team is responsible for waste disposal and operation of the incinerator.

- There is no infection control policy or procedures known to occur at the hospital.
- There is no formal waste auditing or inspections.

### 3.2.3 Training

Minimal training programs have been implemented in relation to healthcare waste / infection control at the Northern Districts Hospital aside from the training received during the three year diploma course to be a registered nurse. There are no specific training courses available in relation to infection control or waste management in the Vanuatu. Some NGO's perform training on an infrequent basis. This included:

- The Association Partage Santé Pacifique (APSP) (translate to Sharing Pacific Health Association) perform annual training on hygiene which incorporates healthcare waste management and infection control at Norsup and Northern Districts hospitals in 2012.

## 3.3 Lenakel Hospital

### 3.3.1 Wastestreams, Treatment Constraints and Costs

The Lenakel Hospital generates general wastes and healthcare wastes (including pathological waste, infectious waste, sharps and pharmaceutical wastes) in the approximate quantities described in Table 3. Volumes of waste generated are not formally measured and were estimated based on incinerator volumes and interviews with hospital staff.

The incinerator is wood-fired and there is no cost for this wood.

### 3.3.2 Waste Management and Infection Control Framework

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

- There is no waste management policy, plan or formalised waste management procedure.
- There is no dedicated staffing to infection or quality control.
- The grounds team is responsible for waste disposal and operation of the incinerator.
- There is no infection control policy or procedures known to occur at the hospital.
- There is no formal waste auditing or inspections.

### 3.3.3 Training

Lenekel Hospital has no formal training program in place in relation to health care waste and infection control. There were no records of historical training session having taken place. Anecdotally, waste management training is communicated informally upon new staff employment at a hospital as well as training received during the three year registered nurses university courses which includes units on infection control and waste management.

## 3.4 Norsup Hospital

### 3.4.1 Wastestreams, Treatment Constraints and Costs

The Norsup Hospital generates general wastes and healthcare wastes (including pathological waste, infectious waste, sharps and pharmaceutical wastes) in the approximate

quantities described in Table 3. Volumes of waste generated are not formally measured and were estimated based on incinerator volumes and interviews with hospital staff.

The incinerator is wood-fired and there is no cost for this wood.

### 3.4.2 Waste Management and Infection Control Framework

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

- There is no waste management policy, plan or formalised waste management procedure.
- There is no dedicated staffing to infection or quality control.
- The grounds team is responsible for waste disposal and operation of the incinerator.
- There is no infection control policy or procedures known to occur at the hospital.
- There is no formal waste auditing or inspections.
- Malakula Island, in which Norsup Hospital is located has a waste management committee set up that is considering healthcare waste management options for the hospital. Priority number one of the waste management committee to establish a landfill location as currently general waste form the hospital is dumped at the timber harvesting dumpsite.

### 3.4.3 Training

Minimal training programs have been implanted in relation to healthcare waste / infection control at the Norsup Hospital aside from the training received during the three year diploma course to be a registered nurse. There are no specific training courses available in relation to infection control or waste management in the Vanuatu. Some NGO's perform training on an infrequent basis. These included:

- The Association Partage Santé Pacifique (APSP) (translate to Sharing Pacific Health Association) perform annual training on hygiene which incorporates healthcare waste management and infection control at Norsup and Northern Districts hospitals in 2012.
- Assistance Friends Development (AFD) visited Norsup Hospital in 2006 to provide PPE to the hospital which has been used when handling waste.

## 3.5 Panunagis Healthcare Centre

### 3.5.1 Wastestreams, Treatment Constraints and Costs

The Panunagis Health Care Centre generates general wastes and healthcare wastes (including infectious waste, sharps and pharmaceutical wastes) in the approximate quantities described in Table 3. Volumes of waste generated are not formally measured and were estimated based interviews with health care staff.

There is no healthcare waste treatment infrastructure at Panunagis Health Care Centre so healthcare waste is transported to Port Vila General Hospital for treatment.

### 3.5.2 Waste Management and Infection Control Framework

The following summarises the waste management and infection control framework at the Panunagis Health Care Centre:

- There is no waste management policy, plan or formalised waste management procedure.
- There is no dedicated staffing to infection or quality control.
- The grounds team is responsible for waste disposal and operation of the incinerator.
- There is no infection control policy or procedures known to occur at the hospital.
- There is no formal waste auditing or inspections.

### 3.5.3 Training

Panunagis Health Care Centre has no formal training program in place in relation to health care waste and infection control. There were no records of historical training session having taken place. Anecdotally, waste management training is communicated informally upon new staff employment at a hospital as well as training received during the three year registered nurses university courses which includes units on infection control and waste management.

# 4 Key Health Care Waste Management Issues in Vanuatu

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 Vanuatu hospitals, as part of this assessment.

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

**Table 5: Health care waste – Key Issues for Vanuatu**

| Scale | Category | Item | Minimum Standard Criterion | Port Vila Central Hospital | Northern Districts Hospital | Lenakel Hospital | Norsup Hospital | Panunagis Health Centre | Vanuatu Overall |
|---|---|---|---|---|---|---|---|---|---|
| Healthcare Facility | Policy | Infection Control | Infection control policy incorporates principles of waste management within it | | | | | | |
| Healthcare Facility | Policy | Waste Management Plan | Has been developed by the hospital and is based on a review of healthcare waste management and is current (within 5 years) | | | | | | |
| Healthcare Facility | 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 | Storage before treatment | Meets the standards stated in Appendix E, Recommendation 2, *Correct Storage*. | | | | | | |
| Healthcare Facility | Training | Planning and implementation | A structured waste management education program has been developed with a clear delivery structure | | | | | | |
| Healthcare Facility | Training | Curricula | A structured waste management training program has been developed that targets the different roles within the hospitals. | | | | | | |

**Table 5: Health care waste – Key Issues for Vanuatu**

| Scale | Category | Item | Minimum Standard Criterion | Port Vila Central Hospital | Northern Districts Hospital | Lenakel Hospital | Norsup Hospital | Panunagis Health Centre | Vanuatu Overall |
|---|---|---|---|---|---|---|---|---|---|
| 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 | 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 | 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 | 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. | | | | | | |
| Local Council | Waste Treatment Facility | Landfill | Healthcare waste is disposed of at a dedicated location and covered immediately on arrival. Scavengers cannot access untreated healthcare waste. | | N/A | N/A | N/A | | |

### 4.1.1 Port Vila Central Hospital – Key Issues

The most significant health care waste management issues observed at Port Vila Central Hospital were:

- Healthcare waste is disposed offsite without segregation or treatment to the municipal landfill. Both wastes are reportedly burnt together in an open landfill.
- Inside the hospital ward healthcare waste is poorly segregated, only sharps are properly separated into sharps containers (combination of reusable and disposable. This was evident during the site visit with general waste bins containing healthcare waste such as dressings and vice versa. This is due to poor signage and labelling; no formal training or auditing; and the knowledge that the general waste and healthcare waste is going to the same location (landfill) therefor the importance of segregating waste appears irrelevant to hospital staff (refer to Photos 5 and 6 in **Appendix A**).
- The waste storage area for both healthcare waste and general waste is not roofed, fenced off, enclosed or bunded. The public is able to access the waste prior to transportation to the municipal landfill as well as feral animals (in particular rodents which have been seen at the waste storage area). Runoff is also possible as the waste storage area is not paved or bunded (refer to Photo 1 in **Appendix A**).
- Residential properties that neighbor the facility and in particular the ones that are close to the incinerator have previously complained about the fumes generated by the incinerator which led to the incinerator ceasing operation in January 2013 (hospital staff have also complained). The top of the incinerator stack is approximately six metres from the ground (refer to Photo 1 in **Appendix A**). ENVIRON was not able to view the incinerator in operation to determine if it was used correctly therefore generating enough heat for the fumes to project higher up minimising the impact to hospital and nearby residents. It is less likely that the incinerator was used correctly given none of the staff were provided formal training on the use of the incinerator.
- Hospital space is limited and there is unlikely to be a better location for the incinerator on the hospital owned land. A new incinerator would need to be ‘smokeless’ or there is potential space at the municipal landfill for a new incinerator location which could also mean the incinerator is used for other health clinics on Efate Island healthcare waste. The incinerator would require fencing as the currently landfill is not fenced off.
- There is no documented waste management planning system in place.
- There is no structured training or waste segregation auditing program in place.

### 4.1.2 Northern Districts Hospital – Key Issues

The most significant health care waste management issues observed at Northern Districts Hospital were:

- Incinerator is wood fired and does not get to the temperate required to adequately burn the healthcare waste (vials and sharps are still visible in the ash post burn) (refer to Photo 9 in **Appendix A**). Other contributing factors included green wood and the incinerator is not roofed in a high rainfall area. The ash from the incinerator is disposed of at the landfill adjacent to the incinerator and is not buried.
- There are plans to purchase a new incinerator however funding is still limited.

- Shortage of sharps boxes and containers supplies as well as colour coded waste disposal bins and yellow bad liners.
- There is no documented waste management planning system in place.
- There is no structured training or waste segregation auditing program in place.

### 4.1.3 Lekakel Hospital – Key Issues

The most significant health care waste management issues observed at Lenakel Hospital were:

- The two incinerators are wood fired and do not get to the temperate required to adequately burn the healthcare waste (vials and sharps are still visible in the ash post burn) (refer to Photo 15 in **Appendix A**). Other contributing factors included green wood and the incinerators are not roofed in a high rainfall area. The ash from the incinerators is disposed of at the landfill adjacent to the incinerator and is not buried. The neighbors and hospital staff have previously complained about the fumes from the incinerator as the stacks are quite low (one incinerator does not have a stack and others stack height is approximately two meters from the ground level).
- On-site general waste landfill showed evidence that healthcare waste is dumped inside it from poor segregation practices (refer to Photo 16 in **Appendix A**).
- The incinerators are outside and not in enclosed area and the stacks are low (refer to Photo 14 in **Appendix A**).
- Shortage of colour coded waste disposal bins as well as yellow baggage supplied for the hospital (supplied from Port Vila).
- Limited training and training resources are available to nursing staff in relation to infection control and waste management. The Island is quite isolated from services and supplies.
- There is no documented waste management planning system in place.
- There is no structured training or waste segregation auditing program in place.

### 4.1.4 Norsup Hospital – Key Issues

The most significant health care waste management issues observed at Norsup Hospital were:

- Incinerator is wood fired and does not get to the temperate required to adequately burn the healthcare waste (vials and sharps still visible in the ash post burn) (refer to Photo 21 in **Appendix A**). However the incinerator is in good condition and does burn the majority of the healthcare waste. Other contributing factors included green wood and the incinerator is not roofed in a high rainfall area.
- A landfill area has been built for compost waste however general waste and healthcare waste has been placed in there on occasions.
- Shortage of colour coded waste disposal bins as well as yellow baggage supplied for the hospital.
- There is no documented waste management planning system in place.
- There is no structured training or waste segregation auditing program in place.

### 4.1.5 Panunagis Health Centre – Key Issues

The most significant health care waste management issues observed at Panunagis Health Centre were:

- No incinerator for treating healthcare waste available on site. Sharps are taken to Port Vila Hospital (two hour drive) and healthcare waste is disposed of in the on-site landfill which is burnt weekly or weather permitting. The on-site landfill is not fenced off (refer to Photo 26 in **Appendix A**).
- There are plans for the Health Centre to be upgraded to a mini hospital which will increase waste volumes.
- There is no documented waste management planning system in place.
- There is no structured training or waste segregation auditing program in place.

# 5 Consultation

This section summarises the key issues that have been raised by the jurisdictions in consulting with them on the current national waste reporting scope and methodology.

| Table 6: Summary of key issues raised during consultation and suggested response / actions | |
|---|---|
| **Key consultation personnel** | **Response** |
| Pakoa Lawo Rarua<br>Environmental Health officer<br>Ministry of Health | Concerned with health care waste entering landfills which are not properly contained.<br>Has endorsed using the landfill as a potential incinerator location for the Port Vila Central Hospital. |
| Leipakoa Matariki<br>Hospital Manager<br>Port Vila Hospital | Requires more resources to manage healthcare waste, in particular yellow bins and liners.<br>More available resources to train nursing staff in infection control. |
| Henry Lakeleo<br>Quality Control<br>Port Vila Hospital | A proper waste storage area need to be built. The current one is at risk of spreading infection. |
| Dr Sam Ailo<br>Hospital Manager<br>Northern Districts Hospital | Has limited funding to purchase a new incinerator. |
| Simon Saika<br>Hospital Manager<br>Lenakel Hospital | Incinerators require upgrade.<br>Requires more resources to manage healthcare waste, in particular yellow bins and liners. |
| Noal Nathan<br>Hospital Manager<br>Norsup Hospital | Would like more external training undertaken at the hospital as well as more healthcare waste resources such as yellow bins and liners and laminated signage. |
| Kalwad Poilapa<br>Senior Nurse<br>Panunagis Health Centre | Concerned about the growth of the health centre and increases in healthcare waste. |

# 6 Contractor Roles and Capacity

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

Port Vila in the Shefa Province and Luganville (Northern Districts Hospital) in the Sanma Province has a reasonable service industry and although no specific incinerator service contractor were known by hospital staff or identified during the visit there are electrician, mechanics and general engineers that may be able to service to perform repair work on electronic/diesel/gas incinerators.

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

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

# 7 Analysis of Options for Sustainable Healthcare Waste Management in Vanuatu

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

Table 7 categorizes these key issues (A – F) against potential options that could be adopted to tackle them, as a collated list of high-level responses.

**Table 7: Options for Sustainable Healthcare Waste Management in Vanuatu**

| 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:<br>• Waste Management Plan<br>• Responsible officer for implementation of waste management plan<br>• Waste management committee, appropriate to the scale of each facility and to work between other hospitals in Vanuatu. |
| B. Signage, Segregation & Containers | **Segregation and containment** practices are generally below minimum standard in that:<br>• There is virtually no wall signage present. Signage is limited to bins and not always present.<br>• Waste segregation is intended however is generally poorly practiced (in particular Port Vila Central Hospital).<br>• Colour coded bags (liners) were rarely available.<br>• Some colour coded bin were available but usually there was a shortage which prevented consistency across the individual hospital. | Improve segregation practices by:<br>• 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.<br>• 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.<br>• Supply of signage to explain in words and illustrations the colour-coded segregation system as well as posters to promote it. |
| C. Training & Audit | There is no structured **training** or waste segregation **auditing** program in place | Development and delivery of a structured healthcare waste training program to all hospital personnel as well as personnel from other stakeholders (e.g., government health and environment agencies). This could be facilitated/ delivered by:<br>1. SPREP staff, **or**<br>2. International technical training providers (or a combination of both),<br>- as no competent healthcare waste management training capability were identified in Vanuatu. |
| D. Healthcare Waste Storage Facility | Healthcare waste storage facilities generally did not meet minimum standard (except for Norsup) however generally healthcare waste is placed directly into the incinerator (as is the case at Lekakel and Northern Districts | • Ensure there is a waste storage facility that meets the requirements detailed in Appendix E.<br>• Regular checks and maintenance of waste storage facilities. |

| | | |
|---|---|---|
| | hospitals). | |
| E. Treatment | Typically some form of **treatment** of healthcare waste occurs at the hospitals with exception of Port Vila in which no treatment occurred. Improvements could be made to meet required standards. | Treatment using one (or a combination) of the following for each hospital:<br>1. Rotary kiln (highest temperature)<br>2. Incineration (high, medium temperature)<br>3. Low temperature burning (single chamber incinerator/ pit/ drum/ brick enclosure/ land)<br>4. Autoclave<br>5. Chemical<br>6. Microwave<br>7. Encapsulation<br>8. Landfill (without disinfection)<br>9. Onsite burial<br>10. Shredding |
| F. Occupational Health and Safety | Waste handlers generally wore appropriate **PPE** including, gloves and face masks.<br>Generally overalls /protective clothing and eye protection was not worn.<br><br>**Spill control kits** were not observed anywhere. | Procurement of Consumables (PPE):<br>• Supply spill kits and appropriate PPE including overalls/protective clothing, gloves and eye protection for all waste handlers.<br>• Incinerator staff are provided with additional PPE such as face masks and noise protection. |

## 7.1 Options for (Non-Treatment) Waste Management Aspects

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

- The waste management (and infection control) framework, including policies, plans, procedures, responsibility for implementation and audit of the functioning of the framework (A in Table 7)
- The waste management process, from generation to transport up to the treatment location (B in Table 7)
- Training systems for sustainable healthcare waste management (C in Table 7)
- Healthcare Waste Storage Facility (D in Table 7)
- OHS related protection for waste handlers (F in Table 7)

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

## 7.2 Options for Treatment of Healthcare Waste

Healthcare waste treatment (key issue category E) 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 Vanuatu's Stage 2 assessment:

1. Incineration (high temperature: >1,000$^0$C [10])
2. Incineration (medium temperature: 800 – 1,000$^0$C [4])
3. Low temperature burning (single chamber incinerator/ pit/ drum/ brick enclosure/ land: <400$^0$C [4])
4. Autoclave
5. Encapsulation (of sharps only, in combination with a form of disinfection).

[10] 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 Vanuatu

The Stage 2 local feasibility assessment (for Vanuatu) took these first four[11] technologies and assessed them against the ten dot point criteria listed in 7.2. These criteria are explored qualitatively in **Appendix D**. Table 8 takes these qualitative descriptions and assigns a quantitative score from 1 – 5, to prioritise local applicability of technology options to the Vanuatu 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 Vanuatu context are ranked in order of preference in Table 8:

**Table 8: QUANTITATIVE Treatment Technology Options Assessment (Stage 2) - Local Feasibility Assessment (Vanuatu)**

| Stage 1- Approved Technology Options | Comparatively low cost to implement | Comparative effectiveness across all HCWs | Local Feasibility | | | | | | | | Total Score out of 50 | Rank |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Health & safety to workers & community | Sustainability of solution | Institutional and policy fit | Cultural fit | Implementation barriers can be overcome? | Receiving environment protected | Durability | Ease of operation | | |
| Incineration at high temperature (>1000$^0$C) | 1 | 5 | 4 | 4 | 4 | 4 | 3 | 3 | 3 | 3 | 34 | 1 |
| Incineration at med. temperature (800 - 1000$^0$C) | 4 | 4 | 3 | 3 | 2 | 4 | 4 | 2 | 2 | 4 | 32 | 2 |
| Low temperature burning (<400$^0$C) | 5 | 3 | 1 | 2 | 1 | 3 | 5 | 1 | 5 | 5 | 31 | 3 |
| Autoclave with shredder | 2 | 4 | 3 | 4 | 2 | 2 | 3 | 2 | 2 | 4 | 28 | 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

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

In support of Table 8's ranking:

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

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

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

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

### 7.2.1 Treatment Investment Options for individual Vanuatu Hospitals

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

Table 9 determines 'intervention' options that are suggested to improve treatment of healthcare waste in each Vanuatu hospitals visited. Shading in green indicates where investment is proposed, while orange shading shows where a technology consideration is also relevant.

| Table 9: Technology Options Applicable for Each Hospital in Vanuatu | |
|---|---|
| **Remaining Technology Options** | **Technology Applicability** |
| **Port Vila Central Hospital** | |
| Disinfection & Encapsulation (only sharps assessed) | Currently this option that should be applied in the short term as sharps and healthcare waste are taken to landfill without treatment. Port Vila Central Hospital has two autoclaves that could be used for treatment of sharps in particular.<br>Additionally arrangements should be made with the Bouffa landfill for a burial location for sharps and healthcare wastes. |
| Incineration at high temperature (>1000$^0$C) | If the current decommissioned diesel incinerator was properly used and serviced it is likely it reached the >10000C. However fumes from the incinerator and trained skills to operate and maintain the incinerator are clear barriers to effective operation which led to the incinerator being decommissioned. In addition it is unclear whether the incinerator still works. ENVIRON recommends to a feasibility study into the following two options:<br>• *Procure a new incinerator and construct an enclosure at the Bouffa landfill. Volumes of healthcare waste were not measured however based on hospital numbers it can be expected to be around 1,000+ kg per week. If the incinerator is at the landfill it also has the option to take healthcare waste from the health clinics on Efate Island so therefore an incinerator that can claim a throughput of 300-400 kg/day of healthcare waste is recommended.*<br>• *Procure the option of a new fumeless incinerator for the Port Vila Central Hospital. Given there is limited free space at the hospital it is unlikely there is a better location for the current incinerator. When considering the best options for incinerators, Port Vila Central hospital has access to gas cylinders, oil, diesel and electricity. Additionally refer to* Autoclave with shredder option below. |
| Incineration at med. temperature (800 - 1000$^0$C) | Not applicable to Port Vila Central Hospital as it is large enough to justify a better performing larger option that runs at a higher temperature. |
| Autoclave with shredder | The existing autoclave could be used for healthcare waste (with sharps as a priority) to its maximum capacity, ensuring sufficient temperature/ pressure/ time, followed by landfill of treated waste at the Bouffa landfill. However capacity of the autoclaves and the location in laboratory and operating theatre does not make this a long term option.<br>If the incinerator options do not prove feasible then the following could be considered:<br>• *Procure the option of an integrated sterilizer and shredder specific for medical waste. However these generally operate around the 20kg per load which may be hands on for hospital staff (unless it is limited to sharps only).* |
| Low temperature burning (<400$^0$C) | Not applicable to Port Vila Central Hospital as it has sufficient waste volumes to justify a better performing disinfection technology choice. |
| **Northern Districts Hospital** | |
| Disinfection & Encapsulation (only sharps assessed) | May be applicable to sharps using exciting autoclaves as the sharps are not fully burnt with the current woodfired incinerator which is unlikely to reach (>1000$^0$C). |
| Incineration at high temperature (>1000$^0$C) | Sharps and vials are not fully burnt with the current woodfired incinerator which is unlikely to reach (>1000$^0$C). The incinerator also presents a fume problem (although its isolated location reduces any complaints). The hospital is investigating the options to to purchase a new incinerator with the capability to reach temperatures >1000$^0$C. ENVIRON recommends to:<br>• *Procure a new incinerator* – a diesel MediBurn 30 model has a manufacturer's claimed throughput of 200 kg/day of healthcare waste. Volumes of healthcare waste is estimated to be around the |

| Table 9: Technology Options Applicable for Each Hospital in Vanuatu | |
|---|---|
| **Remaining Technology Options** | **Technology Applicability** |
| | 250kg/week rate which makes it theoretically large enough. However there is a growing population in the island of Santo and charity health centers and health clinics on the island could also use the incinerator. |
| Incineration at med. temperature (800 - 1000$^0$C) | The existing incinerator is 800 - 1000$^0$C or below. The hospital is seeking a new incinerator that can reach higher temperatures. |
| Autoclave with shredder | This option is feasible if a new incinerator (>1000$^0$C) is not purchased. Autoclave with shredder can assist with the current incinerator. |
| Low temperature burning (<400$^0$C) | Not applicable to Northern Districts Hospital as it has sufficient waste volumes to justify a better performing disinfection technology choice and the current option may perform around this temperature. |
| **Lenakel Hospital** | |
| Disinfection & Encapsulation (only sharps assessed) | This option may be applicable to sharps and vials using exciting autoclaves as the sharps are not fully burnt with the current woodfired incinerators which is unlikely to reach >1000$^0$C. Sharps and vials to be placed in the autoclaves prior to incineration. |
| Incineration at high temperature (>1000$^0$C) | It may not be justified to purchase a new incinerator for the investment required given Lenakel hospital has two existing wood fired incinerators and medium-low waste volumes. In addition, given the remoteness of Tanna Island, skilled technicians are in limited supply and diesel/electricity/gas is relatively expensive. |
| Incineration at med. temperature (800 - 1000$^0$C) | The existing incinerator is 800 - 1000$^0$C or below. The existing incinerators need some maintenance work to improve the stacks and a roofed structure. |
| Autoclave with shredder | This option is feasible if a new incinerator (>1000$^0$C) is not purchased. Autoclave with shredder can assist with the current incinerator. |
| Low temperature burning (<400$^0$C) | Not applicable to Lenakel Hospital as it has sufficient waste volumes to justify a better performing disinfection technology choice and the current option may perform around this temperature. Refer to the description in the 'med. temperature (800 - 1000$^0$C)' cell. |
| **Norsup Hospital** | |
| Disinfection & Encapsulation (only sharps assessed) | This option may be applicable to sharps and vials using exciting autoclaves as the sharps are not fully burnt with the current woodfired incinerator which is unlikely to reach >1000$^0$C. Sharps and vials to be placed in the autoclaves prior to incineration. |
| Incineration at high temperature (>1000$^0$C) | It may not be justified to purchase a new incinerator for the investment required given Norsup hospital has on existing wood fired incinerator in reasonable working order and medium-low waste volumes. In addition, given the remoteness of Malakula Island, skilled technicians are in limited supply and diesel/electricity/gas are relatively expensive. |
| Incineration at med. temperature (800 - 1000$^0$C) | The existing incinerator is 800 - 1000$^0$C or below. The existing incinerators need some maintenance work to improve the stacks and a roofed structure. |
| Autoclave with shredder | This option is feasible if a new incinerator (>1000$^0$C) is not purchased. Autoclave with shredder can assist with the current incinerator. |
| Low temperature burning (<400$^0$C) | Not applicable to Lenakel Hospital as it has sufficient waste volumes to justify a better performing disinfection technology choice and the current option may perform around this temperature. Refer to the description in the 'med. temperature (800 - 1000$^0$C)' cell. |
| **Panunagis Health Centre** | |
| Disinfection & | Given the small volumes of waste involved, and the small and dispersed population on Panunagis Health Centre |

| Table 9: Technology Options Applicable for Each Hospital in Vanuatu | |
|---|---|
| **Remaining Technology Options** | **Technology Applicability** |
| Encapsulation (only sharps assessed) | a low cost alternative to incineration could be implemented, at least in the short term with the existing autoclave. Sharps and vials waste can then taken to the waste dump at the rear of the facility. |
| Incineration at high temperature (>1000$^0$C) | Not applicable to Panunagis Health Centre, waste volumes are insufficient to justify the investment required. |
| Incineration at med. temperature (800 - 1000$^0$C) | Not applicable to Panunagis Health Centre, waste volumes are insufficient to justify the investment required. |
| Autoclave with shredder | Not applicable to Panunagis Health Centre on the grounds of waste volume justification, cost, complexity and ease of operation. |
| Low temperature burning (<400$^0$C) | Given the small volumes of waste involved, and the small and dispersed population on Panunagis Health Centre, a low cost alternative to incineration could be implemented, to account for increasing waste volumes. This could involve:<br>• Purchasing a wood fired incinerator to be used at the rear of the facility.<br>• Building a concrete floor and fencing off the incinerator area.<br>• Burning sharps and healthcare waste in the incinerator, to disinfect, followed by burial onsite.<br>This be an economically feasible option but could present problem in the long term with air quality issues to the Health Centre patients and staff as well as surrounding neighbours. . |

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

Table 10 provides a summary of the recommendations for Vanuatu. A colour coding system is used to describe the degree of applicability of each recommendation to each hospital as follows:

| | |
|---|---|
| | Fully Applicable |
| | Partially applicable |
| | Not applicable |

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

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

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

| Table 10: Recommendations for Vanuatu | Applicable to | Port Vila Central Hospital | Northern Districts General Hospital | Lenakel Hospital | Norsup Hospital | Panunagis Health Centre |
|---|---|---|---|---|---|---|
| **Recommendation 1: Develop a Waste Management Framework** | | | | | | |
| **Description** | • A *Healthcare Waste Management Plan*, specific to each healthcare facility<br>• Appoint an *officer's from each hospital responsible* for the development and implementation of the Healthcare Waste Management Plan<br>• A *waste management committee*, appropriate to the scale of each facility. | | | | | |
| **Output** | • An agreed *Healthcare Waste Management Plan*, specific to each healthcare facility outlining procedures and guidelines, waste definitions and characterisation, segregation techniques, containment specifications and storage practices, collection and transport, treatment and disposal and emergency procedures<br>• Accountability for healthcare waste management through clearly defined roles and responsibilities | | | | | |
| **Monitoring & Evaluation Indicators** | • Plan approved by Ministry of Health (all facilities)<br>• Approved budget for implementation of Healthcare Waste Management Plan<br>• The Plan is to include an auditing component to that the WMP can be routinely monitored, reviewed, revised and updated.<br>• Annual assessment of 'Responsible Officer's' or Waste Management Committees' performance against key healthcare waste management competencies. | | | | | |
| **Costs ($US)** | • Establishment – medium - Waste management consultant: $US15,000<br>• Establishment – Low - Travel costs for hospital staff and government departments: $US5,000<br>• Ongoing – Low – intention to incorporate the cost into hospital and MoH budgets. | | | | | |
| **Recommendation 2: Procurement of Consumables (Segregation & Storage)** | | | | | | |
| **Description** | • Supply of colour-coded **waste bins** and **plastic liners** in quantities sufficient to serve all wards/departments for a period of time sufficient to allow bedding down of the segregation process.<br>• 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.<br>• 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 10: Recommendations for Vanuatu | Applicable to | Port Vila Central Hospital | Northern Districts General Hospital | Lenakel Hospital | Norsup Hospital | Panunagis Health Centre |
|---|---|---|---|---|---|---|
| **Monitoring & Evaluation Indicators** | • Wastes are segregated at their place of production.<br>• Infection wastes, general wastes and used sharps are stored in separate colour coded containers and locations within medical areas.<br>• Zero Needle Stick Injuries. | | | | | |
| **Costs ($US)** | Establishment – Low; Ongoing - Low, sustainably funded by country | | | | | |
| **Recommendation 3: Provide a Sustainable Training Program** | | | | | | |
| **Description** | • Development and delivery of a structured healthcare waste training program to all hospital personnel as well as personnel from other stakeholders (e.g., government health and environment agencies)<br>• This could be facilitated/ delivered by SPREP staff, or outside trainers, or a combination of both, as no competent health care waste management training capability exists in Vanuatu<br>• Training should be coordinated with other countries' needs in the region | | | | | |
| **Output** | • Improvement of personnel skills and competency in managing healthcare waste<br>• Promotion of the advantages of sustainable segregation and storage techniques for the different waste streams and an understanding of the health and safety risks resulting from the mismanagement risks of healthcare waste. | | | | | |
| **Monitoring & Evaluation Indicators** | • Competency Assessments<br>• Refresher Training<br>• No/very little cross contamination between waste streams demonstrated by waste audits. | | | | | |
| **Costs ($US)** | • Establishment – Low-medium per facility if regional synergies are utilised<br>• Ongoing – Low-medium per facility if regional synergies are utilised | | | | | |
| **Recommendation 4: Appropriate Storage Facilities** *U2H* | | | | | | |
| **Description** | **Short Term (0 – 6 months)**<br>• Procure contractors to design and develop a healthcare waste storage facility at the Port Vila Central Hospital and Lenakel Hospital.<br>• Procure contractors to design and develop an upgrade to the waste storage facility at Northern Districts Hospital.<br>• Upgrade central storage areas to meet minimum standards outlined in **Appendix C and Appendix E** to eliminate the risk of ongoing public risk and environmental harm. | | | | | |
| **Output** | A disposal system that reduces the potential hazard posed by health-care waste, while endeavoring to protect the environment (**meet minimum standards outlined in** Appendix C and Appendix E). | | | | | |

| Table 10: Recommendations for Vanuatu | Applicable to | Port Vila Central Hospital | Northern Districts General Hospital | Lenakel Hospital | Norsup Hospital | Panunagis Health Centre |
|---|---|---|---|---|---|---|
| **Monitoring & Evaluation Indicators** | Suitability of storage areas regularly assessed by 'responsible officer' of waste management committee. | | | | | |
| **Costs ($US)** | • Establishment - Medium$US15,000 ($10,000 for Port Vila and $5,000 for Northern Districts Hospital).<br>• Ongoing – low – monitoring and maintenance. | | | | | |
| **Recommendation 5: Improved Treatment Infrastructure** *U2H* | | | | | | |
| **Description** | • Feasibility study into the following two options for healthcare waste treatment at the Port Vila Central Hospital:<br>- Procure a new incinerator and construct an enclosure at the Bouffa landfill.<br>- Procure the option of a new fumeless incinerator for the Port Vila Central Hospital and large scale autoclave and shredder.<br>• Procurement of new incinerator at the Northern Districts Hospital.<br>• Procurement contractor for incinerator and upgrade/maintenance at Lenakel Hospital and Norsup hospitals which includes increasing the stack height and building an enclosure.<br>• Procure woodfired incinerator for Panunagis Health Centre. | | | | | |
| **Output** | A disposal system that reduces the potential hazard posed by health-care waste, while endeavoring to protect the environment. | | | | | |
| **Monitoring & Evaluation Indicators** | Assessment of the following should be regularly undertaken for new and existing incinerators:<br>Operations and construction (e.g. pre-heating and not overloading the incinerator and incinerating at temperatures above 800ºC only)<br>Maintenance program.<br><br>Ensuring lowest emissions, materials containing chlorine such as polyvinyl chloride products (e.g. some blood bags, IV bags, IV tubes, etc.,) or heavy metals such as mercury (e.g. broken thermometers) should never be incinerated. | | | | | |
| **Costs ($US)** | • Establishment (incinerators) – High (approx. $50-70,000 per unit (average) including housing and commissioning costs;<br>• Establishment (maintenance) – Low (approx. $2,000 per hospital).<br>• Ongoing – medium (fuel and maintenance) | | | | | |
| **Recommendation 6: Procurement of Consumables (PPE)** | | | | | | |
| **Description** | • Supply appropriate PPE, in particular overalls/protective clothing, and eye protection for all waste handlers. | | | | | |

| Table 10: Recommendations for Vanuatu | Applicable to | Port Vila Central Hospital | Northern Districts General Hospital | Lenakel Hospital | Norsup Hospital | Panunagis Health Centre |
|---|---|---|---|---|---|---|
| | • Incinerator staff are provided with additional PPE such as face masks and noise protection. | | | | | |
| **Output** | Adequate supply of PPE for protection of waste handlers | | | | | |
| **Monitoring & Evaluation Indicators** | • PPE is provided to all staff and staff are aware on how to protect themselves from injuries and infectious wastes<br>• Zero Needle Stick Injuries. | | | | | |
| **Costs ($US)** | Establishment – Low; Ongoing - Low, sustainably funded by country | | | | | |
| **Monitoring & Evaluation Indicators** | • Plan approved by Ministry of Health (all facilities)<br>• Approved budget for implementation of Healthcare Waste Management Plan<br>• The Plan should be regularly monitored, reviewed, revised and updated.<br>• Annual assessment of 'Responsible Officer's' or Waste Management Committees' performance against key healthcare waste management competencies. | | | | | |
| **Costs ($US)** | • Establishment – Low, if existing systems (such as those for Fiji) are used as a starting points and document drafting assistance is provided<br>• Ongoing – Low | | | | | |

## 8.1 Implementation Priorities

### 8.1.1 Recommendation 1: Develop a Waste Management Framework

1. Develop a **Healthcare Waste Management Plan** (WMP) 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.

No known polices, guidelines and management plan were identified at federal, provincial or hospital level relating to the management of healthcare waste. It is therefore proposed that a Waste Management plan be developed for each hospital. However given it is rare that anyone at any of the hospitals visited had any training in developing such a Plan external assistance will be required.

It is proposed that the first aim of the WMP is for the two largest public hospitals (Port Vila Central Hospital and Northern District Hospital) to develop a waste management plan specific to their hospital but in consultation with each other for consistency. This part of the project will need to be overseen and assisted by an external waste consultant and/or SPREP representative.

Once the plan has been developed and rolled out it can then be applied to other hospitals and health care centres in Vanuatu who can tailor WMP to be specific to their facility.

The WMP needs compatible with any regional or local waste strategy to ensure consistency of approaches such as with external transport, disposal of treated direction etc. For example there is the *Sanma Province and Luganville Municipality Waste Management Plan for 2013-2016* which would apply for any waste management plan relating to the Northern Districts Hospital.

#### 8.1.1.1 Short Term (0-6 months)

Locations: Luganville and Port Vila

- Engage waste management consultant to oversee the project.
- First aim of the plan is for the two largest public hospitals (Port Vila Central Hospital and Northern District Hospital) to develop a waste management plan specific to their hospital but in consultation with each other for consistency.
- Waste management consultant in consultation with key hospital staff to formulate a plan to develop the WMP.

- 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 between the two hospitals and environmental health officers at the Ministry of Health and the local municipal council.

#### 8.1.1.2 Medium Term (6 months-1 year)

Locations: Luganville and Port Vila

- Peer review of WMP's by waste management consultant.
- The Final Plan should be based on an expanded version of the discussion document and should be presented to Hospital Administration, Waste Management Committee or Responsible Officer.
- Implement Waste Management Plan.

#### 8.1.1.3 Long Term (1year-3 years)

Locations: Nation wide

- Roll out WMP to the remaining hospitals in Vanuatu highlighting successful and unsuccessful aspects of the plan.
- The Waste Management Plan should be reviewed annually. Interim revisions should also be made as well as provisions for future planning.

An auditing component of the WMP will allow for monitoring the success of the implementation of the WMP as well as reviewing the WMP contents for any changes or updates that need to be made.

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

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

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 adheres 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.

From the inspections undertaken by ENVIRON it was evident proper coloured coded healthcare waste bins and liner were not readily available and consequently healthcare waste was not properly segregation. Supply of signage that clearly illustrates and explains the colour-coded segregation system will be of great benefit educating staff and the general public.

#### 8.1.2.1 Short Term (0-6 months)

Locations: Nation wide

- Procurement of in-hospital healthcare waste management consumables including:
    - Colour coded bins and bin liners (approximately 30 each of yellow healthcare; black general waste and green organic waste for each hospital)
    - Wheelie bins (approximately 10 for each hospital)
    - 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 (1year-3 years)

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

### 8.1.3 Recommendation 3: Provide a Sustainable Training Program

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

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

Training should be coordinated with other countries'

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: Appropriate Storage Facilities

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

It was evident from the hospitals visited in Vanuatu that public access is generally unrestricted and feral animals and vermin such as dogs and rats are common therefore it is important that waste is storage is kept in a manner that restricts access to such beings.

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

#### 8.1.4.1 Short Term (0 – 6 months)

- Procure contractors to design and develop a healthcare waste storage facility at the Port Vila Central Hospital and Lenakel Hospital.
- Procure contractors to design and develop an upgrade to the waste storage facility at Northern Districts Hospital.
- Upgrade central storage areas to meet minimum standards outlined in **Appendix C** to eliminate the risk of ongoing public risk and environmental harm.

#### 8.1.4.2 Medium Term (6 months – 1 year)

- Procure spill kits for each central storage area.

#### 8.1.4.3 Long Term (1 year – 3 years)

- Implement an ongoing healthcare waste facilities audit program to monitor the condition of central storage areas
- Port Vila Hospital and Northern Districts - Procurement of a new incinerator and/or new incinerator location (high priority).
- Northern Districts Hospital - Procurement of a new incinerator of existing incinerator to replace missing transformer (high priority).
- Lenakel Hospital - Procurement contractor for incinerator and upgrade/maintenance at Lenakel Hospital which includes increasing the stack height and building an enclosure (medium priority).
- Norsup hospitals - Procurement contractor for incinerator and upgrade/maintenance at Norsup Hospital which includes increasing the stack height and building an enclosure (low priority).

### 8.1.5 Recommendation 5: Improved Treatment Infrastructure [U2H]

Wastes should be treated and disposed of accordingly to ensure the infectious hazard is destroyed. All five healthcare facilities in Vanuatu require some investment in either replacement or maintenance of infrastructure:

**Port Vila Hospital** - Procurement of a new incinerator.

**Northern Districts Hospital** - Procurement of a new incinerator.

Procurement contractor for incinerator and upgrade/maintenance at **Lenakel Hospital** and **Norsup Hospital** which includes increasing the stack height and building an enclosure.

#### 8.1.5.1 Short Term (0 – 6 months)

- Feasibility study into the following two options for healthcare waste treatment at the Port Vila Central Hospital:
  - Procure a new incinerator and construct an enclosure at the Bouffa landfill. Discussions with the Port Vila local landfill (Bouffa landfill) about possible siting of an incineration with enclosure to built on the landfill site as well as fencing. This incinerator has the potential to service other health clinics on Efate Island
  - Procure the option of a new fumeless incinerator for the Port Vila Central Hospital. Additionally refer to Autoclave with shredder option below.
- Procurement of incinerator at the Northern Districts Hospital.
- Procurement contractor for incinerator and upgrade/maintenance at Lenakel Hospital and Norsup hospitals which includes increasing the stack height and building an enclosure.

#### 8.1.5.2 Medium Term (6 months – 1 year)

- Installation of incinerators for Port Vila Hospital / Bouffa landfill and Northern Districts Hospital including enclosure.
- Ongoing assessment of incinerator function, implemented through a long-term incineration systems assessment program.

#### 8.1.5.3 Long Term (1 year – 3 years)

- Upgrade/maintenance work performed at the Lenakel Hospital and Norsup hospitals.
- Ongoing incineration system maintenance support, promotion of non-incineration/smokeless incinerator upgrades to prevent exposure to dioxins and furans.
- Procure woodfired incinerator for Panunagis Health Centre.

### 8.1.6 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.

#### 8.1.6.1 Short Term (0-6 months)

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

#### 8.1.6.2 Medium Term (6 months-1 year)

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

#### 8.1.6.3 Long Term (1-3 years)

Nil.

# Appendix A

## Photo Log

# Appendix B

# Collected Data from Hospital Audits in Vanuatu

**Table B1: Collected Data from Hospital Audits in Vanuatu**

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| HOSPITAL DETAILS | Region | | Efate Island, Shefa Province. | | Espiritu Santo Island, Sanma Province | | Tanna Island, Tafea Province | | Malakula Island - Malampa Province | | Efate Island, Shefa Province. | |
| | Facility Name & Contact Information | Hospital Name | Port Vila General Hospital | | Northern Districts Hospital (opened 1998) | | Lenakel Hospital | | Norsup Hospital | | Panunagis Health Centre, North Efate. | |
| | | Contact Name & Position | Leipakoa Matarika | Nurses Manager | Dr Sam Ailo | Hospital Manager | Simon Saika | Hospital Manager | Noal Nathan | Hospital Manager | Kalwad Poilapa | Senior Nurser |
| | | Email | lmatariki@vanuatu.gov.vu | | ailo@vanuatu.gov.au | | sedenjo2@gmail.com | | nnathan@vanuatu.gov.vu | | kpoilapa@vanuatu.gov.vu | |
| | | Phone | 677 3634545 | | 677 7730809804 | | 677 7103280 | | +678 48410 | | | |
| | Key Services Data | Summary of Services Provided | TB ward; maternity/paediatric ward; medical ward; and surgical ward. Plus – emergency room, ICU and mental illness room. | | Medical ward; childrens ward; TB ward; maternity ward; and surgical ward Plus – emergency room, pharmacy and a blood bank. | | Maternity/paediatric ward; medical and surgical ward; TB ward; Men's ward. Plus – emergency room and heath clinic. | | Maternity Ward; Surgical/Medical/Paediatric Ward; Operating Theater; Laboratory; Pharmacy; Radiology and Health Clinic. | | Outpatient; Health Centre: Family Planning; Maleria; | |
| | | Pop Served | 65,000 | | 40,000 | | 32,000 | | 36,000 | | 12,000 | |
| | | No. of Beds | 146 | | 43 | | 43 | | 54 | | 4 | |
| | | OBD's [1] | 80-90% | | 60-70% | | 60-70% | | 33% | | 10% | |
| | | No. Operations | Not provided | | Not provided | | Not provided | | Not provided | | Not provided | |
| | | No. of Births[2] | 3,000 | | 1,200 | | 589 | | 344 | | 120 | |
| | | Emergency Patients Attended[2] | 480 | | Not provided | | 85 | | 85 | | 72 | |
| | | Out-Patients Attended[2] | 121,340 | | 146,000 | | 4,200 | | 4,869 | | 3,600 | |
| | | No of Staff | 102 | | 107 | | 50 | | 33 | | 4 | |
| WASTE MANAGEMENT PROCESS | Waste Steams Managed | Estimates | Volumes (kg/wk) | Cost ext. ($US) | Volumes (kg/wk) | Cost ext. ($US) | Volumes (kg/wk) | Cost ext. ($US) | Volumes (kg/wk) | Cost ext. ($US) | Volumes (kg/wk) | Cost ext. ($US) |
| | | Healthcare Waste | Not recorded | A flat rate fee of | 250 | | 250 | Not known | 100 | | 10kg | Not known |

**Table B1: Collected Data from Hospital Audits in Vanuatu**

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Sharps | Not recorded | ~SUS64,000 annually is paid to the municipal waste dump for all waste. | Included in above estimates | | Included in above estimates | Not known | Included in above estimates | | Not recorded | Not known |
| | | Pharmaceutical | Not recorded | | Not recorded | | Not recorded | Not known | Not recorded | | Not recorded | Not known |
| | | Cytotoxic | Not recorded | | | | | | | | | |
| | | General | Not recorded | | 500 | Not known | 350 | Not known | 500 | Not known | Not recorded | Not known |
| | | Recycling | Not recorded | | Not recorded | Not known | Not recorded | Not known | Not recorded | Not known | Not recorded | Not known |
| | | TOTAL | 0 | $ 64,000.00 | 750 | $ - | 600 | | 600 | $ - | 0 | $ 64,000.00 |
| | Generation & Segregation | Dedicated Containers/ Bags | N | | Y | | N | | Y | | N | |
| | | Colour Coding | N | | N | | N | | Y | | Y | |
| | | Sharps segregated & secure | Y | | Y | | Y | | Y | | Y | |
| | | Signage Present | N | | N | | N | | Y | | N | |
| | Internal Handling | Degree of manual handling of bags | High | | High | | High | | Medium | | High | |
| | | Internal Transport Mode | Manual | | Manual | | Manual | | Wheelie Bin | | Manual | |
| | | Spill Kit Present | N | | N | | N | | N | | N | |
| | Storage | Dedicated & Appropriate Area | N | | Y | | N | | Y | | Y | |
| | | Loading/unloading acceptable | N | | Y | | Y | | Y | | Y | |
| | | Spill Kits Present | N | | N | | N | | N | | N | |
| | | Monitoring & record keeping occurs | N | | N | | N | | N | | N | |
| | Treatment | Treatment per Waste Stream | Tech. Type | Int/Ext | Tech. Type | Int/Ext | Tech. Type | Int/Ext | Tech. Type | Int/Ext | Tech. Type | Int/Ext |
| | | Healthcare Waste | Landfill (without treatment) | External | Incinerate (internal) | Internal | Incinerate (internal) | Internal | Incinerate (internal) | Internal | Landfill (without treatment) | Internal |

**Table B1: Collected Data from Hospital Audits in Vanuatu**

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Sharps | Landfill (without treatment) | External | Incinerate (internal) | Internal | Incinerate (internal) | Internal | Incinerate (internal) | Internal | Landfill (without treatment) | External |
| | | Pharmaceutical | Landfill (without treatment) | External | Incinerate (internal) | Internal | Incinerate (internal) | Internal | Incinerate (internal) | Internal | Landfill (without treatment) | External |
| | | Cytotoxic | | | | | | | | | | |
| | | General | Landfill (without treatment) | External | Landfill (without treatment) | External | Landfill (without treatment) | Internal | Landfill (without treatment) | External | Landfill (without treatment) | Internal |
| | | If incinerator present | Yes - Ceased operation in 2013 due to fumes impacting the nearby residents. | | Yes | | Yes - Ceased operation in 2013 due to fumes impacting the nearby residents. | | Yes | | No | |
| | | Make, Model, Year commissioned | Inciner Kagyo Co Ltd - FG5 | | Simple wood fired incinerator - no branding | | Simple wood fired incinerator - no branding | | Simple wood fired incinerator - no branding | | N/A | |
| | | Operating Temp ($^0$C) | Not known | | Not known | | Not known | | Not known | | N/A | |
| | | No. chambers | 1 | | 1 | | 1 | | 1 | | | |
| | | Condition | Reasonable | | Reasonable | | Reasonable | | Reasonable | | | |
| | | | Per week | Per year | Per week | Per year | Per week | Per year | Per week | Per year | Per week | Per year |
| | | Waste Throughput (tonnes) | Not known | Not known | ~0.4 | ~20.8 | Not known | Not known | ~0.4 | 20.8 | N/A | N/A |
| | | Operating Hours (hr) | | | 8am-4pm | Mon-Fri | Once per week | | Twice per week | | N/A | |
| | | Fuel | Diesel | | Wood | | Wood | | Wood | | | |
| | | Fuel use (kg/litres) | Not known | Not known | Not known | | Not known | Not known | Not known | | | |
| | | Fuel use per kg waste burnt | Not known | | | | Not known | | | | | |
| | | Technology siting and operation issues | Low stack (approx 5 m) and in close vicinity to residents. | | Incinerator does not get hot enough to properly burn the medical waste. Basic incinerator, green wood and wet conditions (no cover) are the main factors | | Incinerator does not get hot enough to properly burn the medical waste. Basic incinerator, green wood and wet conditions (no cover) are the main factors | | Incinerator does not get hot enough to properly burn the medical waste. Basic incinerator, green wood and wet conditions (no cover) are the main factors | | N/A | |

**Table B1: Collected Data from Hospital Audits in Vanuatu**

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| WASTE MANAGEMENT FRAMEWORK | | Offsite transport assessment | Fair | | Fair | | Fair | | Fair | | Good | |
| | Waste Management Documents | Waste Management Policy | N | | N | | N | | N | | N | |
| | | Waste Management Plan | N | | N | | N | | N | | N | |
| | | Waste Management Procedure | N | | N | | N | | N | | N | |
| | | Waste Management Committee | N | | N | | N | | N | | N | |
| | Infection Control | Infection Control Policy | N | | N | | N | | N | | N | |
| | | Infection Control Procedures | N | | N | | N | | N | | N | |
| | Auditing and Record Keeping | Audit Program | N | | N | | N | | N | | N | |
| | | What is audited | Segregation | N | Segregation | N | Segregation | N | Segregation | N | Segregation | N |
| | | | Compliance P&P | N | Compliance P&P | N | Compliance P&P | N | Compliance P&P | N | Compliance P&P | N |
| | | | Int. transport | N | Int. transport | N | Int. transport | N | Int. transport | N | Int. transport | N |
| | | | Storage | N | Storage | N | Storage | N | Storage | N | Storage | N |
| | | | Treatment/ disposal | N | Treatment/ disposal | N | Treatment/ disposal | N | Treatment/ disposal | N | Treatment/ disposal | N |
| | | Frequency | N/A | | | | N/A | | | | N/A | |
| | Training | Training Program | N | | N | | N | | N | | N | |
| | | Curricula | Infection Control | N | Infection Control | N | Infection Control | N | Infection Control | N | Infection Control | N |
| | | | Waste Mgt | N | Waste Mgt | N | Waste Mgt | N | Waste Mgt | N | Waste Mgt | N |
| | | | PPE | N | PPE | N | PPE | N | PPE | N | PPE | N |

**Table B1: Collected Data from Hospital Audits in Vanuatu**

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Treat. Tech operation | N | Treat. Tech operation | N | Treat. Tech operation | N | Treat. Tech operation | N | Treat. Tech operation | N |
| | | Duration / frequency of training | N | N | N | N | N | N | N | N | N | N |
| | | Records of who has been trained | N | | N | | N | | N | | N | |
| | | Monitoring or refresher courses | N | | N | | N | | N | | N | |
| PROJECTED ISSUES | Forecasting | 10 year projections for waste management | No planning. There is a recognised need for to construct a better waste storage facility. | | | | No planning. There is a recognised need for to construct a better waste storage facility. | | | | None | |
| | | Barriers to change | Close proximity to residents. Financial resources. Skills. | | Resources, skills, attidude. | | Resources, skills, attitude, remoteness. | | Resources, skills, attitude, remoteness, skilled educators. . | | | |
| | | Other issues | No treatment of medical waste is occurring. | | | | No treatment of medical waste is occurring. | | No municipal landfills on the Island. | | No nearby landfills in the vicinity. | |
| LOCAL CONTRACTORS | | Potential in-country contractors | Who | Key Capability | Who | Key Capability | Who | Key Capability | Who | Key Capability | Who | Key Capability |
| | | | - | | - | | - | | - | | - | |
| | | | - | | - | | - | | - | | - | |
| | | | - | | - | | - | | - | | - | |
| | | | - | | - | | - | | - | | - | |

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

[2] *Previous 12 months*

# Appendix C

# Minimum Standards Assessment

| HEALTHCARE WASTE - MINIMUM STANDARDS FRAMEWORK & ASSESSMENT FOR VANUATU | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Scale** | **Category** | **Item** | **Minimum Standard Criterion** | **Port Vila Central Hospital** | **Northern Districts Hospital** | **Lenakel Hospital** | **Norsup Hospital** | **Panunagis Health Centre** | **Overall** |
| National Authority | National Legislation | Definitions | A clear definition of hazardous health-care 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 health-care waste management plan | A national strategy for management of healthcare waste has been published and is up to date (ie., within 5 years) and hospitals required to adhere to its requirements | | | | | | |
| Healthcare Facility | Policy | Infection Control | Infection control policy incorporates principles of waste management within it | | | | | | |
| Healthcare Facility | Policy | Waste Management Plan | Has been developed by the hospital and is based on a review of healthcare waste management and is current (within 5 years) | | | | | | |
| Healthcare Facility | Responsible Person | | An officer has been appointed to assume responsibility for waste management within the hospital, and has been allocated sufficient time and resources - this person could have waste management as part of other duties | | | | | | |
| Healthcare Facility | Management Committee | | A waste management committee has been formed that has representatives from a broad range of departments and meets at least twice per year. A clear set of objectives has been developed for this committee. It reports to the senior management of the hospital. | | | | | | |
| Healthcare Facility | Signage | | Signs are located in all wards/department areas where waste bins are located indicating the correct container for the various waste types | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Healthcare Facility | Segregation | | Waste are correctly segregated in all wards/departments with use of containers that are colour coded for the different waste types | | | | | | |
| Healthcare Facility | Containers | | All areas have dedicated waste containers are suitable for the types of waste generated. All waste containers are colour coded and have correct wording on them. Sharps are deposited into containers that reduce potential for needle-stick injury | | | | | | |
| Healthcare Facility | Storage | Interim storage in healthcare facility | Storage areas at ward/department level should be secure and located away from public areas. Storage areas should be sufficient in size to allow waste to be segregated and so as to avoid waste of different classifications being stored together. | | | | | | |
| | | Storage before treatment | Meets the standards stated in Appendix E, Recommendation 2, *Correct Storage*. | | | | | | |
| Healthcare Facility | Internal Handling | Transport Trolley | A dedicated trolley is used for waste transport. The trolley is designed so that any spills are contained. | | | | | | |
| | Internal Handling | Routing | Healthcare waste is not transported where clean linen and/or food are transported | | | | | | |
| Healthcare Facility | Training | Planning and implementation | A structured waste management education program has been developed with a clear delivery structure | | | | | | |
| Healthcare Facility | Training | Curricula | A structured waste management training program has been developed that targets the different roles within the hospitals. | | | | | | |
| Healthcare Facility | Training | Follow-up & refresher courses | All staff receive waste management education during induction. All staff receive refresher training annually. Waste management training is delivered following an adverse incident to the relevant staff/ward/department. | | | | | | |
| Healthcare Facility | Training | Training responsibility | A hospital officer has responsibility for ensuring all training occurs as required and that records are maintained of all training and attendance. | | | | | | |

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

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

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

# Appendix D

# Qualitative Local Feasibility Assessment – Treatment Technology

**Table D1: QUALITATIVE Treatment Technology Options Assessment - Local Feasibility (Vanuatu)**

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

**Table D1: QUALITATIVE Treatment Technology Options Assessment - Local Feasibility (Vanuatu)**

| 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 |
| | | | | | & other pollutants is high – Vanuatu is a party to Stockholm | used in hospitals | | air pollution, but not likely to be an issue in isolated small communities. | maintenance | |
| Low temperature burning (<400$^0$C) | $6,485 USD over 10 years (ref Whole of Project – Summary Report, Appendix E) | Not applicable for all waste types, relatively high disinfection efficiency, incomplete combustion, will not destroy needles | Some issues for operators (requires training & PPE); issues for community (smoke, emissions not controlled at all) | No equipment; sustainability dependant government & community acceptance which would be expected to decline with time | Potential for smoke nuisance is very high and the potential for contribution to combustion derived POPs & broader range of other pollutants is very high – Vanuatu is a party to Stockholm | Burning of rubbish is historically accepted & widely practised in Vanuatu. | No equipment operation reliability barrier; burning rubbish common practice in Vanuatu | Emissions of air pollutants/ smoke and leaching from ash disposal to receiving environment are potential impacts. Low temperature operation provides no controls on air pollution. Risk of fire impact. | Simple, zero technology so there is nothing that can break down | Simple, zero technology so there is nothing that can break down and no specific training is required other than health and safety. |
| Autoclave with shredder | $158,000 USD over 10 years (ref Whole of Project – Summary Report, | Cannot treat all waste types, achieves complete sterilization when correctly | Some issues for operators (requires training & PPE); small potential for | Equipment lifespan ~ 10 years; sustainability dependant on maintaining | No legal barriers; no potential for smoke nuisance; some potential | Not familiar with use of sterilisers for waste – potential community | Equipment breakdown and lack of local skills to maintain equipment – real barrier but can be | No emissions of air pollutants/ smoke; some potential for odour impacts; still requires | Equipment will only last if maintained. Adding shredder to autoclave | Requires skilled operators to achieve best level of disinfection. |

| Table D1: QUALITATIVE Treatment Technology Options Assessment - Local Feasibility (Vanuatu) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **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** |
| | Appendix E) | operated, no combustion required, shredder destroys needles | odours and wastewater discharge (community) | operator skills plus longevity of equipment use given technology complexity | for odour nuisance; no air pollution (no combustion-POPs) and some potential for waste water management issues | issue with waste appearance if steriliser not operated correctly or shredder not used | managed through skills training & supplier support. Increased complexity of equipment (compared to incineration) increases barrier | 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 Port Vila. | technology increases mechanical parts that can go wrong. May require moderate level of maintenance | |
| Encapsulation (only post-disinfection sharps assessed) | Virtually zero additional cost to disinfection system costs | Not applicable to non-sharps waste. In the context of pre-sterilised sharps only: no combustion required and completely removes downstream | Encapsulation has handling issues for operators (requires training & PPE) and no community issues | No equipment; sustainability dependant burial space available. Only engineered landfill is in Port Vila so increases waste volume that requires burial. | No legal barriers; no smoke nuisance; no odour nuisance; no air pollution and some potential for leachate to groundwater, | No particular cultural fit concerns | New practice proposed – may face some inertia barrier. Lack of new 'shiny' machinery may imply the change is not that important. | Encapsulation itself poses no smoke nuisance; no odour nuisance; no air pollution and some potential for leachate to groundwater, although limited inherent hazard. | Highly durable due to its simplicity. | Simple procedure once operator understands and manages the risk of sharps handling and knows how to mix cement correctly. |

| **Table D1: QUALITATIVE Treatment Technology Options Assessment - Local Feasibility (Vanuatu)** | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **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** |
| | | needle injury risk | | | although limited inherent hazard | | | | | |

# Appendix E

# Recommendation Guidelines

## Recommendation 1: Develop a Waste Management Framework

### Healthcare Waste Management Plan

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

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

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

### Appointment of a Responsible Officer

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

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

**Appointment of a Waste Management Committee**

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

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

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

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

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

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

The Waste Management Committee should:

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

- Agree on the Waste Reduction targets for the hospital and outline the key objectives of the committee
- Review current work and waste management practices and develop waste management/minimisation initiatives.
- Conduct mini audits to review progress.

Visually inspect waste and recycling containers to ascertain if staff are depositing appropriate items into them.

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

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

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

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

**Waste containers specification and siting**

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

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

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

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

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

**Setting and Maintaining Segregation Standards**

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

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

**Correct Signage**

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

**Correct Storage**

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

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

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

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

Conditions related to security of healthcare waste include the following:

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

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

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

**Recommendation 3: Provide a Sustainable Training Program**

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

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

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

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

- Conduct of a training needs analysis
- Identification and prioritisation of employees that need to be trained.
- Defining the specific learning objectives for each target audience.
- Develop a detailed curriculum specifying the training plan for each session.
- Incorporate pre-evaluation and post evaluation of learners, evaluation of trainers, follow-up activities, and documentation into the training program.
- Develop training content or adapt available training materials, tailor training content to specific target audiences.
- Identify potential trainers and build training skills
- Develop a budget and secure funding
- Explore incentives for training (e.g. training in collaboration with a health professional society or university that can award certificates or professional credentials)

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

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

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

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

**Training of Waste Disposal Treatment Operators**

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

- Overview of healthcare waste management including risks and management approaches
- General functioning of the incinerator, including basic maintenance and repair training.
- Health, safety and environmental implications of treatment operations
- PPE, its correct use and removal and cleaning (if appropriate)
- Technical procedures for operation of the plant.

- Recognition of abnormal or unusual conditions
- Emergency response, in case of equipment failures.
- Maintenance of the facility and record keeping
- Surveillance of the quality of ash and emissions.
- Disposal of residues

**Recommendation 4: Appropriate Storage Facilities**

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

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

Specifically the following measures should be implemented

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

**Recommendation 5: Improved Treatment Infrastructure**

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

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

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

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

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

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

It is also very clear that there is little work been undertaken on the consequences of landfilling untreated healthcare waste, and in particular pharmaceuticals and cytotoxic wastes. The literature does relate to impacts resulting from untreated pharmaceuticals being discharged into the environment from hospital sewers and wastewater treatment plants and does indicate that there are potential negative environmental and health consequences. The implications of these studies could legitimately be applied to discharge of waters such as leachate or surface water runoff from landfills should these wastes be deposited untreated. According to the World Health Organization[12, 13], incineration is the preferred method for treating pharmaceutical and cytotoxic wastes. This is further supported by the United Nations[14, 15] in that they have also recommended incineration as the preferred method for treatment prior to disposal of pharmaceuticals and cytotoxic wastes. These

[12] World Health Organization Regional Office for Europe, EURO Reports and Studies 97, Management of Wastes from Hospitals and other Health Care Establishments, 1983.
[13] World Health Organization, Safe management of Wastes from healthcare Facilities, Geneva, 1999.
[14] United Nations Environment Programme – Technical Working Group on the Basel Convention, Draft Technical Guidelines on Biomedical and Health Care Wastes, 1999.
[15] Environment Australia, Basel Convention – Draft Technical Guidelines on Hazardous Waste: Clinical and Related Waste (Y1), March 1998.

recommendations are generally standard throughout the world in relation to these two specific waste types[16, 17].

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[18, 19, 20, 21, 22, 23]. This is also quite evident in a review of Australian State/Territory environmental agency licence conditions for approved clinical and related waste treatment technologies. In countries that do allow landfilling of clinical and related wastes, often these two specific waste categories are specifically excluded from this option[24].

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.

[16] Health care Without Harm, Non-Incineration Treatment Technologies, August 2001.

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

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

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

[20] NSW Department of Health, Waste Management Guidelines for Health care Facilities, August 1998.

[21] Queensland Government, Environmental Protection (Waste Management) Regulation, 2000.

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

[23] 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.

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