ST. VINCENT AND THE GRENADINES
HIV/AIDS PREVENTION AND CONTROL PROJECT

ENVIRONMENTAL ASSESSMENT

The proposed project would generate bio-medical/hazardous waste in the course of clinical management of patients infected with the AIDS virus and the environmental impact must be considered. This annex deals with the management of biomedical waste and has four specific tasks: (1) an audit of waste management practices, (2) review of existing biomedical waste treatment technologies, (3) development of a national biomedical waste management plan, and (4) a training program/implementation and monitoring. Proposed small-scale remodelling of existing counselling rooms would not have an environmental impact but nonetheless guidelines will be incorporated in the project's Operations Manual.

A. Introduction

In November 2002, a National Biomedical Waste Management Plan was completed for St. Vincent and the Grenadines. This plan was a component of a larger World Bank-funded program to address the problem of solid and ship-generated wastes with the goal of protecting the environment and enforcing the MARPOL 73/78 Convention. The program involves six members of the Organization of Eastern Caribbean States (OECS) and is coordinated by the Natural Resources Management Unit of OECS. Audits were conducted during October 2001 and January 2002 that became the basis for an Interim Biomedical Waste Management Plan. The latter document was submitted and accepted by St Vincent and the Grenadines Central Water & Sewerage Authority in April 2002. The annex presented here represents a synthesis of the findings and recommendations of the national biomedical waste management plan. The full plan can be found in the World Bank project files.

Estimates Of Biomedical Waste Generation. The estimation method used for quantifying waste data is based on total population. Data and assumptions used for calculations:

Population: est. 120,000
Milton Cato Memorial Hospital: 204-bed hospital
Several smaller facilities
Numerous health clinics throughout the island (public health clinics, labs, private practitioners, dental practices)

Estimated biomedical waste generation rate:

It is necessary to estimate the amount of medical waste generated in St. Vincent to determine the appropriate size of a treatment technology. While specific quantities and volumes are not presently known, the WHO utilizes an average an average of .4kg/year

per capita. Using this estimates, one calculates the following generation rates for St. Vincent and the Grenadines: 120,000 x .4kg-= 48,000 kg/year.

Treatment technologies are generally rated on a per hour or per day basis. Assuming the treatment technology will be used 5 days a week (261 weekdays per year), the following daily throughput rates are required: 184 kg per day. Assuming 4 hours of operation per day, the following hourly throughput rates are required: $45/ kg per hour (100 lbs/hr). Hence, the treatment technology should be sized as close as possible to this throughput rate.

Existing Legal Framework and Practices. There are no written policies on waste management in St. Vincent and the Grenadines. Colour coding is used when supplies of bags are available. There is limited signage used. Sharps are generally collected in cardboard sharps containers that are not puncture resistant. Fluids from placenta waste are disposed in the sewer. Placentas are buried on the grounds of Milton Cato Memorial Hospital. This is also an acceptable practice as long as health-care workers are protected from splashes from body fluids. In-house (hospital) transport of waste is performed using an open trolley instead of a dedicated, fully enclosed cart. Waste had been burned at an incinerator on-site of the hospital. Other facilities engaged in open burning, burial, or disposal with solid waste. All designated sharps containers on St. Vincent and the Grenadines were returned to Milton Cato Memorial Hospital for disposal. Other islands burn or bury their waste using crude burning methods or burial. Treated waste residues from the incinerator were disposed of behind the existing incinerator area. Employee training on waste management is informal and infection control committees are either dormant or inexistent.

Landfills. Arnos Vale is the old solid waste disposal area. Dumping is supervised. Regular garbage is leveled and compacted by a bulldozer and an earth cover is added at the end of the day. A new landfill is now open in Diamond.

RECOMMENDATIONS

A. Legal Framework

Future legislation and the resulting regulations concerning biomedical waste management should include the following elements:
- Clear definitions of what constitutes biomedical waste and its categories;
- Cradle-to-grave approach to biomedical waste management (the management of biomedical waste from the point of generation to the point of disposal as described in this plan i.e., tracking of waste via a manifest/shipping paper to point of disposal);
- Coordination with hazardous (non-biomedical) waste management laws, as well as other statutes dealing with health (including prevention of infectious diseases, hospital hygiene and infection control), sanitation, environment (air quality, water quality, land disposal), and occupational safety and health;

- Delineation of national and local government authorities which are responsible for implementation (Ministry of Health and Environment for St. Vincent and the Grenadines);
- Legal obligations of the biomedical waste generator;
- Provisions for record-keeping and reporting of pertinent information relative to the transport, treatment and final disposal of biomedical waste;
- Provisions for the institution of fees for transport, treatment, and final disposal; and
- Provisions related to inspections to enforce the laws and regulations, penalties for non-compliance, and legal procedures for managing appeals of enforcement actions.
- A policy document which discusses the rationale for the legislation, national goals, key steps to achieve these goals, and an assessment of costs should be developed to augment the statutes. In addition, a technical guideline should be prepared to clearly present the generators' regulatory responsibilities and may include:
- Legal framework relating to the safe management of biomedical waste;
- Responsibilities of public health and environmental authorities, heads of health-care establishments, directors of public or private agencies dealing with waste management and disposal, and small generators;
- Practical specifications related to biomedical waste minimization, segregation, handling, storage, and transport ;
- List of approved treatment and disposal methods for each of the categories of biomedical waste; and
- Training requirements.

B. Administration and Responsibilities

- Proper management of biomedical waste depends on good administration and organization. - On a national level, biomedical waste management is generally under the principal authority of the Ministry of Health and Environment working closely with other relevant ministries. - - - Policy commitment should be reflected in budgetary allocations for staff and other resources to ensure compliance with biomedical waste laws and regulations.
- On the level of the health care facility, there should be a written policy on biomedical waste management. The policy should state the facility's objective of providing a system for management of biomedical waste in order to protect patients, staff and the general public from hazards associated with the waste. It should provide an overview of responsibilities and outline the major procedures for biomedical waste management.

Hospital Waste Management Team

To institute this policy, a major facility such as Milton Cato Memorial Hospital should establish a waste management team to be chaired by the hospital administrator. This individual will also act as the designated contact with the regulatory authorities. The administrator should appoint one member of the team as the Waste Management Officer responsible for the day-to-day operation and monitoring of the waste management system.

Other Healthcare Facilities Waste Management Teams

All health-care facilities should have a person or group that would be responsible for the management of biomedical waste, including the implementation of waste management plans. Ideally, that person or group should be the infection control officer or infection control committee so that the management of waste can be incorporated into policies, procedures, and programmes to minimize the risk of spreading infection in the hospital thereby protecting patients, health-care workers, and the public. One of the first tasks of the committee or officer is to post educational material on segregation (see sample poster in the Appendix) and to make sure that the health-care staff is familiar with the segregation procedure

C. Occupational Safety and Health Guidelines

- An effective occupational safety and health program related to biomedical waste management includes:
- Risk assessment and designing hazard control measures;
- Proper training on safe practices;
- Provision of personnel protection equipment;
- Immunization and personal hygiene;
- Special precautions for cleaning up spillage;
- Post-exposure prophylactic treatment and medical surveillance; and
- Continuous monitoring of workers' health and safety.

D. Waste Classification

There are many ways of classifying the different components of biomedical waste. In light of the types of waste produced in St. Vincent, the following simple classification is proposed:

Table 1: Biomedical Waste Categories

Waste Category	Description	Examples	Where Found
Sharps	Items that could cut or puncture regardless of whether they harbor infectious agents	Hypodermic needles, syringes, suture needles, scalpel and other blades, lancets, saws, knives, broken or unbroken glass, vials, tubes, pipettes, etc.	Nursing Stations, Laboratory, Accident and Emergency Room, Surgery, Maternity Ward, Clinics
Cultures and Stocks	Cultures and stocks of infectious agents and associated biologicals	Human and animal cell cultures, stocks of etiologic agents, discarded live and attenuated vaccine or serum, culture dishes and other devices used to transfer, inoculate or mix cell cultures	Laboratory, Microbiology
Human Blood, Blood Products, and Body	Free-flowing blood, components or products of blood,	Free-flowing blood or blood components, semen, vaginal secretions, cerebrospinal fluid,	Patient Wards, Surgery, Laboratory,

Fluids	and specific body fluids	synovial fluid, pleural fluid, pericardial fluid, peritoneal fluid, amniotic fluid, and body fluids contaminated with blood	Accident and Emergency Room
Pathological Waste	Human pathological waste	Tissues, organs, anatomical waste (recognizable body parts except teeth) removed during surgery, autopsy or other procedures	Surgery, Pathology, Autopsy
Animal Waste	Contaminated animal waste	Animal carcasses, animal body parts, blood, body fluids, and bedding known to have been exposed to infectious agents	Veterinary Hospitals and Clinics, Research Laboratories
Selected Isolation Waste	Waste generated by patients who are isolated to prevent the spread of highly communicable diseases	Swabs, excreta, soiled dressings, drainage sets, items saturated or dripping with human blood, etc. from patients infected with highly communicable diseases (see below)	Isolation Ward

E. Waste Minimization

Waste minimization is the reduction, to the greatest extent possible, of waste that is destined for ultimate disposal, by means of reuse, recycling, and other programmes. The combination of segregation (see next section) and waste minimization is an effective tool to lessen not just the quantity of waste that must be treated as biohazardous but the amount of regular garbage that goes to the landfill. Health-care facilities should initiate waste minimization programmes following the guidelines and ideas listed below. The potential benefits of waste minimization are: environmental protection, enhanced occupational safety and health, cost reductions, reduced liability, conformance with international conventions on sustainability and the protection of the regional environment, and improved community relations.

Waste Minimization Techniques: The following is the recommended hierarchy of waste minimization techniques in order of decreasing preference:
- Segregation – making sure waste items are in the appropriate container. Staff training is essential to keep biomedical waste separated from regular garbage.
Source reduction - minimizing or eliminating the generation of waste at the source itself; source reduction should have a higher priority than recycling or reuse. Users and waste managers should be aware of what waste is generated by the products they buy. Source reduction requires the involvement of purchasing staff. Steps should be taken to reduce at the source biomedical waste as well as regular garbage. A cost-benefit analysis should be conducted to evaluate the use of reusable versus disposable products with the objective of reducing the volume of waste.

Some specific source reduction techniques include:

- Material elimination, change or product substitution, e.g., substituting a non-toxic biodegradable cleaner for a cleaner that generates hazardous waste; employing multiple-use (reusable) instead of single-use (disposable) products;
- Technology or process change, e.g., using non-mercury-containing devices instead of mercury thermometers;
- Good operating practice, e.g., improving inventory control to avoid expired product waste; covering disinfecting solution trays to prevent evaporative losses; using the minimum formulation recommended for an application;
- Preferential purchasing such as selecting vendors that minimize packaging waste;

Resource recovery and recycling - recovery and reuse of materials from the waste stream. Some specific examples include:
- Recycling newspapers, packaging material, office paper, glass, aluminum cans, construction debris, and other recyclables;
- Purchasing products made of post-consumer recycled material such as recycled paper Composting organic food waste;
- Recovering silver from photographic chemicals in radiology;
- Treatment - treatment to remove and concentrate waste, preferably in process rather than end-of-pipe treatment. An example might be the use of filters and traps to remove mercury from wastewater; and
- Proper Disposal – when all possible waste minimization options have been exhausted, the remaining waste should be disposed in the method with the least environmental impact.

F. Waste Segregation

Biomedical waste should be separated or segregated from the general waste stream created in the routine operation of a health care facility. The segregation should occur at the point of generation to assure that the components of biomedical waste are appropriately processed. In addition, this separation of the two waste streams may allow the facility to reduce its overall costs for the treatment and disposal of biomedical waste and permit the facility to effectively divert a portion of the materials for recycling. In many countries, the inclusion of biomedical waste with the general wastes will cause the entire waste stream to be designated as potentially infectious requiring all waste to be treated. The most efficient means of segregating biomedical waste is to provide separate, distinct containers at the points of generation throughout each health care facility, e.g., hospitals, clinics, doctors and dentists offices.

G. Waste Collection

As previously noted, biomedical waste should be segregated at the point of generation in appropriately marked, color coded containers and/or bags that meet the specifications described below.

Table 2: Biomedical Waste Container Specifications

TYPE OF WASTE	SPECIFICATIONS FOR CONTAINER OR BAG
Sharps	- Container should be puncture-resistant, leakproof on the sides and bottom, durable, and closable (closure should be secure) - Container should be labeled and color-coded - Container should be designed so that it is easily and safely determined when the container is nearly full
Non-sharps bio-medical waste (solid/semi-solid)	- Container should be leakproof, rigid, durable, labeled, and color coded - Plastic bag should be leakproof; designed to prevent ripping, tearing, or bursting under normal use; labeled; and color coded. The plastic bag should be placed inside a rigid container
Non-sharps bio-medical waste (liquid)	- Container should be leakproof and durable - Container should be designed such that it can be transported without spillage

H. Handling and Transport Within the Facility

Housekeeping staff or other personnel should collect all biomedical waste throughout the facility on a regular basis in order to prevent the accumulation of the material in unsecured locations. Those designated with this task should be equipped with appropriate PPE including gloves, gowns, masks, face shields, and/or safety goggles or glasses.

I. Storage

An on-site storage area should be a specifically designated location either within or outside of the health care facility. It should be large enough to accommodate the daily maximum volume of waste generated and be situated at a location physically separate from food preparation and supply areas. The integrity of the packaging should be maintained during storage and to that end, care should be taken in arranging or orienting the waste packages while in storage to avoid spills. Stacking and piling of biomedical waste containers should be avoided. Wheeled carts or bins should not be overloaded during the time they are held in storage. Appropriate personnel protective equipment and spill response supplies should be available in the storage room.

J. Transport Outside the Facility

Transport of untreated biomedical waste outside a health-care facility to a central point for treatment should be regulated by appropriate governmental agencies, the Ministry of Health and Environment, and possibly the Ministry of Public Works, Utilities, Transport, and Posts in relation to vehicular transport.

K. Waste Treatment

Interim Plan

Until a long term treatment solution is implemented, the following interim plan should be considered. A long term approach follows this section.

The single-chamber incinerator or open burning should not be used in the hospitals and health centres. As an interim solution, the categories of waste in #3 above should be treated in one of the following ways or using a combination of ways shown in the table below. Cultures should not be transported as untreated waste but should be treated on-site using a small autoclave.

Table 3: Interim Treatment Methods

APPLICABLE WASTE	METHOD	NOTES
All wastes *except* cultures and anatomical parts (large body parts)	Packaging, Transport, and Burial in Special Landfill Trenches	This interim method should be used by the large generators (hospitals).
Sharps, blood-soaked material, small tissues (e.g., skin tags), placenta waste	Small On-Site Burial Pits	This method could be used in health centres.
Anatomical parts	Interment at Burial Grounds or Cemeteries	This is the preferred method for body parts.
Cultures	Small On-Site Autoclave	This should be the method used for cultures at the Milton Cato Memorial Hospital laboratory.
Free-flowing blood and body fluids	Sanitary Sewer	This method applies to all health facilities with sanitary sewers.

These methods could be used in combination. Health centres may decide to bury blood-soaked material, small tissues, and placenta in small burial pits while transporting sharps for disposal to Milton Cato. This would reduce the amount of waste being transported and avoid the problem of storing putrescent waste for extended periods.

Long Term Plan for Treatment

Liquid blood and body fluids should be discharged directly and carefully into the sanitary health-care facilities, both public and private, and the treatment of the waste at a centralized waste treatment facility. The centralized facility would employ a state-of-the-art alternative treatment technology that would not have the adverse environmental and

health impacts associated with incineration or open burning while enhancing the safety of landfill workers and waste pickers who will not have to deal with untreated waste. The centralized facility will handle the bulk of the biomedical waste stream for the foreseeable future. Biomedical waste generators that choose not to participate in the collection and centralized treatment programme must be able to show that they are able to treat their biomedical waste in some other manner that meets the treatment criteria and any applicable environmental and health regulations.

L. Final Disposal

In general, treated biomedical waste, when made unrecognizable through shredding, can be mixed with regular garbage and transported for final disposal in a sanitary landfill. A sanitary landfills is constructed with a clay or geomembrane liner such as high density polyethylene and provided with a leachate collection system. St. Vincent and the Grenadines has developed a landfill suitable for disposal of treated material.

M. Contingency Planning

As a general rule, all health-care facilities should develop contingency plans in the event that biomedical waste is spilled, a worker is injured, or the treatment technology is down for repairs.

N. Employee Training and Public Education

Employee training and public education are key components of medical waste management. General employee training programs should include the following:
- Overview and rationale of the health care facility's policy on waste management and the objectives of the policy;
- Roles and responsibilities of each staff member in implementing the policy;
Risks associated with biomedical waste, the basic elements of infection, and the importance of safe practices;
- Waste classification;
- Procedures for waste minimization;
- Procedures for waste segregation including labeling and color coding;
- Overview of the fate of medical waste after collection: handling, storage, transport, treatment, and final disposal;
- General cleaning, disinfection, and contingency procedures for spills and accidents; and
- Reporting procedures for accidental exposures to infectious waste (needle-sticks, blood splashes, etc.) or improper collection, handling, or treatment practices.

For health care providers, the following additional precautions should be emphasized:

- Special care has to be taken when dealing with sharps waste. Sharps containers should not be overfilled. Needles should not be manually removed from syringes;

- No attempt should be made to remove items from a biomedical waste bag or container. If any waste item is accidentally placed in a regular trash bag, the entire mixture should be treated as potentially infectious waste; and
- Hazardous chemicals, such as mercury and formaldehyde, and pressurized containers such as aerosol cans, should not be mixed with potentially infectious waste.

Waste handlers and treatment technology operators should receive specialized instruction. In addition to the above topics, training programs should also include:

- Specific procedures for handling, including identifying the types of waste in bags and containers through their colors and labels; when to seal bags; how bags are sealed; how bags are picked up and deposited; how bags should be carried; procedures for handling sharps containers; and ergonomic issues;
- Specific procedures for storage (if needed) and transport of biomedical waste, including how to keep waste segregated, loading and unloading bags, and the proper use of carts;
- Safe practices and use of protective equipment such as gloves and footwear;
- Emergency response to spills and other accidents;
- General operating principles of the treatment technology;
- Occupational safety, health, and environmental issues related to the treatment technology;
- Specific technical procedures for the operation and monitoring of the treatment technology, including the loading and unloading of waste, start-up and shut-down procedures, understanding equipment monitoring data, and the use of controls;
- Emergency response to equipment alarms and failures, including how to detect abnormal conditions and malfunctions;
- Maintenance procedures related to the treatment technology; and
- Removal of residues from the treatment technology.

O. Budget for Implementation

The Ministry of Health & Environment is implementing the recommendations of the Biomedical Waste Management Plan and is in the process of acquiring new incineration technology to dispose of medical waste in an environmentally acceptable manner. Funding for the technology is available from existing resources and the Government is in the process of selecting the appropriate type of incineration technology. It is of critically important to ensure that health care staff , incinerator operators and waste disposal handlers are adequately trained on issues regarding medical waste management. The project will finance an extensive training program of health care workers and staff handling bio-medical waste at an estimated of cost US$ 45,000 over the project life.

Institutional Arrangements and Responsibilities for Implementation and Supervision of Mitigation Activities

Each of the participating agencies, with support from the project's PCU, would be in charge of managing the implementation and supervision of the mitigation activities identified in this environmental assessment.